

Traffic Quality on Georgia Regional Highway Networks

**Augusta, Columbus
Macon-Warner Robins, Savannah
(Fall 2010)**

Prepared for
The Georgia Department of Transportation
by Skycomp, Inc. (Columbia, Maryland)

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INTRODUCTION

The purpose of this aerial survey program is to rate the performance of regional highway systems on a recurring basis, and to provide related data to regional planners, stakeholders, and decision-makers. The four Georgia cities in this program include Augusta, Columbus, Macon-Warner Robins and Savannah. This mobility-monitoring program was initiated in the fall of 2002, at which time designated highways in each of the metropolitan areas were surveyed during both morning and evening peak commuter periods. Coverage was repeated eight years later, in the fall of 2010, leading to an identification of locations experiencing both improved and degraded mobility.

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 could not be affordably accomplished using traditional ground-based survey methods. During each survey period, high-winged Cessna aircraft followed designated routes along the primary highways; each highway segment is photographed in its entirety approximately 24 times. Performance ratings derived from the photography are presented in this report in graphical format.

FEATURES OF THE AERIAL SURVEY PROGRAM

During this aerial survey program, overlapping photographic coverage was obtained for each designated highway, repeated once an hour over four mornings and four evening commuter periods. The morning coverage time was 6:30-9:30 a.m., and the evening time was 4:00-7:00 p.m. 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. Features of the aerial survey program include:

1) Report of findings: Highway Performance Rating Tables, 2010

This report presents performance-rating tables of 2010 traffic conditions on each of the region's freeway sub-system. The ratings are presented by highway, highway segment, direction, and time period. For these uninterrupted-flow facilities, the ratings are density-based level-of-service (LOS) designations "A", "B", "C", "D", "E" and "F", as defined in the 2010 Highway Capacity Manual. Details on how these level-of-service ratings were generated are provided in *Appendix A*.

For interrupted-flow facilities, a surrogate level-of-service measure has been used, based on the size of vehicle platoons and the degree of queuing at signalized intersections. Details on how these surrogate level-of-service ratings were generated are also provided in *Appendix B*.

The performance rating tables also contain arrowheads that depict locations of recurring congestion; narratives that clarify the severity and frequency of the congestion accompany each arrowhead. Where evident, apparent causes of the problems are also described.

2) Special Summary Report: 2010 Update: Mobility Assessment and Bottleneck Changes

The *Mobility Assessment and Bottleneck Changes Report* compares conditions found during the 2010 and 2002 surveys. This special report summarizes the state of mobility on each highway network as of the current survey year; and highlights the specific bottleneck improvements and degradations that have been documented. This report also presents "bottleneck" and "comparative" arrowhead maps that depict the location and typical extent of congested bottlenecks. "Before" and "after" highlight aerial photographs are also provided to illustrate major changes on each system.

3) Web-Based Module

The web-based product presents data collected from all surveyed highways; this product allows data queries from each of the surveyed years, and includes highlight aerial photographs of congestion found in the each metropolitan area. This product also contains detailed 2010 “bottleneck” arrowhead maps that highlight exactly where congestion was found in 2010; “comparative” arrowhead maps depict specific bottleneck improvements and degradations that were found. The product can be viewed over the Internet for private or group use; the interactive feature allows a presenter to respond to audience interests by going to specific locations as appropriate. This product also supports digital downloads of reports created in 2002 and 2010. Lastly, a data extraction module allows users to create graphic displays and download performance-rating tables based on user-selected filters.

4) Survey Database

A primary deliverable for this project is the *Survey Database*, built for the *Microsoft Access*™ platform. This database contains all of the data collected from the aerial survey program, including vehicle counts and road segmentation, flight times and dates, and the highway segment measurements used to calculate freeway densities. Using this database, a number of reports can be displayed or printed, including day-by-day comparative reports, segment densities, and incident information.

5) Speed/Density Relationship on freeways

In order to allow the estimation of vehicle speeds from densities on the freeways, Skycomp has built a database from data collected in the Washington D.C. metropolitan area and other cities. This database demonstrates the relationship between traffic densities and speeds. From this database, a look-up table was developed relating the two variables. The result of Skycomp’s work is provided in *Appendix C*.

DISCLAIMER

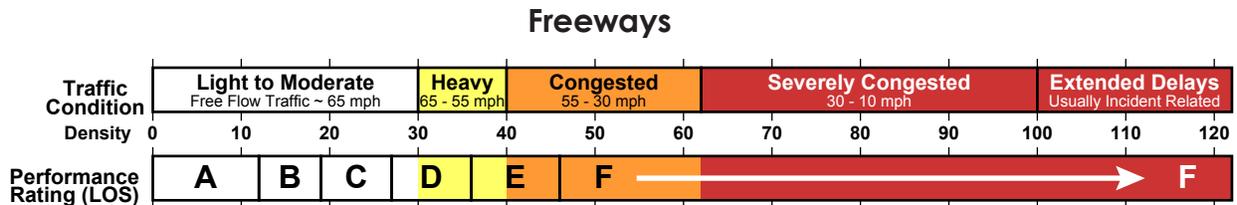
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QUESTIONS

If there are any questions about this survey program or the underlying methodology, please direct them to Greg Jordan at 410-884-6900.

Performance Rating Descriptions: FREEWAYS

For limited access facilities, the ratings are density-based level-of-service designations “A” through “F”, as defined in the 2010 Highway Capacity Manual. A summary of density based level-of-service is provided below (a more detailed discussion of level-of-service is provided in Appendix A).



Note: In some segments congestion was not uniform, so that high densities associated with congestion were “diluted” by low densities found elsewhere in the segment or at other times. In these cases, averaged density values do not reflect the variety of conditions found in the segments. This occurrence is known as “nested congestion”. Accordingly, four types of “nested congestion” have been identified with superscripts, as follows:

Nested congestion superscripts:

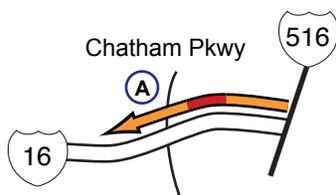


- 1 Type 1 nested congestion (some days, not others).
- 2 Type 2 nested congestion (more severe in left or right-hand lanes).
- 3 Type 3 nested congestion (present only in the first or second half-hour period).
- 4 Type 4 nested congestion (partial length of segment).

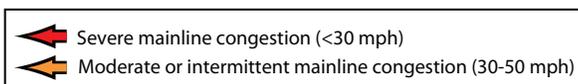
Bottleneck Graphics and Analytical Notes

Each performance rating table includes arrowheads that depict locations where congestion was found; notes that clarify the frequency and severity of the congestion accompany each arrowhead. Examples from the report are provided below.

Freeways



A
 Congestion Type: Mainline Congestion
 Frequency: Peak Hour
 Direction: Westbound
 Location: Between I-516 and Dean Forest Rd
 Queue Length: 1 to 2 miles
 Estimated Speed: 30 to 50 mph
 Potential Cause(s): Factors contributing to the congestion were:
 1) traffic entering at I-516 and Chatham Parkway; and 2) the geometrics of the roadway (sharp bends).



Performance Rating Descriptions: ARTERIALS

For interrupted-flow facilities, a surrogate level-of-service measure has been used. Developed by Skycomp for use with overlapping aerial photographs, this surrogate measure is based on platoon sizes and queuing characteristics at signalized intersections. Because this is a surrogate LOS measure, the letters “A” through “F” have been underlined to identify them as surrogate LOS measures. A summary of the surrogate level-of-service is provided below (a more detailed discussion is provided in Appendix B).

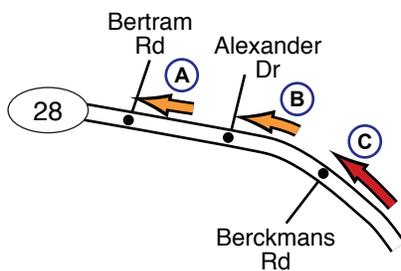
Signalized Arterial Highways:

Traffic Condition	Very Light	Light	Moderate	Heavy	Congested	Severe
Performance Rating (surrogate LOS)	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>

Bottleneck Graphics and Analytical Notes

Each performance rating table includes arrowheads that depict locations where congestion was found; notes that clarify the frequency and severity of the congestion accompany each arrowhead. Examples from the report are provided below.

Signalized Arterial Highways



- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

A
 Congestion Type: Mainline Signal Queue
 Location: Bertram Rd
 Frequency: Intermittent
 Direction: Northbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

B
 Congestion Type: Mainline Signal Queue
 Location: Alexander Dr
 Frequency: Intermittent
 Direction: Northbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 2

C
 Congestion Type: Mainline Signal Queue
 Location: Berckmans Rd
 Frequency: Peak Hour
 Direction: Northbound
 Queue Population: 20 to 50 vpl
 Number of Lanes: 2



AUGUSTA

HIGHWAY TRAFFIC QUALITY

FALL 2010

Augusta, GA (Surveyed Highways)

Fall 2010

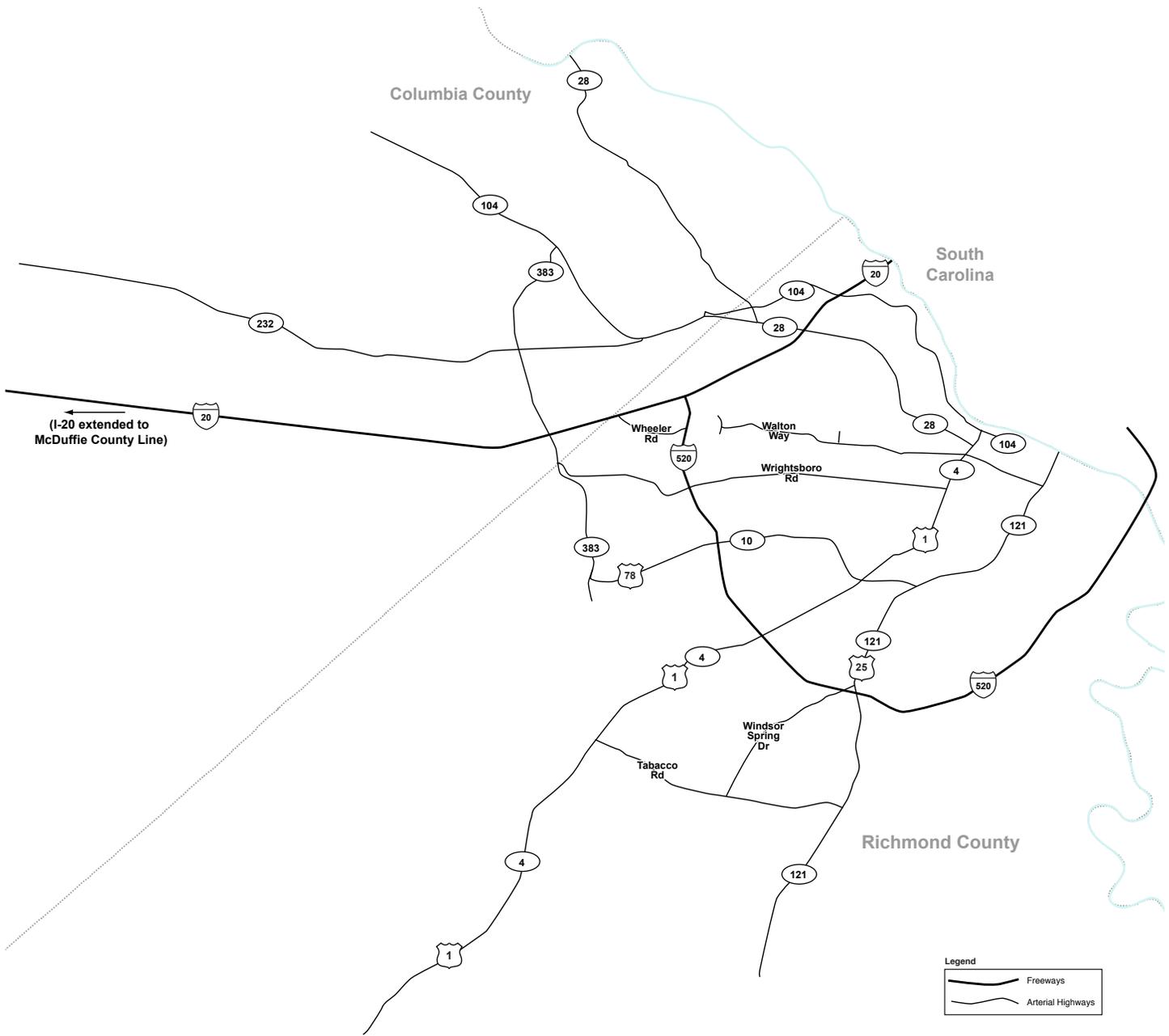


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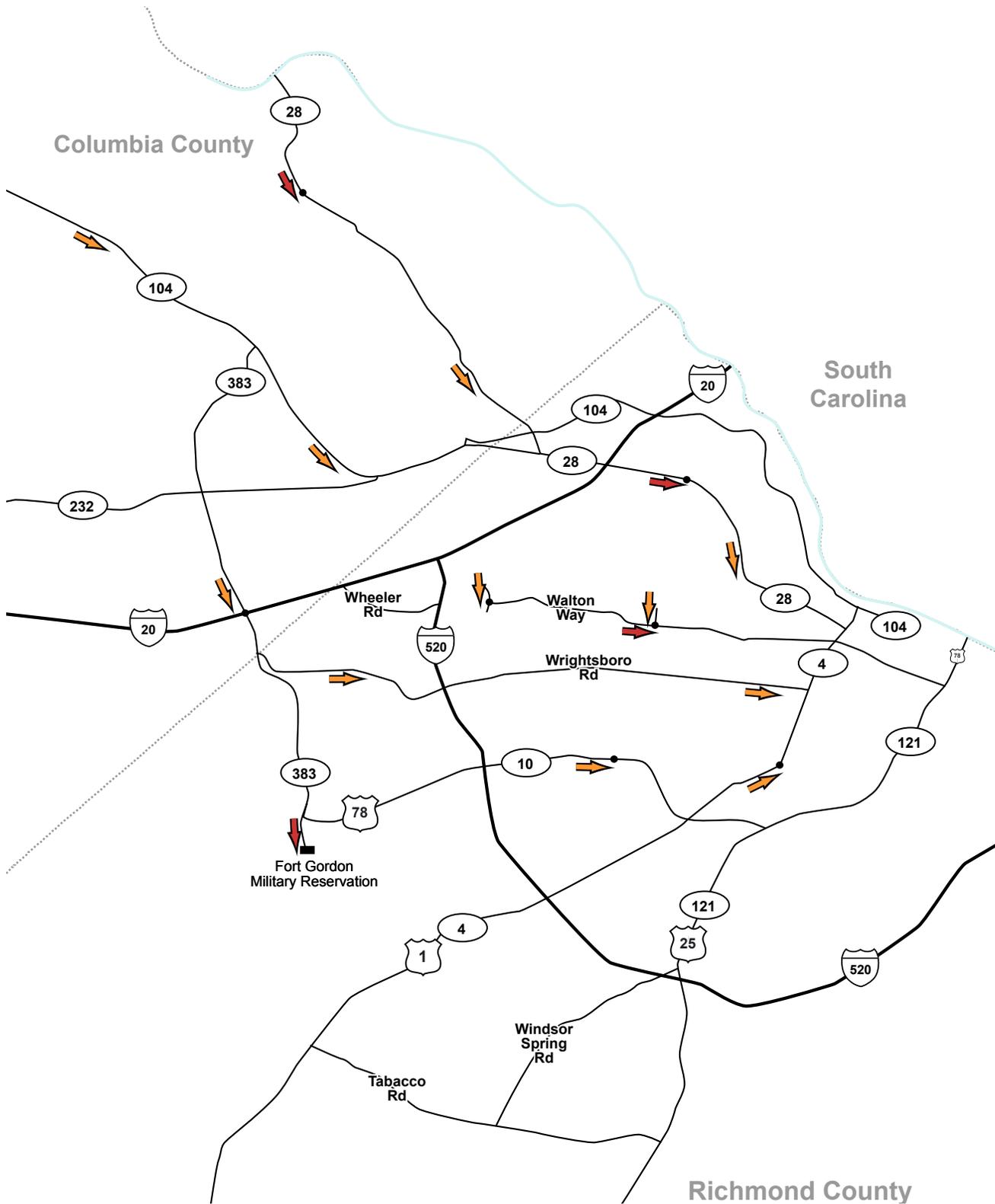
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Augusta, GA (Locations Where Congestion Was Found)

Morning, Fall 2010



Freeway Legend

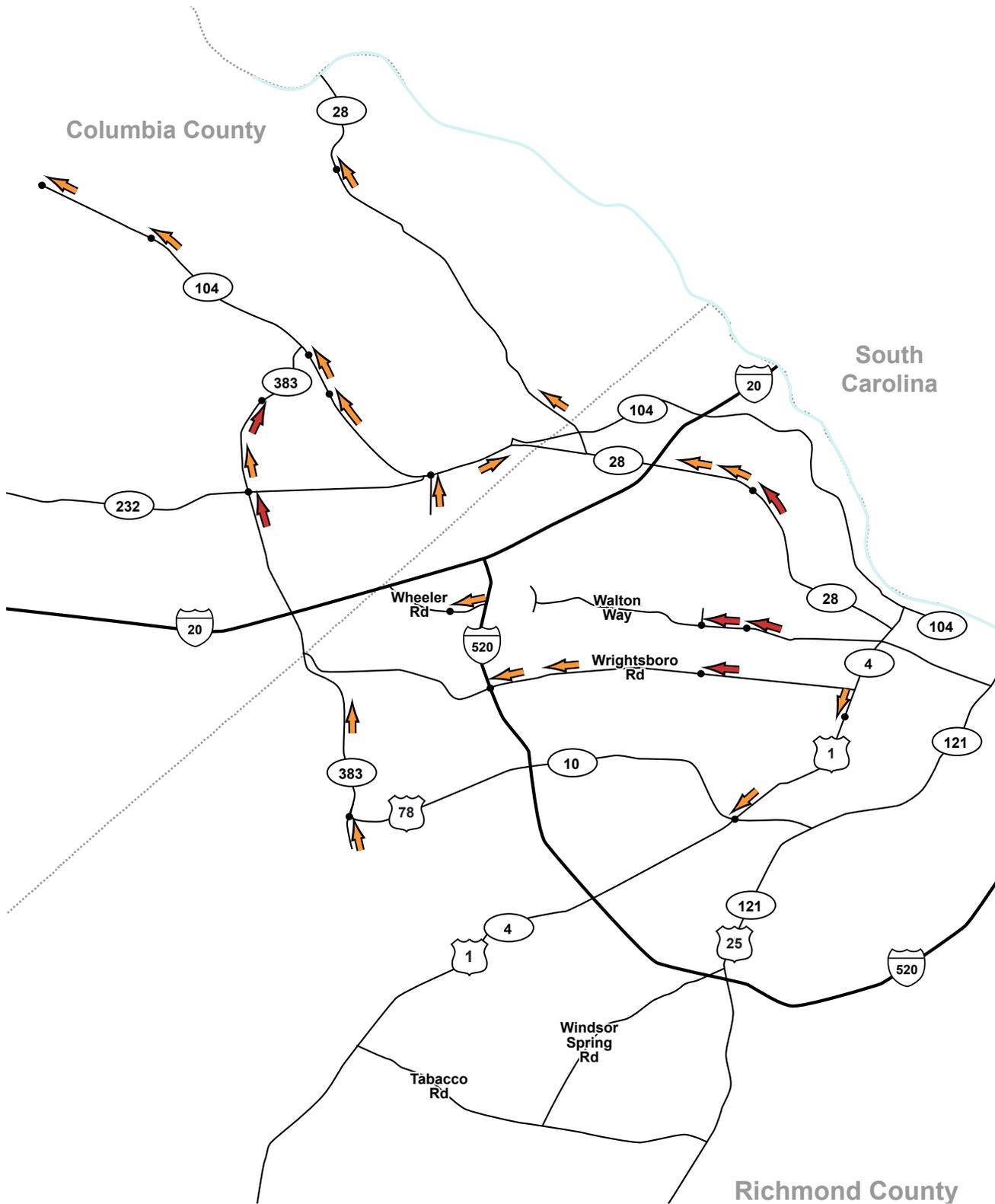
- Severe mainline congestion (<30 mph)
- Moderate or intermittent mainline congestion (30-50 mph)

Arterial Legend

- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

Augusta, GA (Locations Where Congestion Was Found)

Evening, Fall 2010



Freeway Legend

- Severe mainline congestion (<30 mph)
- Moderate or intermittent mainline congestion (30-50 mph)

Arterial Legend

- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

SR 4 / US 1 (Deans Bridge Rd / 15th St)- Morning

A

Congestion Type: Left-Turn Queue

Location: 15th Ave

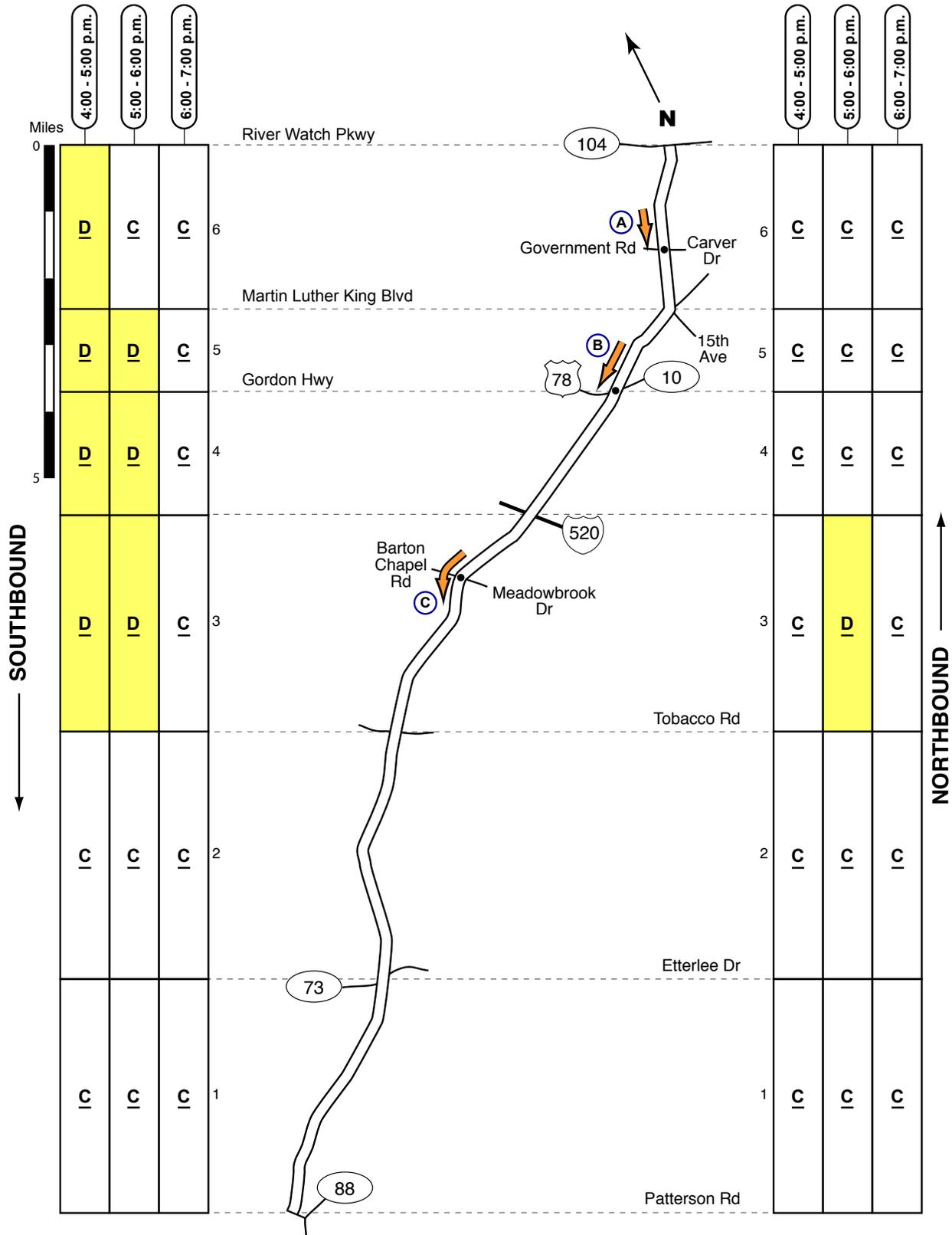
Frequency: One Time Only

Direction: Northbound

Queue Population: 20 to 25 vpl

Number of Lanes: 1

SR 4 / US 1 (Deans Bridge Rd / 15th St) - Evening



Traffic Quality Rating



SR 4 / US 1 (Deans Bridge Rd / 15th St) - Evening

A

Congestion Type: Mainline Signal Queue
 Location: Government Rd / Carver Dr
 Frequency: One Time Only
 Direction: Southbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 1

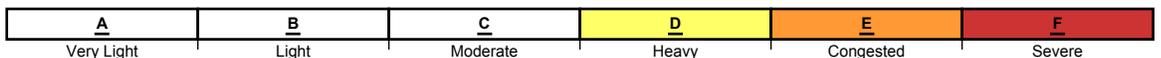
B

Congestion Type: Mainline Signal Queue
 Location: SR 10 (Gordon Hwy)
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

C

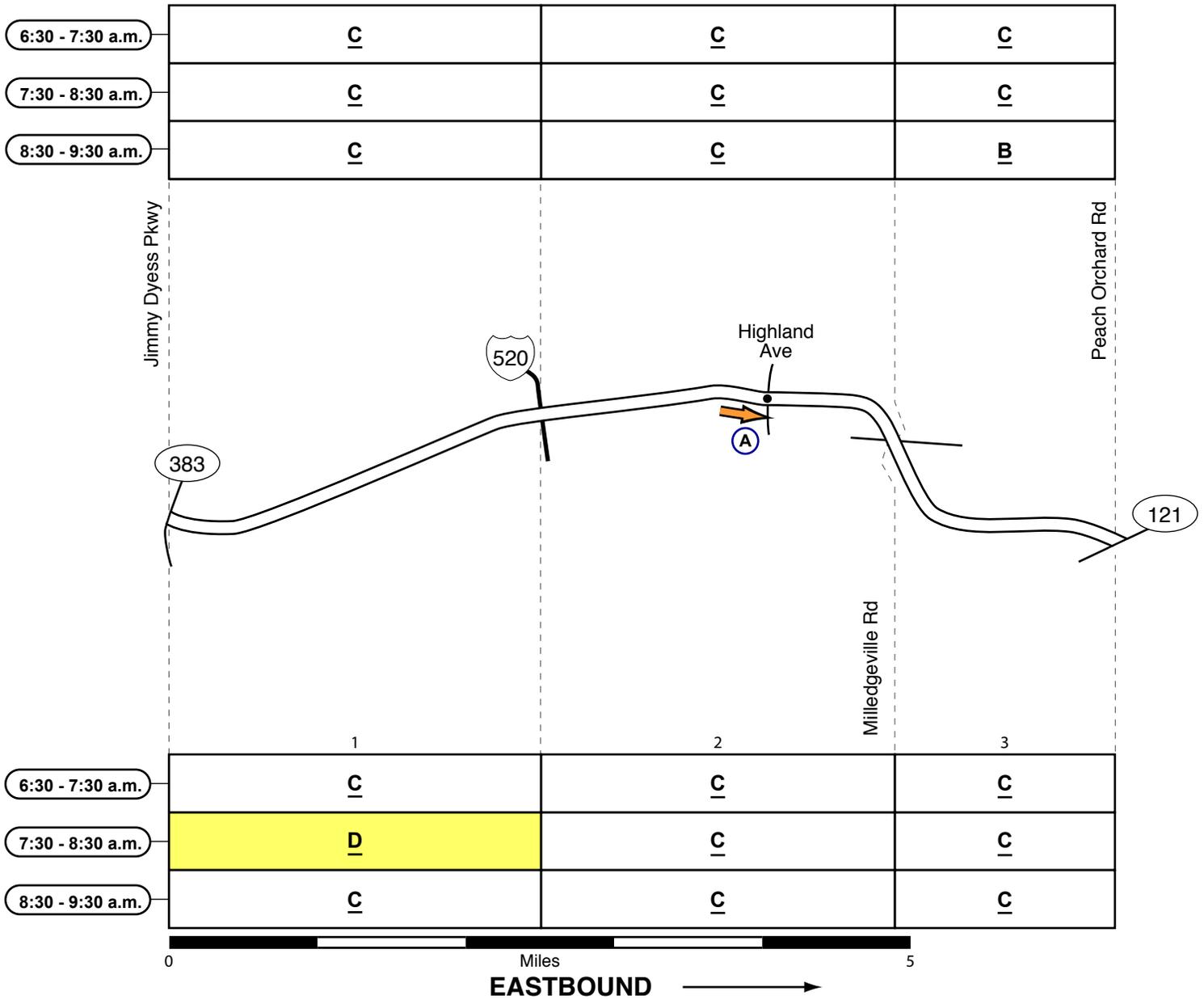
Congestion Type: Platoons
 Location: Vicinity of Barton Chapel Rd
 Frequency: One Time Only
 Direction: Southbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

Traffic Quality Rating



SR 10 (Gordon Hwy) - Morning

← WESTBOUND



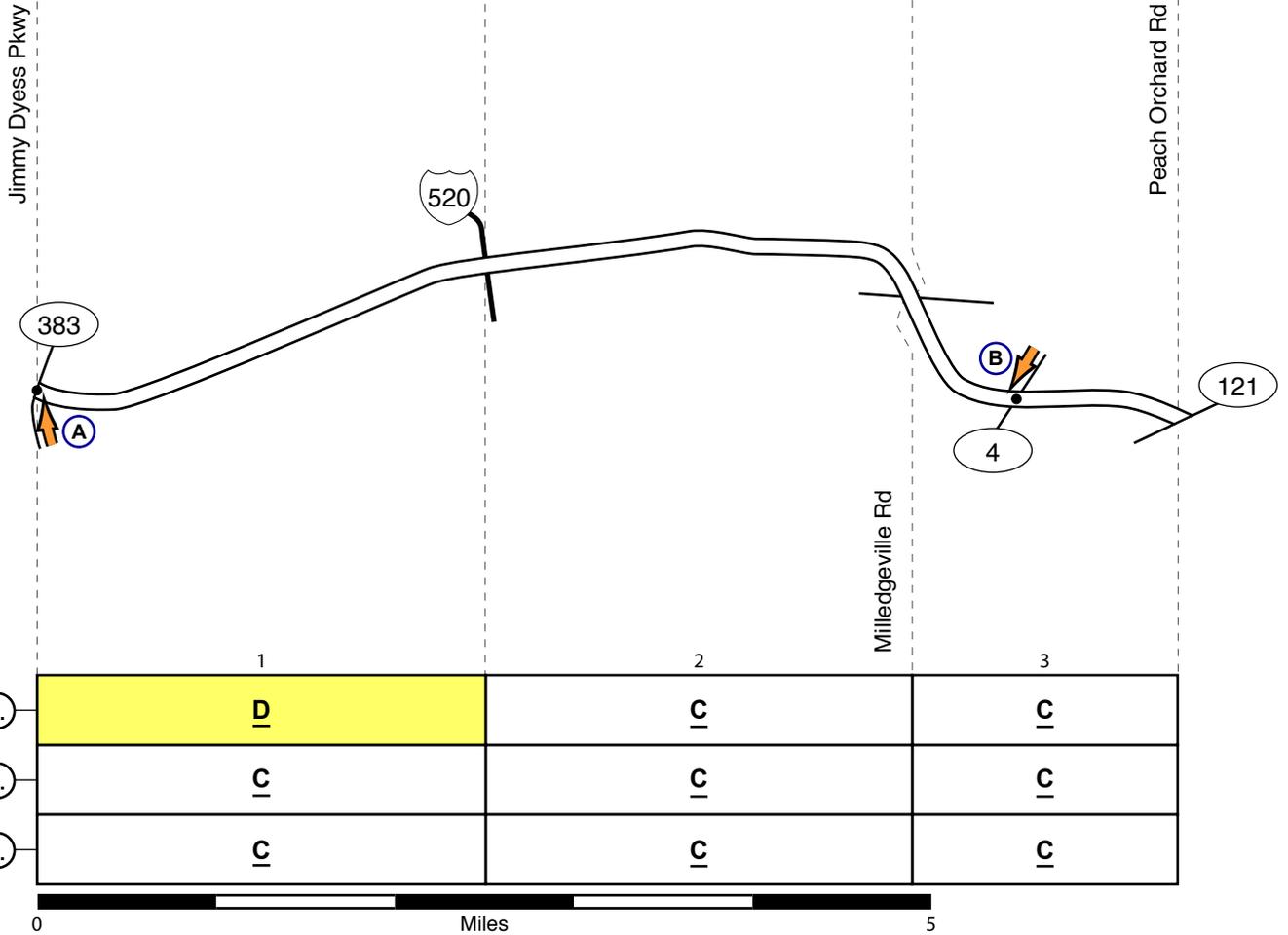
A
 Congestion Type: Left-Turn Queue
 Location: Highland Ave
 Frequency: Intermittent
 Direction: Eastbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 1

Traffic Quality Rating	<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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SR 10 (Gordon Hwy) - Evening

← WESTBOUND

4:00 - 5:00 p.m.	<u>C</u>	<u>D</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>D</u>	<u>D</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>



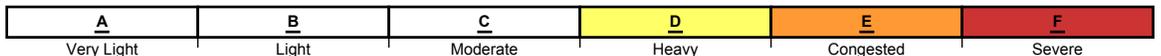
4:00 - 5:00 p.m.	<u>D</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>

0 Miles 5
EASTBOUND →

A
 Congestion Type: Surveyed Cross Road Signal Queue
 Location: SR 383 (Jimmy Dyess Pkwy)
 Frequency: Intermittent
 Direction: Northbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

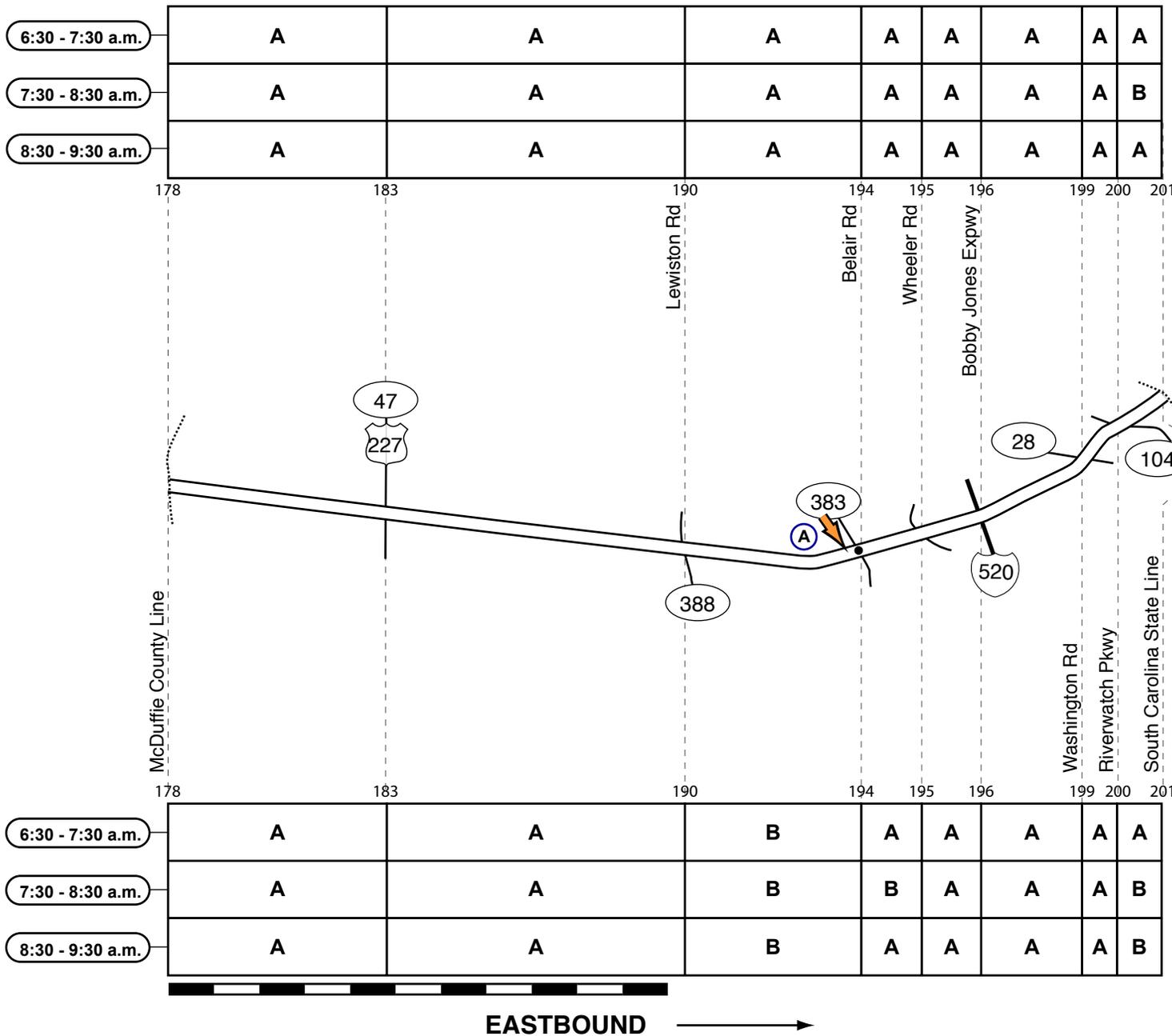
B
 Congestion Type: Surveyed Cross Road Signal Queue
 Location: SR 4
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

Traffic Quality Rating



I-20 - Morning

← WESTBOUND



A
 Congestion Type: Surveyed Cross Road Signal Queue
 Location: SR 383 (Belair Rd)
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2



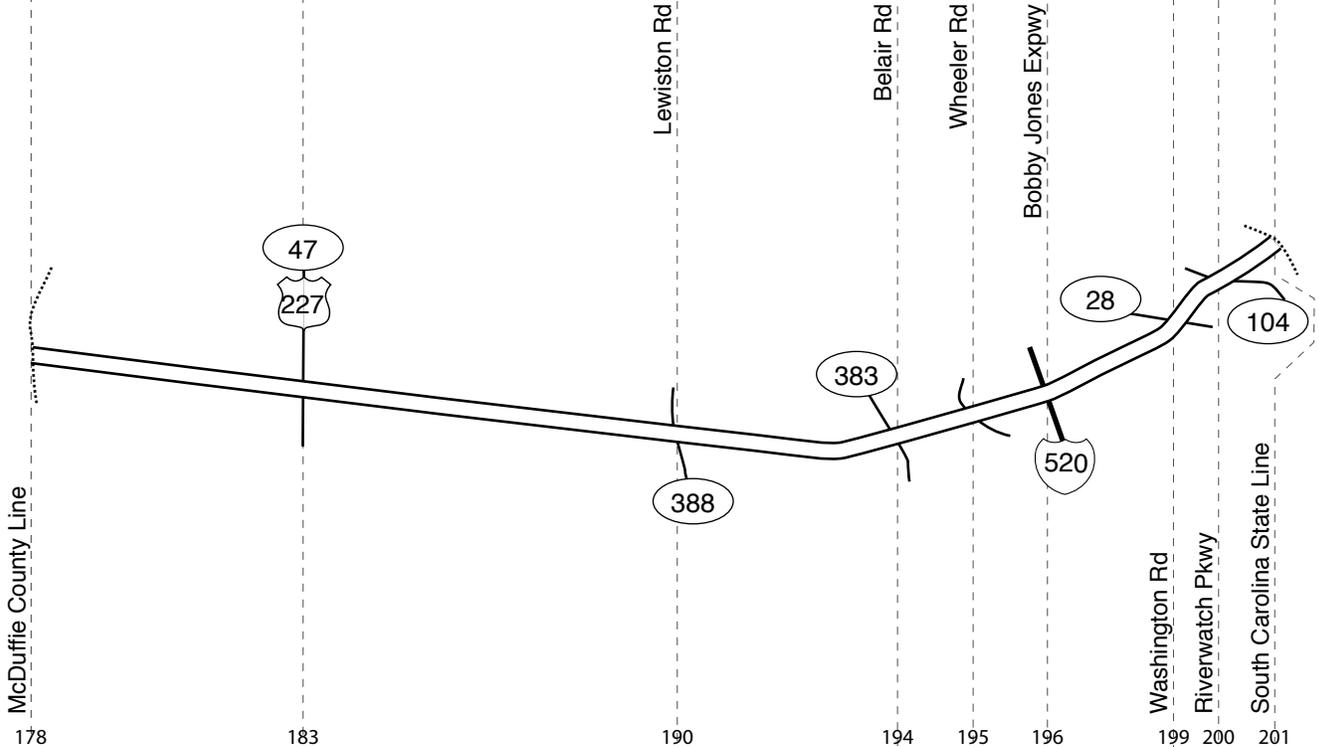
Superscripts: ¹Type 1 nested congestion (some days, not others). ²Type 2 nested congestion (more severe in left or right-hand lanes). ³Type 3 nested congestion (present only in the first or second half-hour period). ⁴Type 4 nested congestion (partial length of segment).

I-20 - Evening

← WESTBOUND

4:00 - 5:00 p.m.	A	A	B	B	A	A	A	A
5:00 - 6:00 p.m.	A	B	C	B	B	B	A	B
6:00 - 7:00 p.m.	A	A	A	A	A	A	A	A

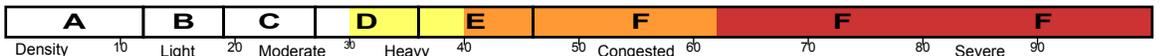
178 183 190 194 195 196 199 200 201



4:00 - 5:00 p.m.	A	A	A	A	A	B	A	B
5:00 - 6:00 p.m.	A	A	A	A	A	B	A	B
6:00 - 7:00 p.m.	A	A	A	A	A	A	A	B

EASTBOUND →

Traffic Quality Rating



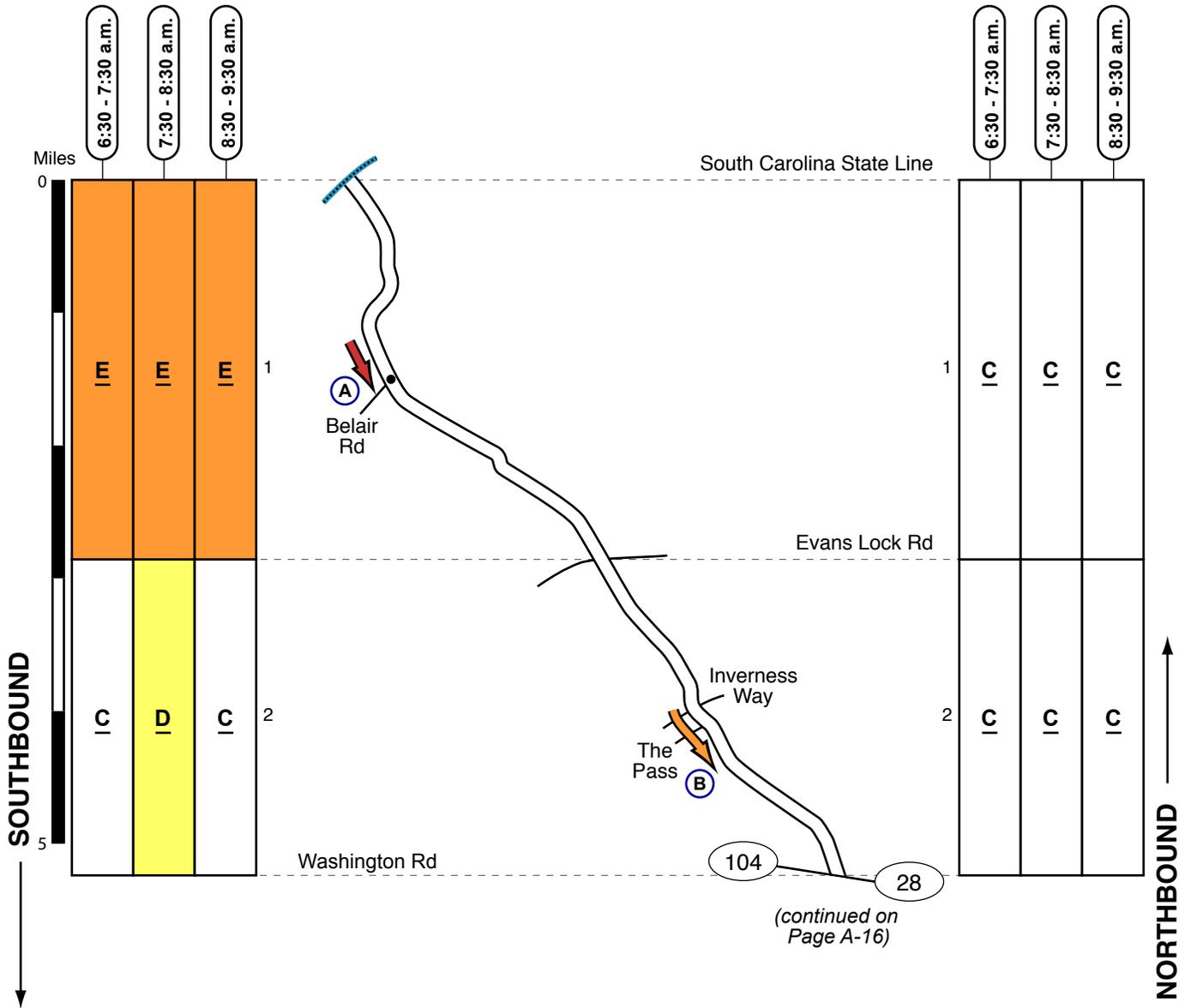
Superscripts: ¹ Type 1 nested congestion (some days, not others).

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).

SR 28 (Furys Ferry Rd) - Morning



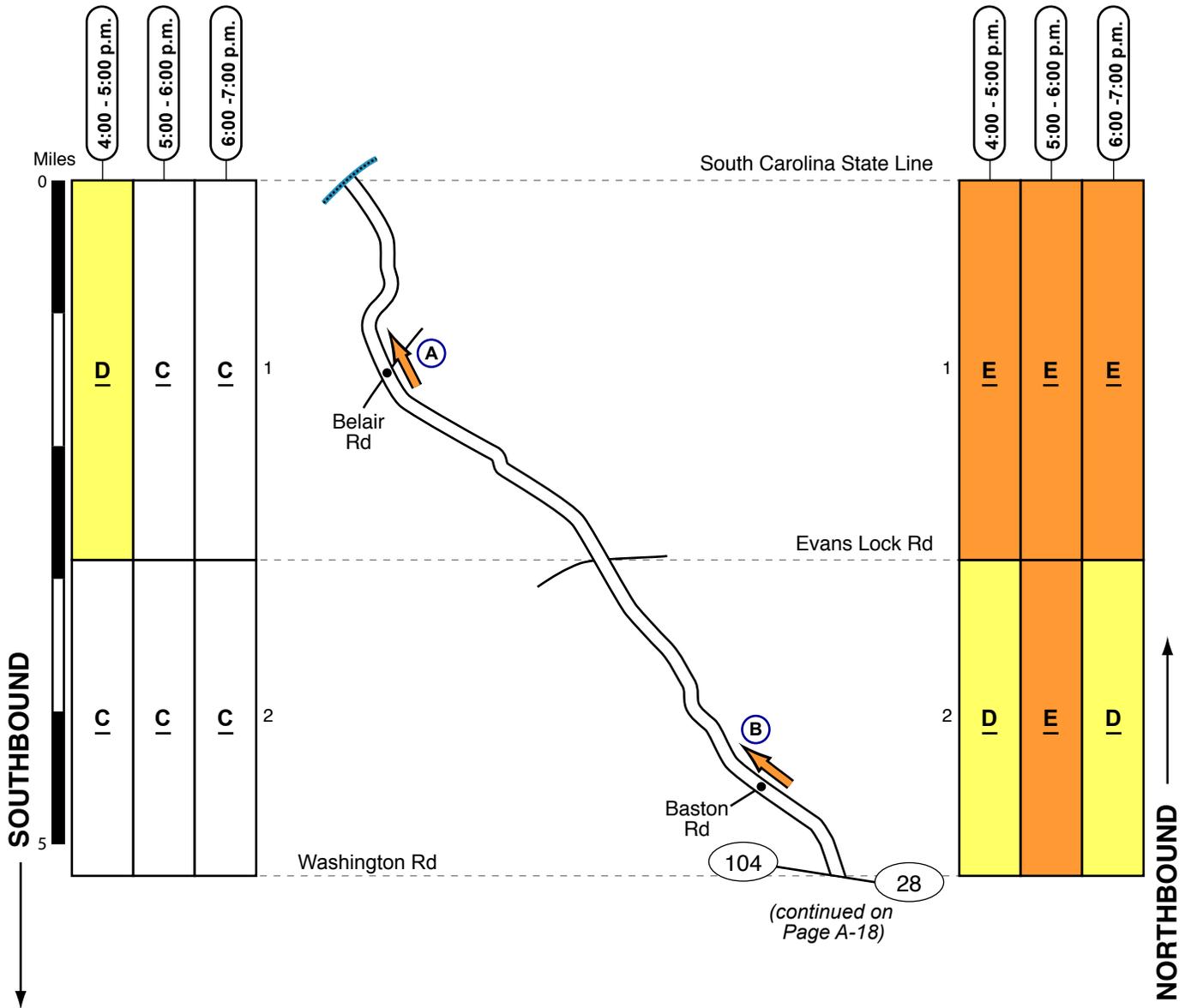
A
 Congestion Type: Mainline Signal Queue
 Location: Belair Rd
 Frequency: Peak Hour
 Direction: Southbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 1

B
 Congestion Type: Platoons
 Location: Vicinity of Inverness Way & The Pass
 Frequency: Intermittent
 Direction: Southbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

Traffic Quality Rating



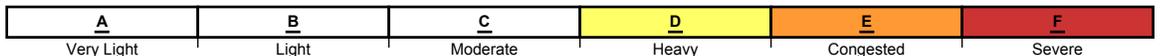
SR 28 (Furys Ferry Rd) - Evening



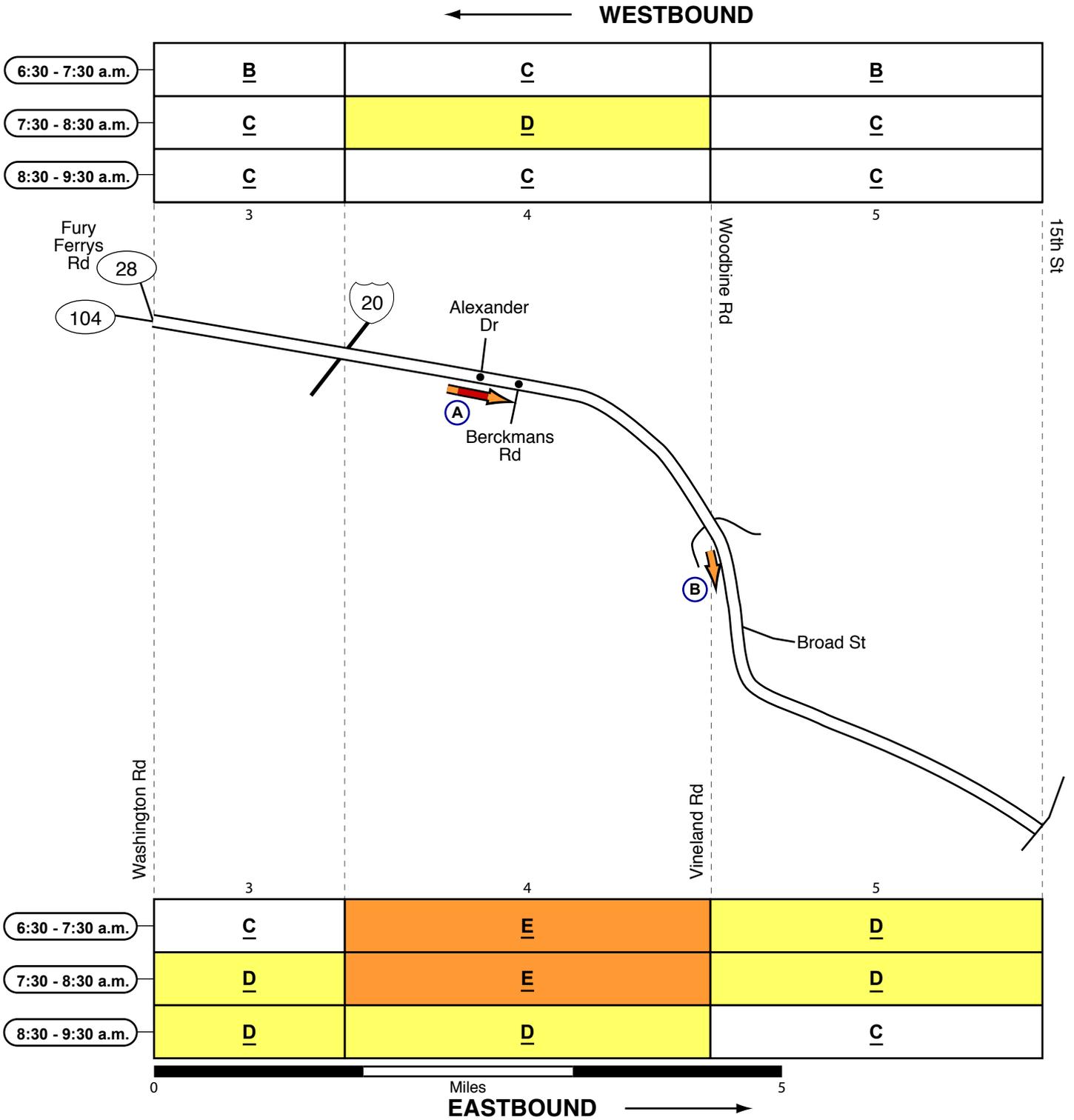
A
 Congestion Type: Platoons
 Location: Vicinity of Belair Rd
 Frequency: Intermittent
 Direction: Northbound
 Platoon Population: 25 to 35 vpl
 Number of Lanes: 1

B
 Congestion Type: Platoons
 Location: Between SR 104 & Evans Lock Rd
 Frequency: Intermittent
 Direction: Northbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

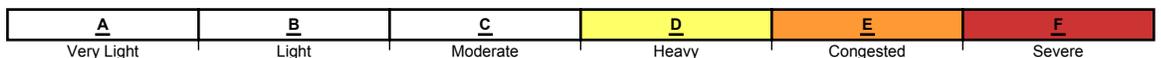
Traffic Quality Rating



SR 28 (Washington Rd / Calhoun Expwy) - Morning



Traffic Quality Rating



SR 28 (Washington Rd / Calhoun Expwy) - Morning

A

Congestion Type: Mainline Signal Queues

Location: Alexander Dr & Berckmans Rd

Frequency: Peak Hour

Direction: Eastbound

Queue Population: 20 to 40 vpl

Number of Lanes: 2

Note: During one observation, congestion at Berckman Rd
exntended back through the upstream signal at Alexander Dr.

B

Congestion Type: Platoons

Location: Vicinity of Woodbine Rd

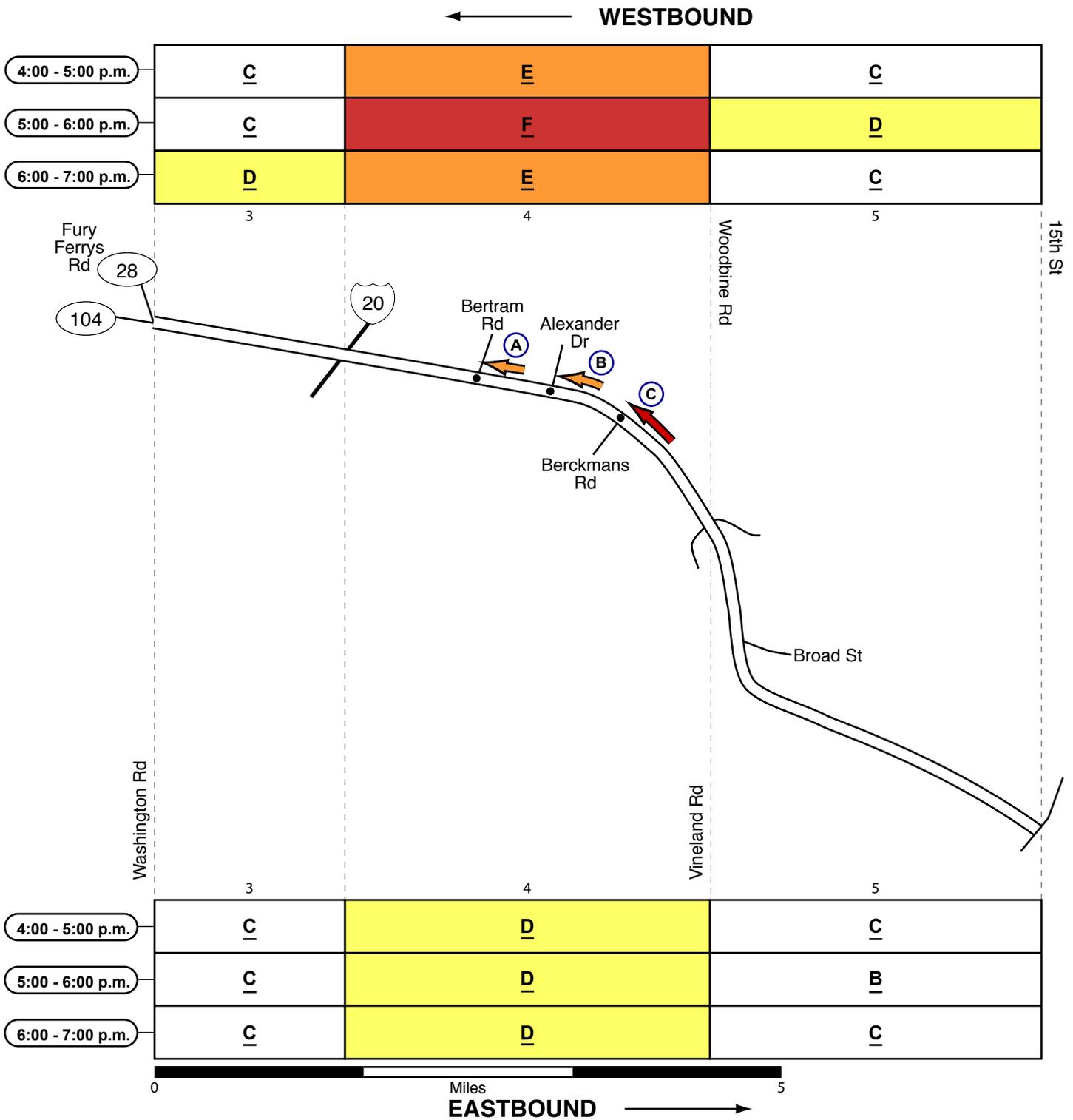
Frequency: Intermittent

Direction: Eastbound

Platoon Population: 25 to 30 vpl

Number of Lanes: 2

SR 28 (Washington Rd / Calhoun Expwy) - Evening



Traffic Quality Rating



SR 28 (Washington Rd / Calhoun Expwy) - Evening

A

Congestion Type: Mainline Signal Queue
Location: Bertram Rd
Frequency: Intermittent
Direction: Westbound
Queue Population: 20 to 25 vpl
Number of Lanes: 2

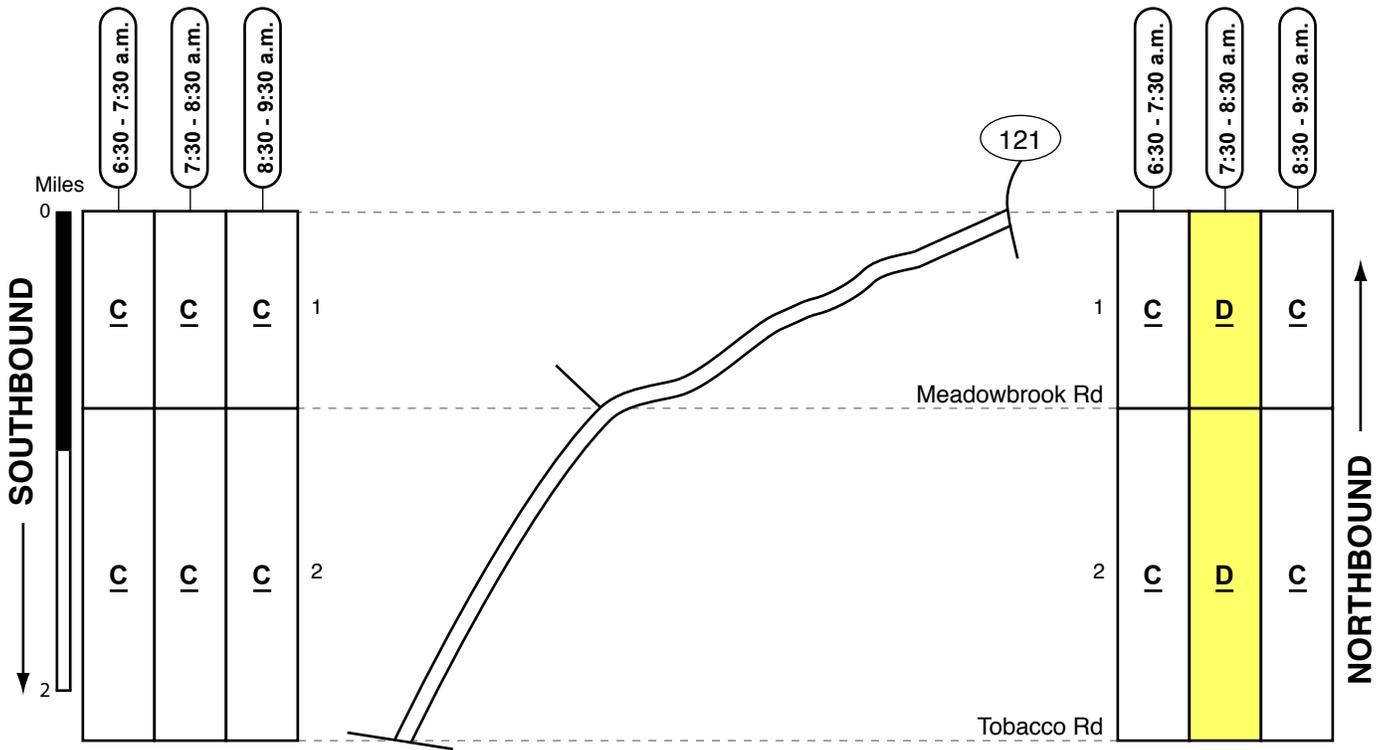
B

Congestion Type: Mainline Signal Queue
Location: Alexander Dr
Frequency: Intermittent
Direction: Westbound
Queue Population: 20 to 40 vpl
Number of Lanes: 2

C

Congestion Type: Mainline Signal Queue
Location: Berckmans Rd
Frequency: Peak Hour
Direction: Westbound
Queue Population: 20 to 50 vpl
Number of Lanes: 2

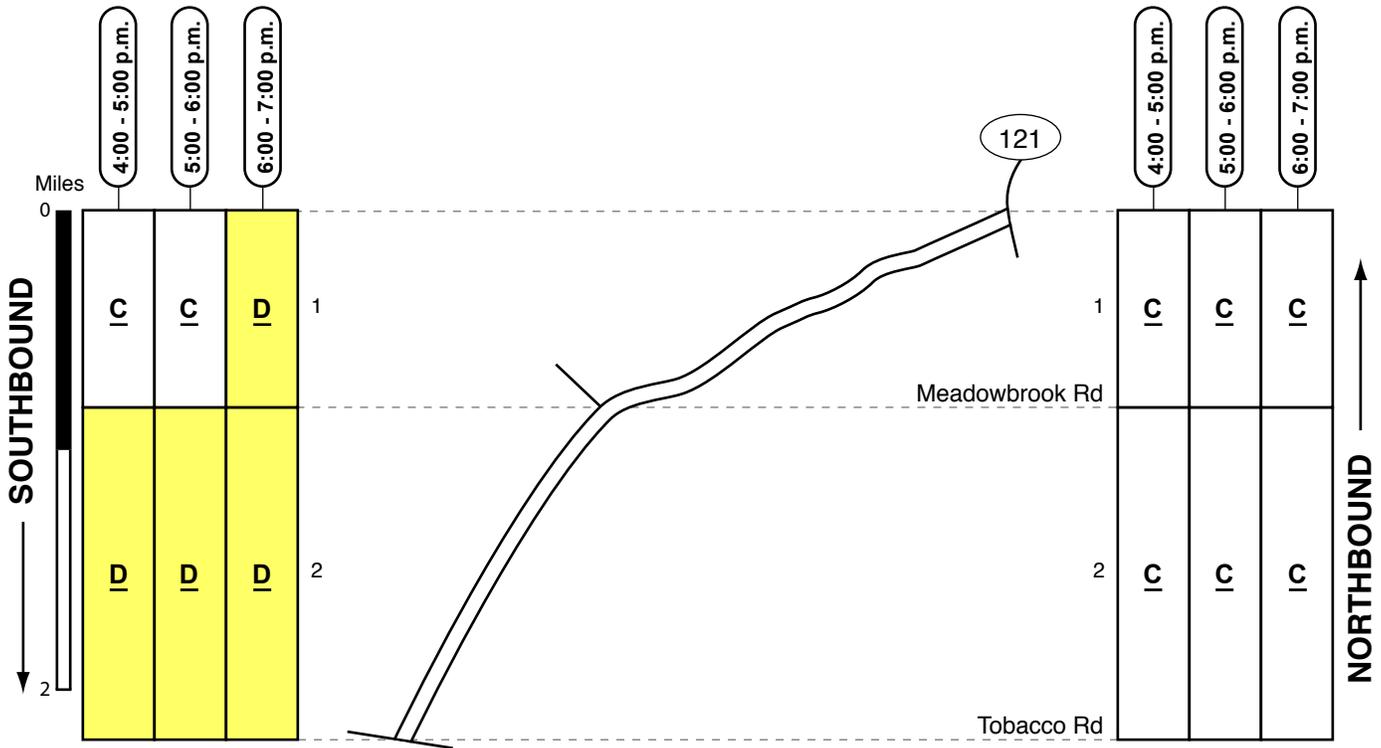
CR 65 (Windsor Spring Rd) - Morning



Traffic Quality Rating



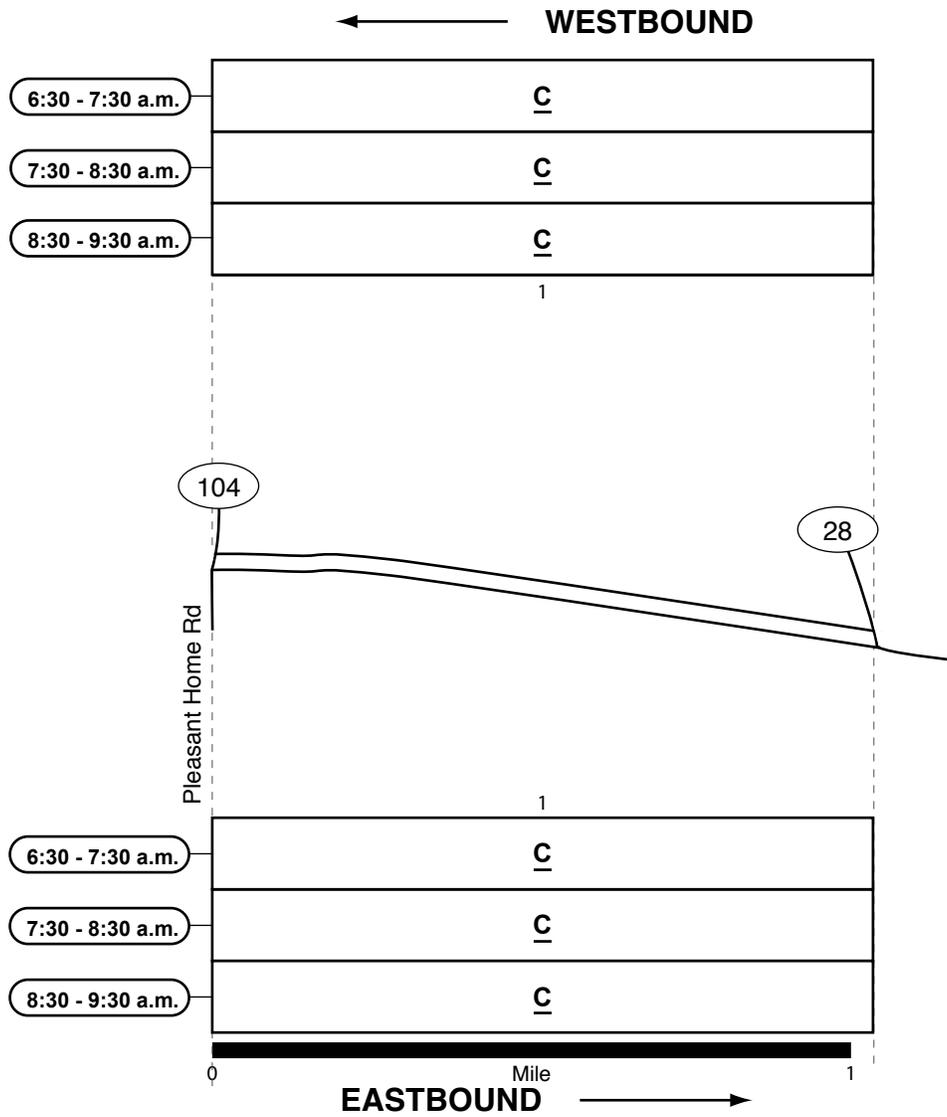
CR 65 (Windsor Spring Rd) - Evening



Traffic Quality Rating



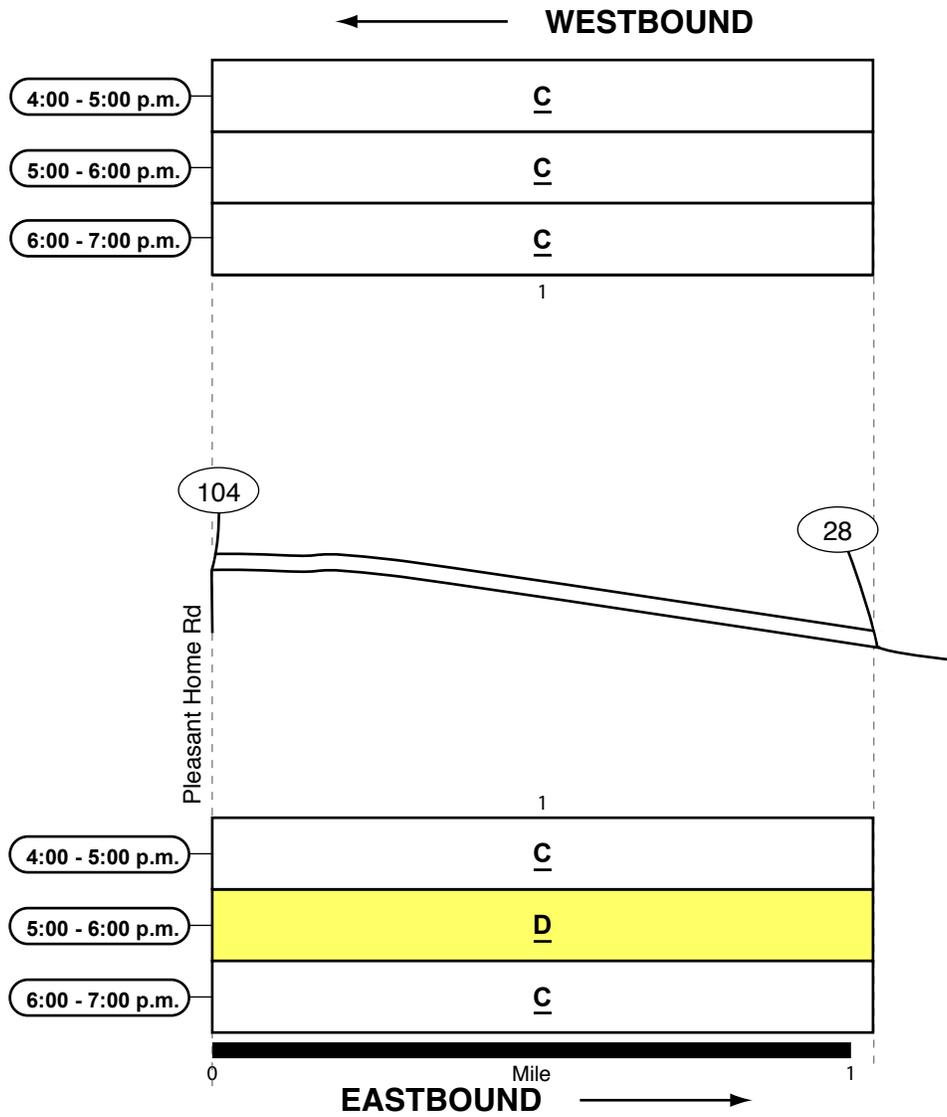
SR 104 Connector - Morning



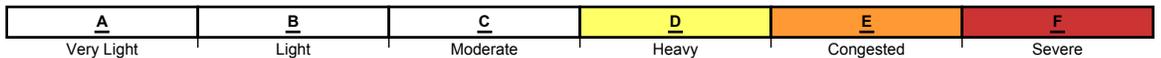
Traffic Quality Rating



SR 104 Connector - Evening



Traffic Quality Rating

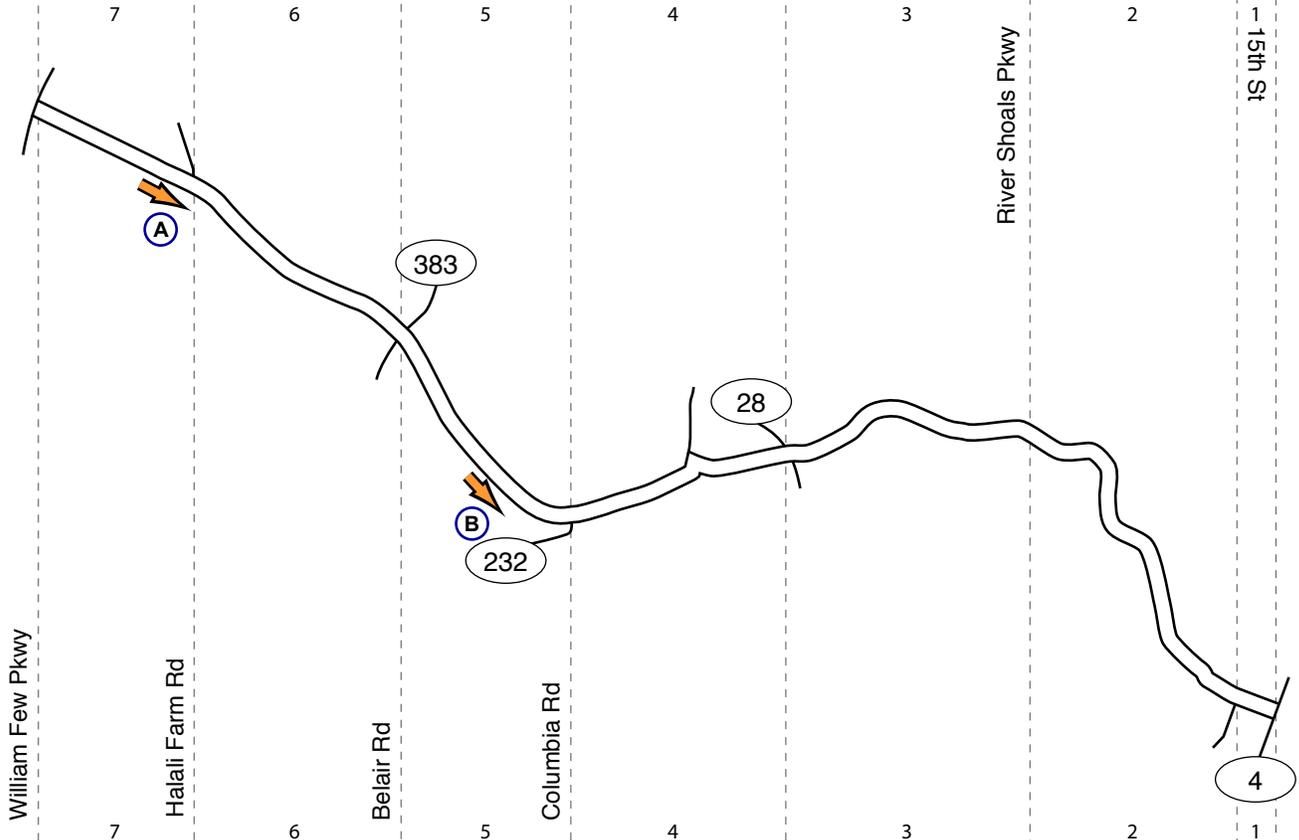




SR 104 (Washington Rd / Riverwatch Pkwy) - Morning

← WESTBOUND

6:30 - 7:30 a.m.	D	C	C	C	C	A	B
7:30 - 8:30 a.m.	C	C	C	C	C	A	B
8:30 - 9:30 a.m.	C	C	C	D	C	A	B

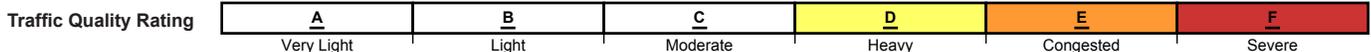


6:30 - 7:30 a.m.	E	D	E	D	C	A	B
7:30 - 8:30 a.m.	E	D	E	D	D	B	C
8:30 - 9:30 a.m.	D	C	D	D	C	A	C

0 Miles 5
EASTBOUND →

A
Congestion Type: Platoons
Location: Between William Few Pkwy & Halali Farm Rd
Frequency: Most Observations
Direction: Eastbound
Platoon Population: 25 to 40 vpl
Number of Lanes: 1

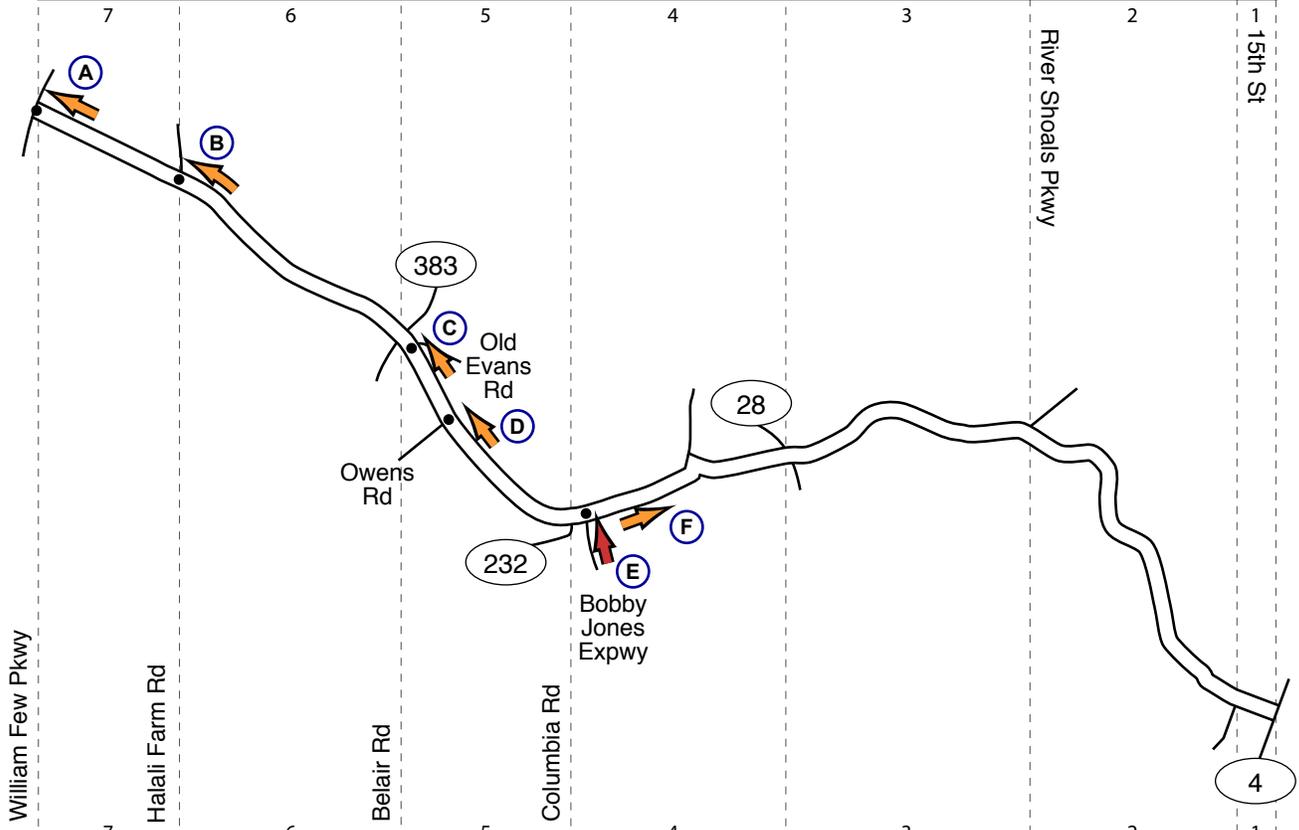
B
Congestion Type: Platoons
Location: Between SR 383 & SR 232
Frequency: Intermittent
Direction: Eastbound
Platoon Population: 25 to 30 vpl
Number of Lanes: 2



SR 104 (Washington Rd / Riverwatch Pkwy) - Evening

← WESTBOUND

4:00 - 5:00 p.m.	<u>E</u>	<u>D</u>	<u>E</u>	<u>D</u>	<u>C</u>	<u>B</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>E</u>	<u>E</u>	<u>E</u>	<u>D</u>	<u>D</u>	<u>B</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>D</u>	<u>E</u>	<u>D</u>	<u>D</u>	<u>C</u>	<u>A</u>	<u>B</u>



4:00 - 5:00 p.m.	<u>D</u>	<u>C</u>	<u>D</u>	<u>D</u>	<u>C</u>	<u>A</u>	<u>B</u>
5:00 - 6:00 p.m.	<u>D</u>	<u>D</u>	<u>D</u>	<u>E</u>	<u>C</u>	<u>A</u>	<u>B</u>
6:00 - 7:00 p.m.	<u>D</u>	<u>D</u>	<u>D</u>	<u>D</u>	<u>C</u>	<u>A</u>	<u>B</u>



Traffic Quality Rating

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
Very Light	Light	Moderate	Heavy	Congested	Severe

SR 104 (Washington Rd / Riverwatch Pkwy) - Evening

A
 Congestion Type: Mainline Signal Queue/Platoons
 Location: William Few Pkwy
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1

B
 Congestion Type: Mainline Signal Queue/Platoons
 Location: Halali Farm Rd
 Frequency: Most Observations
 Direction: Westbound
 Platoon Population: 25 to 35 vpl
 Number of Lanes: 2

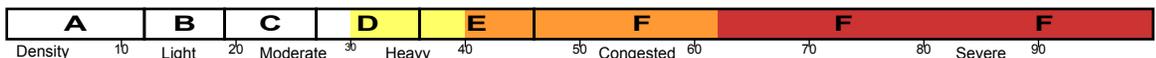
C
 Congestion Type: Mainline Signal Queue
 Location: Old Evans Rd
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2
 Note: During one observation, approximately 60 vehicles per lane were queued at the signal.

D
 Congestion Type: Mainline Signal Queue
 Location: Owens Rd
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

E
 Congestion Type: Cross Road Signal Queue
 Location: Bobby Jones Expwy
 Frequency: Peak Hour
 Direction: Northbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 2
 Note: Northbound congestion was typically found in the two dedicated left-turn lanes and the one thru-lane.

F
 Congestion Type: Platoons
 Location: Between Bobby Jones Expwy & SR 28
 Frequency: Intermittent
 Direction: Eastbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

Traffic Quality Rating



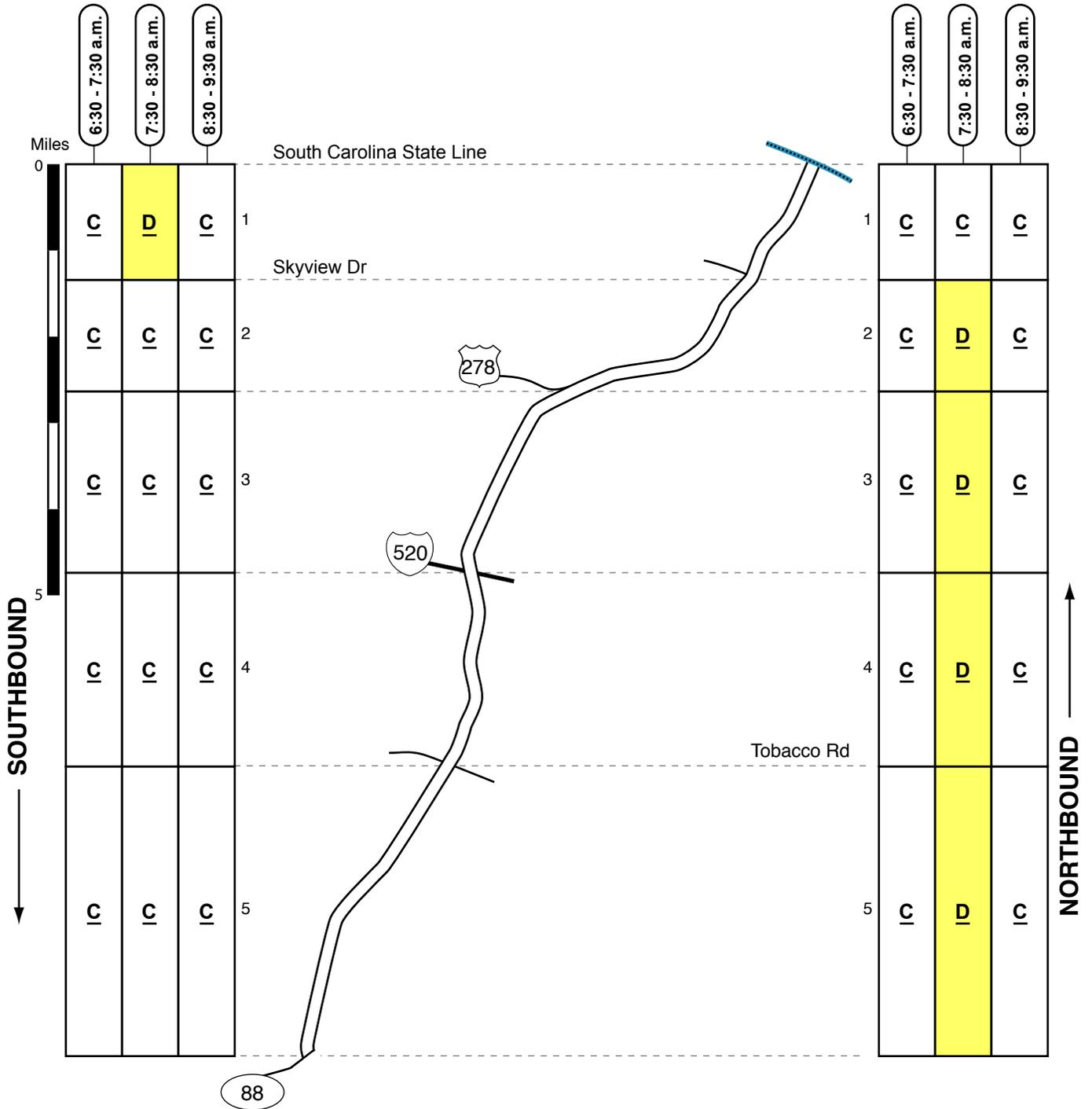
Superscripts: ¹ Type 1 nested congestion (some days, not others).

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).

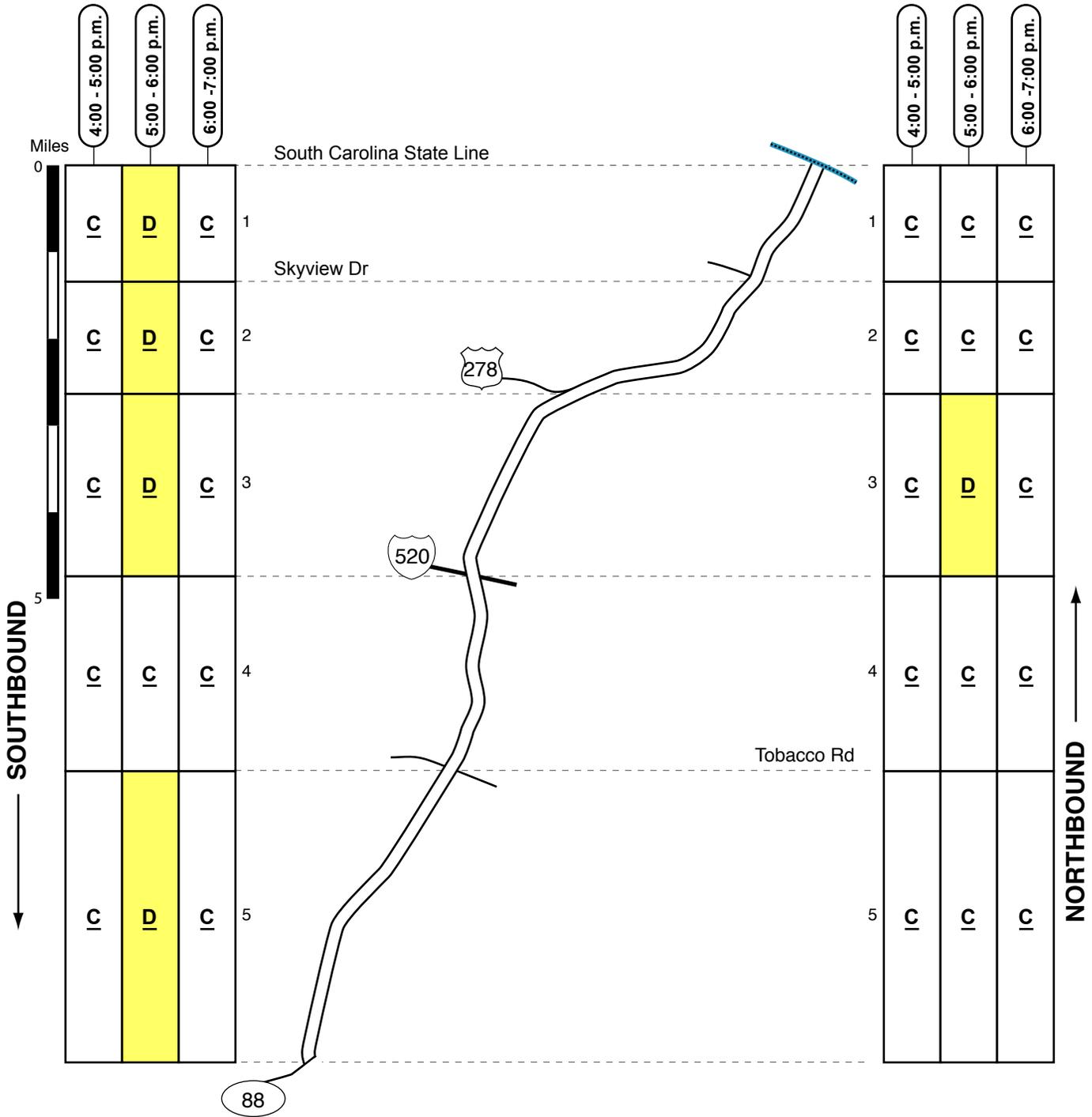
SR 121 - Morning



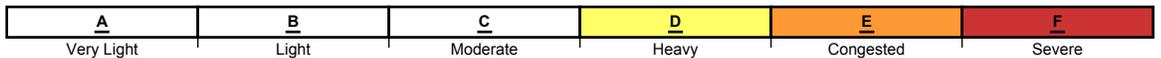
Traffic Quality Rating



SR 121 - Evening

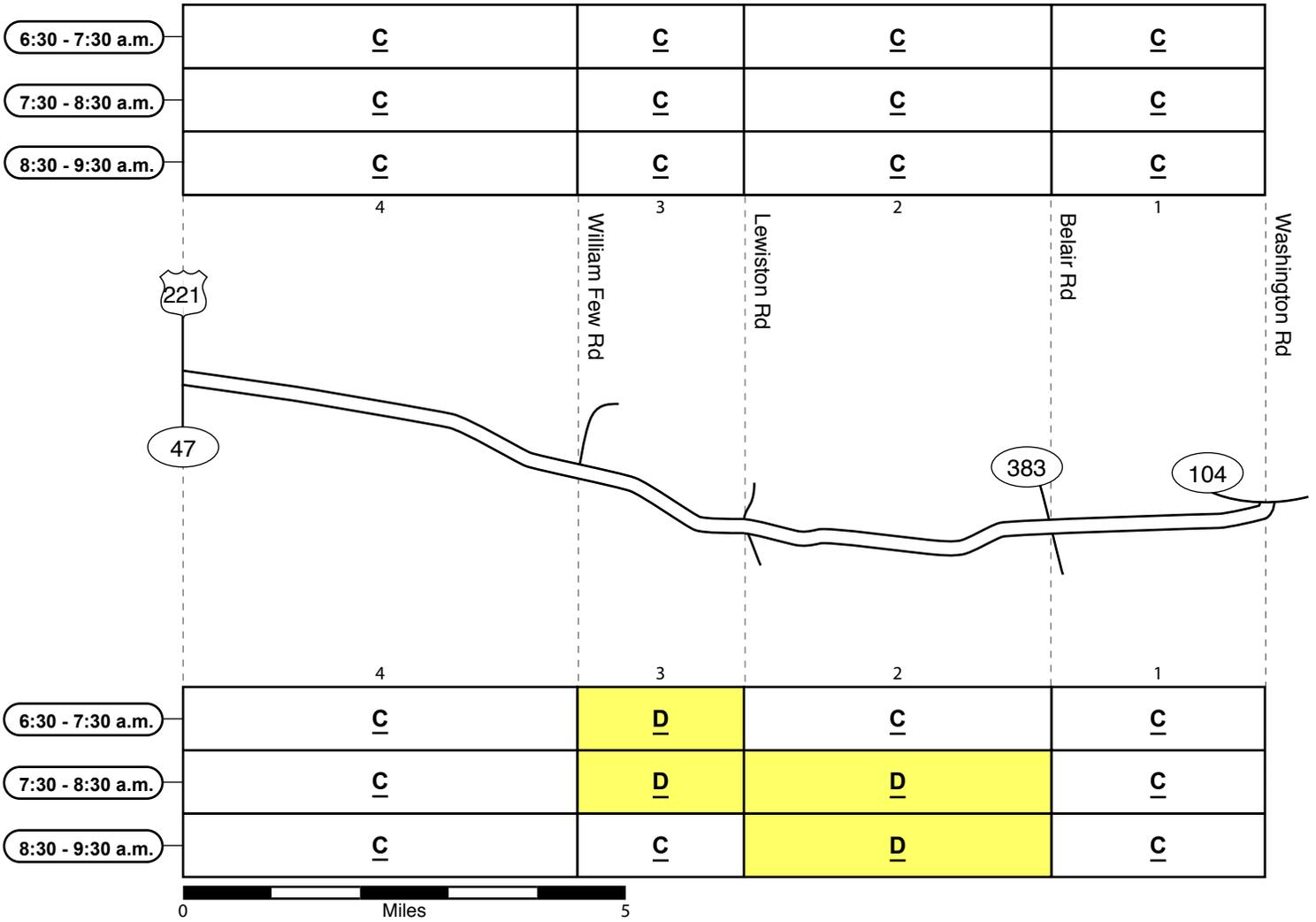


Traffic Quality Rating



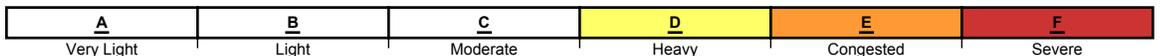
SR 232 (Columbia Rd) - Morning

← WESTBOUND



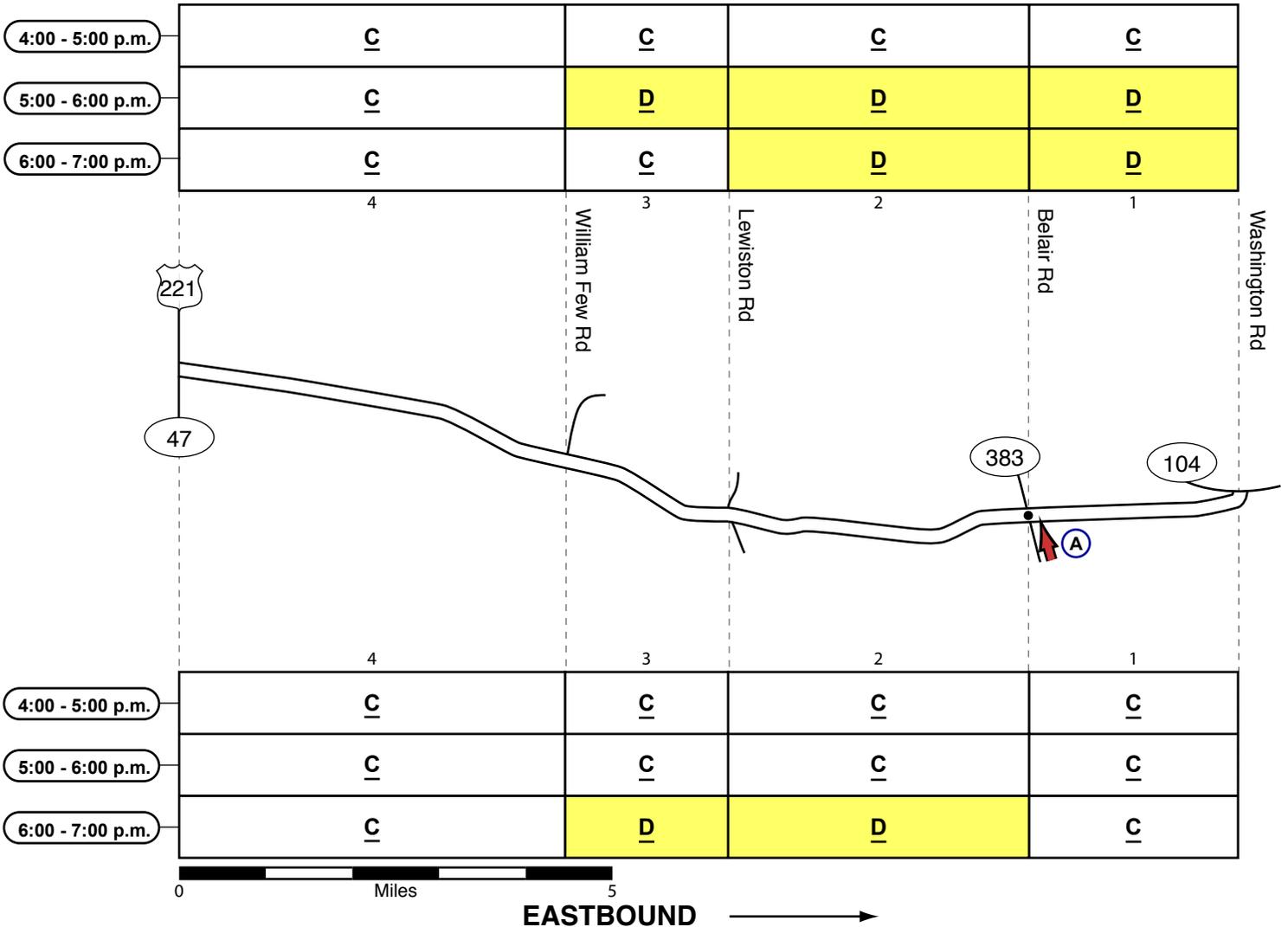
EASTBOUND →

Traffic Quality Rating

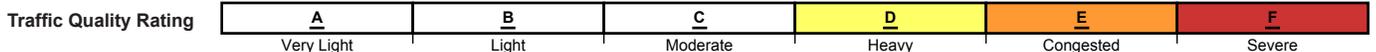


SR 232 (Columbia Rd) - Evening

← WESTBOUND

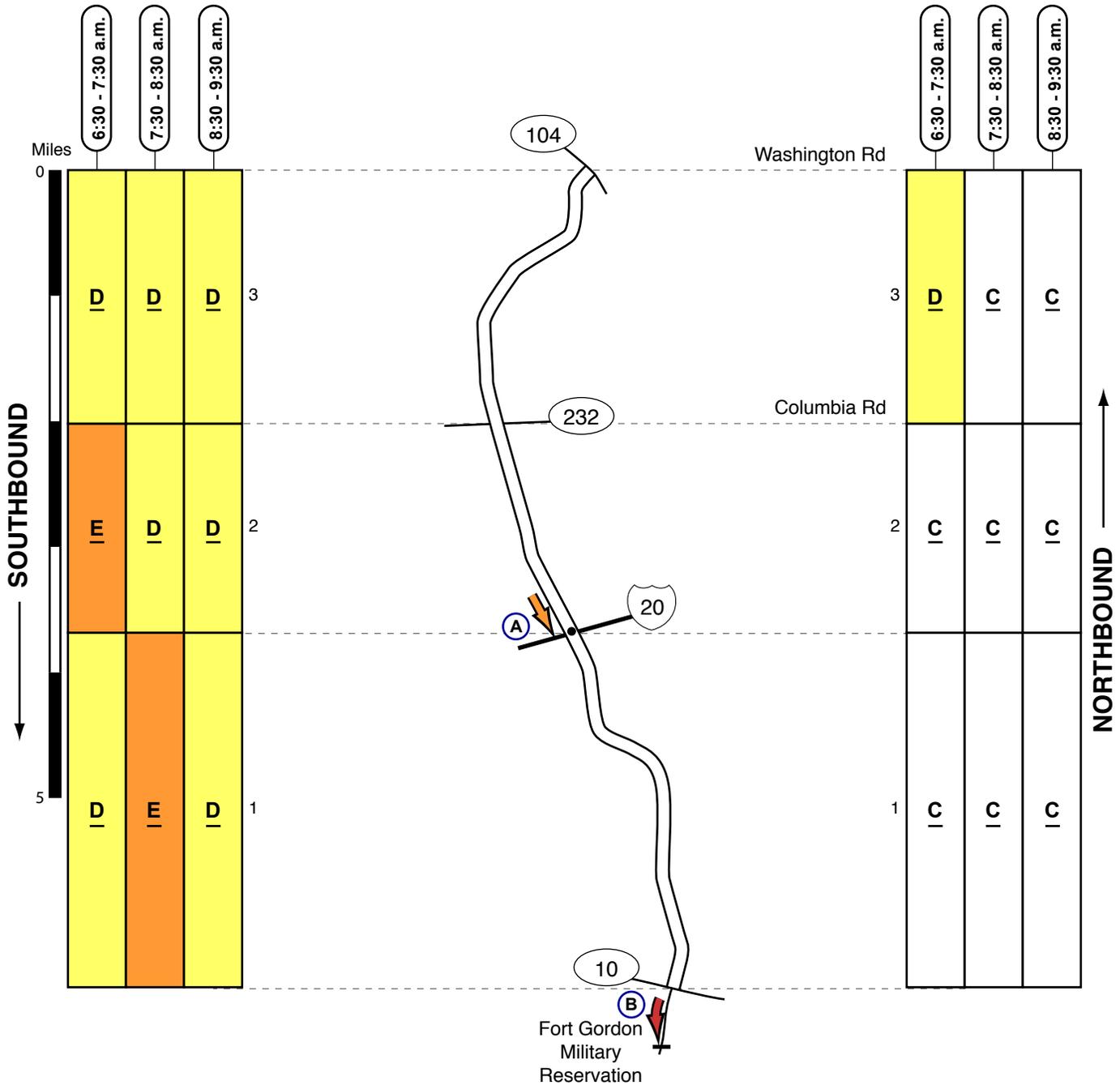


A
 Congestion Type: Surveyed Cross Road Signal Queue
 Location: SR 383 (Belair Rd)
 Frequency: Peak Hour
 Direction: Northbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

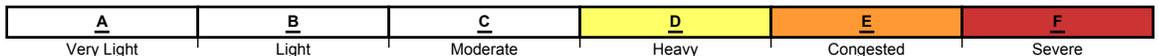




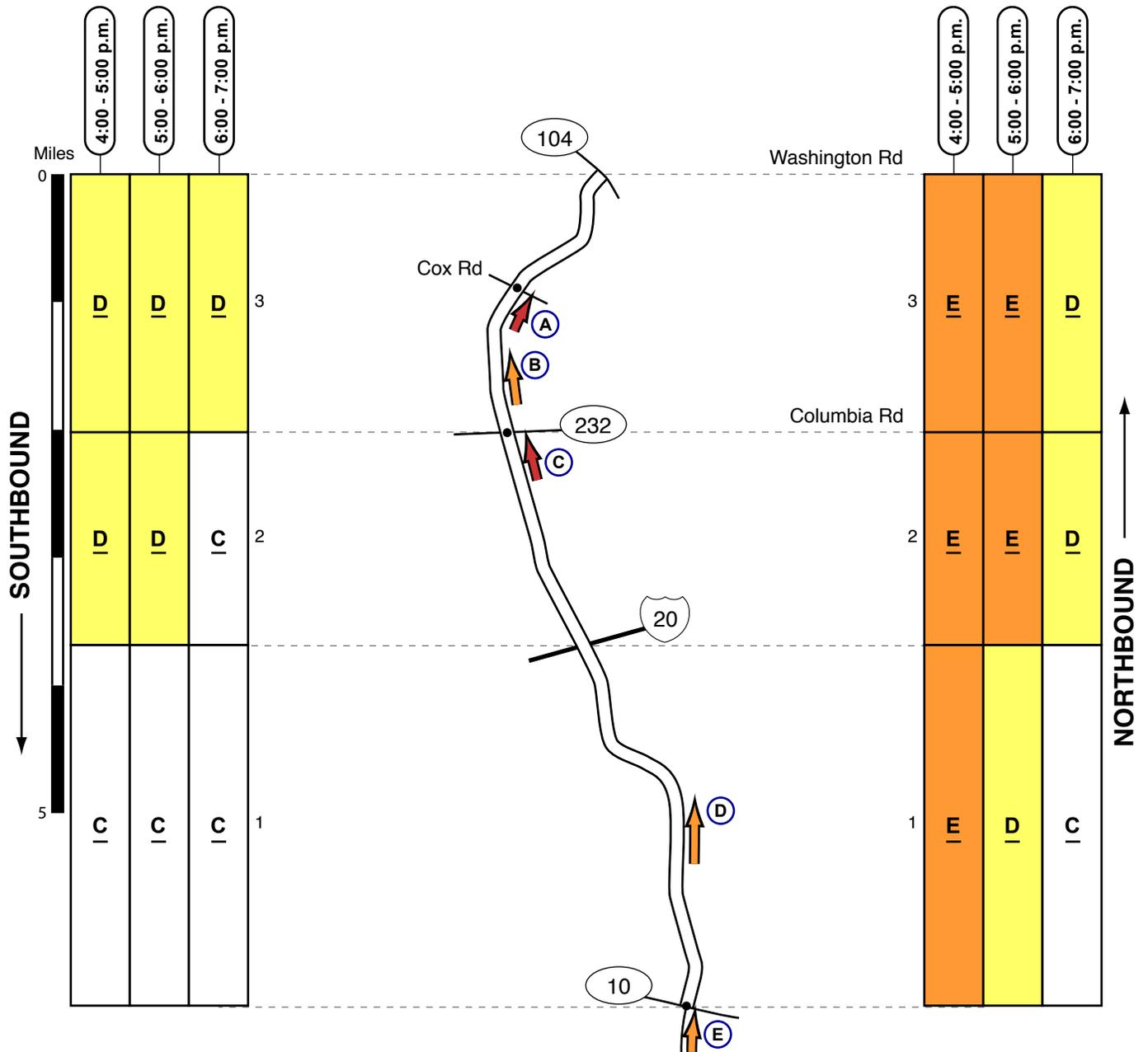
SR 383 (Belair Rd / Jimmy Dyess Pkwy) - Morning



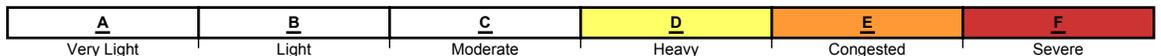
Traffic Quality Rating



SR 383 (Belair Rd / Jimmy Dyess Pkwy) - Evening



Traffic Quality Rating



SR 383 (Belair Rd / Jimmy Dyess Pkwy) - Evening

A

Congestion Type: Left-Turn Queue
Location: Cox Rd
Frequency: Peak Hour
Direction: Northbound
Queue Population: 20 to 30 vpl
Number of Lanes: 1

B

Congestion Type: Platoons
Location: Between SR 232 & Cox Rd
Frequency: Intermittent
Direction: Northbound
Platoon Population: 25 to 35 vpl
Number of Lanes: 2

C

Congestion Type: Mainline Signal Queue
Location: SR 232 (Columbia Rd)
Frequency: Peak Hour
Direction: Northbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2

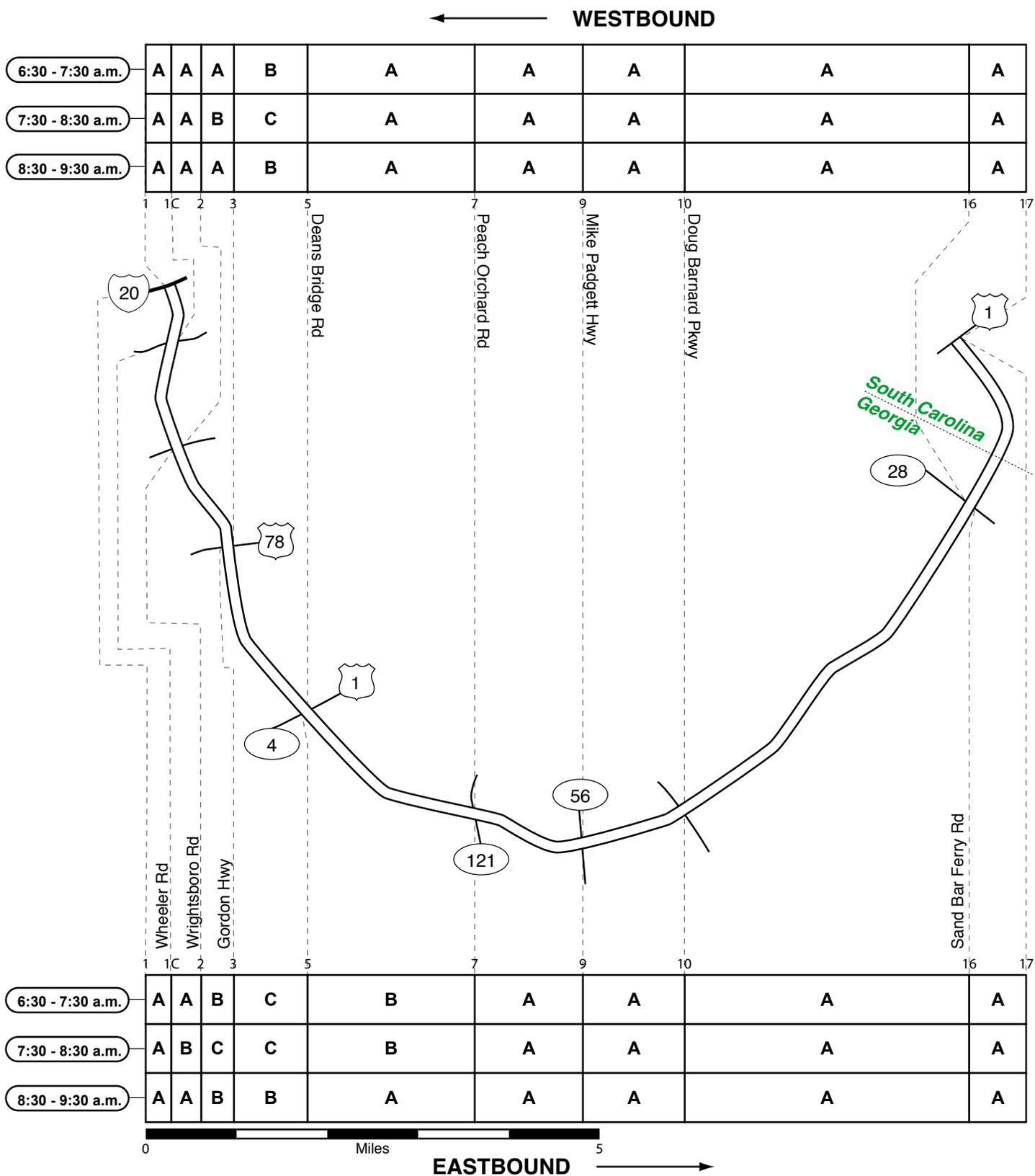
D

Congestion Type: Platoons
Location: Between SR 10 & I-20
Frequency: Intermittent
Direction: Northbound
Platoon Population: 25 to 30 vpl
Number of Lanes: 2

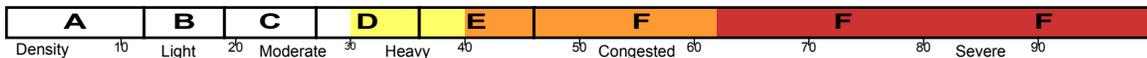
E

Congestion Type: Mainline Signal Queue
Location: SR 10
Frequency: Intermittent
Direction: Northbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2

I-520 - Morning



Traffic Quality Rating



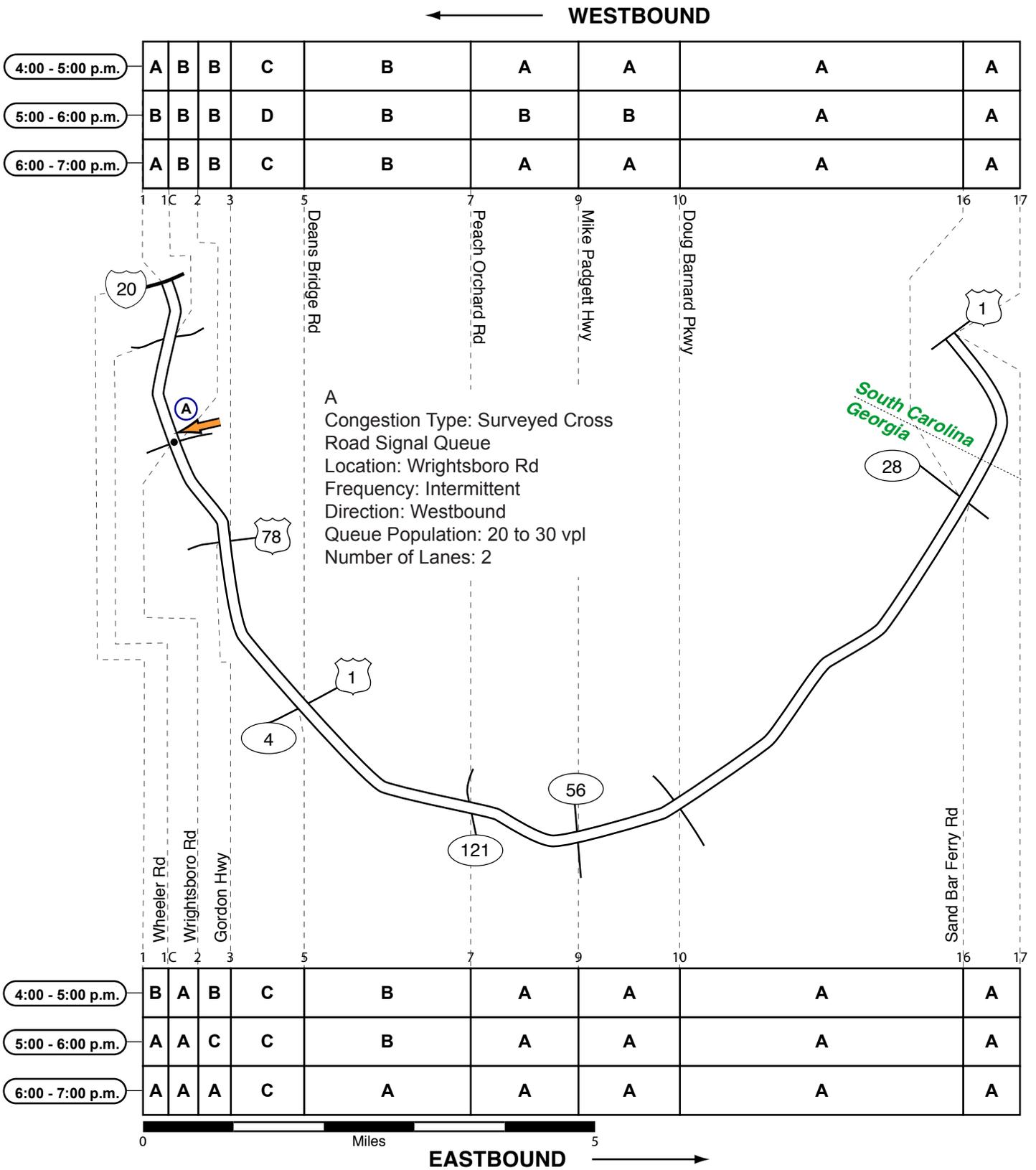
Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

I-520 - Evening



Traffic Quality Rating



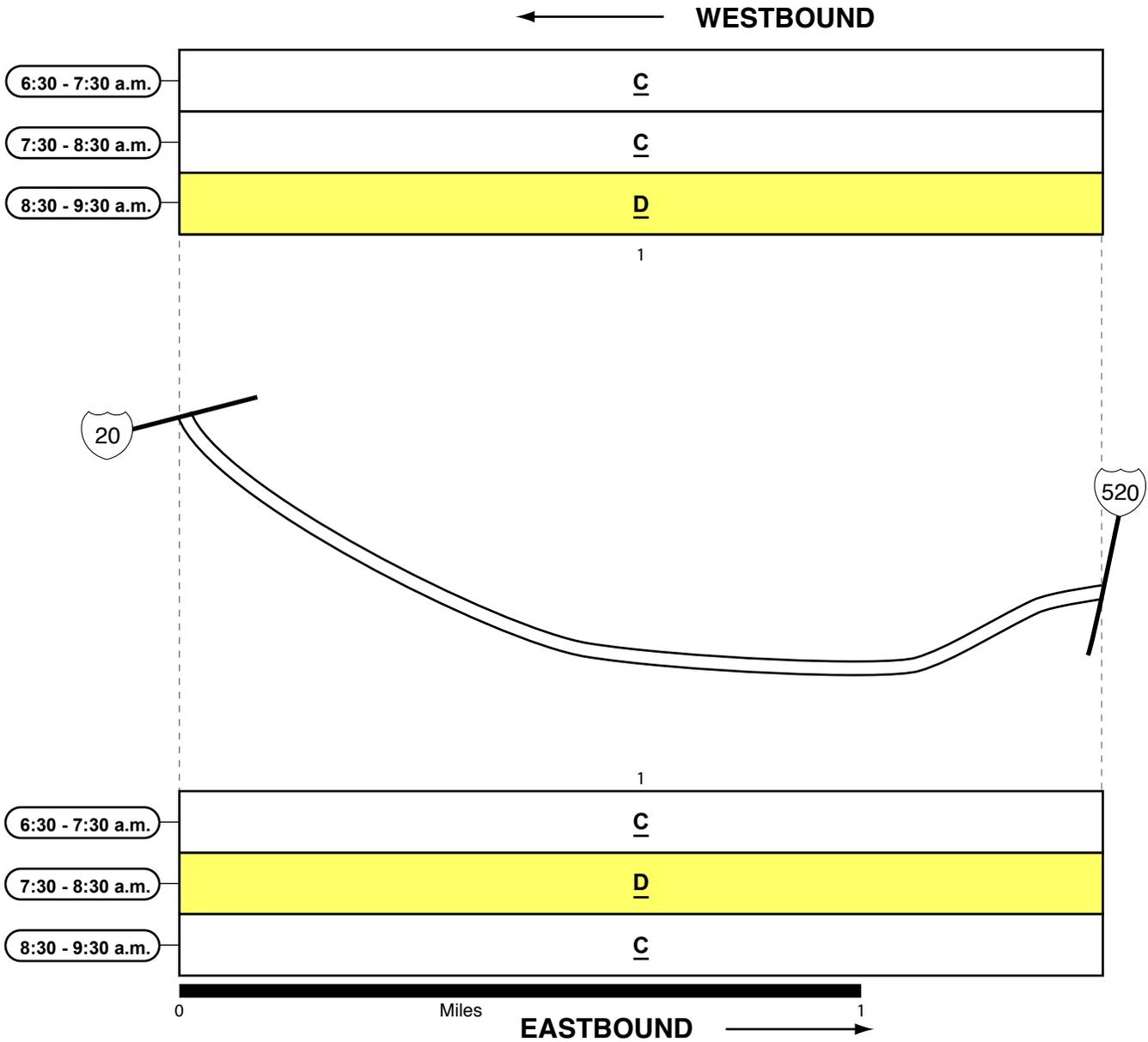
Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

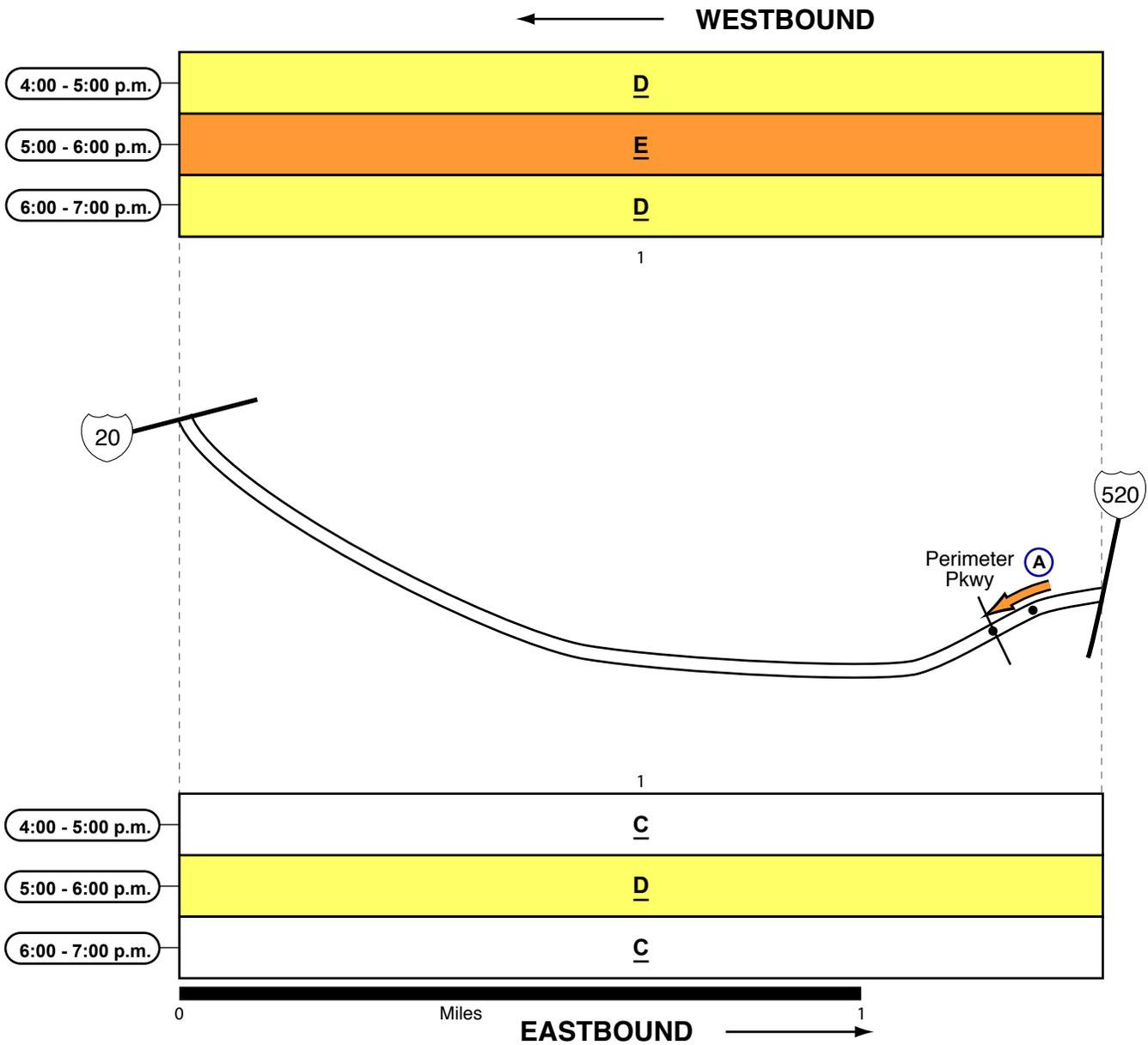
CR 601 (Wheeler Rd) - Morning



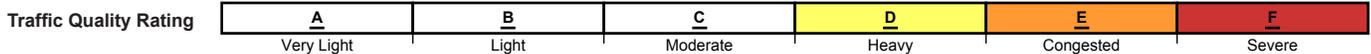
Traffic Quality Rating



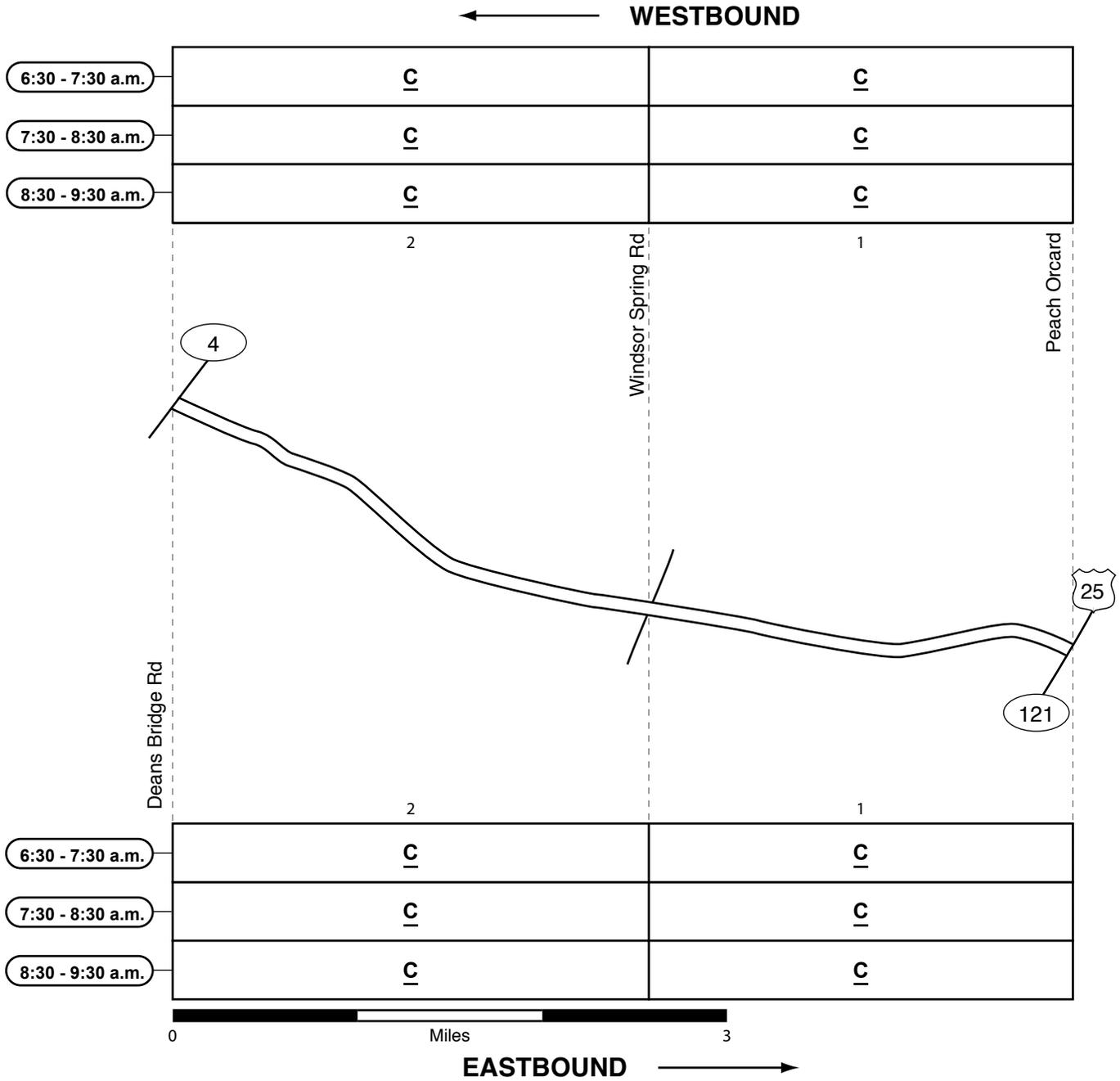
CR 601 (Wheeler Rd) - Evening



A
 Congestion Type: Mainline Signal Queue/Platoons
 Location: Perimeter Pkwy
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 25 to 30 vpl
 Number of Lanes: 2



CR 1503 (Tobacco Rd) - Morning

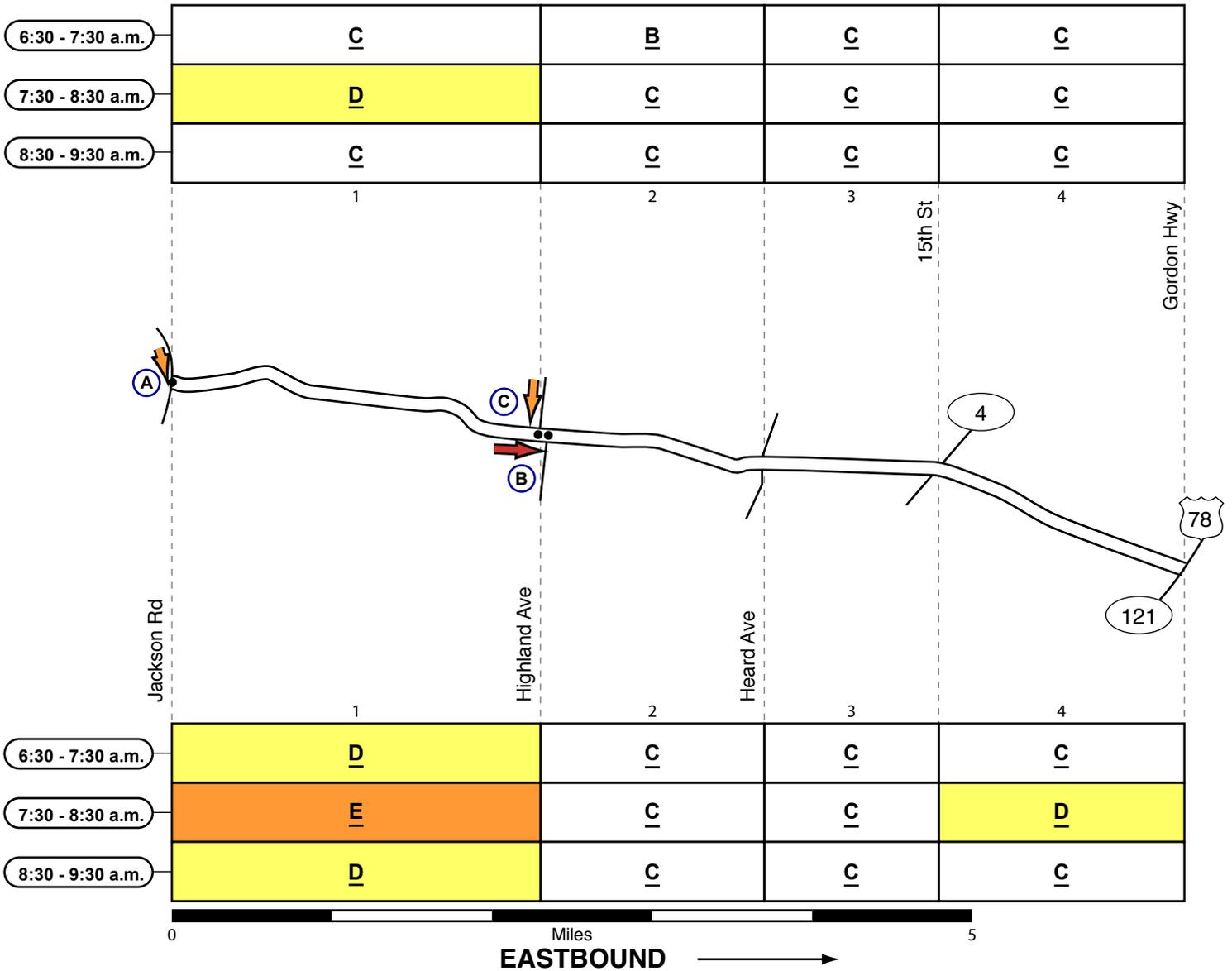


Traffic Quality Rating



CR 1507 (Walton Way) - Morning

← WESTBOUND



A
 Congestion Type: Cross Road Signal Queue
 Location: Jackson Rd
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1
 Note: When congested, vehicles were queued in the dedicated left turn lane waiting to turn eastbound on Walton Way.

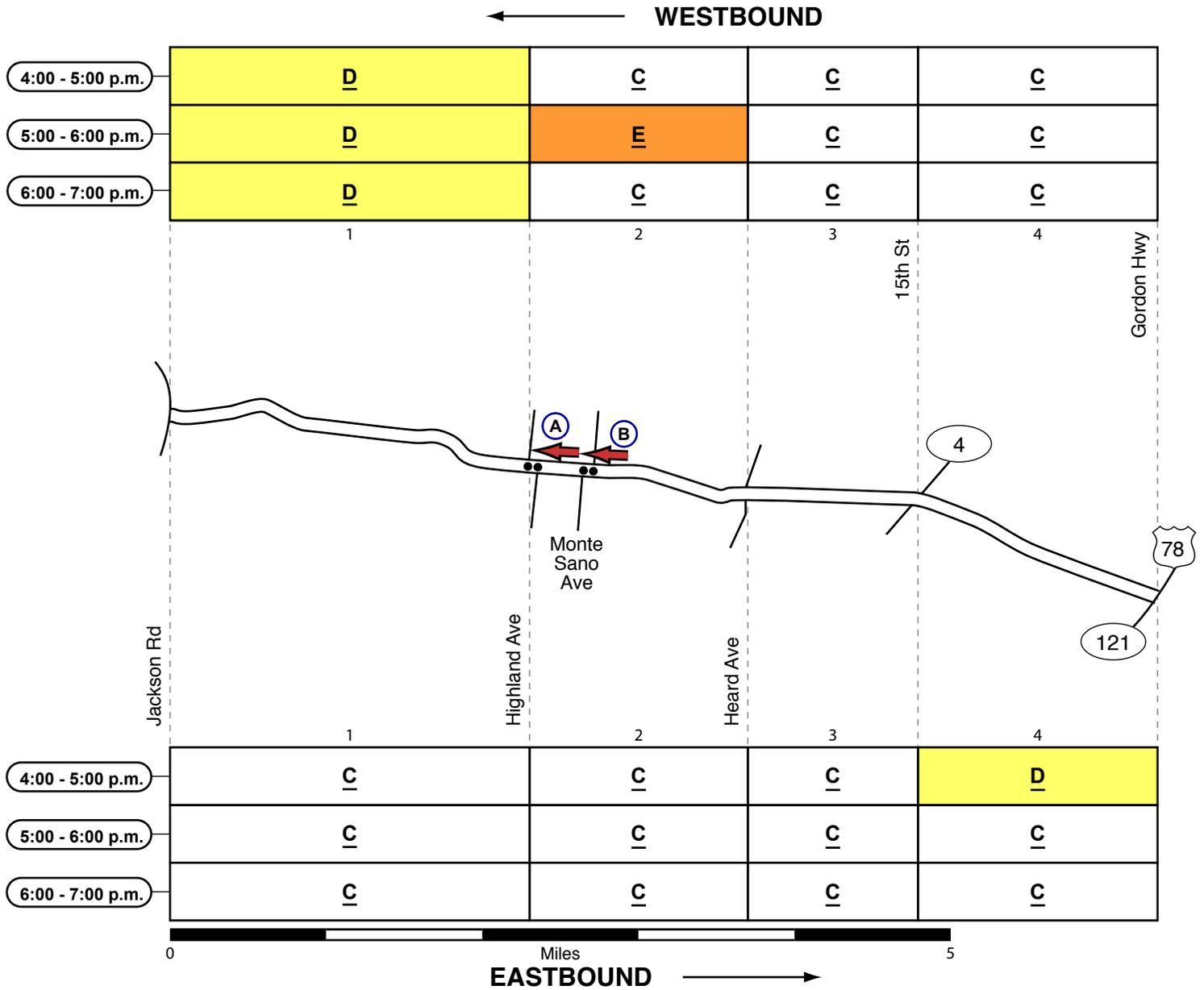
B
 Congestion Type: Mainline Signal Queue
 Location: Highland Ave
 Frequency: Peak Hour
 Direction: Eastbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

C
 Congestion Type: Cross Road Signal Queue
 Location: Highland Ave
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1

Traffic Quality Rating



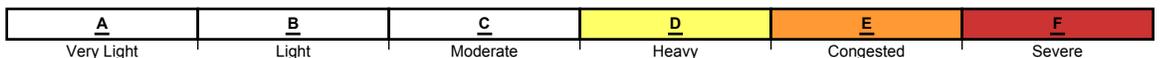
CR 1507 (Walton Way) - Evening



A
 Congestion Type: Mainline Signal Queue
 Location: Highland Ave
 Frequency: Peak Hour
 Direction: Westbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 1
 Note: During some observations, congestion extended back through the upstream signal at Monte Sano Ave.

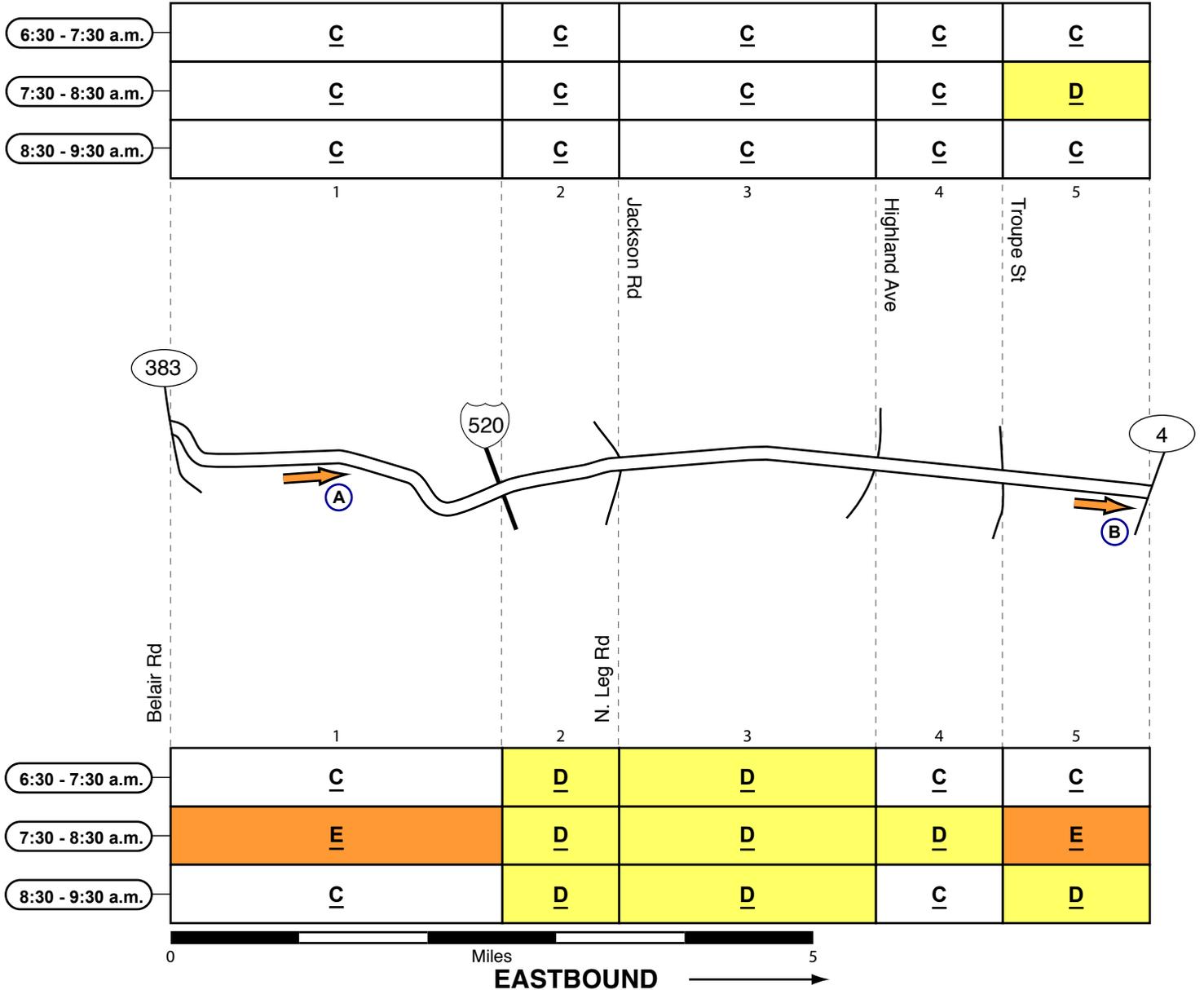
B
 Congestion Type: Mainline Signal Queue
 Location: Monte Sano Ave
 Frequency: Peak Hour
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1
 Note: During some observations, downstream congestion (signal queue at Highland Ave) appeared to exacerbate congestion at Monte Sano Ave.

Traffic Quality Rating



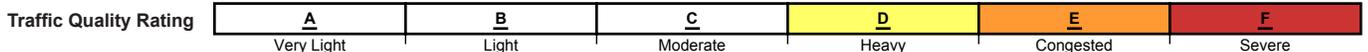
Wrightsboro Rd - Morning

← WESTBOUND



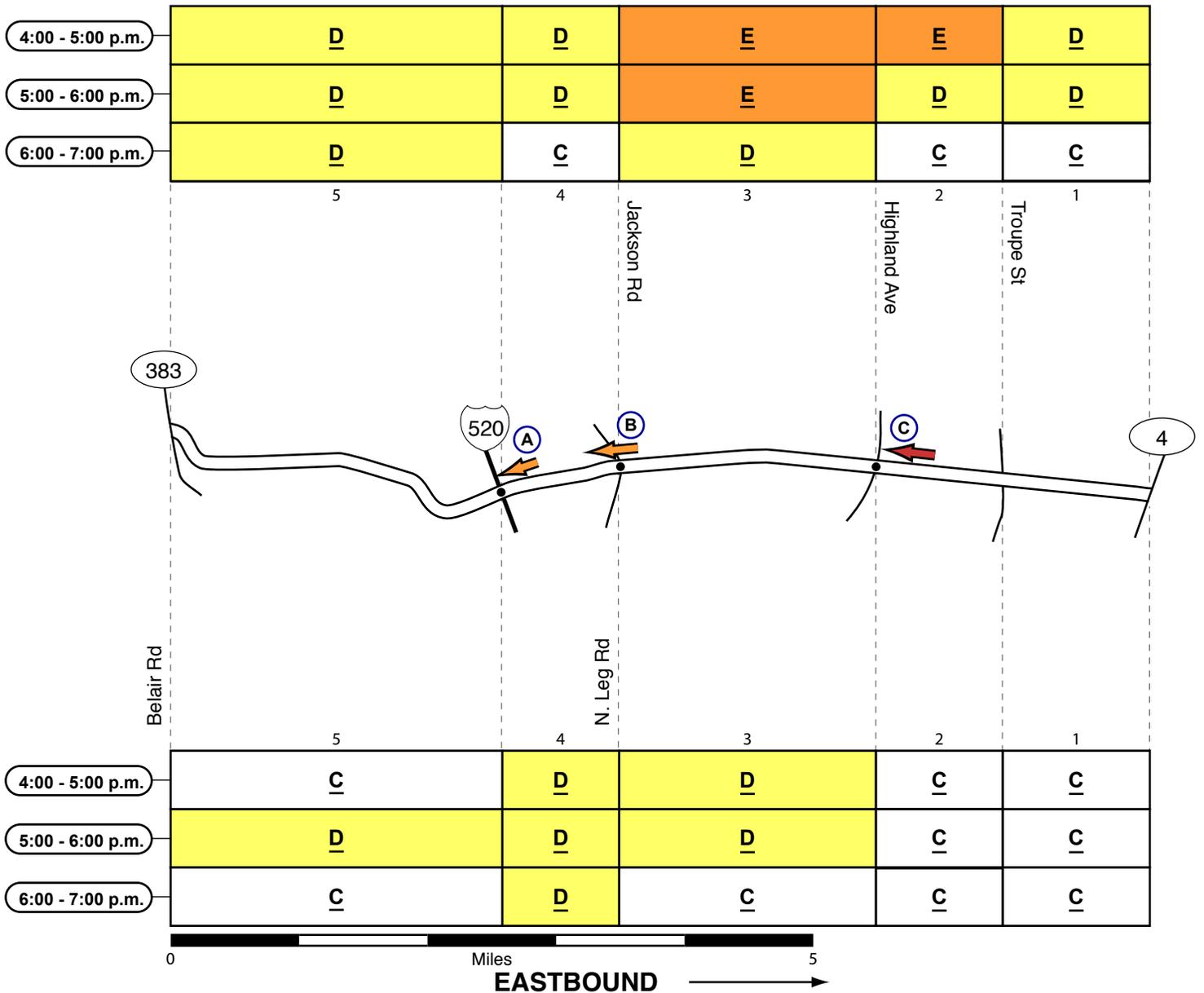
A
 Congestion Type: Platoons
 Location: Between SR 383 & I-520
 Frequency: Intermittent
 Direction: Eastbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 1

B
 Congestion Type: Platoons
 Location: Between Troupe St & SR 4
 Frequency: Intermittent
 Direction: Eastbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 1



Wrightsboro Rd - Evening

← WESTBOUND

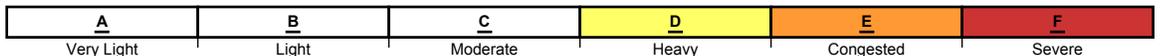


A
 Congestion Type: Mainline Signal Queue
 Location: I-520
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

B
 Congestion Type: Platoons
 Location: Vicinity of Jackson Rd
 Frequency: Intermittent
 Direction: Westbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

C
 Congestion Type: Mainline Signal Queue/Platoons
 Location: Highland Ave
 Frequency: Most Observations
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1

Traffic Quality Rating





COLUMBUS

HIGHWAY TRAFFIC QUALITY

FALL 2010

Columbus, GA (Surveyed Highways)

Fall 2010

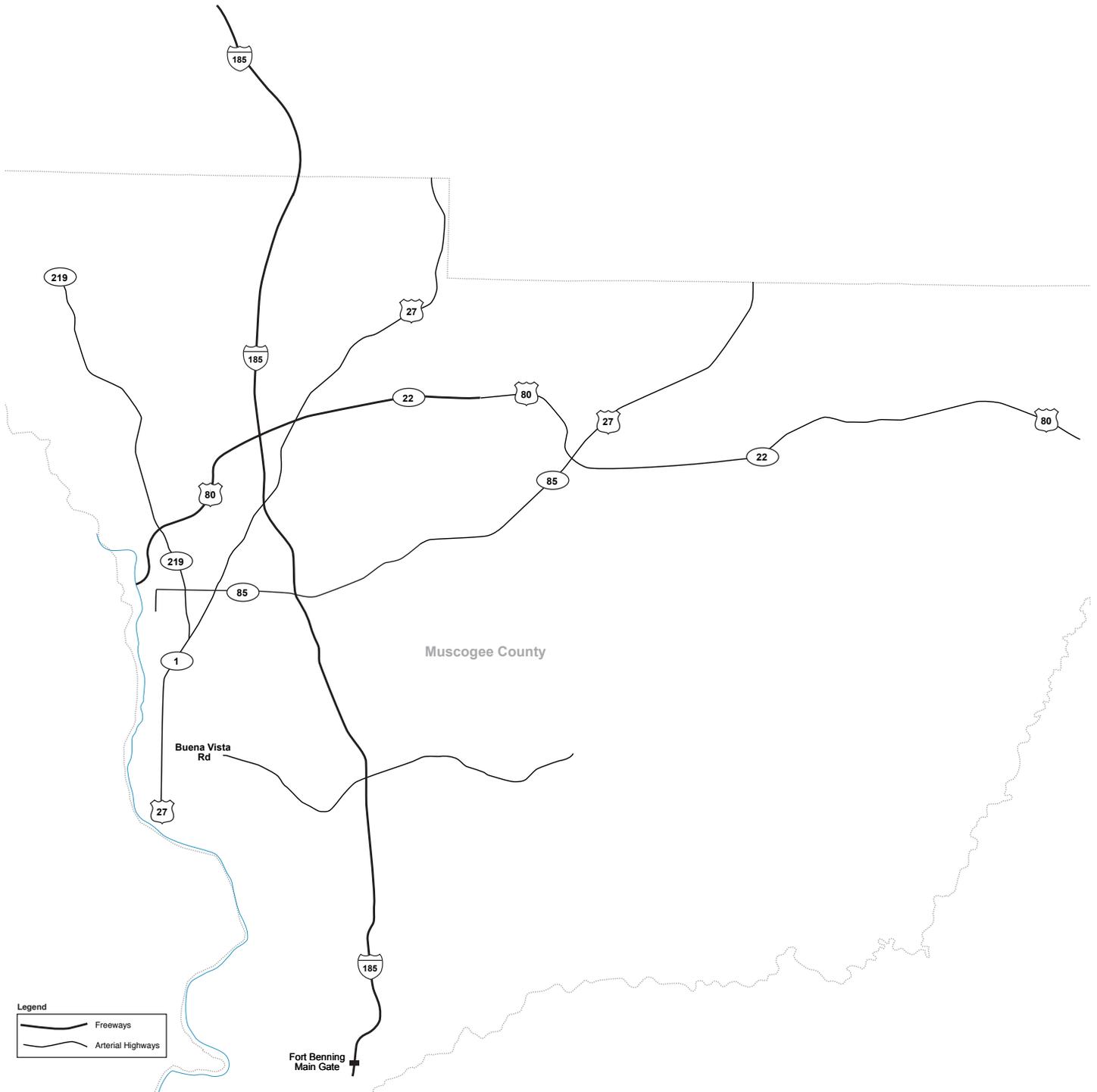


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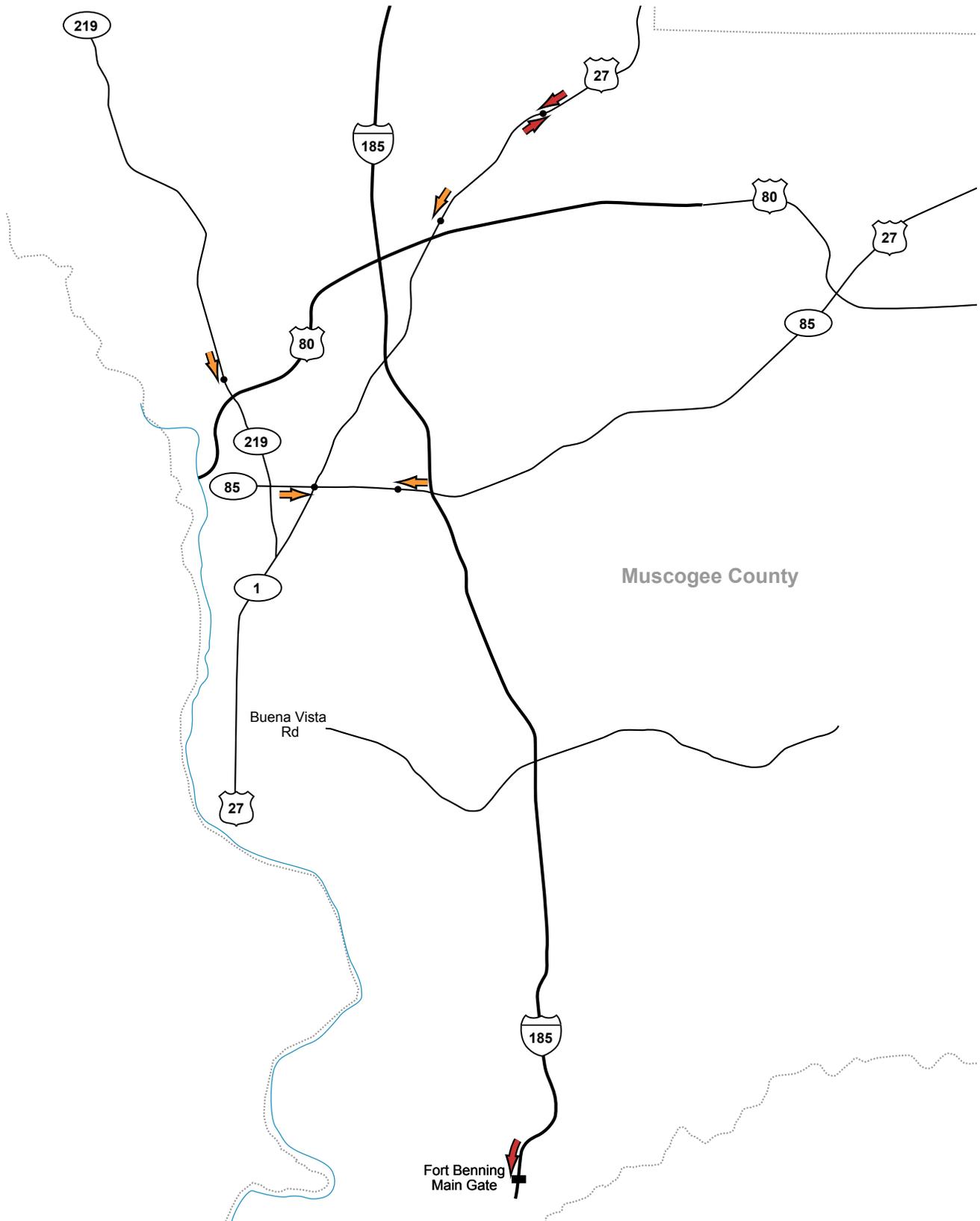
Surveyed Highways.....	C-2
Morning and Evening Regional Congestion Maps	C-4

PERFORMANCE RATINGS

SR 1 / US 27.....	C-6
SR 22 / US 80.....	C-10
SR 85 / US 27.....	C-12
I-185	C-14
SR 219 (Freeman V. Horner Medal of Honor Hwy)	C-18
Buena Vista Rd.....	C-20

Columbus, GA (Locations Where Congestion Was Found)

Fall 2010 (Morning)



Freeway Legend

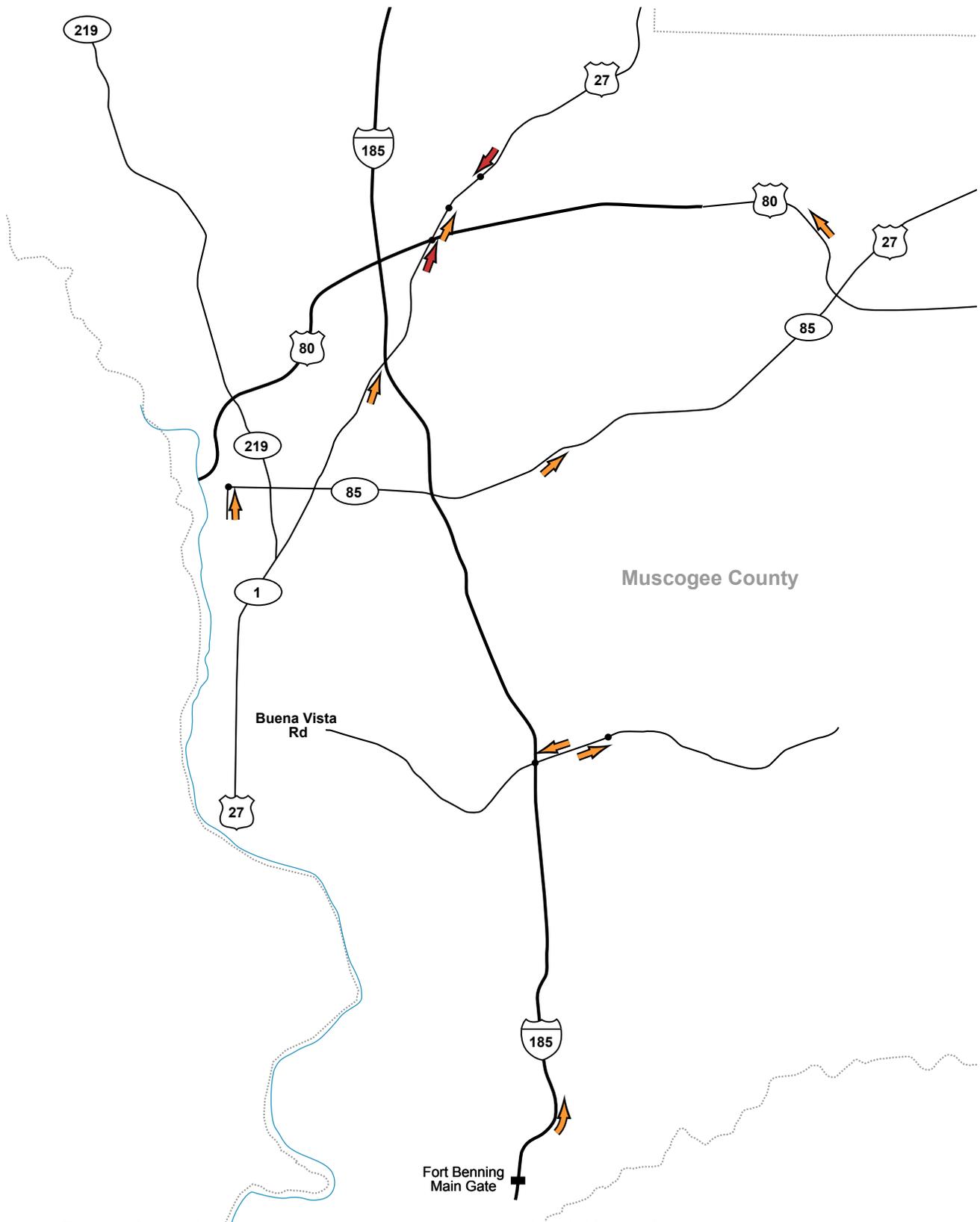
- Severe mainline congestion (<30 mph)
- Moderate or intermittent mainline congestion (30-50 mph)

Arterial Legend

- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

Columbus, GA (Locations Where Congestion Was Found)

Fall 2010 (Evening)



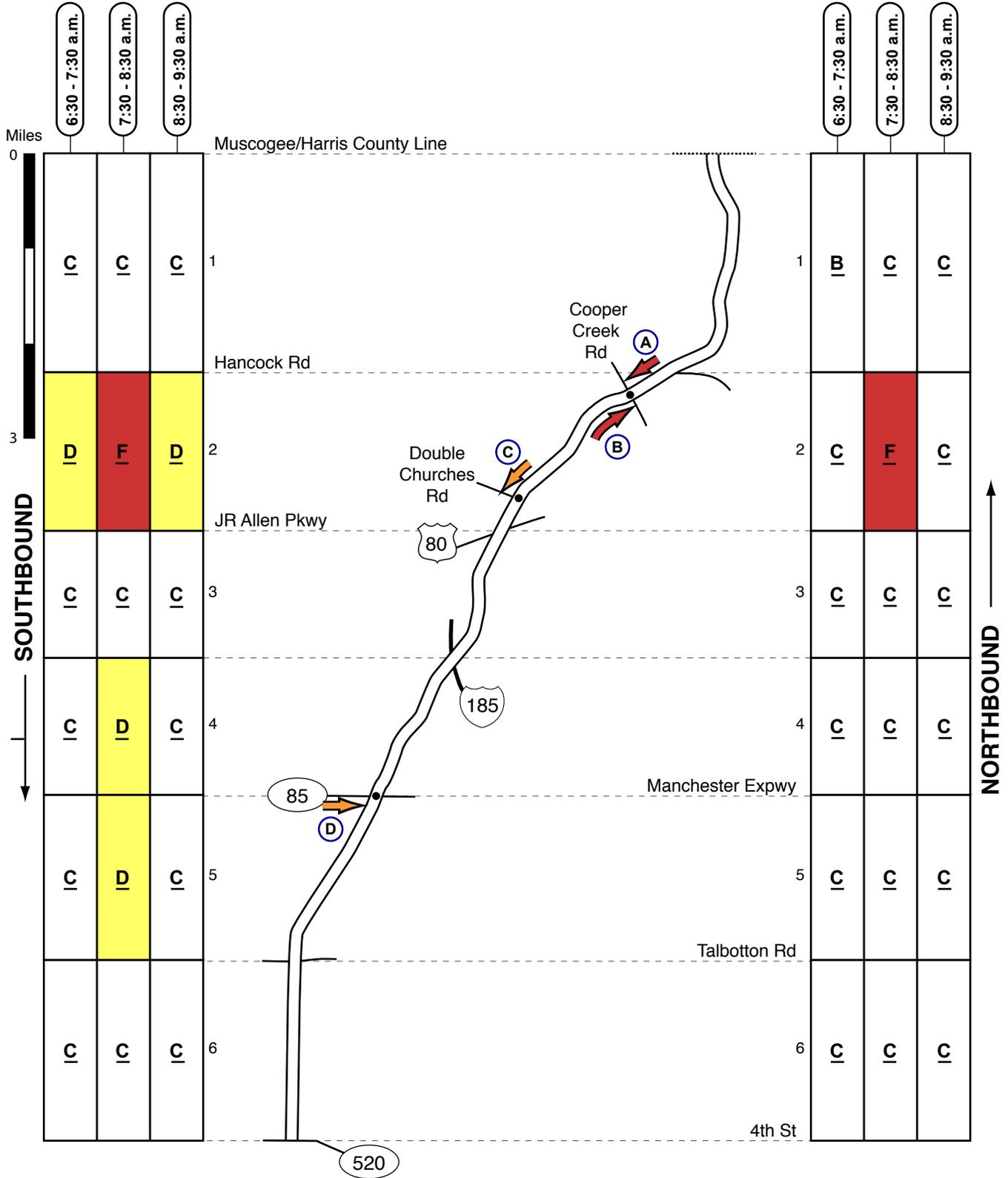
Freeway Legend

- Severe mainline congestion (<30 mph)
- Moderate or intermittent mainline congestion (30-50 mph)

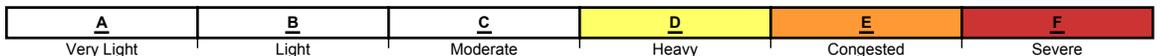
Arterial Legend

- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

SR 1 / US 27 - Morning



Traffic Quality Rating



SR 1 / US 27 - Morning

A

Congestion Type: Mainline Signal Queue
Location: Cooper Creek Rd
Frequency: Peak Hour
Direction: Southbound
Queue Population: 30 to 60 vpl
Number of Lanes: 1

B

Congestion Type: Mainline Signal Queue/Left-turn Queue
Location: Cooper Creek Rd
Frequency: Peak Hour
Direction: Northbound
Queue Population: 30 to 50 vpl
Number of Lanes: 2
Note: Congestion was typically found in both the left-turn and thru-lanes.

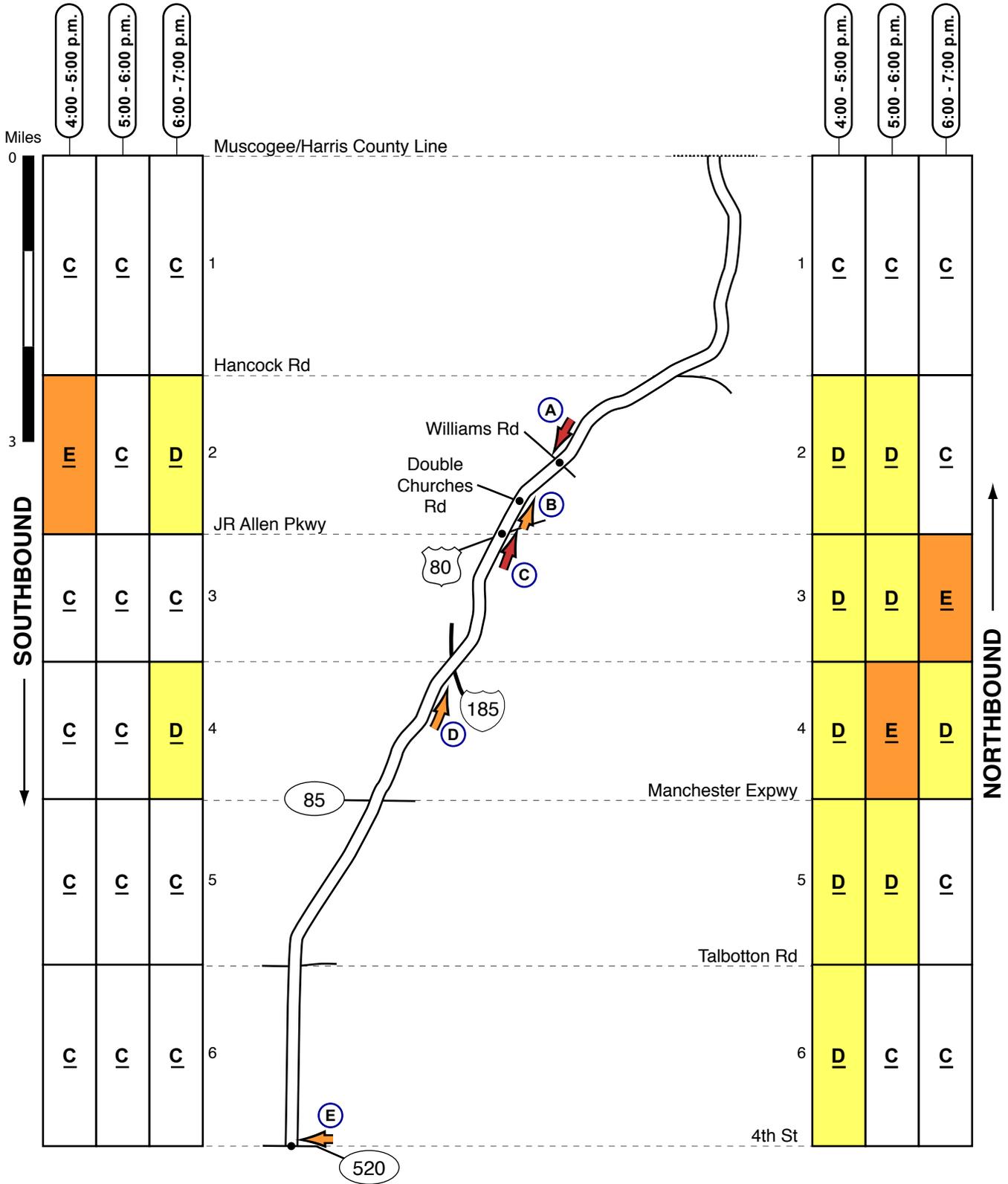
C

Congestion Type: Left-Turn Queue
Location: Double Churches Rd
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 25 vpl
Number of Lanes: 1

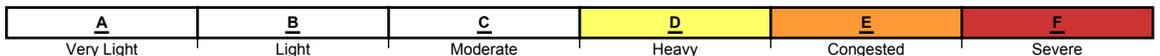
D

Congestion Type: Surveyed Cross Road Signal Queue
Location: SR 85
Frequency: Intermittent
Direction: Eastbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2

SR 1 / US 27 - Evening



Traffic Quality Rating



Fall 2010
SR 1 / US 27 - Evening

A

Congestion Type: Mainline Queue
Location: Approaching Williams Rd
Frequency: Intermittent
Direction: Southbound
Queue Population: 40 to 50 vpl
Number of Lanes: 1
Note: Factors contributing to the congestion were: 1) the signal at Williams Rd and; 2) left-turning vehicles at community entrance just north of Williams Rd.

B

Congestion Type: Left-Turn Queue
Location: Double Churches Rd
Frequency: Intermittent
Direction: Northbound
Queue Population: 20 to 25 vpl
Number of Lanes: 1

C

Congestion Type: Mainline Signal Queue
Location: US 80
Frequency: Intermittent
Direction: Northbound
Queue Population: 40 to 50 vpl
Number of Lanes: 2
Note: One some days but not others, congestion was found approaching the signal at the ramps to US 80; congestion backed through the upstream signal at the shopping center.

D

Congestion Type: Platoons
Location: Between SR 85 and I-185
Frequency: Intermittent
Direction: Northbound
Platoon Population: 25 to 30 vpl
Number of Lanes: 2

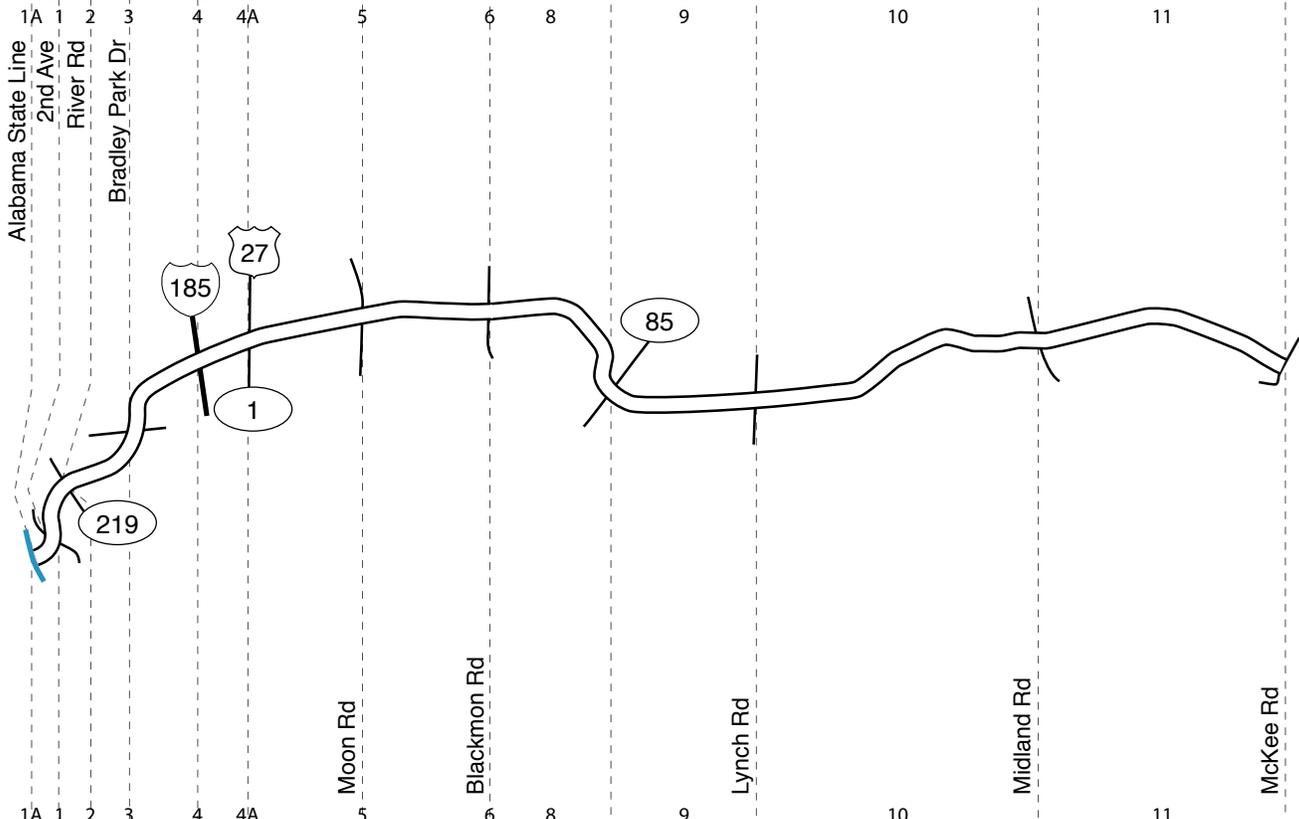
E

Congestion Type: Cross Road Signal Queue
Location: SR 520 (4th St)
Frequency: Intermittent
Direction: Westbound
Queue Population: 20 to 40 vpl
Number of Lanes: 2

SR 22 / US 80 - Morning

← WESTBOUND

6:30 - 7:30 a.m.	A	A	A	A	A	A	A	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
7:30 - 8:30 a.m.	A	C	C	B	A	A	B	<u>D</u>	<u>D</u>	<u>C</u>	<u>C</u>
8:30 - 9:30 a.m.	B	B	B	A	A	A	A	<u>C</u>	<u>C</u>	<u>C</u>	<u>B</u>



6:30 - 7:30 a.m.	B	B	B	A	A	A	A	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
7:30 - 8:30 a.m.	C	B	B	A	A	A	A	<u>C</u>	<u>C</u>	<u>C</u>	<u>B</u>
8:30 - 9:30 a.m.	C	B	B	A	A	A	A	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>

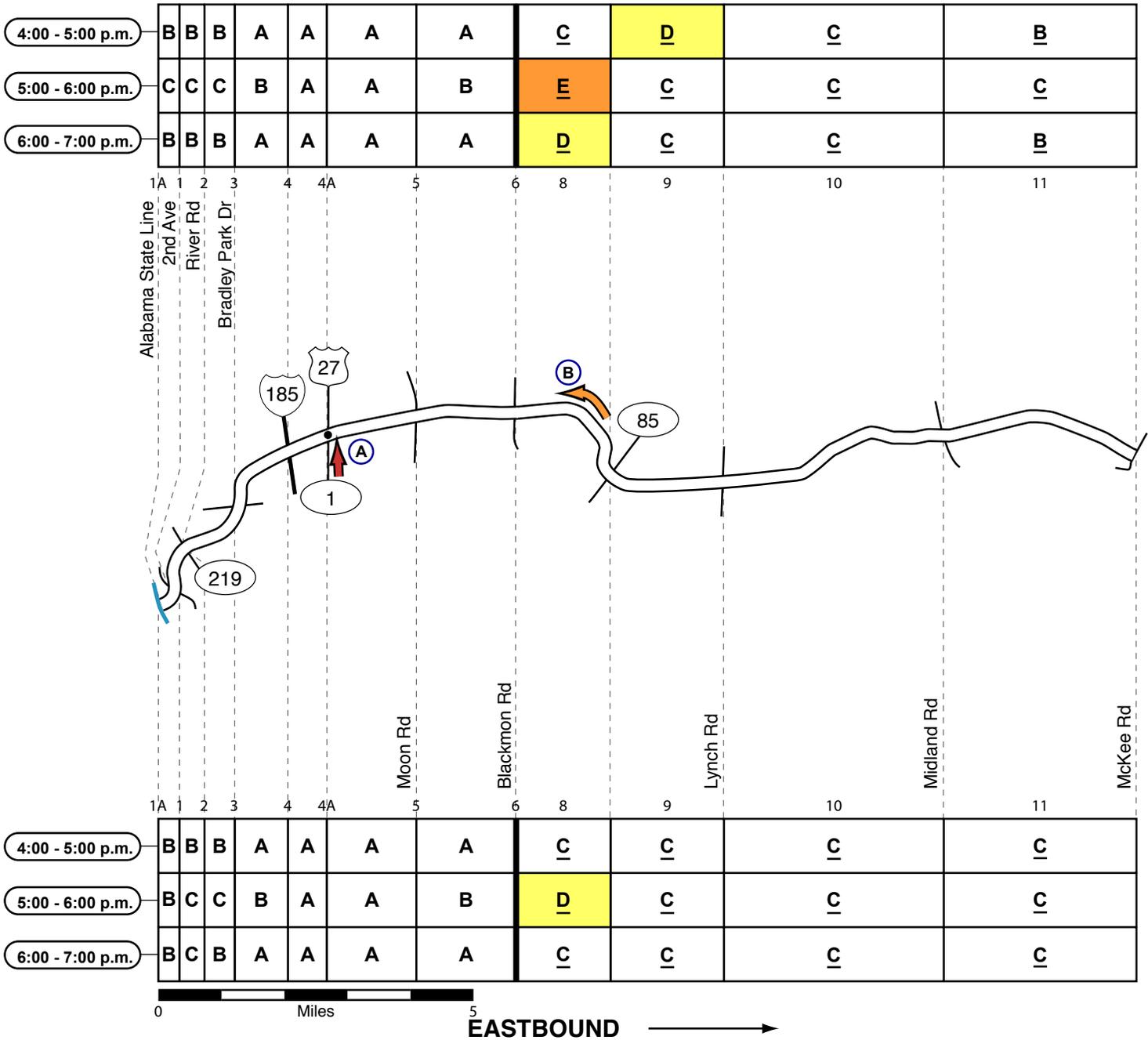


Traffic Quality Rating

<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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Fall 2010 SR 22 / US 80 - Evening

← WESTBOUND



A
 Congestion Type: Surveyed Cross Road Signal Queue
 Location: US 27/US 1
 Frequency: Intermittent
 Direction: Northbound
 Queue Population: 40 to 50 vpl
 Number of Lanes: 2
 Note: One some days but not others, congestion was found approaching the signal at the ramps to US 80; congestion backed through the upstream signal at the shopping center.

B
 Congestion Type: Platoons
 Location: Between SR 85 & Blackmon Rd
 Frequency: Intermittent
 Direction: Westbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

Traffic Quality Rating



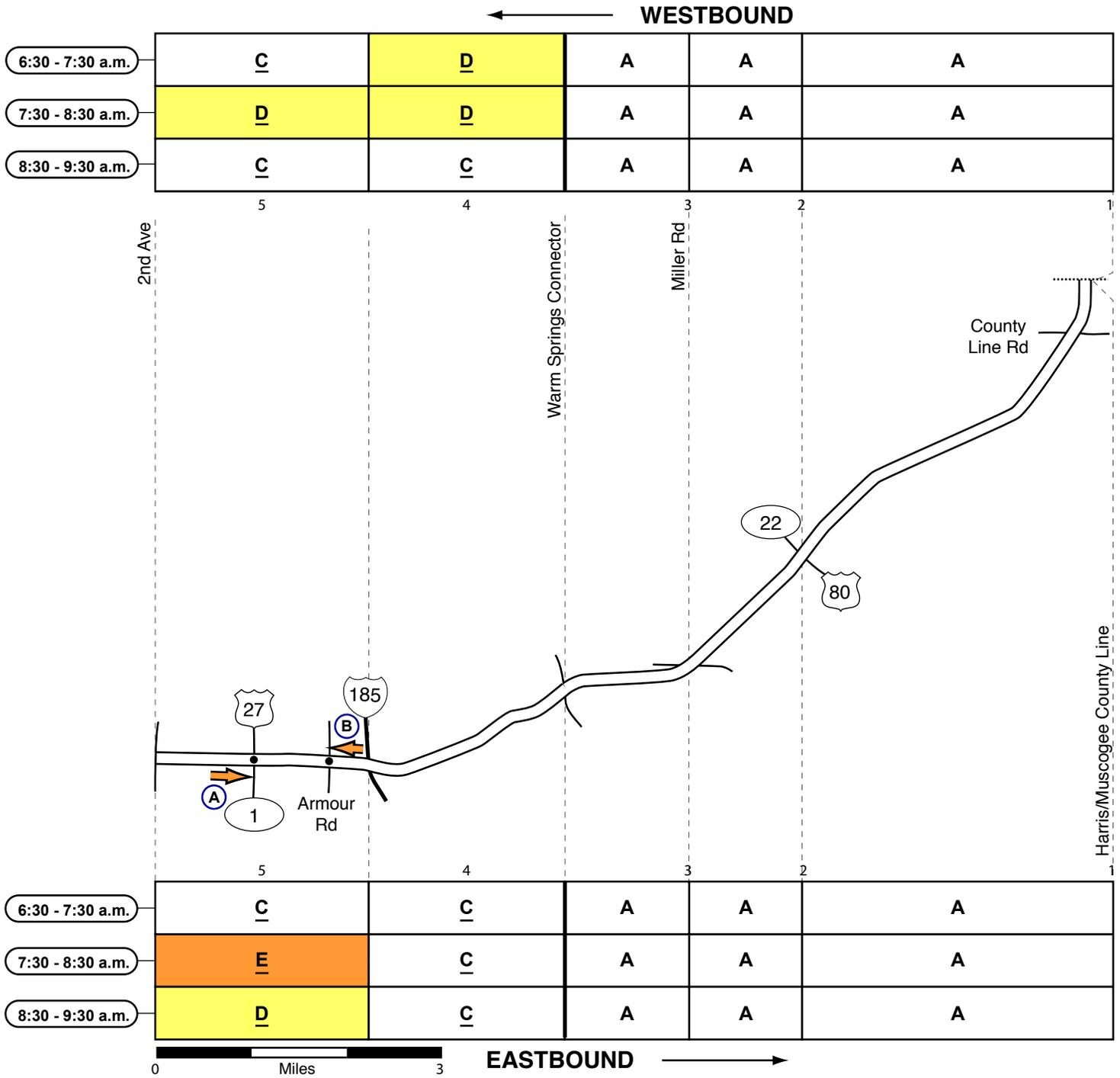
Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

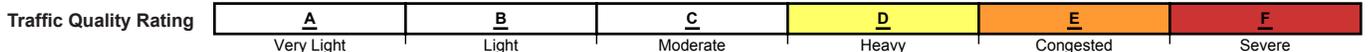
⁴Type 4 nested congestion (partial length of segment).

SR 85 / US 27 - Morning

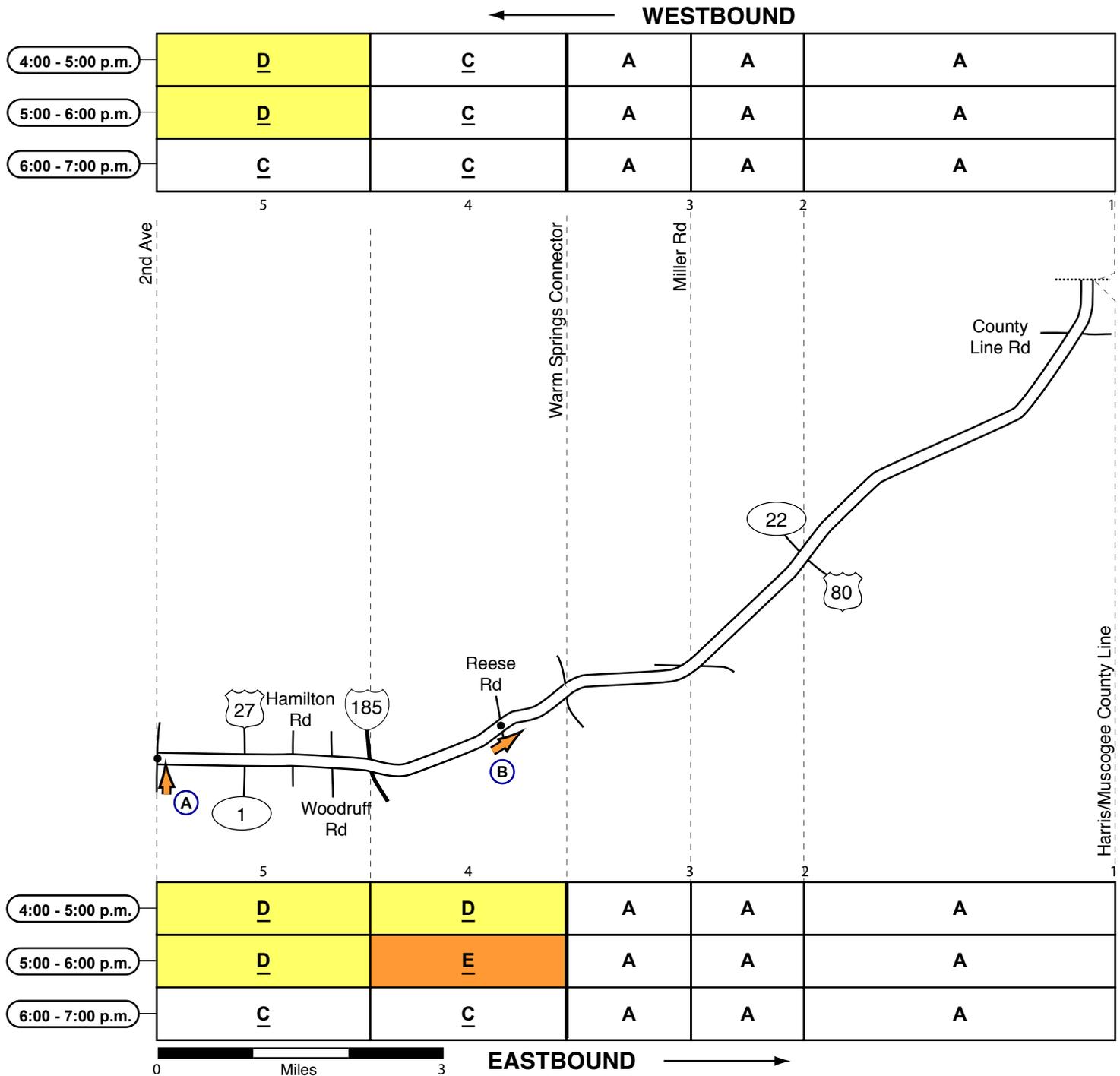


A
Congestion Type: Mainline Signal Queue
Location: US 27
Frequency: Intermittent
Direction: Eastbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2

B
Congestion Type: Mainline Signal Queue
Location: Armour Rd
Frequency: Intermittent
Direction: Westbound
Queue Population: 20 to 25 vpl
Number of Lanes: 3



Fall 2010 SR 85 / US 27 - Evening



A
 Congestion Type: Cross Road Signal Queue
 Location: 2nd Ave
 Frequency: Intermittent
 Direction: Northbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 2

B
 Congestion Type: Platoons
 Location: Between I-185 and Warm Springs Connector
 Frequency: Intermittent
 Direction: Eastbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2



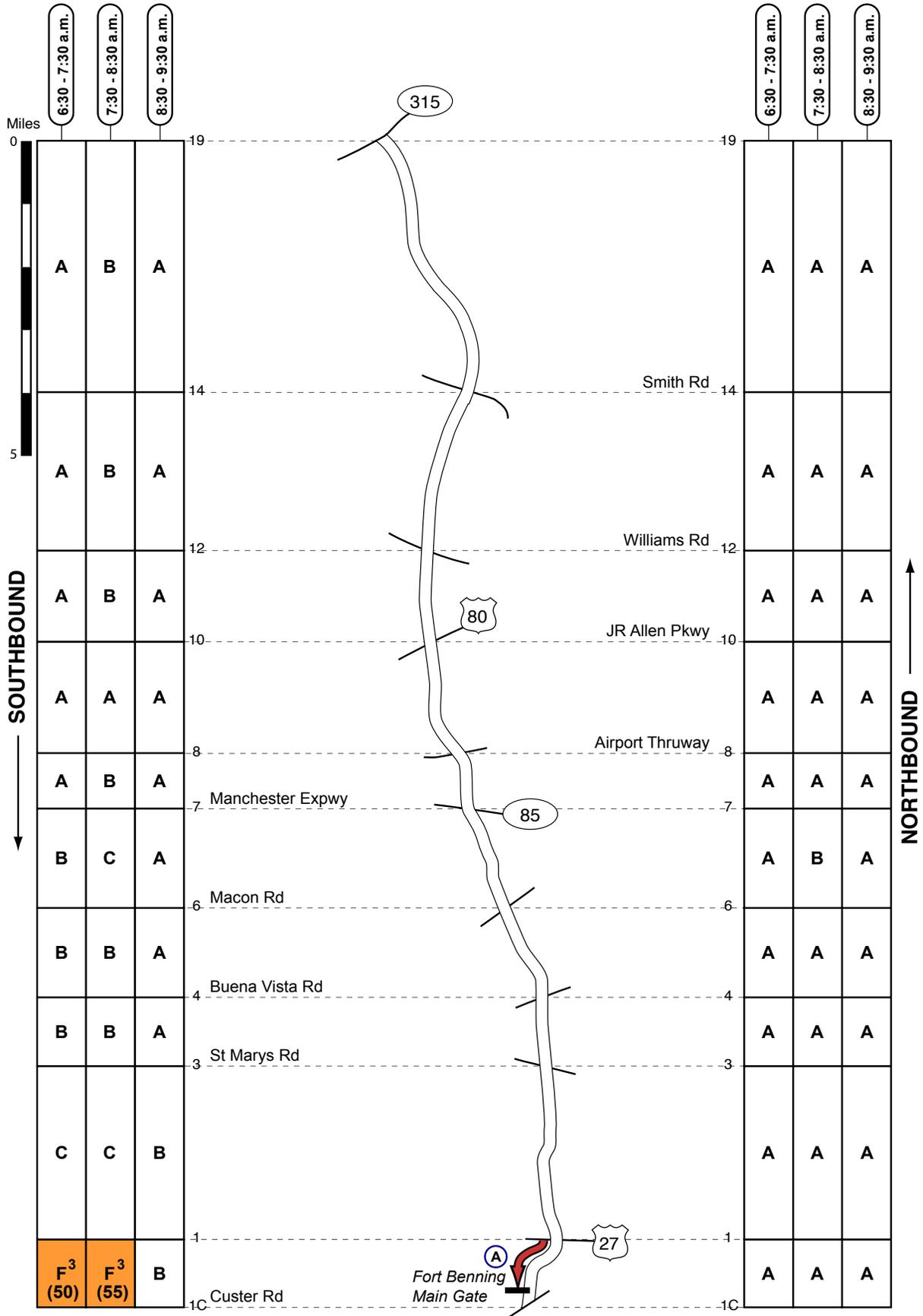
Superscripts: ¹ Type 1 nested congestion (some days, not others).

³ Type 3 nested congestion (present only in the first or second half-hour period).

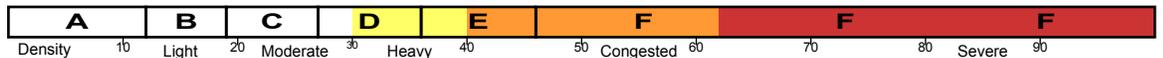
² Type 2 nested congestion (more severe in left or right-hand lanes).

⁴ Type 4 nested congestion (partial length of segment).

Fall 2010 I-185 - Morning



Traffic Quality Rating



Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

Fall 2010
I-185 - Morning

A

Congestion Type: Mainline Congestion

Frequency: Most observations between 7:00 and 8:00 a.m.

Direction: Southbound

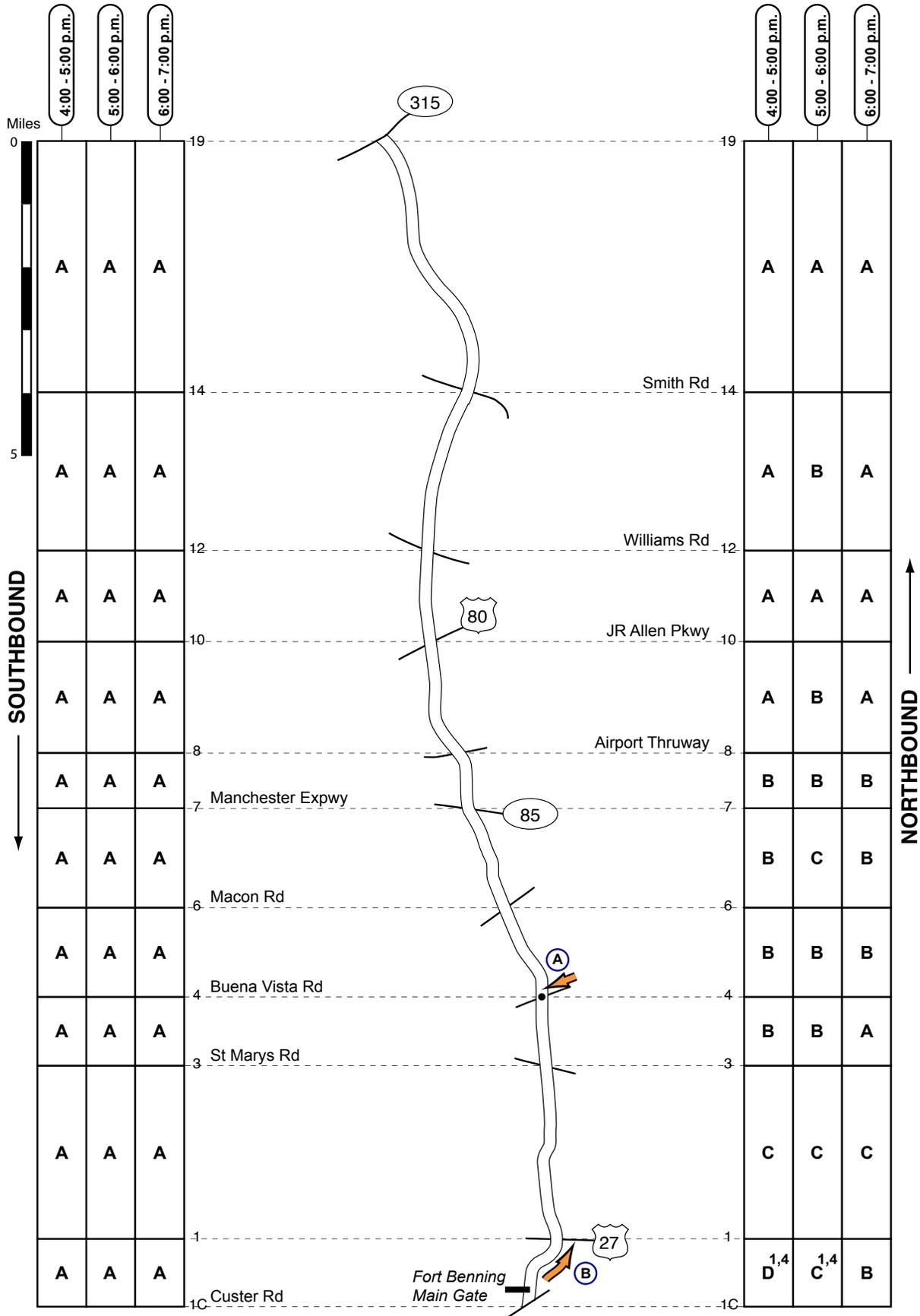
Location: Approaching the Ft. Benning Entrance

Queue Length: 0.5 to 1 miles

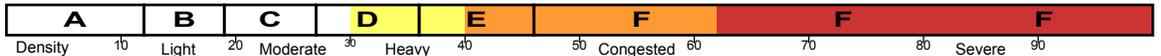
Estimated Speed: 10 to 30 mph

Potential Cause(s): The head of the queue was found at the Ft. Benning entrance/security checkpoint; at its maximum observed extent, the tail of the queue was found in the vicinity of US 27.

Fall 2010 I-185 - Evening



Traffic Quality Rating



Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

Fall 2010
I-185 - Evening

A

Congestion Type: Surveyed Cross Road Signal Queue

Location: Buena Vista Rd

Frequency: Intermittent

Direction: Westbound

Queue Population: 20 to 25 vpl

Number of Lanes: 2

B

Congestion Type: Mainline Congestion

Frequency: Intermittent

Direction: Northbound

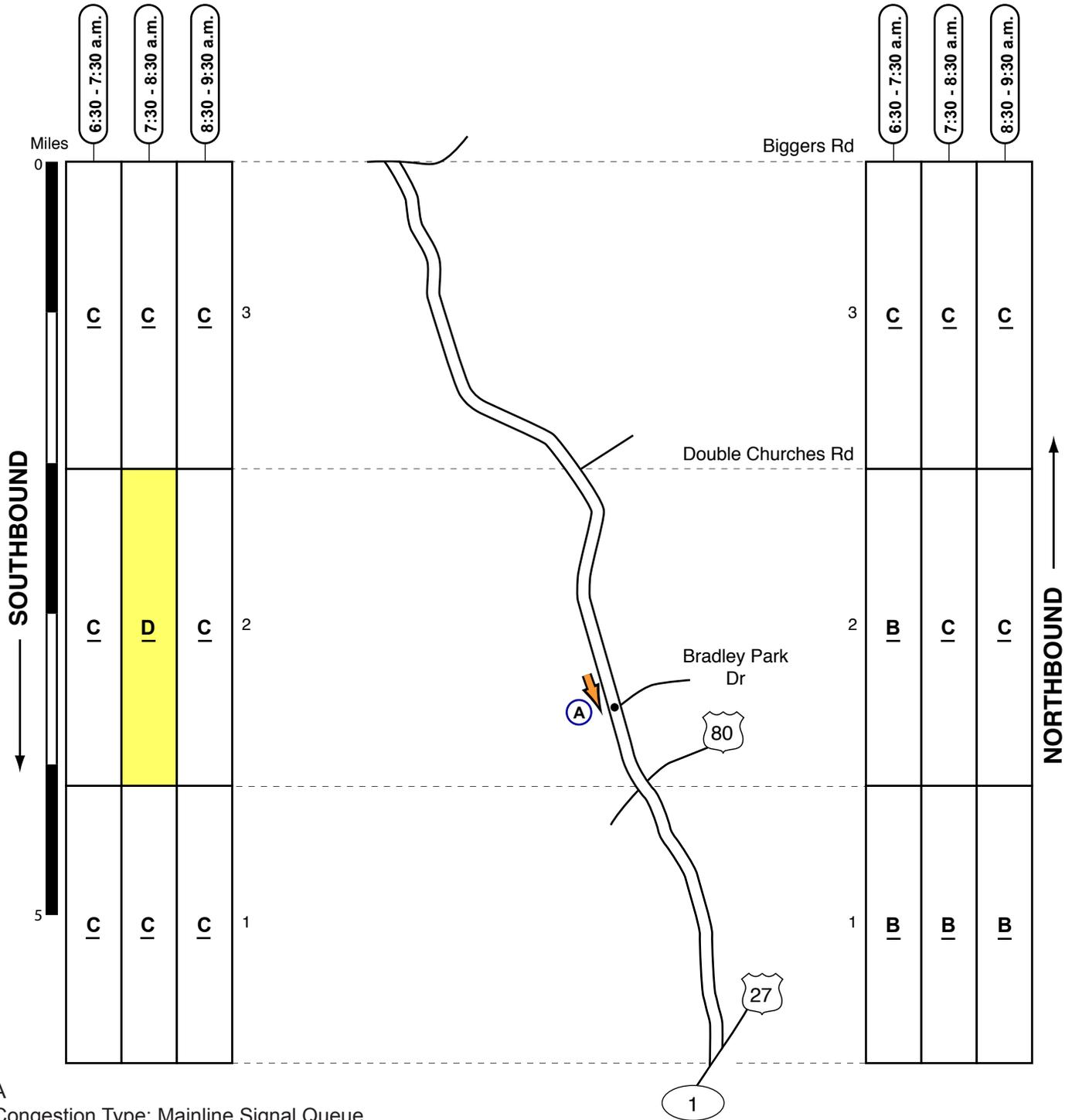
Location: Between Custer Rd & US 27

Queue Length: 0.5 to 1 miles

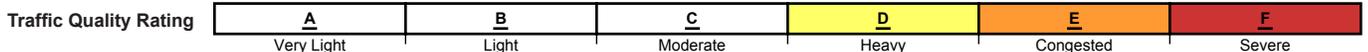
Estimated Speed: 40 to 50 mph

Potential Cause(s): Factors contributing to the congestion were: 1) traffic entering at Custer Rd and; 2) roadway geometrics (sharp bends).

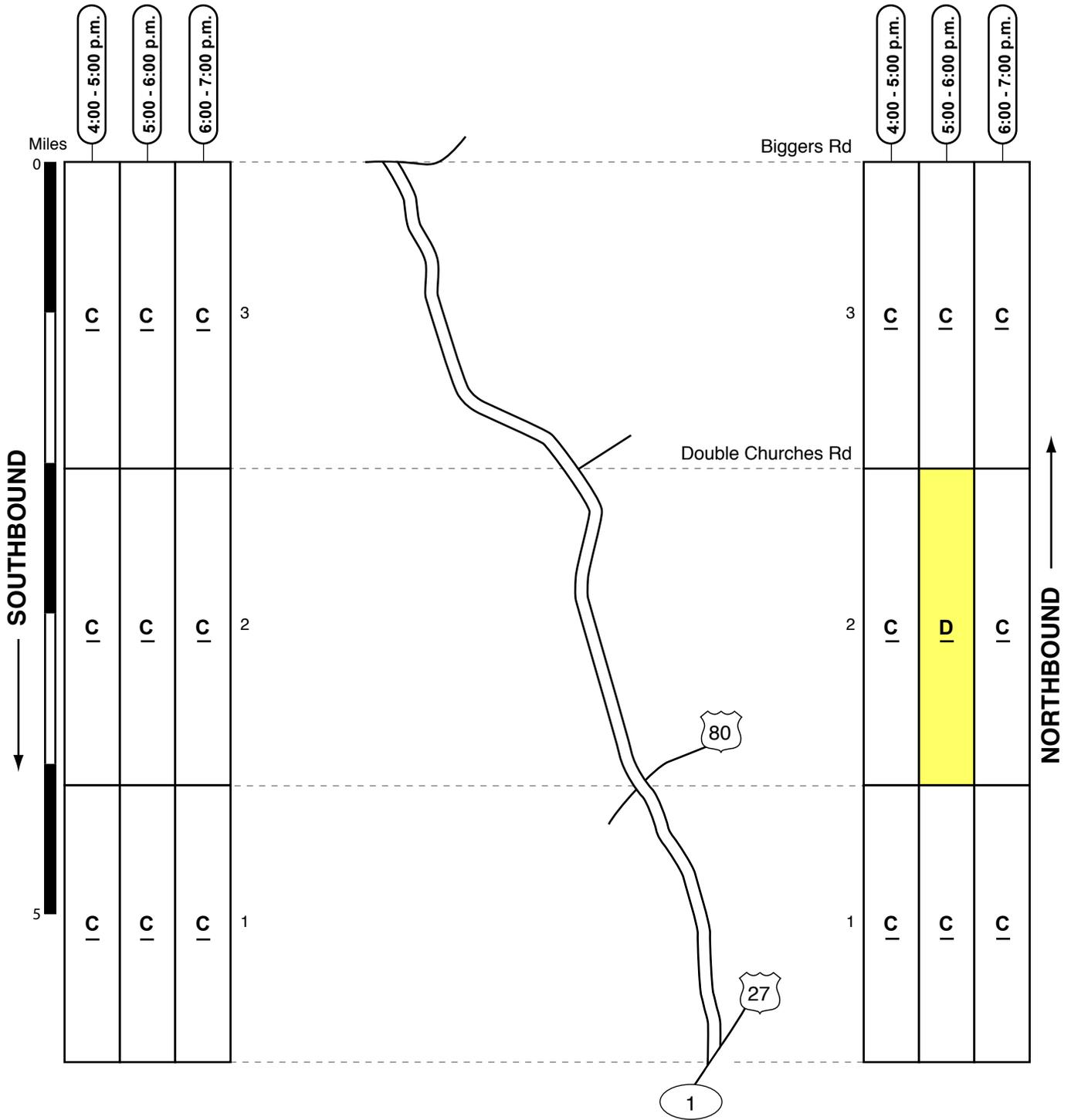
SR 219 (Freeman V. Horner Medal of Honor Hwy) - Morning



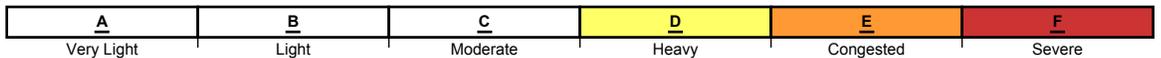
A
 Congestion Type: Mainline Signal Queue
 Location: Bradley Park Dr
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1
 Note: Conditions appeared to be exacerbated by downstream congestion on Bradley Park Dr approaching the Brookstone School.



SR 219 (Freeman V. Horner Medal of Honor Hwy) - Evening



Traffic Quality Rating

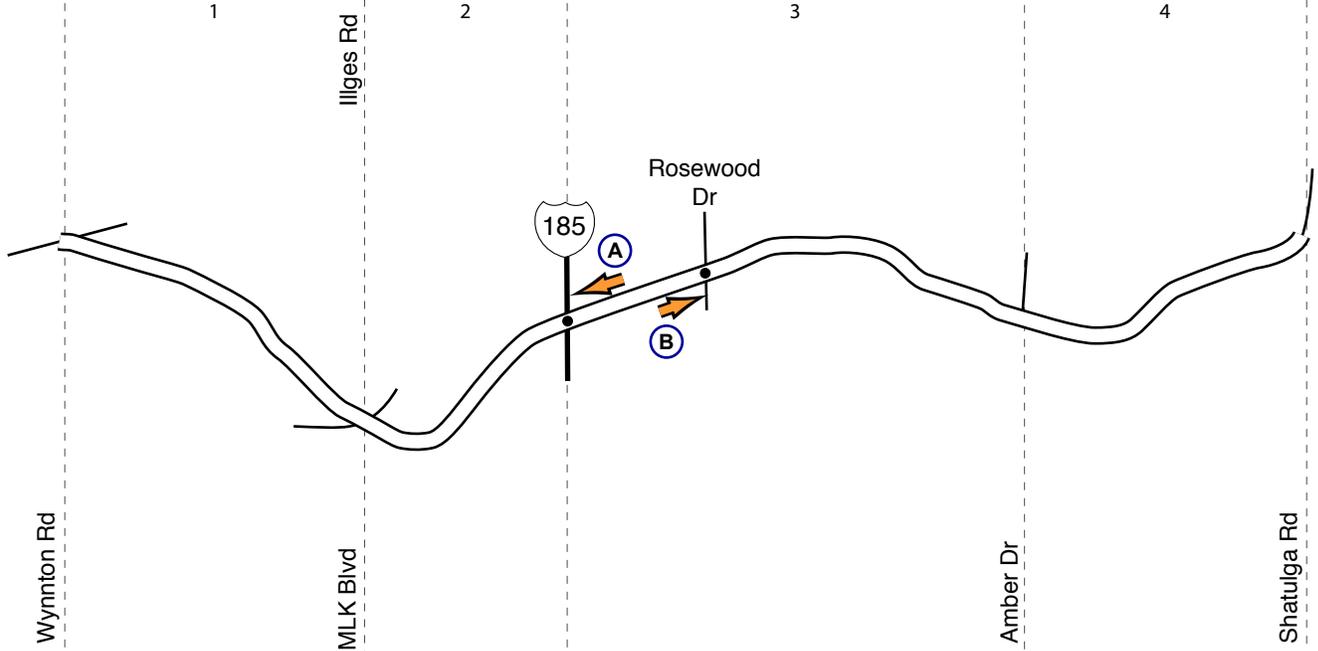


Buena Vista Rd - Evening

← WESTBOUND

4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>D</u>	<u>D</u>	<u>C</u>

1 2 3 4



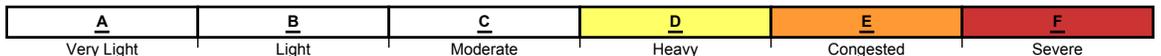
4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>D</u>	<u>D</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>C</u>

0 Miles 3 → EASTBOUND

A
 Congestion Type: Mainline Signal Queue
 Location: I-185
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

B
 Congestion Type: Mainline Signal Queue/Platoons
 Location: Rosewood Dr
 Frequency: Intermittent
 Direction: Eastbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

Traffic Quality Rating





Macon-Warner Robins

HIGHWAY TRAFFIC QUALITY

FALL 2010

Macon-Warner Robins, GA (Surveyed Highways)

Fall 2010 (Morning)

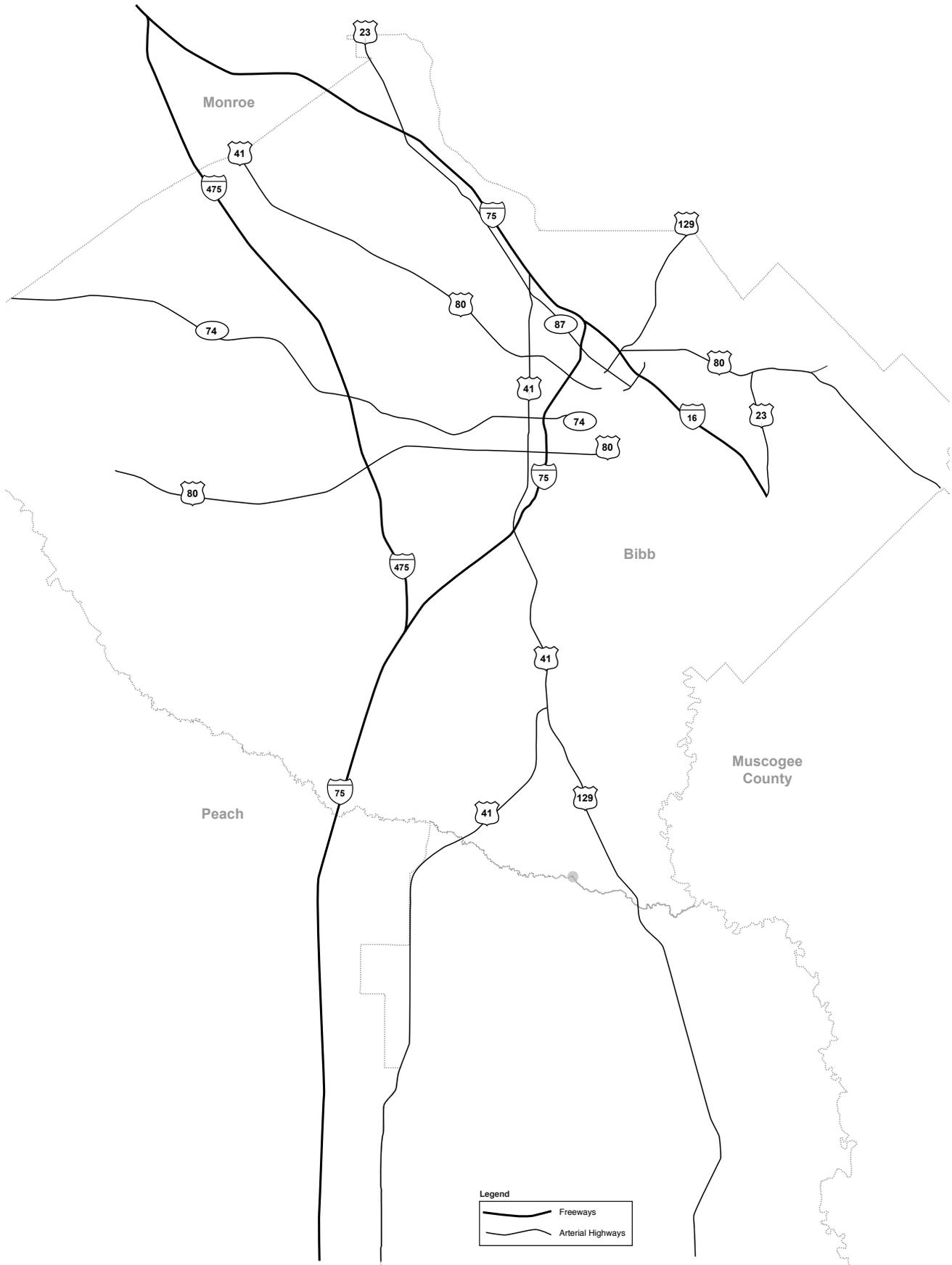


TABLE OF CONTENTS

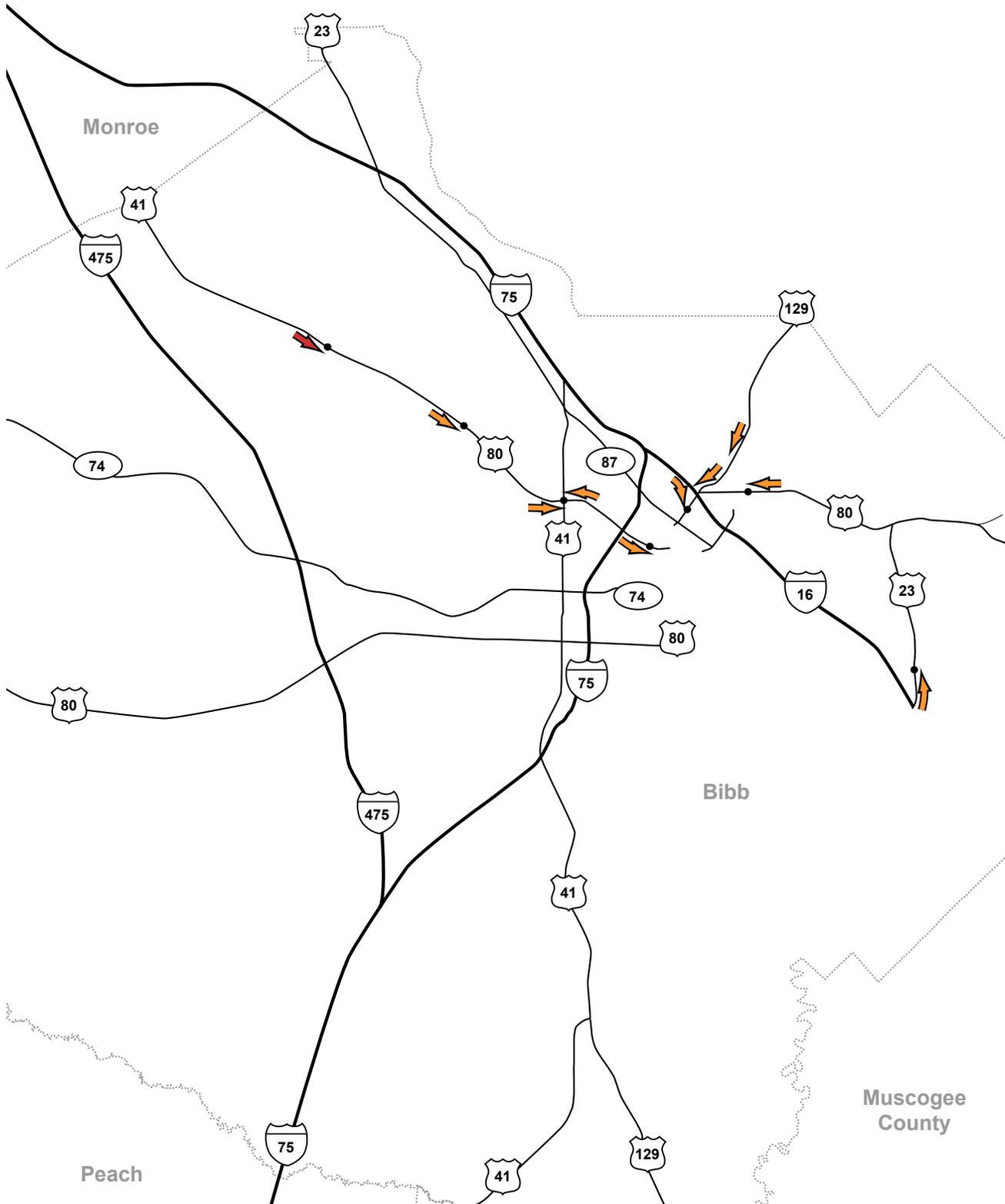
Surveyed Highways.....	M-2
Morning and Evening Regional Congestion Maps	M-4

PERFORMANCE RATINGS

SR 11 / SR 22 / US 129 (Gray Hwy).....	M-6
I-16	M-8
SR 19 / US 41.....	M-10
SR 19 / US 80 (Emery Hwy / Jacksonville Rd).....	M-14
SR 22 / US 80.....	M-16
US 23 (Ocmulgee East Blvd).....	M-18
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Macon-Warner Robins, GA (Locations Where Congestion Was Found)

Fall 2010 (Morning)



Freeway Legend

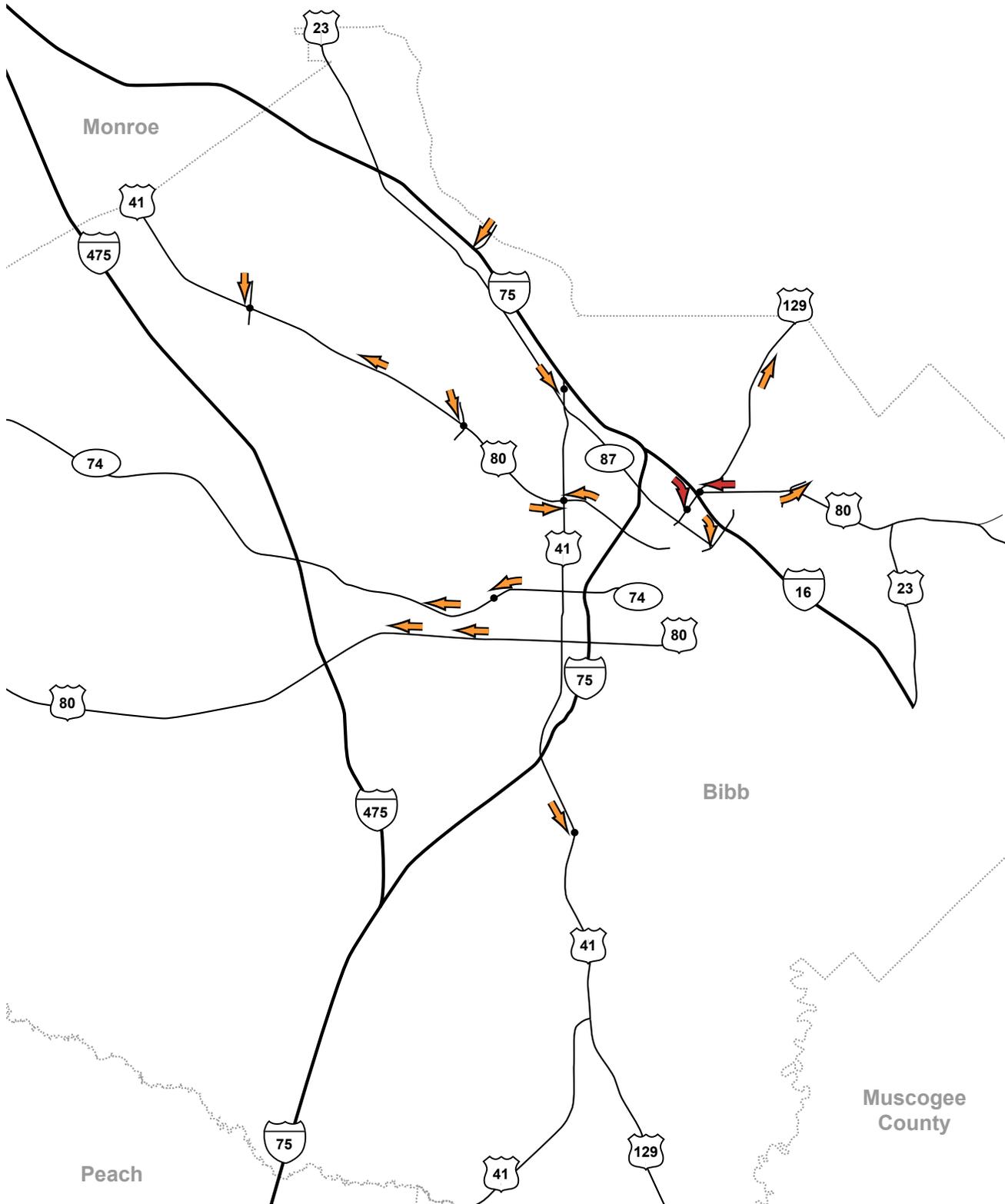
- Severe mainline congestion (<30 mph)
- Moderate or intermittent mainline congestion (30-50 mph)

Arterial Legend

- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

Macon-Warner Robins, GA (Locations Where Congestion Was Found)

Fall 2010 (Evening)



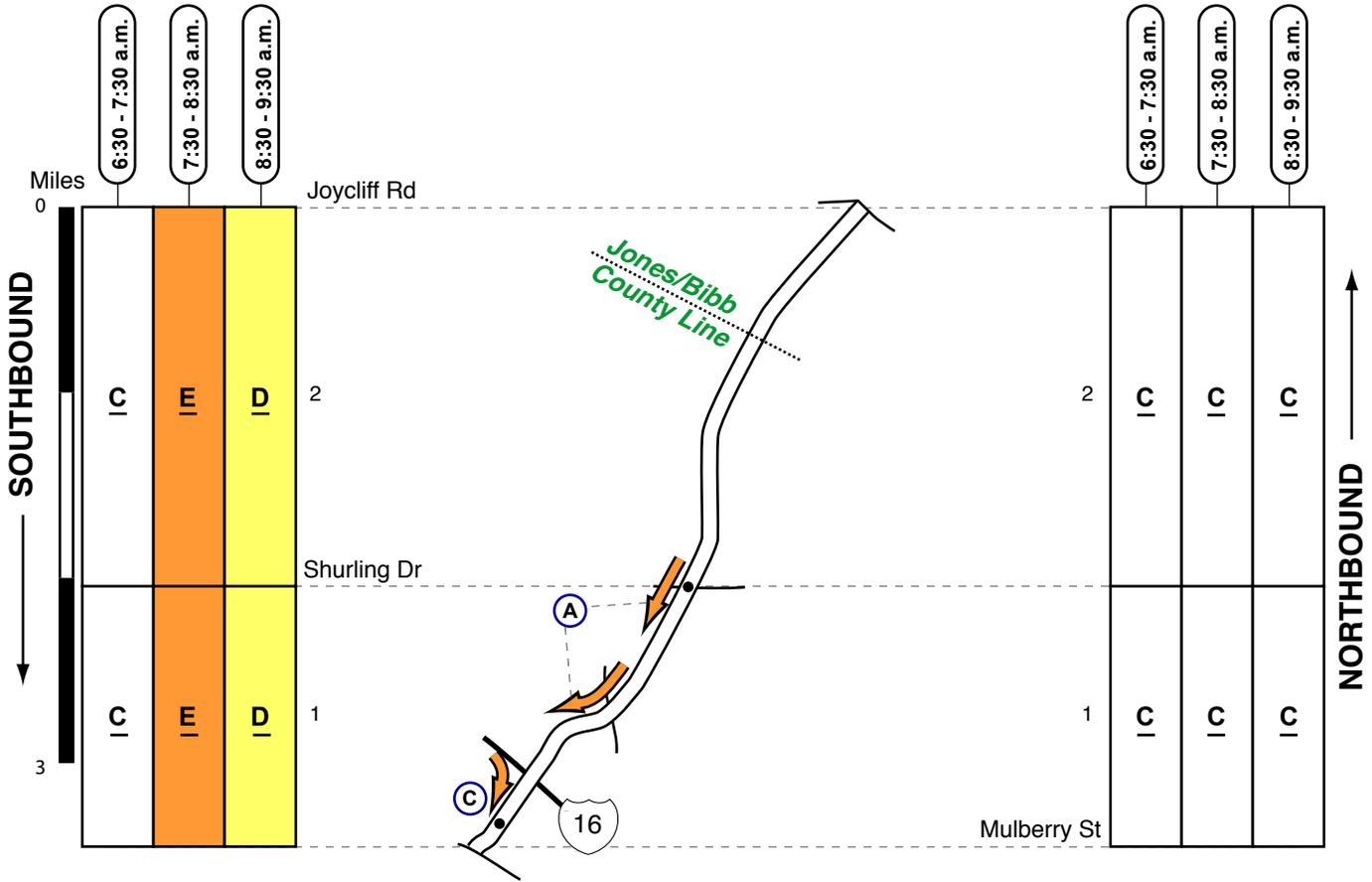
Freeway Legend

- Severe mainline congestion (<30 mph)
- Moderate or intermittent mainline congestion (30-50 mph)

Arterial Legend

- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

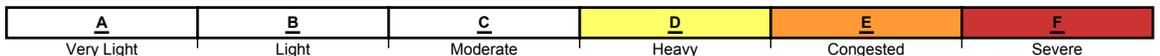
SR 11 / SR 22 / US 129 (Gray Hwy) - Morning



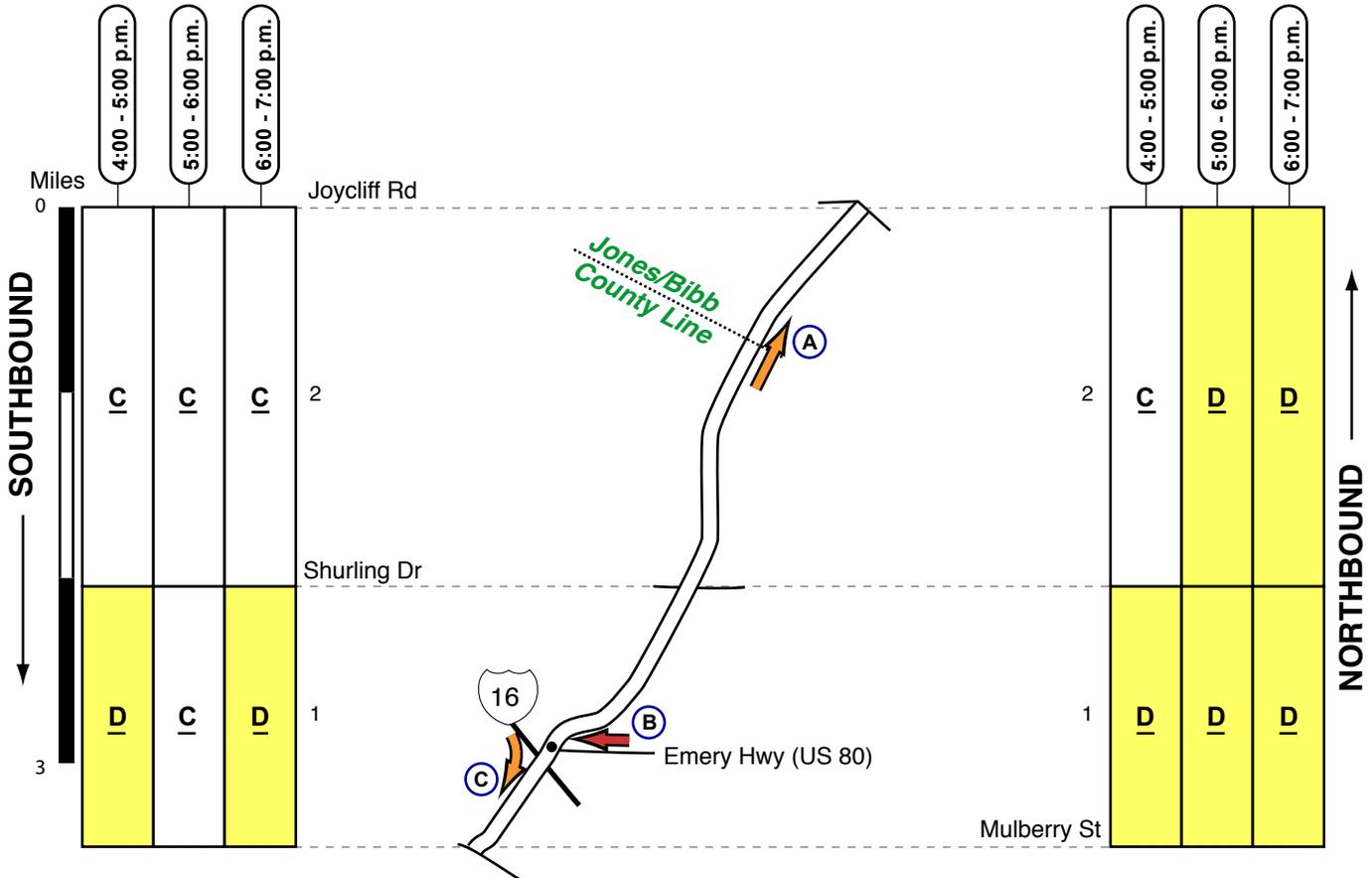
A
 Congestion Type: Platoons
 Location: Between Shurling Dr & I-16
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 25 to 30 vpl
 Number of Lanes: 2

B
 Congestion Type: Exit Ramp Queue
 Location: I-16
 Frequency: One time only
 Direction: Eastbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

Traffic Quality Rating



SR 11 / SR 22 / US 129 (Gray Hwy) - Evening

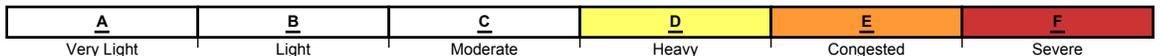


A
 Congestion Type: Platoons
 Location: Between Shurling Dr & Joycliff Rd
 Frequency: Intermittent
 Direction: Northbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

C
 Congestion Type: Exit Ramp Queue
 Location: I-16
 Frequency: One time only
 Direction: Eastbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

B
 Congestion Type: Surveyed Cross Road Signal Queue
 Location: US 80 (Emery Hwy)
 Frequency: Peak Hour
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1
 Note: When congested, vehicles were queued in the right lane of two at the signal (thru-lane to I-16 westbound ramp or right-turn onto Gray Hwy).

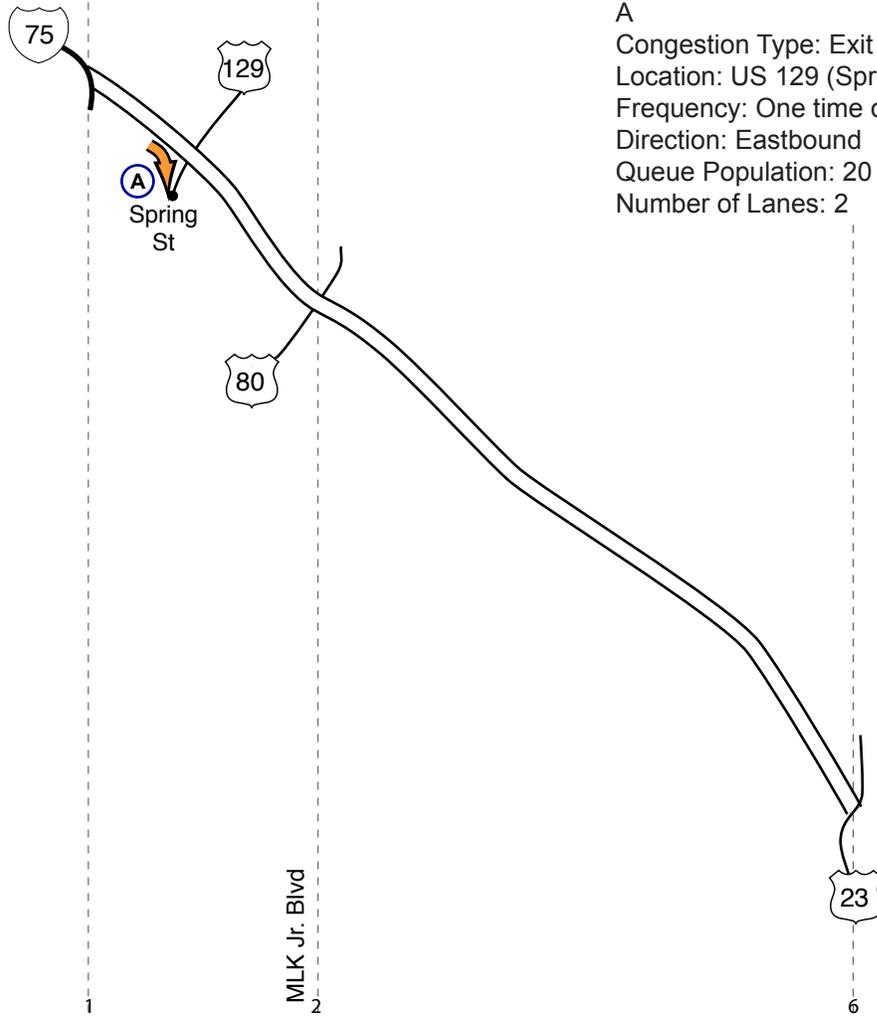
Traffic Quality Rating



I-16 - Morning

← WESTBOUND

6:30 - 7:30 a.m.	A	A
7:30 - 8:30 a.m.	B	A
8:30 - 9:30 a.m.	A	A



A
Congestion Type: Exit Ramp Queue
Location: US 129 (Spring St)
Frequency: One time only
Direction: Eastbound
Queue Population: 20 to 25 vpl
Number of Lanes: 2

6:30 - 7:30 a.m.	A	A
7:30 - 8:30 a.m.	B	B
8:30 - 9:30 a.m.	B	A



Traffic Quality Rating



Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

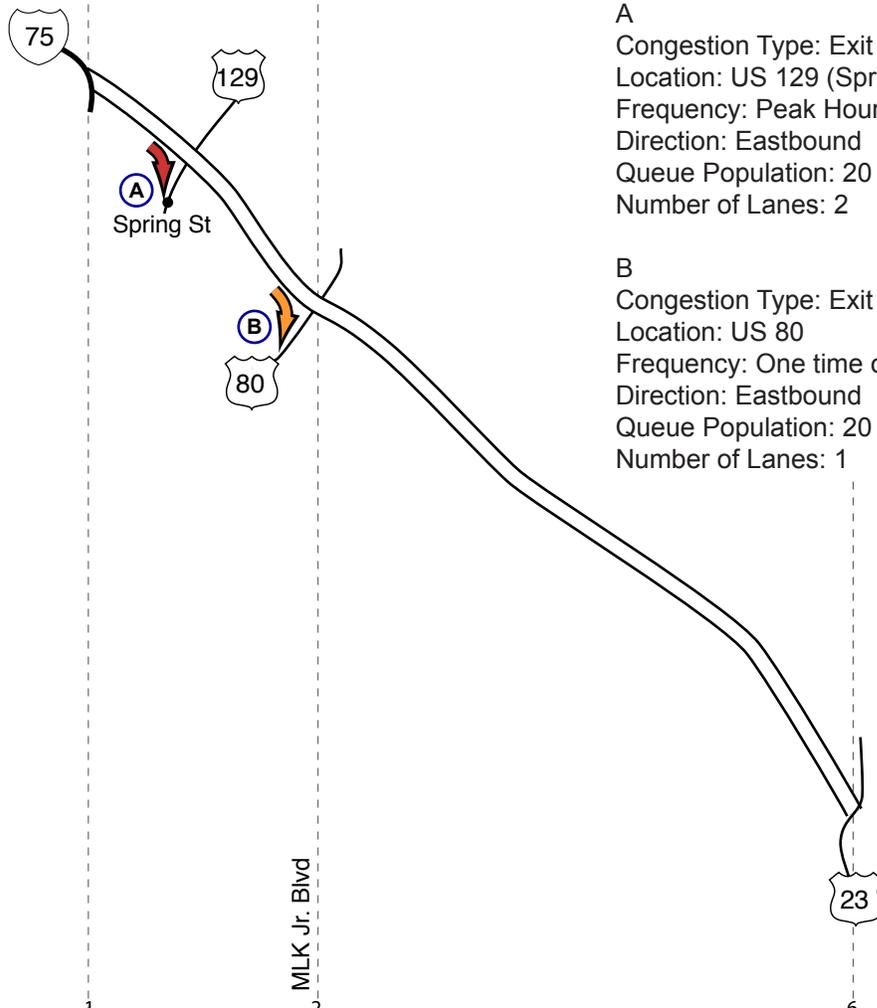
²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

I-16 - Evening

← WESTBOUND

4:00 - 5:00 p.m.	B	A
5:00 - 6:00 p.m.	C	A
6:00 - 7:00 p.m.	B	A



A
 Congestion Type: Exit Ramp Queue
 Location: US 129 (Spring St)
 Frequency: Peak Hour
 Direction: Eastbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 2

B
 Congestion Type: Exit Ramp Queue
 Location: US 80
 Frequency: One time only
 Direction: Eastbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 1

4:00 - 5:00 p.m.	A	A
5:00 - 6:00 p.m.	A	A
6:00 - 7:00 p.m.	A	A

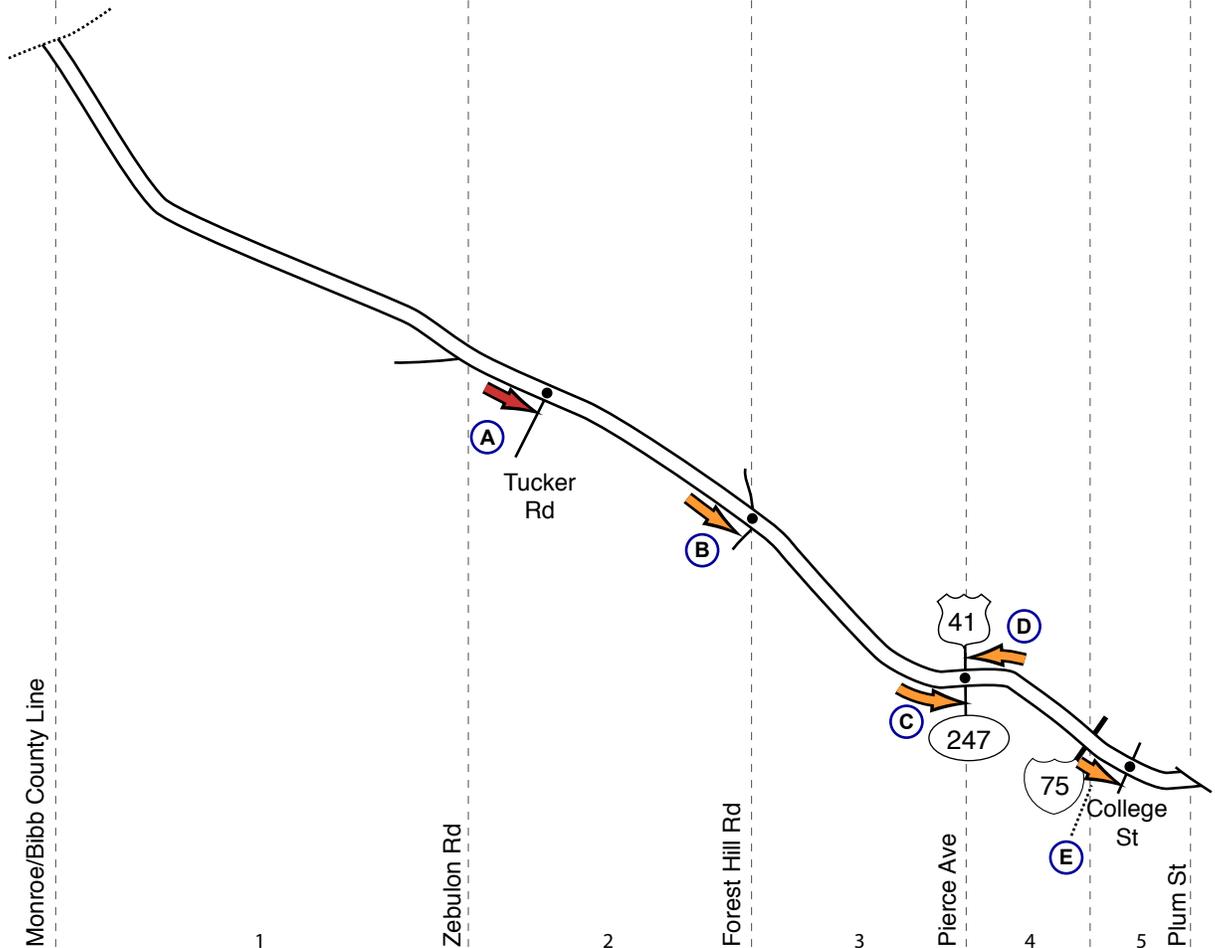


Superscripts: ¹Type 1 nested congestion (some days, not others). ²Type 2 nested congestion (more severe in left or right-hand lanes). ³Type 3 nested congestion (present only in the first or second half-hour period). ⁴Type 4 nested congestion (partial length of segment).

SR 19 / US 41 - Morning

← NORTHBOUND

6:30 - 7:30 a.m.	<u>D</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
7:30 - 8:30 a.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>C</u>
8:30 - 9:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
	1	2	3	4	5



6:30 - 7:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
7:30 - 8:30 a.m.	<u>D</u>	<u>E</u>	<u>E</u>	<u>D</u>	<u>D</u>
8:30 - 9:30 a.m.	<u>B</u>	<u>C</u>	<u>D</u>	<u>C</u>	<u>C</u>
	1	2	3	4	5



Traffic Quality Rating	<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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SR 19 / US 41 - Morning

A

Congestion Type: Mainline Signal Queue
 Location: Tucker Rd
 Frequency: Peak Hour
 Direction: Southbound
 Queue Population: 20 to 35 vpl
 Number of Lanes: 2

B

Congestion Type: Mainline Signal Queue
 Location: Forest Hill Rd
 Frequency: One Time Only
 Direction: Southbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2
 Note: Vehicles were queued in the left lane of two at the signal (the right lane drops a short distance beyond the signal).

C

Congestion Type: Mainline Signal Queue
 Location: SR 247 (Pierce Ave)
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

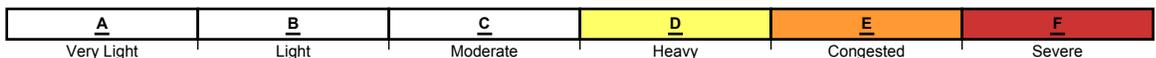
D

Congestion Type: Mainline Signal Queue
 Location: SR 247 (Pierce Ave)
 Frequency: Intermittent
 Direction: Northbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 1
 Note: When congested, vehicles were queued in the right lane of two at the signal (the left lane drops a short distance beyond the signal).

E

Congestion Type: Mainline Signal Queue
 Location: College St
 Frequency: One Time Only
 Direction: Southbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

Traffic Quality Rating



Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

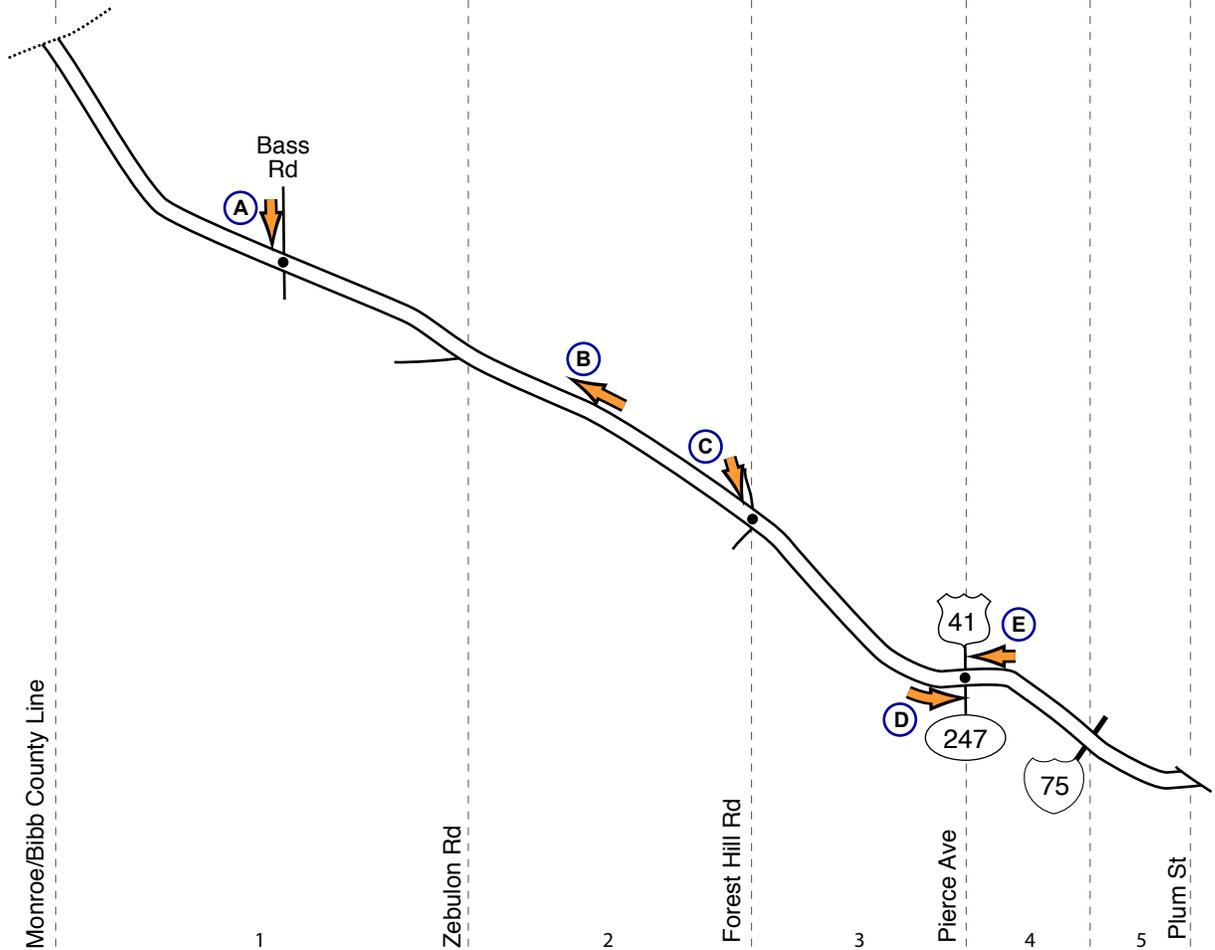
²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

SR 19 / US 41 - Evening

← NORTHBOUND

4:00 - 5:00 p.m.	<u>C</u>	<u>D</u>	<u>D</u>	<u>D</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>E</u>	<u>D</u>	<u>E</u>	<u>D</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>D</u>	<u>C</u>	<u>C</u>	<u>C</u>
	1	2	3	4	5



4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
	1	2	3	4	5



Traffic Quality Rating	<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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SR 19 / US 41 - Evening

A

Congestion Type: Cross Road Signal Queue
Location: Bass Rd
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 25 vpl
Number of Lanes: 1

B

Congestion Type: Platoons
Location: Between Forest Hill Rd & Zebulon Rd
Frequency: Intermittent
Direction: Northbound
Platoon Population: 25 to 30 vpl
Number of Lanes: 2

C

Congestion Type: Cross Road Signal Queue
Location: Forest Hill Rd
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 40 vpl
Number of Lanes: 1

D

Congestion Type: Mainline Signal Queue
Location: SR 247 (Pierce Ave)
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2

E

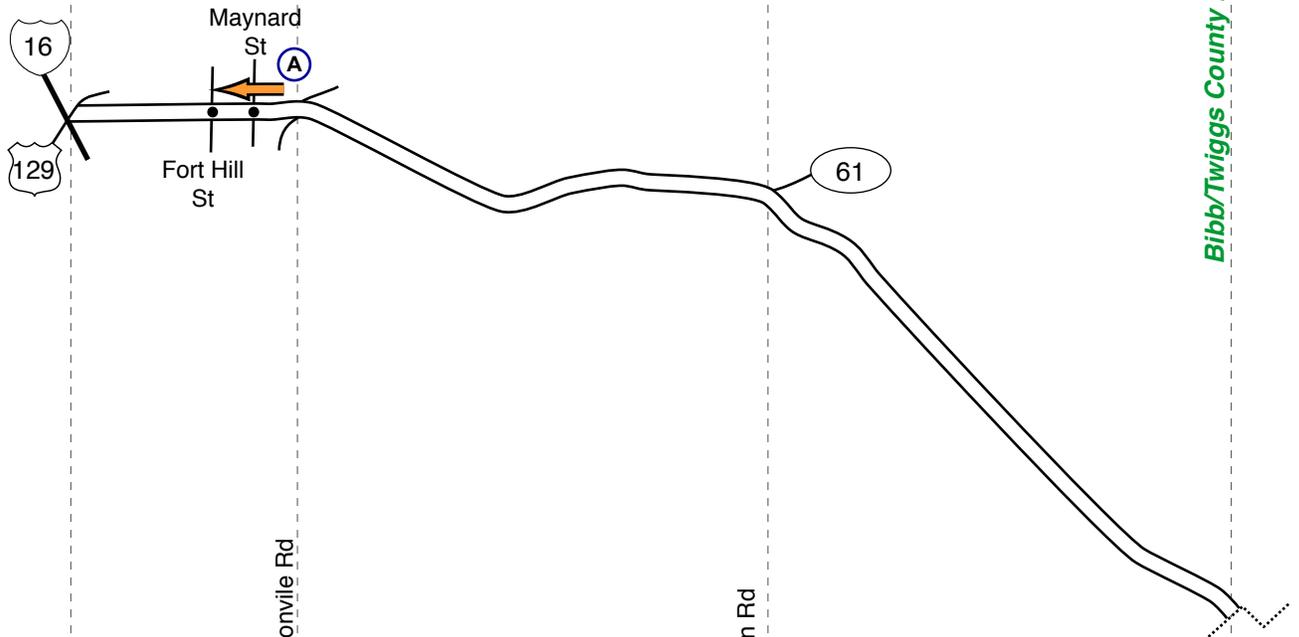
Congestion Type: Mainline Signal Queue
Location: SR 247 (Pierce Ave)
Frequency: Intermittent
Direction: Northbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2

SR 19 / US 80 (Emery Hwy / Jacksonville Rd) - Morning

← WESTBOUND

6:30 - 7:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>
7:30 - 8:30 a.m.	E	<u>C</u>	<u>C</u>
8:30 - 9:30 a.m.	<u>C</u>	<u>C</u>	<u>B</u>

3 2 1



6:30 - 7:30 a.m.	<u>C</u>	<u>C</u>	<u>B</u>
7:30 - 8:30 a.m.	<u>C</u>	<u>C</u>	<u>B</u>
8:30 - 9:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>



A
 Congestion Type: Mainline Signal Queue
 Location: Fort Hill St & Maynard St
 Frequency: One Time Only
 Direction: Westbound
 Queue Population: 50 to 60 vpl
 Number of Lanes: 2

Traffic Quality Rating	<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	E Congested	F Severe
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SR 19 / US 80 (Emery Hwy / Jacksonville Rd) - Evening

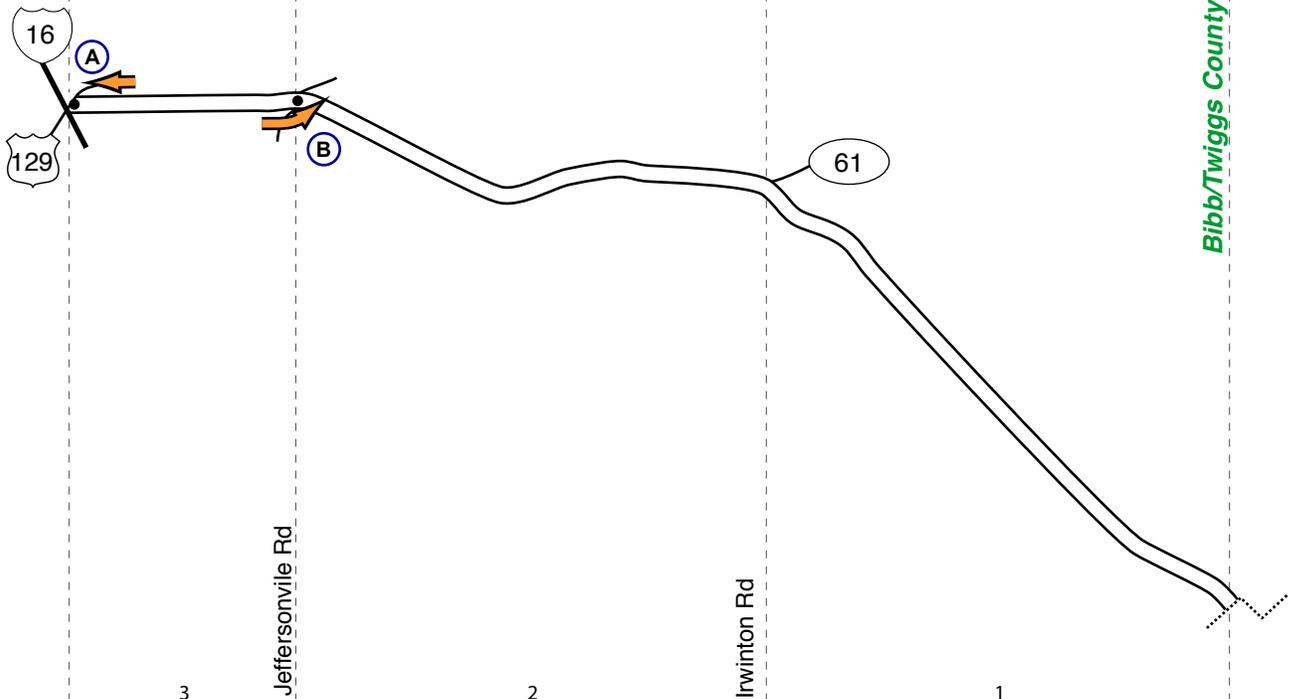
← WESTBOUND

4:00 - 5:00 p.m.	<u>D</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>D</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>B</u>

3

2

1



4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>

3

2

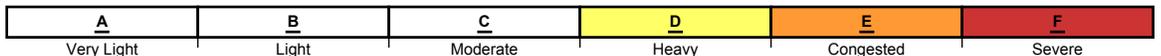
1



A
 Congestion Type: Mainline Signal Queue
 Location: US 129 (Gray Hwy)
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1
 Note: When congested, vehicles were queued in the right lane of two at the signal (thru-lane to I-16 westbound ramp or right-turn onto US 129).

B
 Congestion Type: Left-Turn Queue
 Location: Jeffersonville Rd
 Frequency: Intermittent
 Direction: Eastbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 1

Traffic Quality Rating



SR 22 / US 80 - Morning

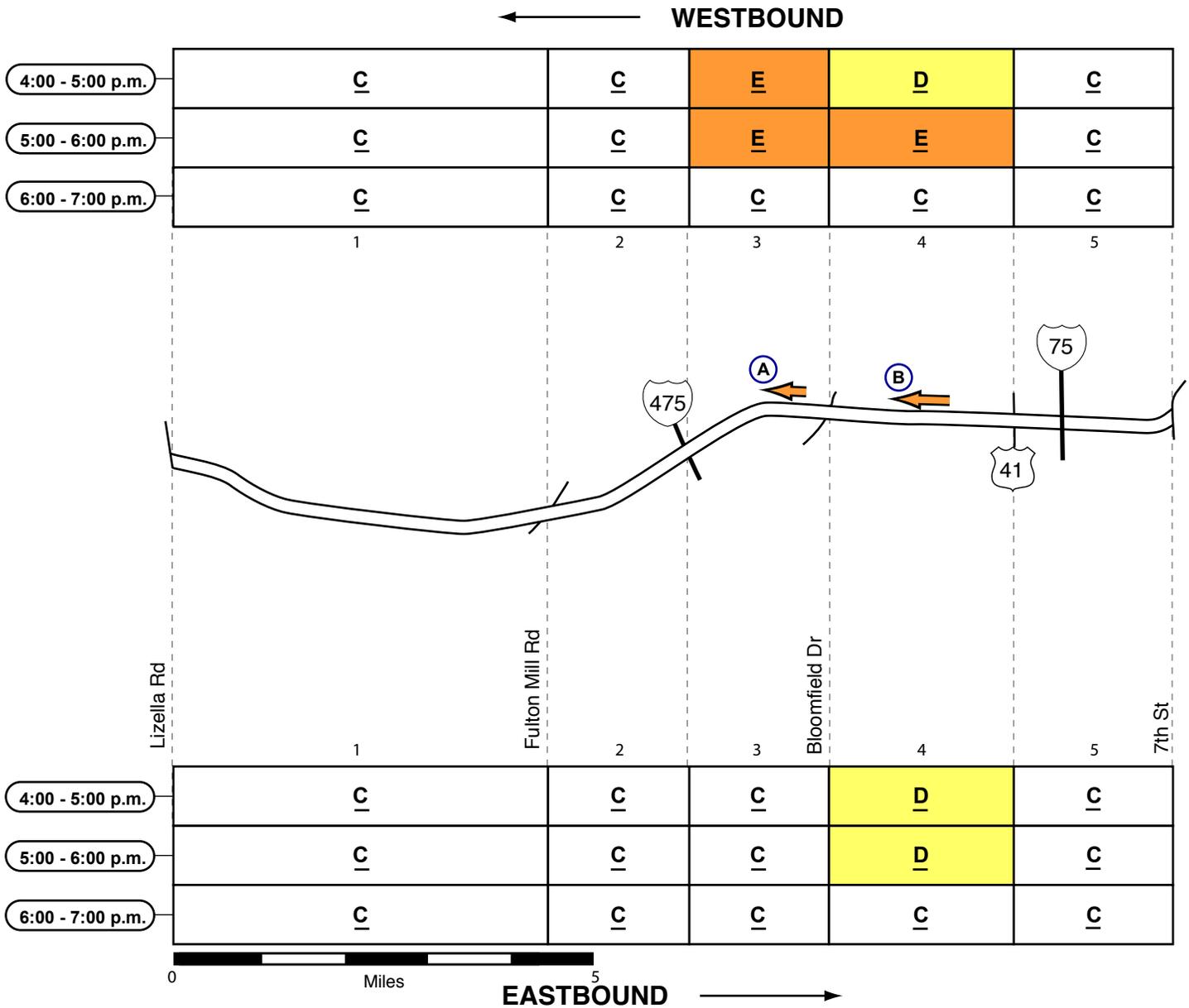
← WESTBOUND



Traffic Quality Rating



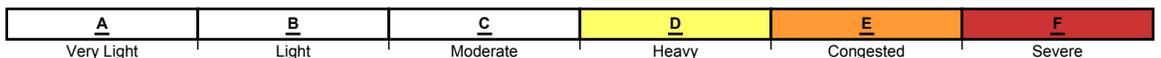
SR 22 / US 80 - Evening



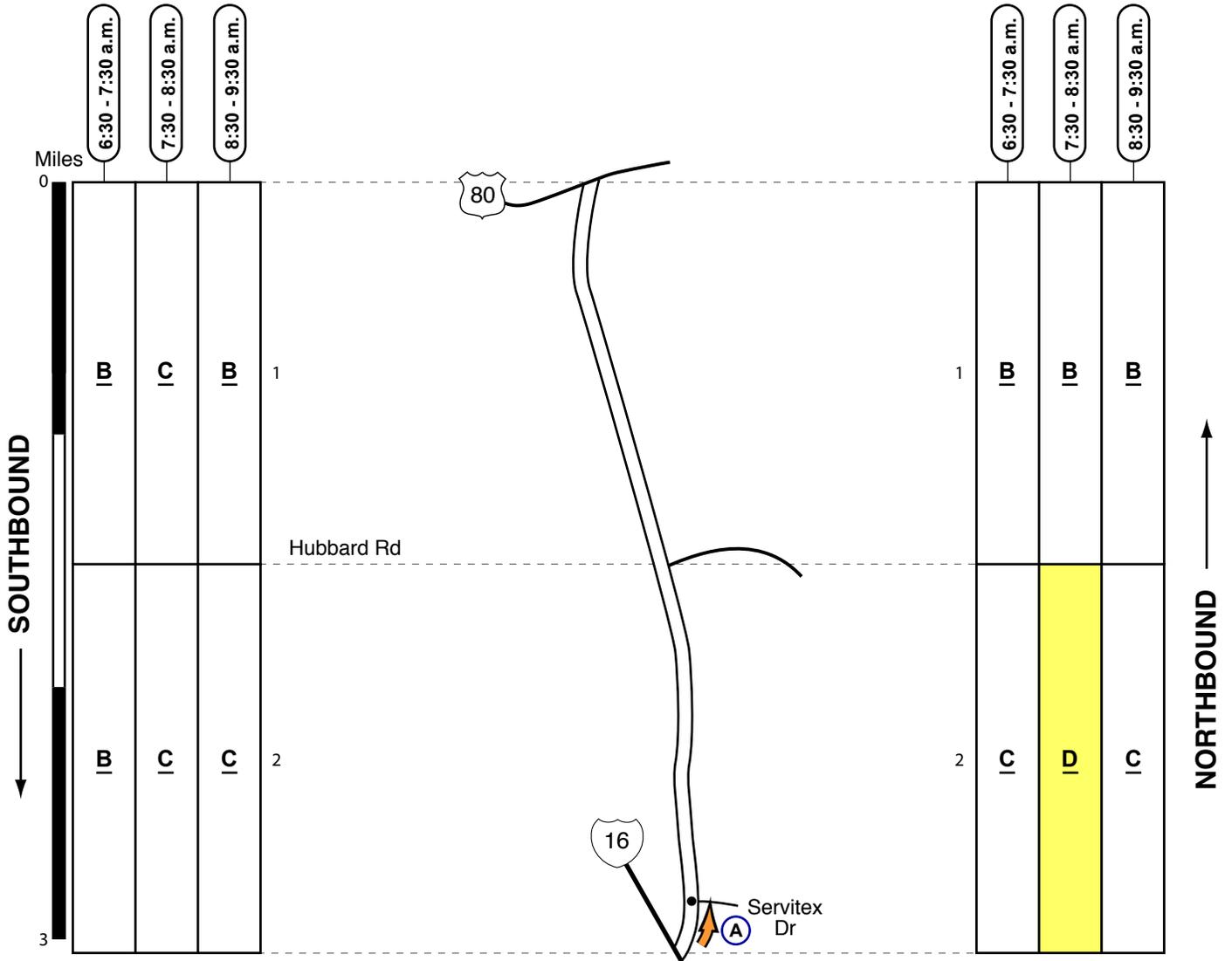
A
 Congestion Type: Platoons
 Location: Between Bloomfield Rd & I-475
 Frequency: Intermittent
 Direction: Westbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

B
 Congestion Type: Platoons
 Location: Between I-75 & Bloomfield Dr
 Frequency: Intermittent
 Direction: Westbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

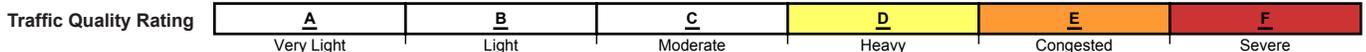
Traffic Quality Rating



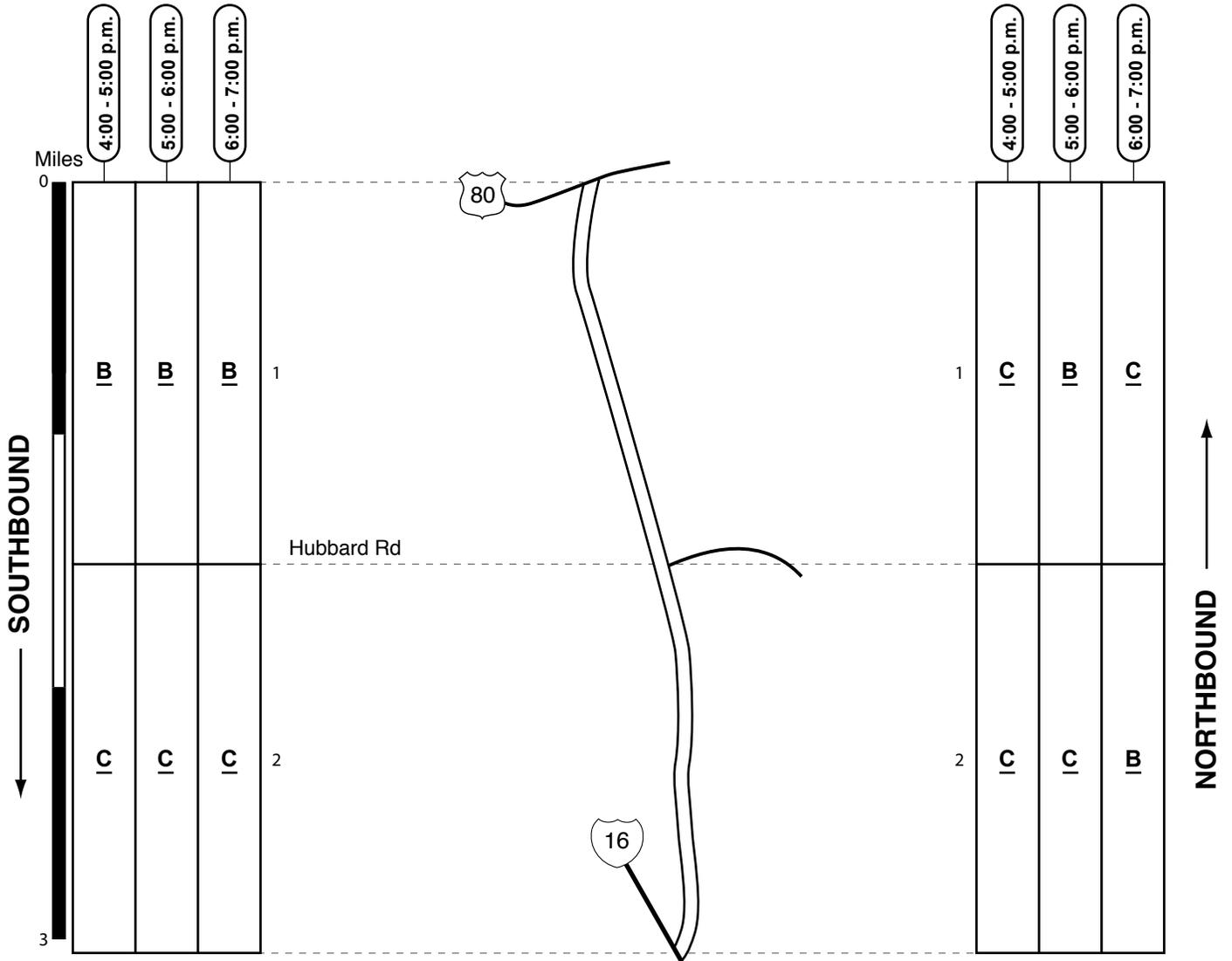
US 23 (Ocmulgee East Blvd) - Morning



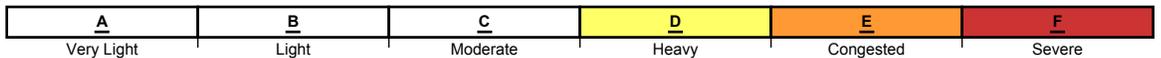
A
 Congestion Type: Mainline Signal Queue
 Location: Servitex Dr
 Frequency: One Time Only
 Direction: Northbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2



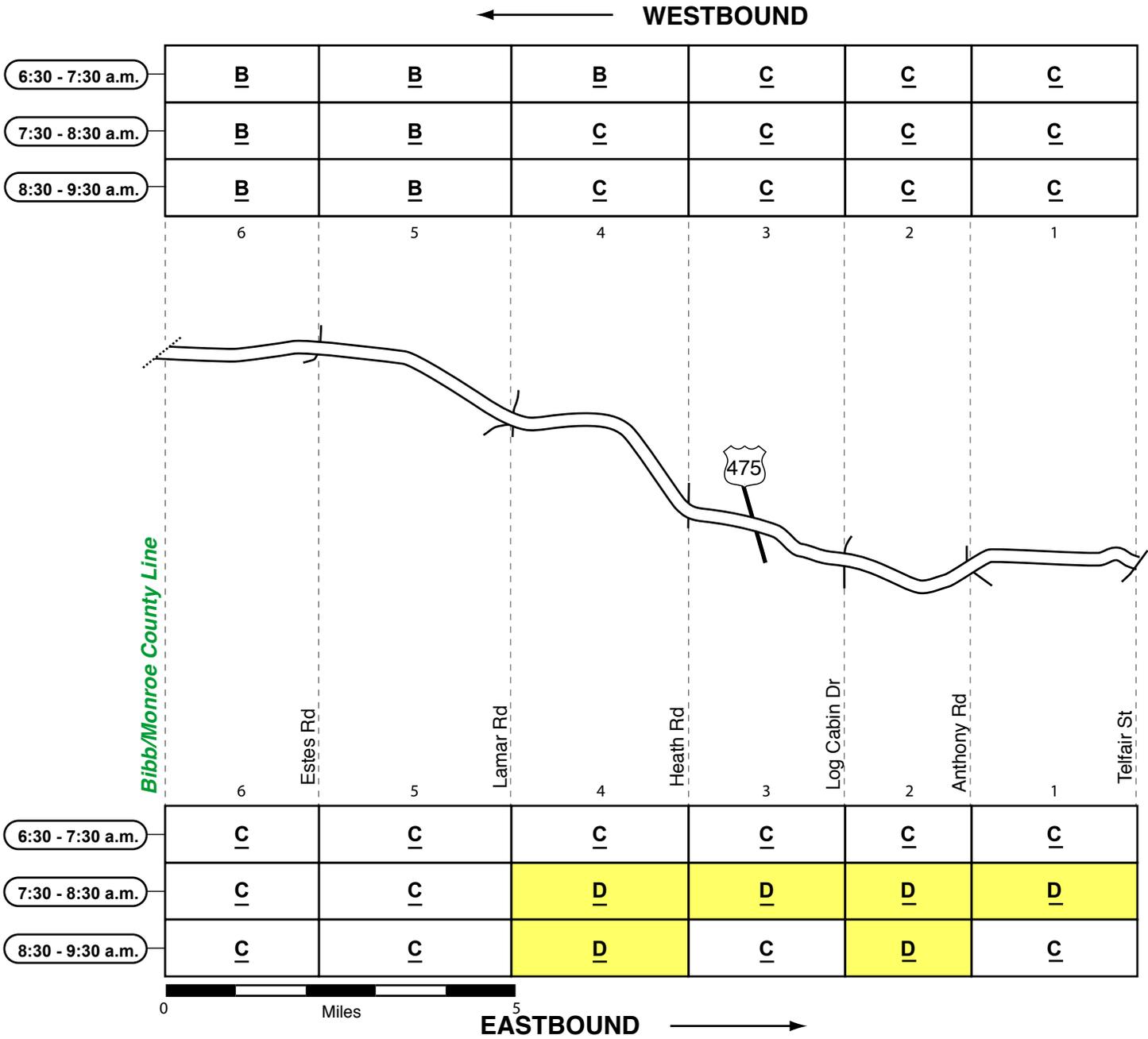
US 23 (Ocmulgee East Blvd) - Evening



Traffic Quality Rating



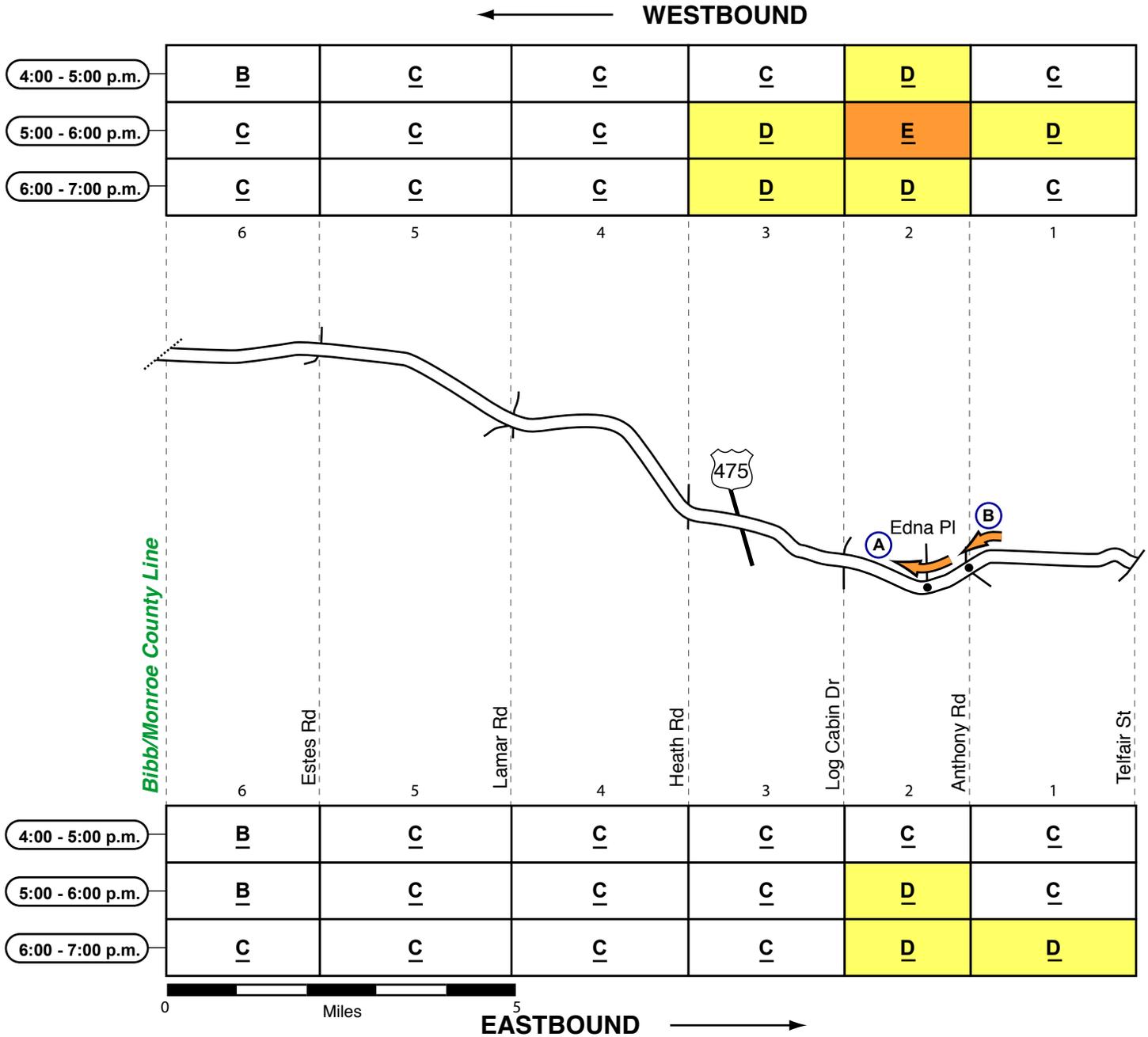
SR 74 - Morning



Traffic Quality Rating

A	B	C	D	E	F
Very Light	Light	Moderate	Heavy	Congested	Severe

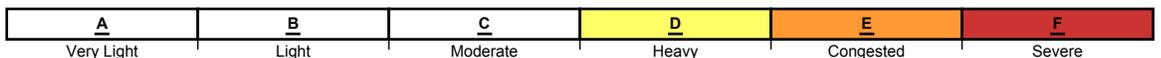
SR 74 - Evening



A
 Congestion Type: Mainline Signal Queue/Platoons
 Location: Between Anthony Rd & Log Cabin Dr
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

B
 Congestion Type: Mainline Signal Queue
 Location: Anthony Rd
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

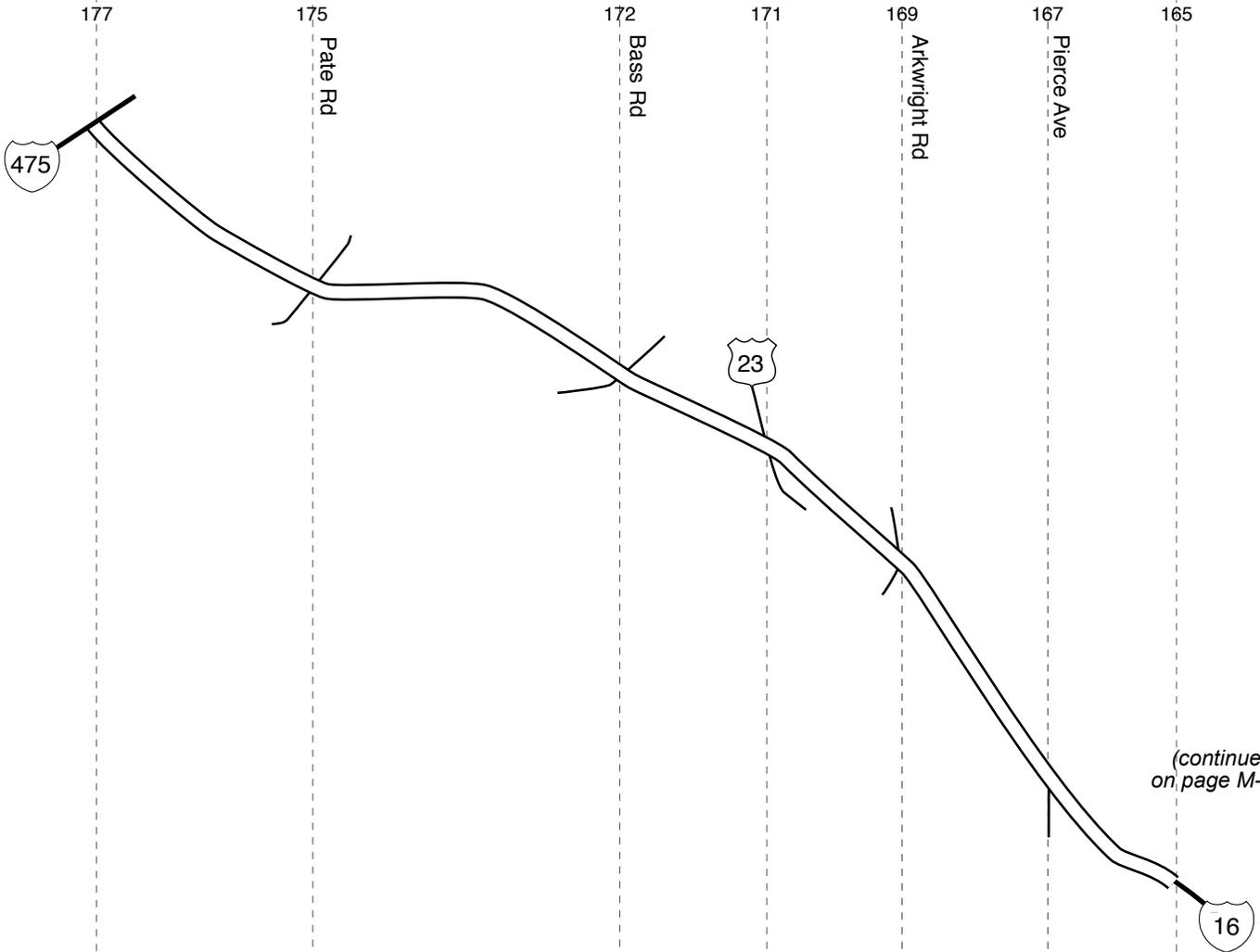
Traffic Quality Rating



I-75 - Morning

← NORTHBOUND

6:30 - 7:30 a.m.	A	A	A	A	A	A
7:30 - 8:30 a.m.	A	A	A	A	C	B
8:30 - 9:30 a.m.	A	A	A	A	A	B



6:30 - 7:30 a.m.	A	A	A	B	B	B
7:30 - 8:30 a.m.	A	B	B	B	C	C
8:30 - 9:30 a.m.	A	A	A	A	B	B



→ SOUTHBOUND



Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

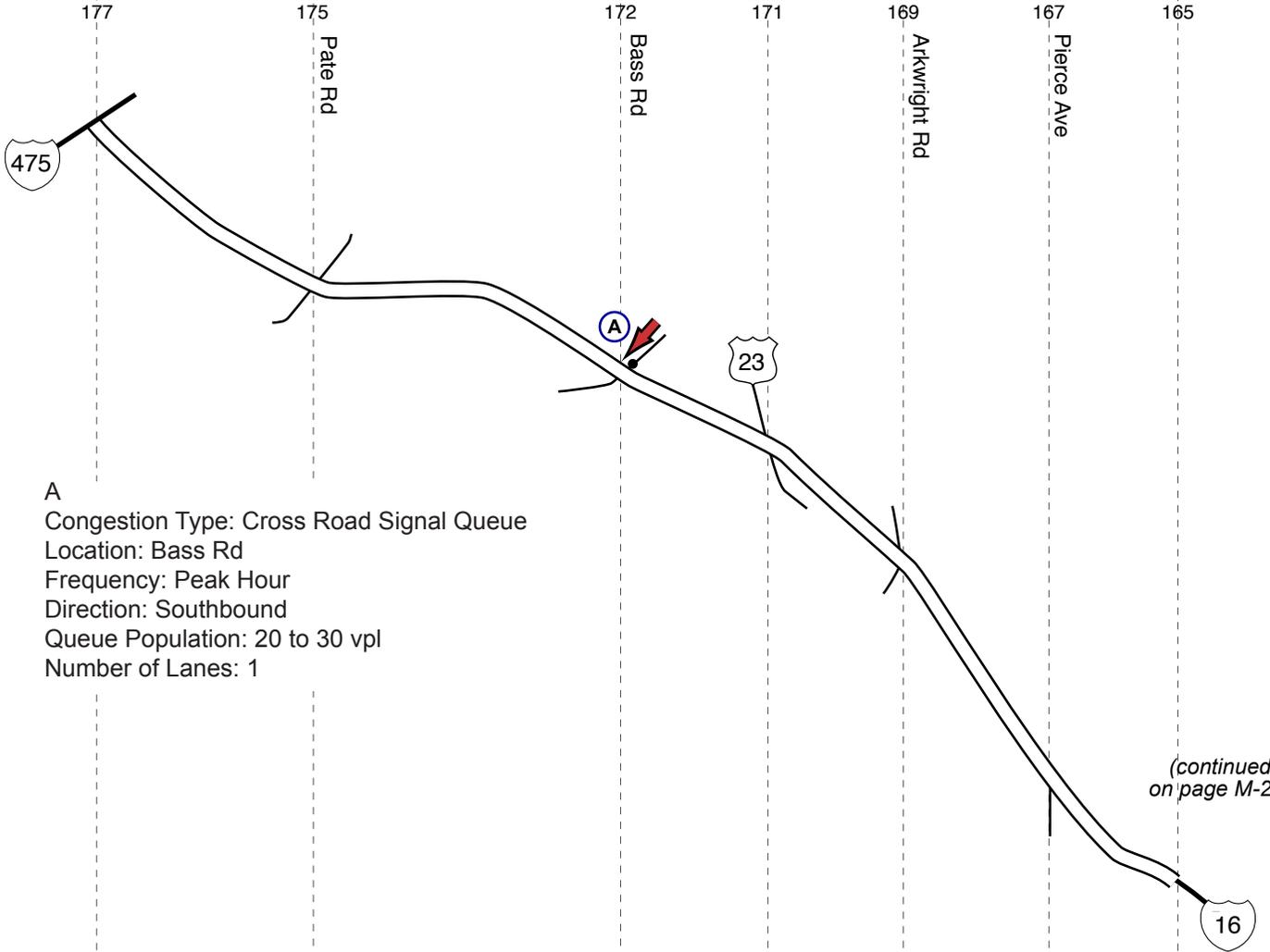
²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

I-75 - Evening

← NORTHBOUND

4:00 - 5:00 p.m.	A	A	B	A	C	C
5:00 - 6:00 p.m.	B	A	B	B	C	D
6:00 - 7:00 p.m.	A	A	A	B	B	B



A
Congestion Type: Cross Road Signal Queue
Location: Bass Rd
Frequency: Peak Hour
Direction: Southbound
Queue Population: 20 to 30 vpl
Number of Lanes: 1

(continued on page M-25)

4:00 - 5:00 p.m.	A	A	A	B	B	B
5:00 - 6:00 p.m.	A	A	A	B	B	C
6:00 - 7:00 p.m.	A	A	A	A	B	B



Traffic Quality Rating



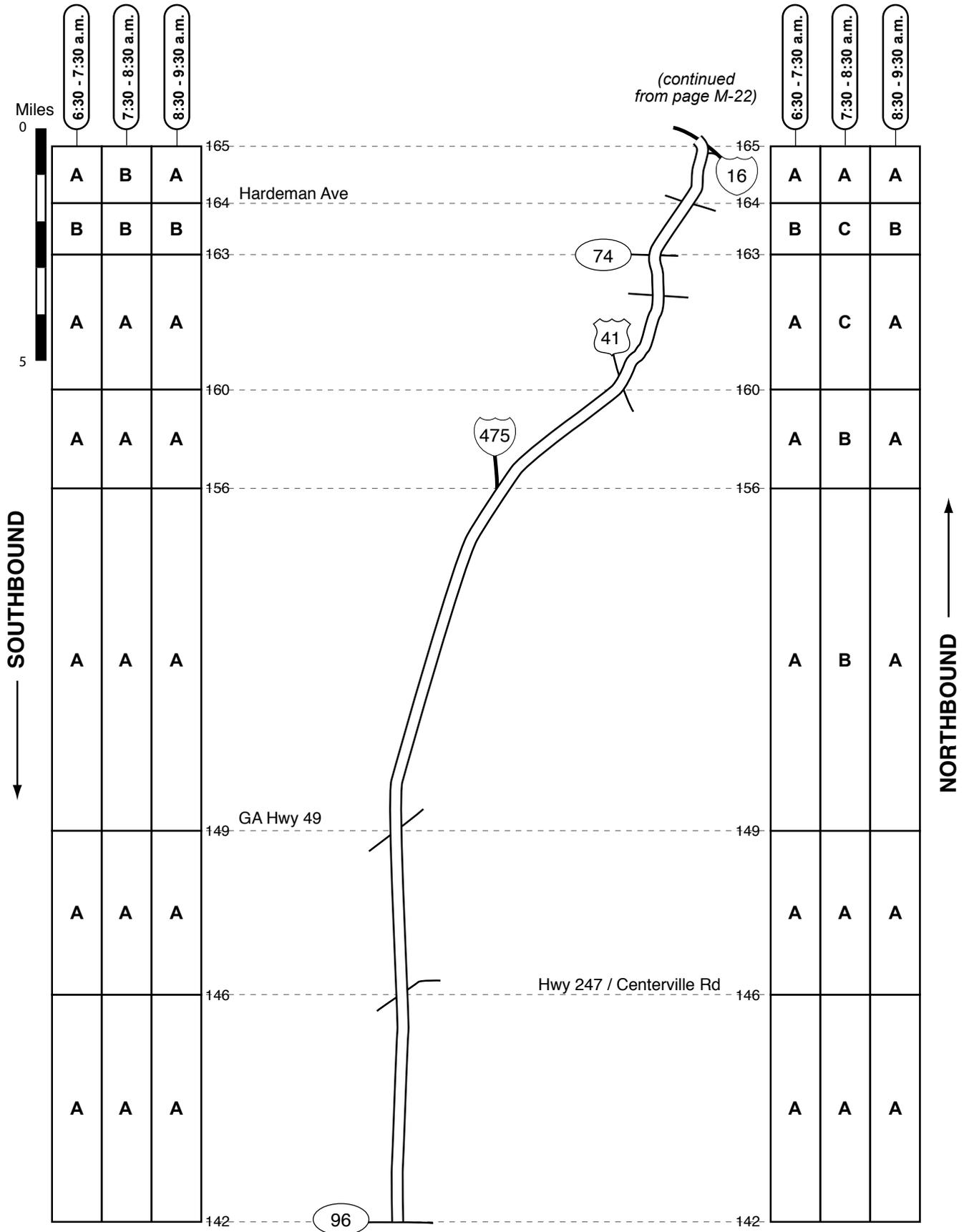
Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

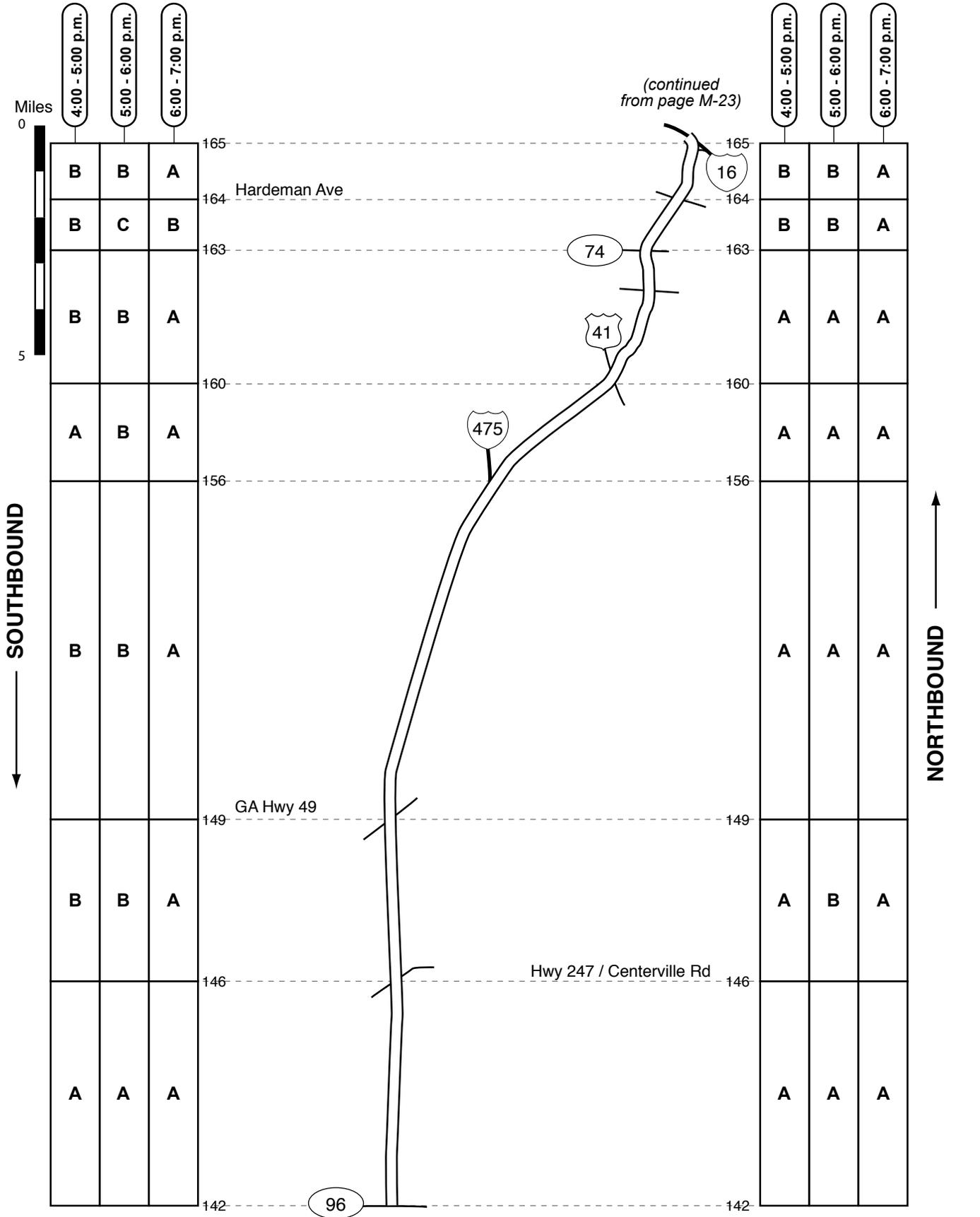
⁴Type 4 nested congestion (partial length of segment).

I-75 - Morning

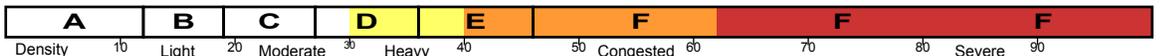


Superscripts: ¹Type 1 nested congestion (some days, not others). ²Type 2 nested congestion (more severe in left or right-hand lanes). ³Type 3 nested congestion (present only in the first or second half-hour period). ⁴Type 4 nested congestion (partial length of segment).

I-75 - Evening



Traffic Quality Rating



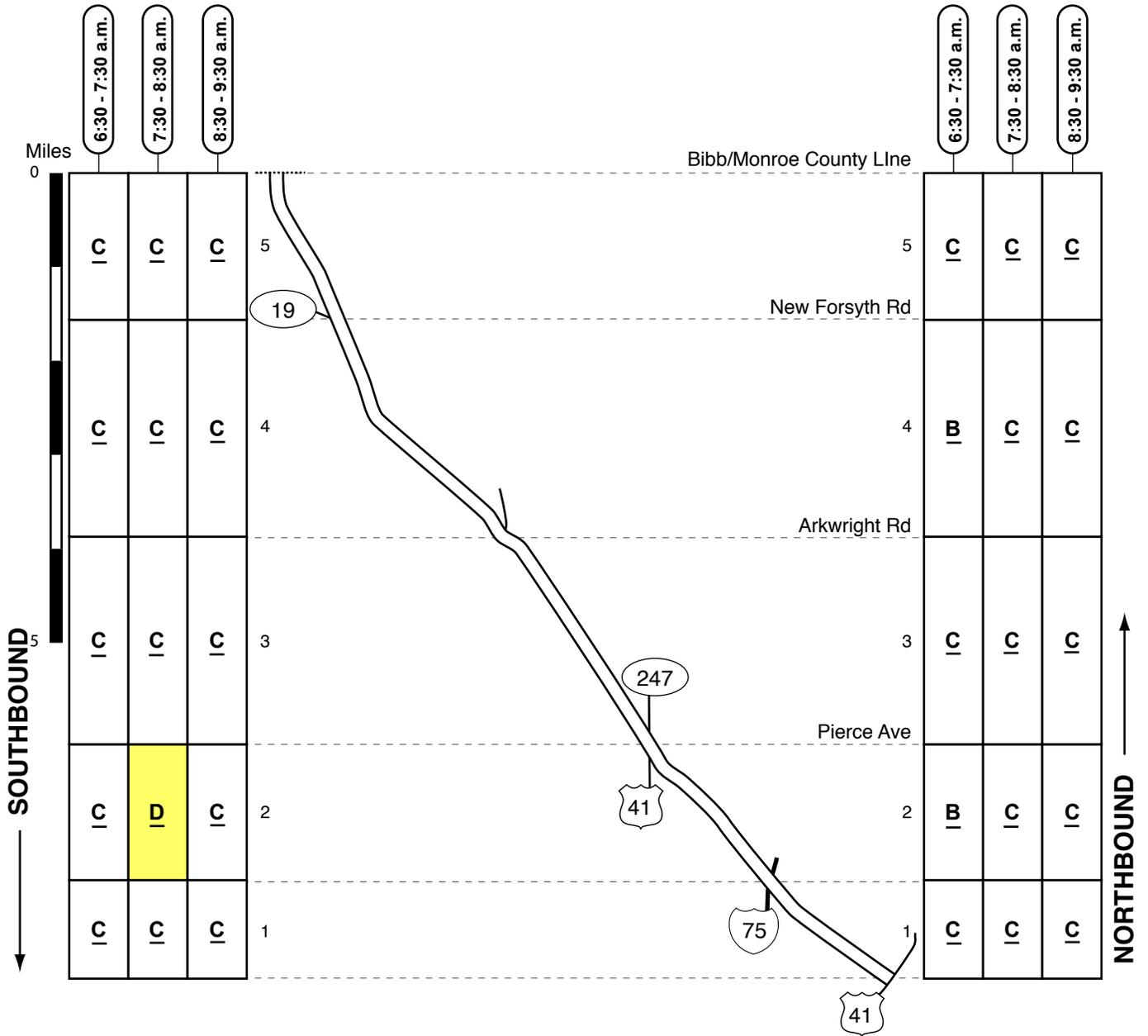
Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

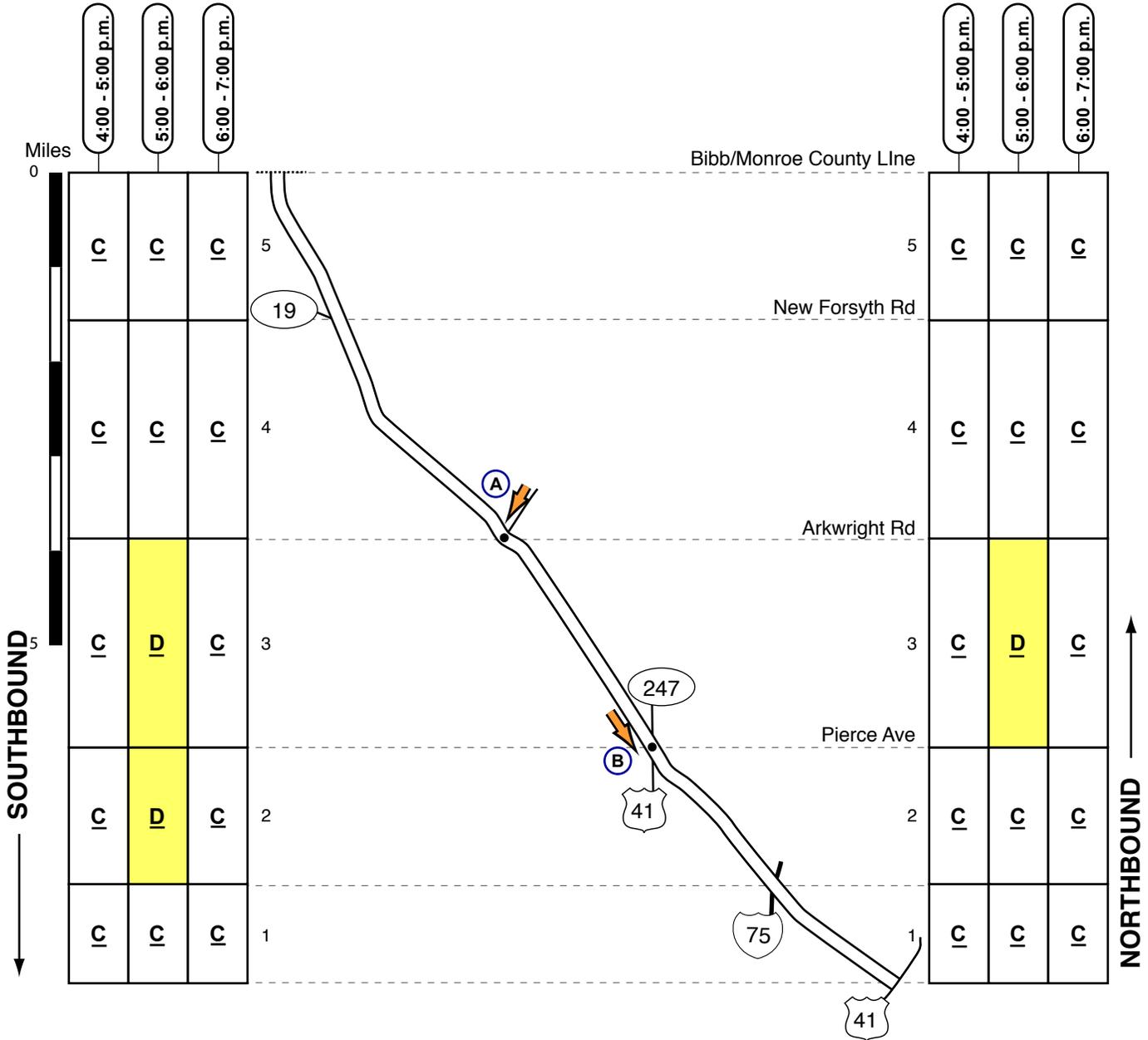
SR 87 / US 23 (Riverside Dr) - Morning



Traffic Quality Rating



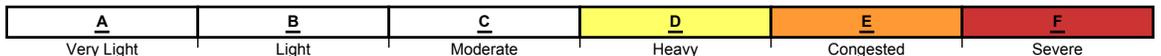
SR 87 / US 23 (Riverside Dr) - Evening



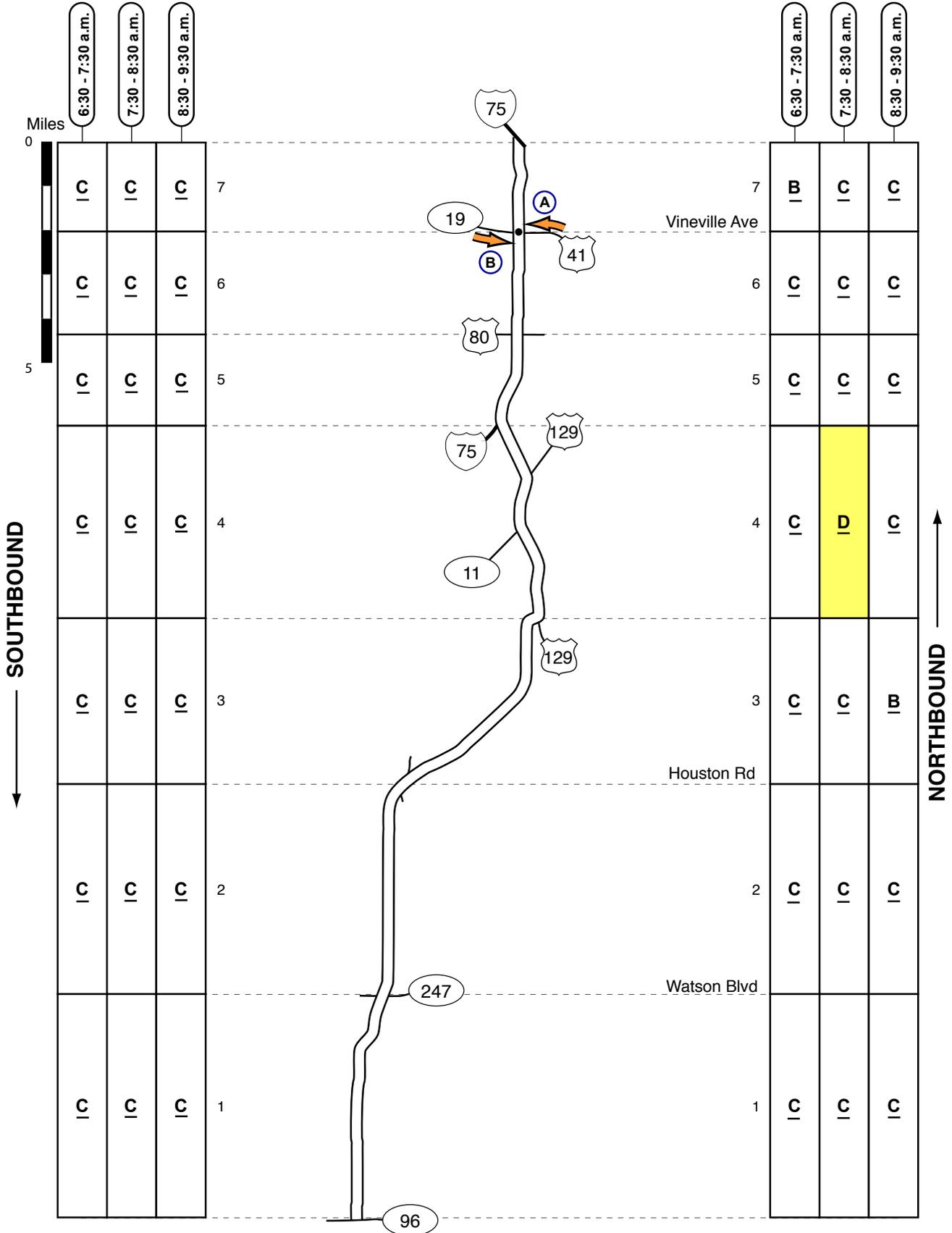
A
 Congestion Type: Cross Road Signal Queue
 Location: Arkwright Rd
 Frequency: One Time Only
 Direction: Southbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2

B
 Congestion Type: Mainline Signal Queue
 Location: Pierce Ave
 Frequency: One Time Only
 Direction: Southbound
 Queue Population: 25 to 30 vpl
 Number of Lanes: 2

Traffic Quality Rating



SR 247 / US 41 - Morning



Traffic Quality Rating



SR 247 / US 41 - Morning

A

Congestion Type: Surveyed Cross Road Signal Queue

Location: SR 19 / US 41

Frequency: Intermittent

Direction: Northbound

Queue Population: 20 to 25 vpl

Number of Lanes: 1

Note: When congested, vehicles were queued in the right lane of two at the signal (the left lane drops a short distance beyond the signal).

B

Congestion Type: Surveyed Cross Road Signal Queue

Location: SR 19 / US 41

Frequency: Intermittent

Direction: Southbound

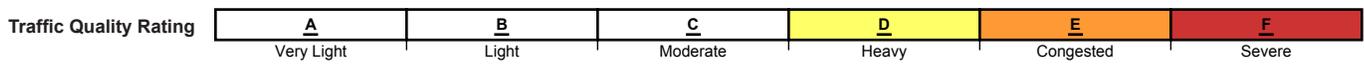
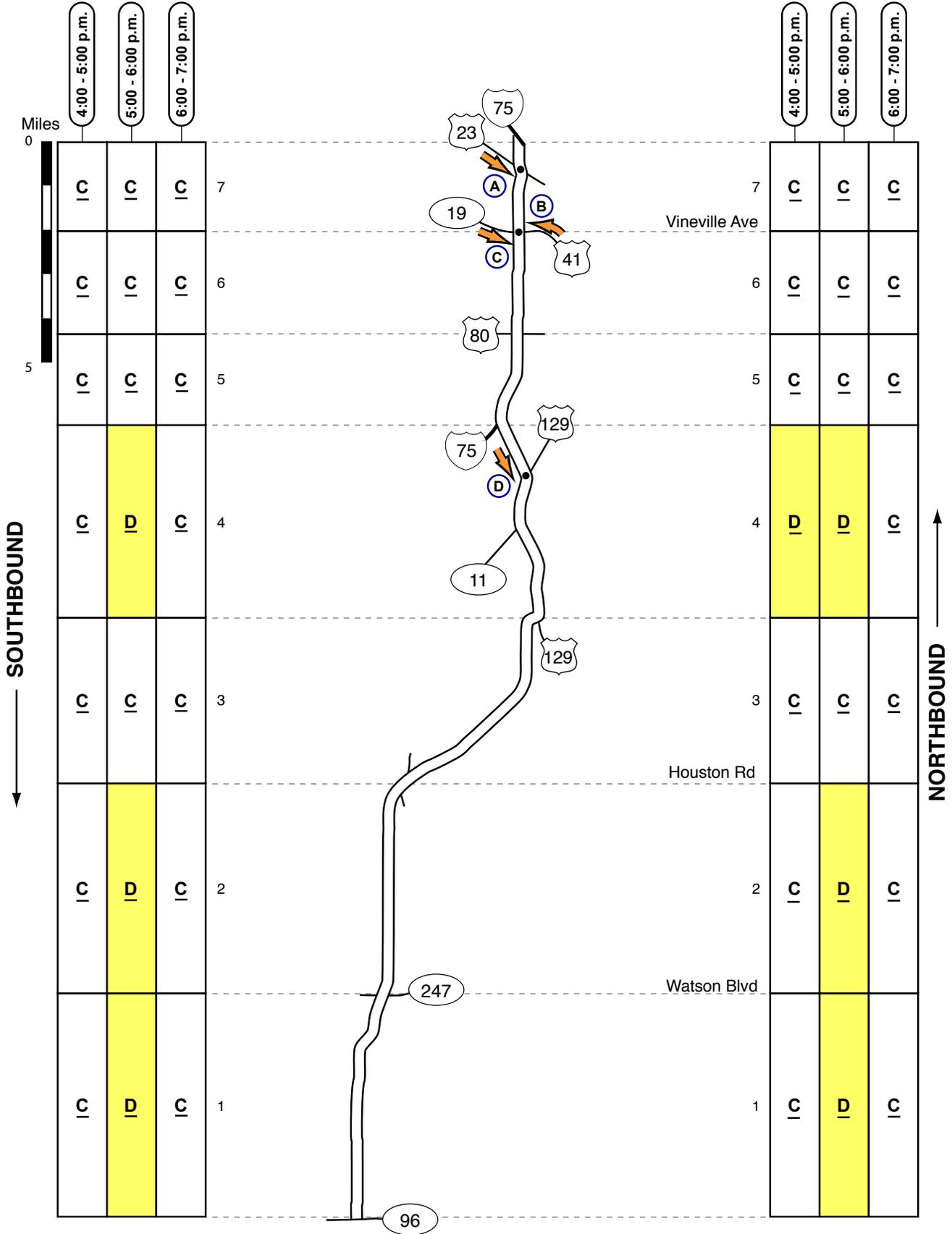
Queue Population: 20 to 30 vpl

Number of Lanes: 2

Traffic Quality Rating

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
Very Light	Light	Moderate	Heavy	Congested	Severe

SR 247 / US 41 - Evening



SR 247 / US 41 - Evening

A

Congestion Type: Surveyed Cross Road Signal Queue
 Location: US 23
 Frequency: One Time Only
 Direction: Southbound
 Queue Population: 25 to 30 vpl
 Number of Lanes: 2

B

Congestion Type: Surveyed Cross Road Signal Queue
 Location: SR 19 / US 41
 Frequency: Intermittent
 Direction: Northbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

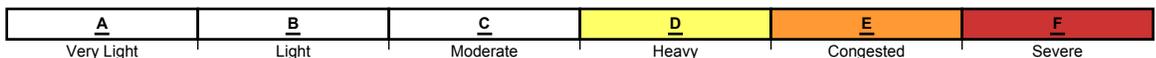
C

Congestion Type: Surveyed Cross Road Signal Queue
 Location: SR 19 / US 41
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

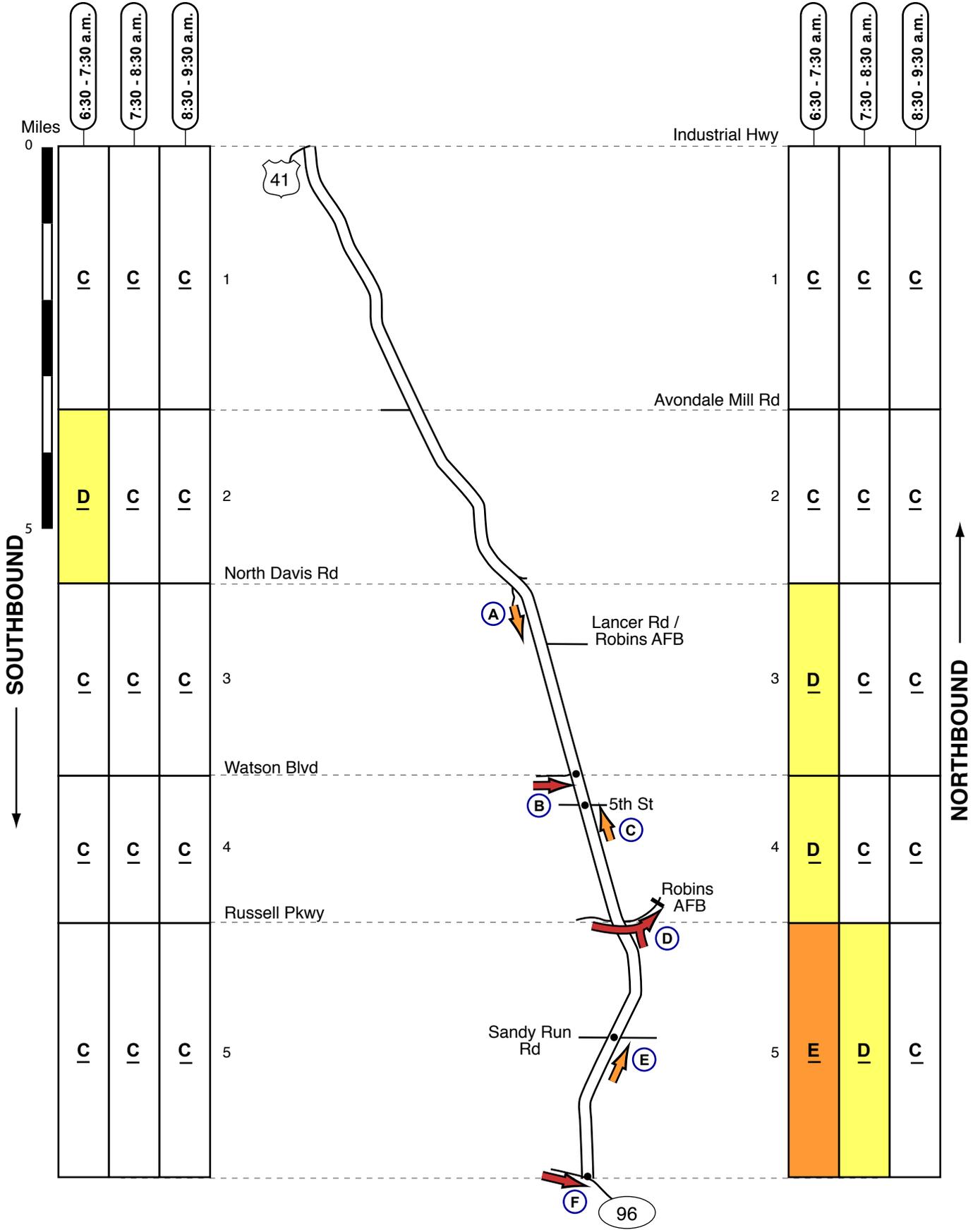
D

Congestion Type: Mainline Signal Queue
 Location: US 129
 Frequency: Intermittent
 Direction: Southbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 1
 Note: When congested, vehicles were queued in the right lane of three at the signal.

Traffic Quality Rating



SR 247 / US 129 - Morning



Traffic Quality Rating



SR 247 / US 129 - Morning

A

Congestion Type: Left-Turn Queue
 Location: Lancer Rd / Robins AFB
 Frequency: Before 7:00 a.m.
 Direction: Southbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 1
 Note: Vehicles at the head of the queue waited for gaps in northbound traffic before turning left onto Lancer Rd (no signal).

B

Congestion Type: Cross Road Signal Queue
 Location: Watson Blvd
 Frequency: Most Observations (before 7:30 a.m.)
 Direction: Eastbound
 Queue Population: 20 to 50 vpl
 Number of Lanes: 2

C

Congestion Type: Right-Turn Queue
 Location: 5th St
 Frequency: Intermittent (before 7:00 a.m.)
 Direction: Northbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 1
 Note: When congested, the head of the queue was found at the base gate at Robins AFB; congestion extended back into the right lane on US 129.

D

Congestion Type: Cross Road Signal Queue
 Location: Robbins Pkwy (Robins AFB)
 Frequency: Most observations before 7:30 a.m.
 Direction: Eastbound
 Note: The head of the queue was found at the base gate where three lanes were available; congestion typically extended upstream for approximately 1/2 mile (eastbound on Russel Pkwy and northbound in the right lane on US 129).

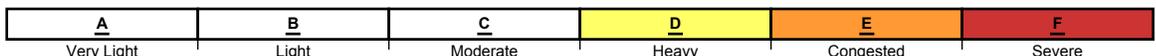
E

Congestion Type: Mainline Signal Queue
 Location: Sandy Run Rd
 Frequency: Intermittent (before 7:30 a.m.)
 Direction: Northbound
 Queue Population: 20 to 30 vpl
 Number of Lanes: 2

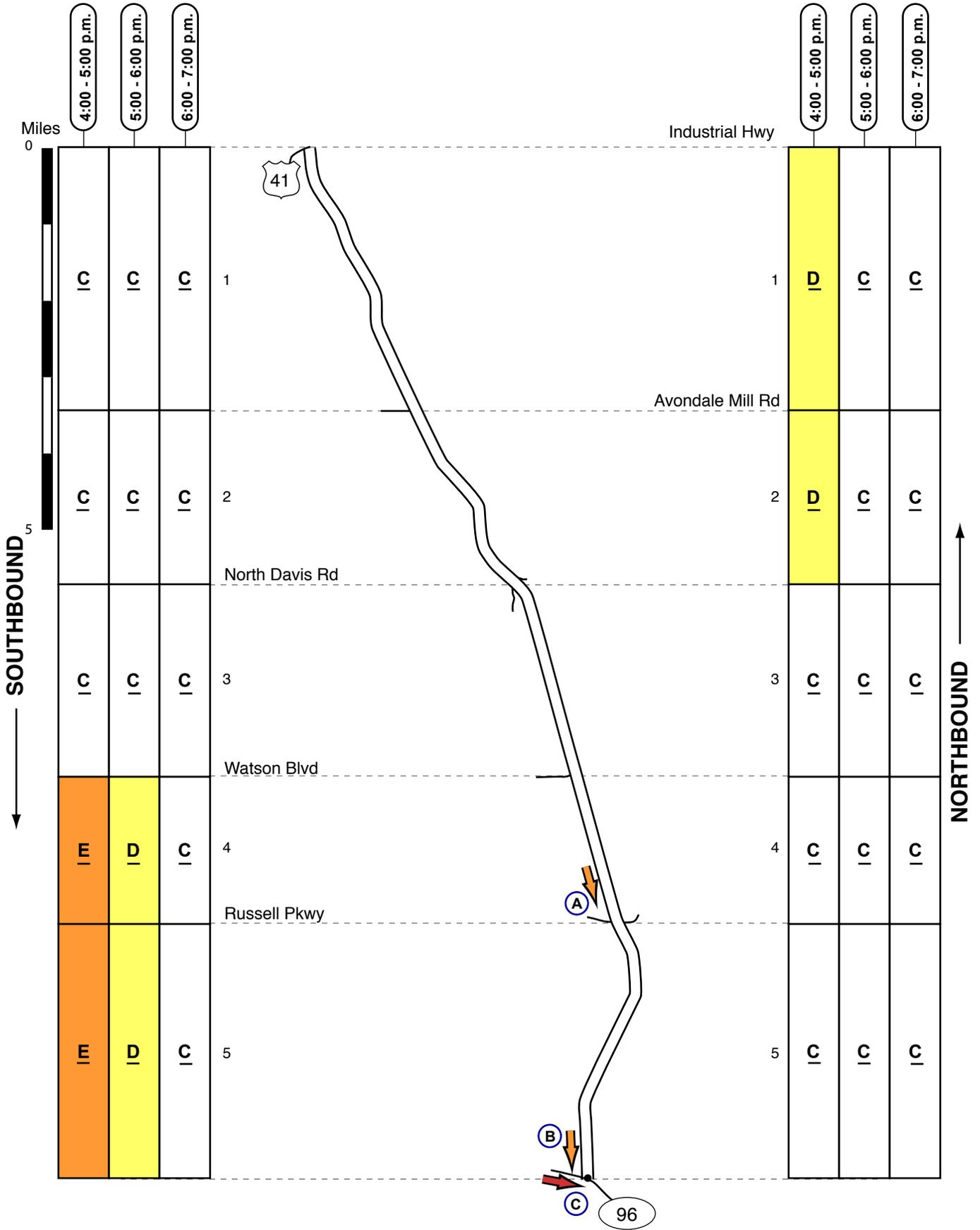
F

Congestion Type: Cross Road Signal Queue
 Location: SR 96
 Frequency: Peak Hour
 Direction: Eastbound
 Queue Population: 20 to 45 vpl
 Number of Lanes: 1

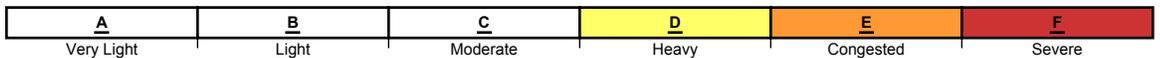
Traffic Quality Rating



SR 247 / US 129 - Evening



Traffic Quality Rating



SR 247 / US 129 - Evening

A

Congestion Type: Platoons
Location: Between Watson Blvd & Russell Pkwy
Frequency: Intermittent
Direction: Southbound
Queue Population: 25 to 30 vpl
Number of Lanes: 2

B

Congestion Type: Mainline Signal Queue
Location: SR 96
Frequency: One Time Only
Direction: Southbound
Queue Population: 20 to 25 vpl
Number of Lanes: 1

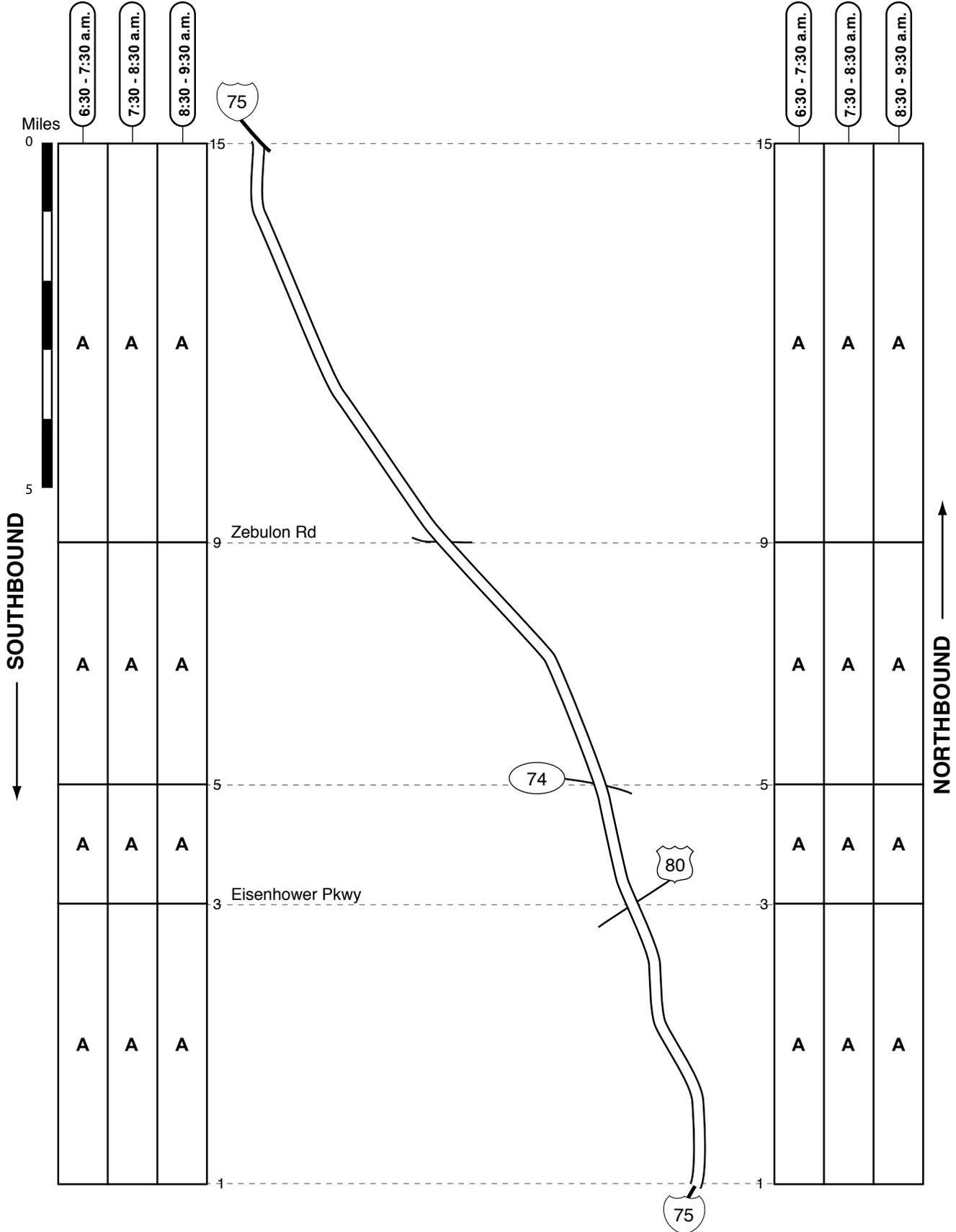
C

Congestion Type: Cross Road Signal Queue
Location: SR 96
Frequency: Peak Hour
Direction: Eastbound
Queue Population: 20 to 45 vpl
Number of Lanes: 1
Note: During one observation, eastbound congestion on SR 96 was exacerbated by the train crossing located just before the signal at US 129.

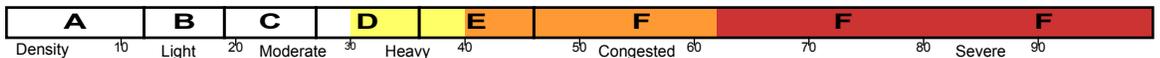
Traffic Quality Rating

A	B	C	D	E	F
Very Light	Light	Moderate	Heavy	Congested	Severe

I-475 - Morning



Traffic Quality Rating



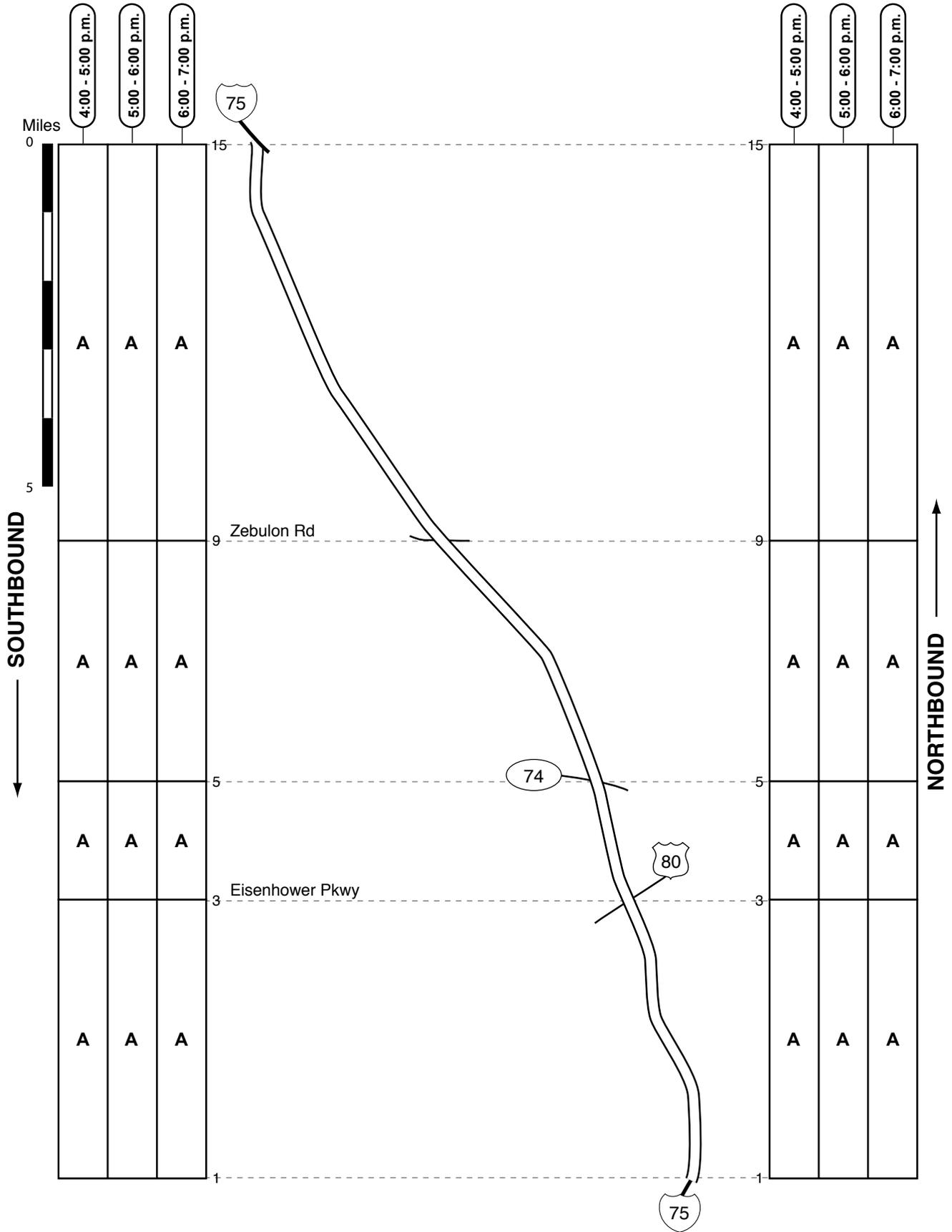
Superscripts: ¹ Type 1 nested congestion (some days, not others).

³ Type 3 nested congestion (present only in the first or second half-hour period).

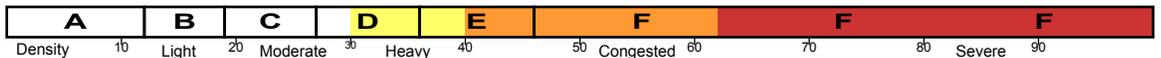
² Type 2 nested congestion (more severe in left or right-hand lanes).

⁴ Type 4 nested congestion (partial length of segment).

I-475 - Evening



Traffic Quality Rating



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).



SAVANNAH

HIGHWAY TRAFFIC QUALITY

FALL 2010

Savannah, GA (Surveyed Highways)

Fall 2010

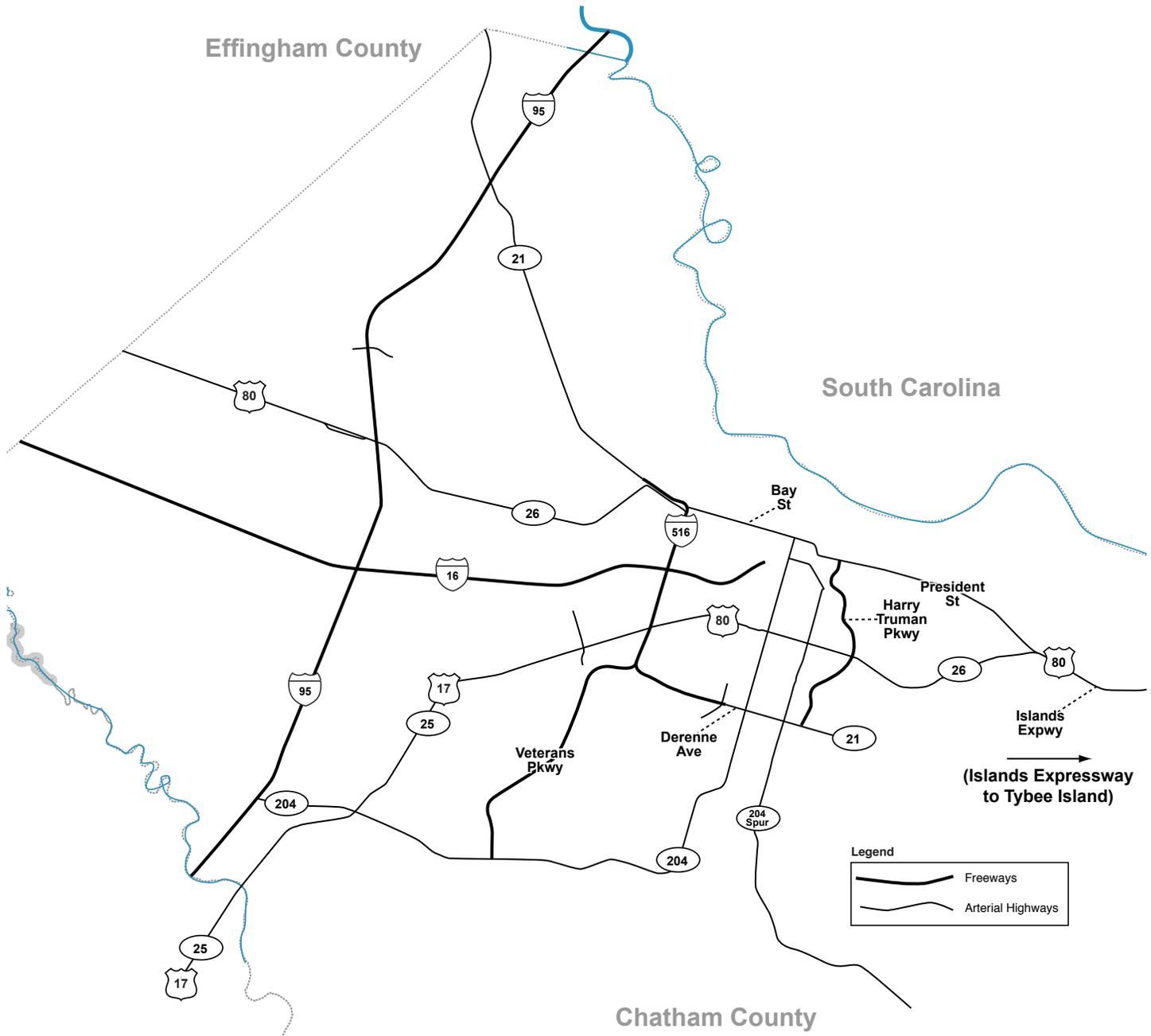


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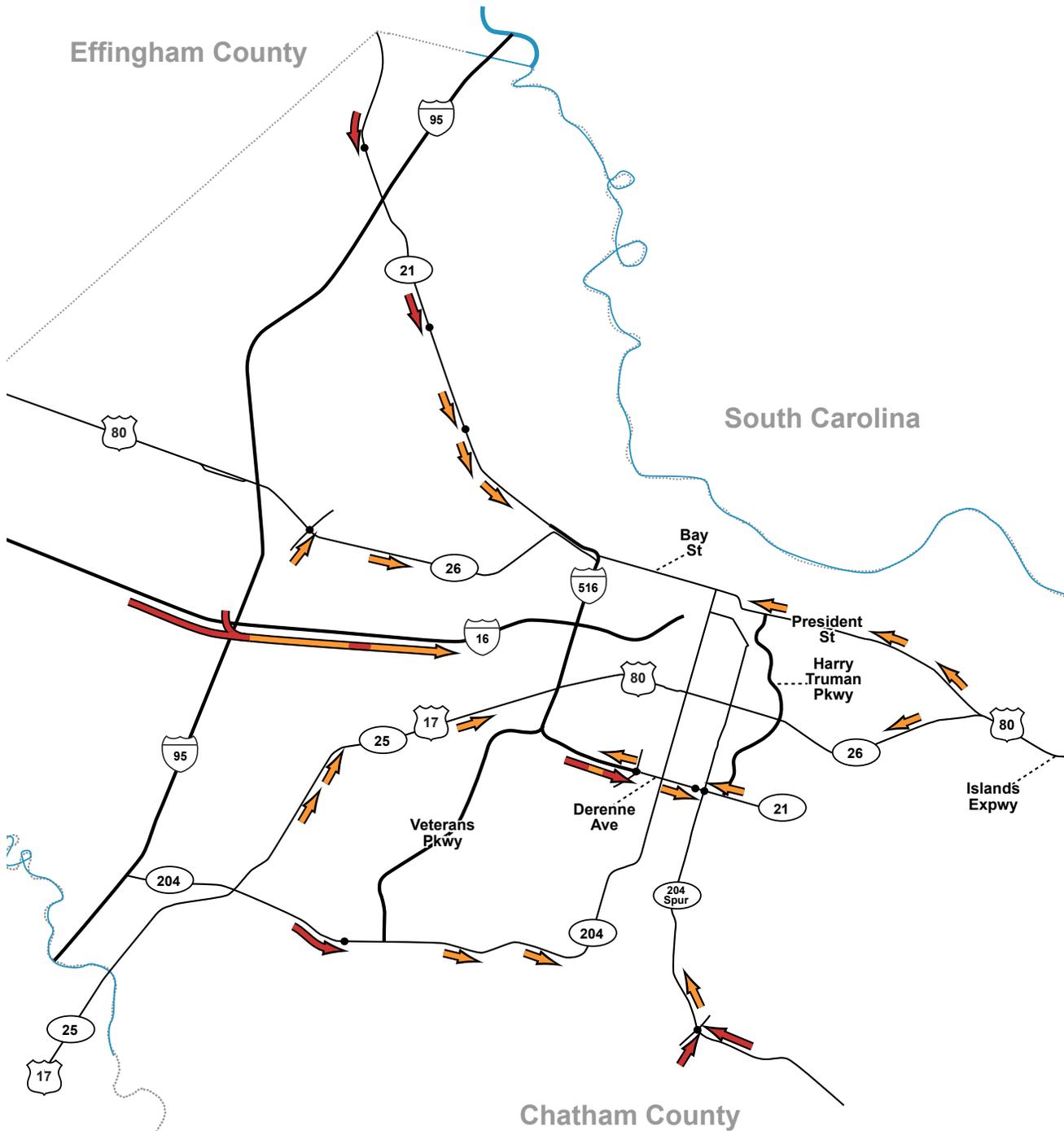
Surveyed Highways.....	S-2
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PERFORMANCE RATINGS

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SR 21 / Derenne Ave.....	S-12
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Veterans Parkway.....	S-48

Savannah, GA (Locations Where Congestion Was Found)

Fall 2010 (Morning)



Freeway Legend

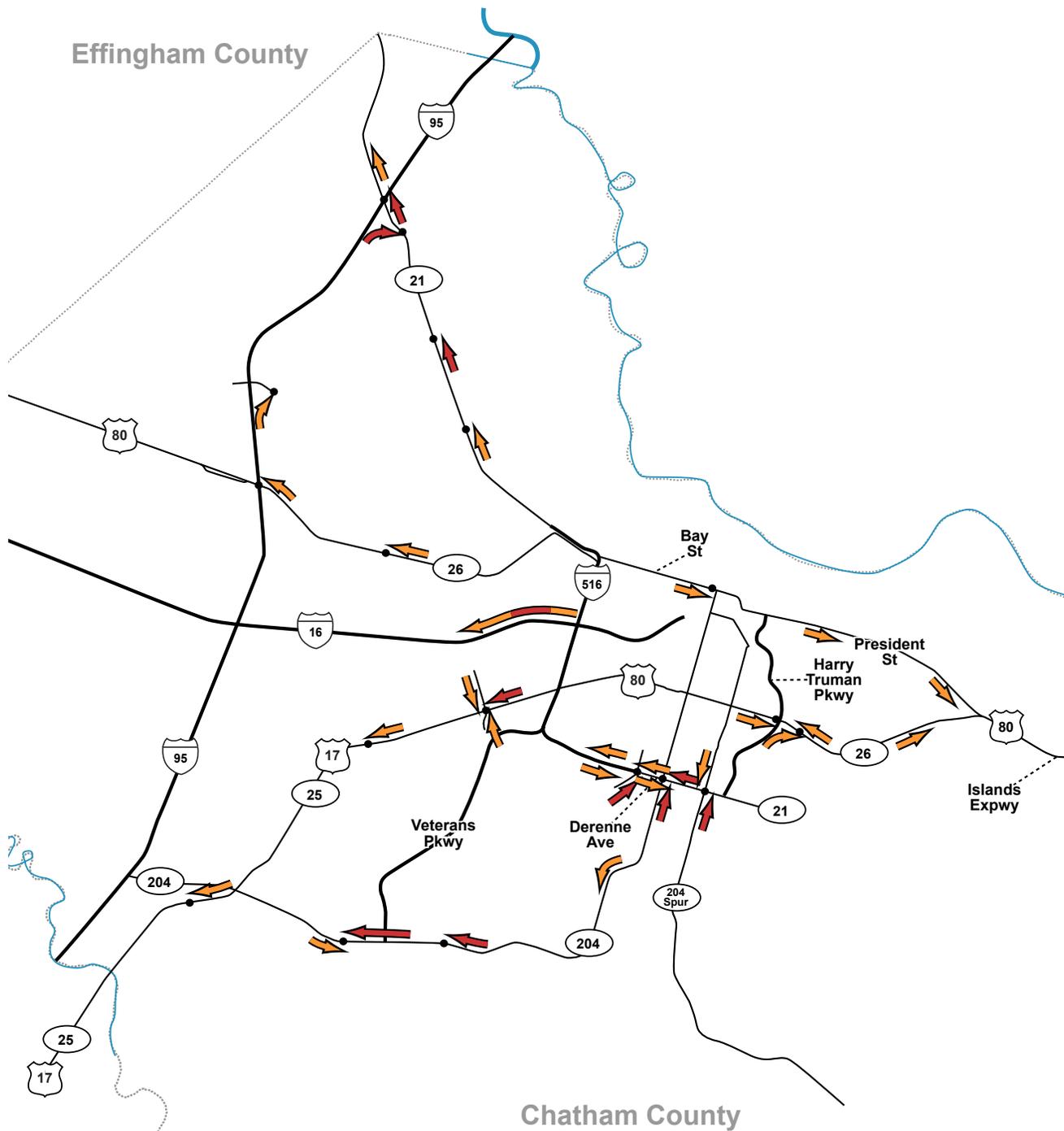
- Severe mainline congestion (<30 mph)
- Moderate or intermittent mainline congestion (30-50 mph)

Arterial Legend

- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

Savannah, GA (Locations Where Congestion Was Found)

Fall 2010 (Evening)



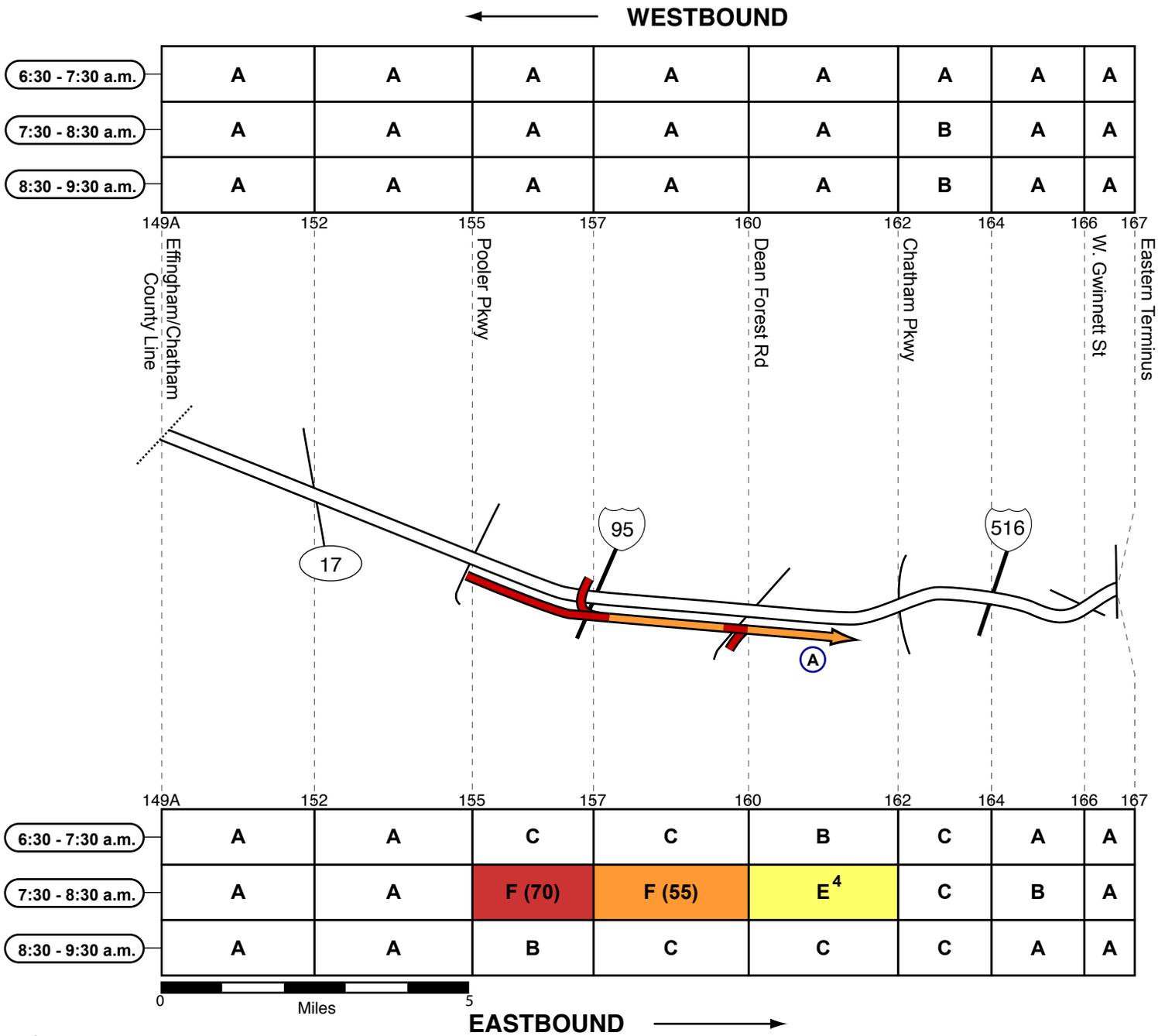
Freeway Legend

- Severe mainline congestion (<30 mph)
- Moderate or intermittent mainline congestion (30-50 mph)

Arterial Legend

- Congested signalized intersection (most observations or queues greater than 40 vpl)
- Congested signalized intersection (intermittent or less severe)
- Platoons (populations greater than 25 vpl)

I-16 - Morning

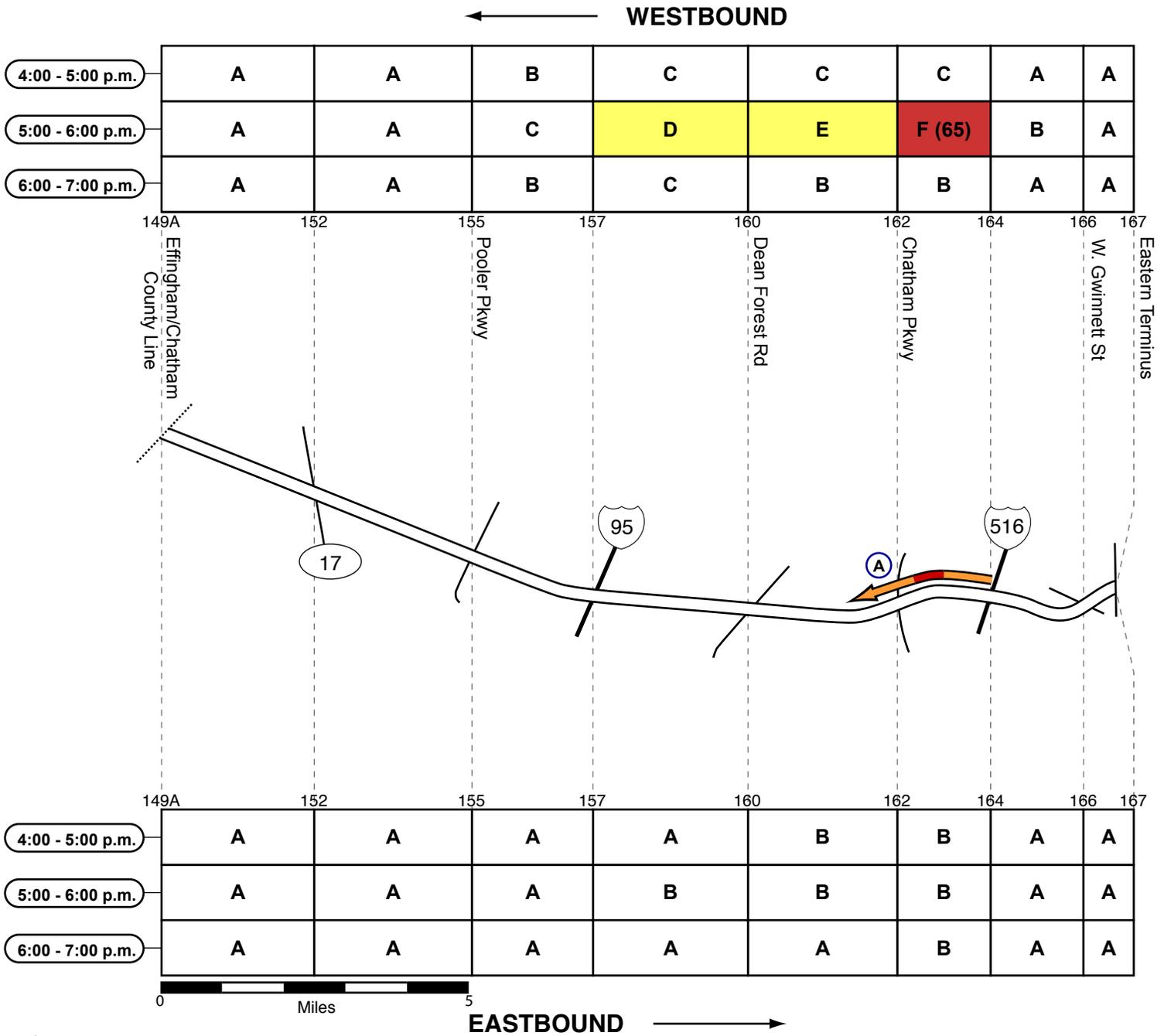


A
 Congestion Type: Mainline Congestion
 Frequency: Peak Hour
 Direction: Eastbound
 Location: Between Pooler Parkway and Chatham Parkway
 Queue Length: 5 to 7 miles
 Estimated Speed: 20 to 50 mph
 Potential Cause(s): Eastbound congestion on I-16 was exacerbated by traffic entering at the I-95 and Dean Forest Rd interchanges; the queue on the I-95 ramp (southbound) typically extended back into the right shoulder of I-95.



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

I-16 - Evening

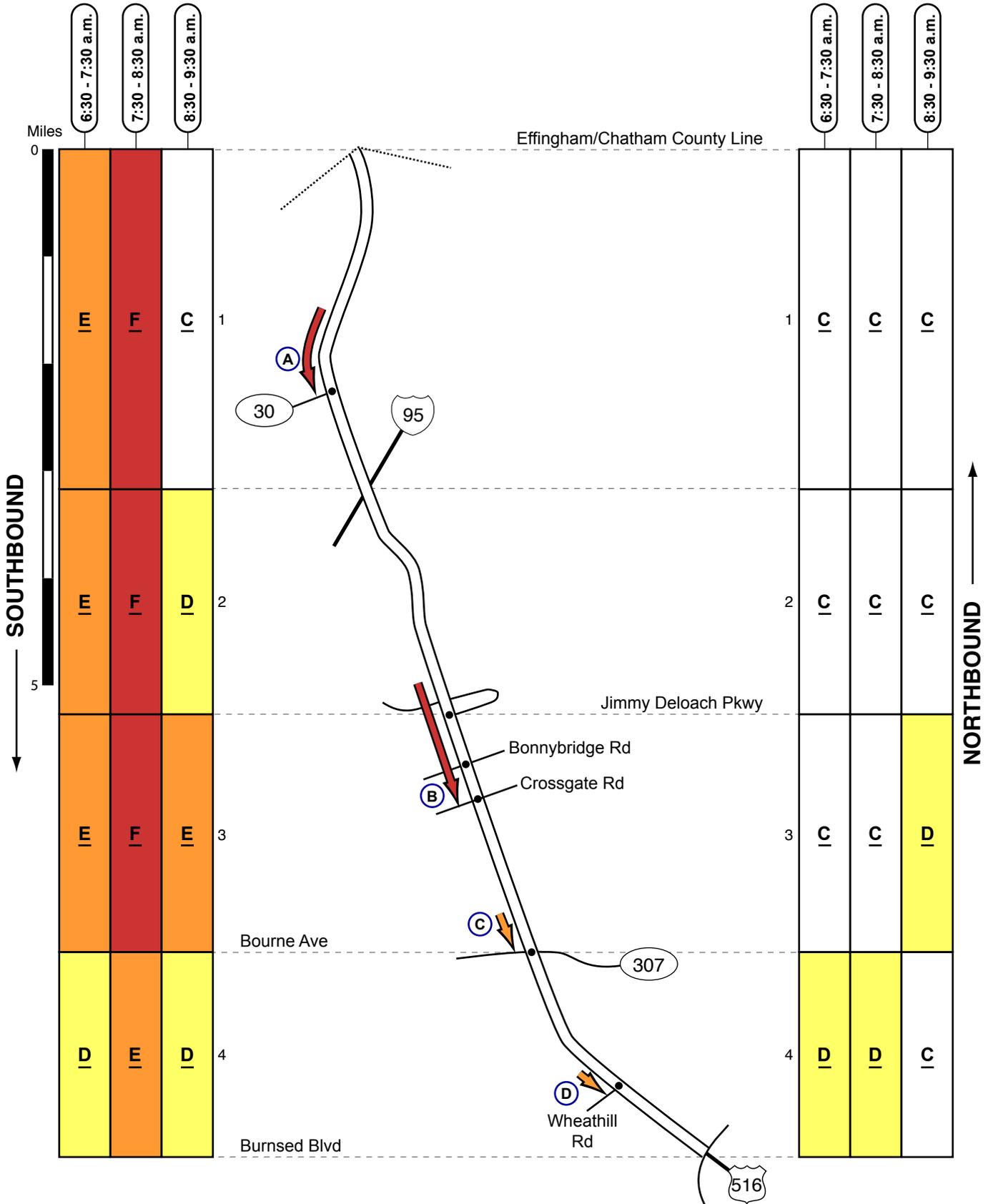


A
 Congestion Type: Mainline Congestion
 Frequency: Peak Hour
 Direction: Westbound
 Location: Between I-516 and Dean Forest Rd
 Queue Length: 1 to 2 miles
 Estimated Speed: 30 to 50 mph
 Potential Cause(s): Factors contributing to the congestion were: 1) traffic entering at I-516 and Chatham Parkway; and 2) the geometrics of the roadway (sharp bends).

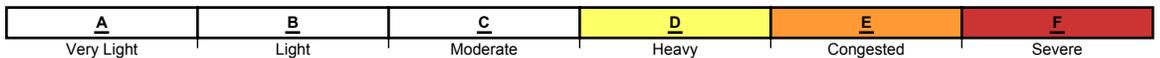


Superscripts: ¹Type 1 nested congestion (some days, not others). ²Type 2 nested congestion (more severe in left or right-hand lanes). ³Type 3 nested congestion (present only in the first or second half-hour period). ⁴Type 4 nested congestion (partial length of segment).

SR 21 - Morning



Traffic Quality Rating



SR 21 - Morning

A

Congestion Type: Mainline Signal Queue
Location: SR 30 (Monteith Rd)
Frequency: Peak Hour
Direction: Southbound
Queue Population: 70 to 130 vpl
Number of Lanes: 2

B

Congestion Type: Mainline Signal Queue
Location: Crossgate Rd
Frequency: Most Observations
Direction: Southbound
Queue Population: 100 to 200 vpl
Number of Lanes: 2

Note: During the peak period, a one to two-mile zone of southbound congestion was found approaching the signal at Crossgate Rd; congestion typically backed through the upstream signal at Bonnybridge Rd, and in some cases, the signal at Jimmy Deloach Parkway.

C

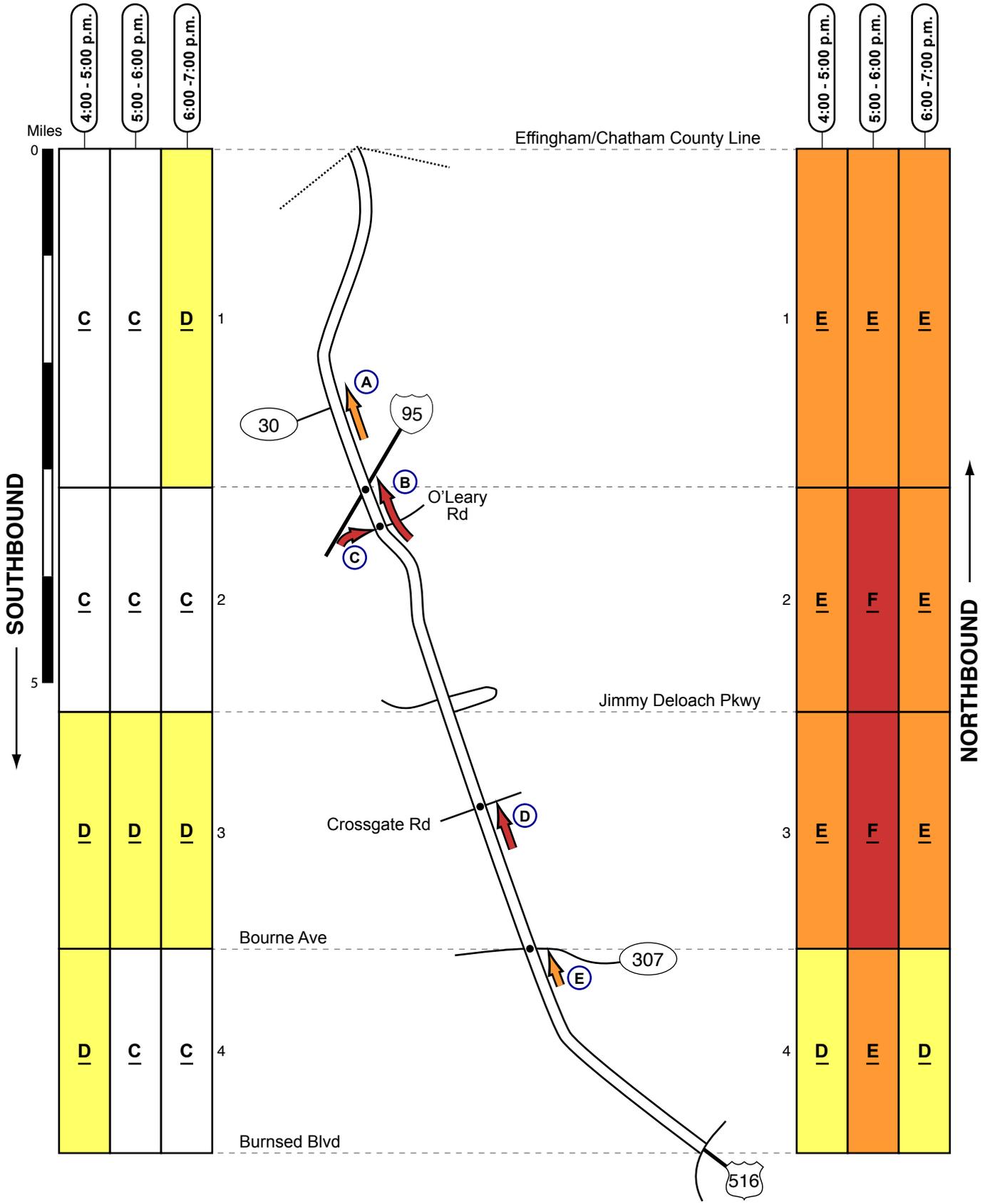
Congestion Type: Mainline Signal Queue
Location: SR 307 (Bourne Ave)
Frequency: One day only
Direction: Southbound
Queue Population: 20 to 25 vpl
Number of Lanes: 2

D

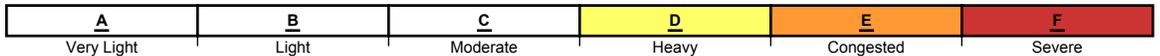
Congestion Type: Mainline Queue
Location: Wheathill Rd
Frequency: One time only
Direction: Southbound
Queue Population: 30 to 35 vpl
Number of Lanes: 3

Note: It appeared that the congestion was related to school bus traffic at Groves High School.

SR 21 - Evening



Traffic Quality Rating



SR 21 - Evening

A

Congestion Type: Platoons

Location: Approaching SR 30

Frequency: Most Observations

Direction: Northbound

Platoon Population: 25 to 35 vpl

Number of Lanes: 2

Note: During one observation only, approximately 30 vehicles per lane were queued at the signal.

B

Congestion Type: Mainline Signal Queue

Location: I-95

Frequency: Peak Hour

Direction: Northbound

Queue Population: 40 to 70 vpl

Number of Lanes: 2

Note: Congestion typically backed though the upstream signal at O'Leary Rd.

C

Congestion Type: Exit Ramp Queue

Location: I-95

Frequency: Peak Hour

Direction: Northbound

Queue Population: 20 to 40 vpl

Number of Lanes: 2

D

Congestion Type: Mainline Signal Queue

Location: Crossgate Rd

Frequency: Most Observations

Direction: Northbound

Queue Population: 30 to 70 vpl

Number of Lanes: 2

E

Congestion Type: Mainline Signal Queue

Location: SR 307 (Bourne Ave)

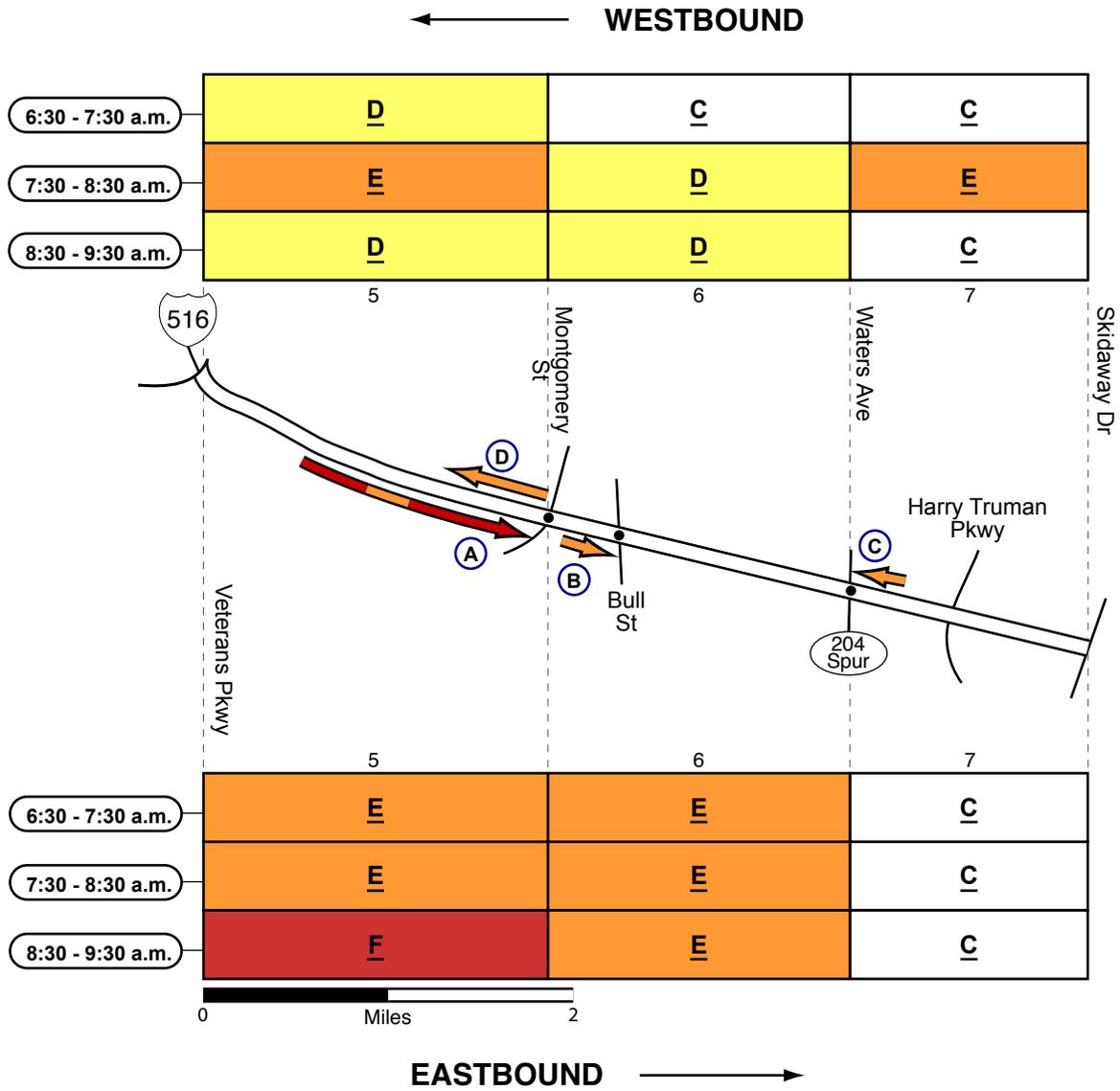
Frequency: Intermittent

Direction: Northbound

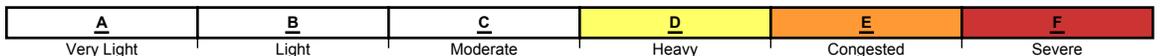
Queue Population: 20 to 30 vpl

Number of Lanes: 2

SR 21 / Derenne Ave - Morning



Traffic Quality Rating



SR 21 / Derenne Ave - Morning

A

Congestion Type: Mainline Signal Queue

Location: Montgomery St

Frequency: Most Observations

Direction: Eastbound

Queue Population: 50 to 120 vpl

Number of Lanes: 3

Note: During the peak period, a one to two mile zone of congestion was found approaching the terminus of I-516 at the signal at Montgomery St.

B

Congestion Type: Mainline Signal Queue

Location: Bull St

Frequency: Intermittent

Direction: Eastbound

Queue Population: 20 to 30 vpl

Number of Lanes: 3

C

Congestion Type: Mainline Signal Queue

Location: SR 204 Spur (Waters Ave)

Frequency: Intermittent

Direction: Westbound

Queue Population: 25 to 35 vpl

Number of Lanes: 2

D

Congestion Type: Platoons

Location: Between Montgomery St & Veterans Parkway

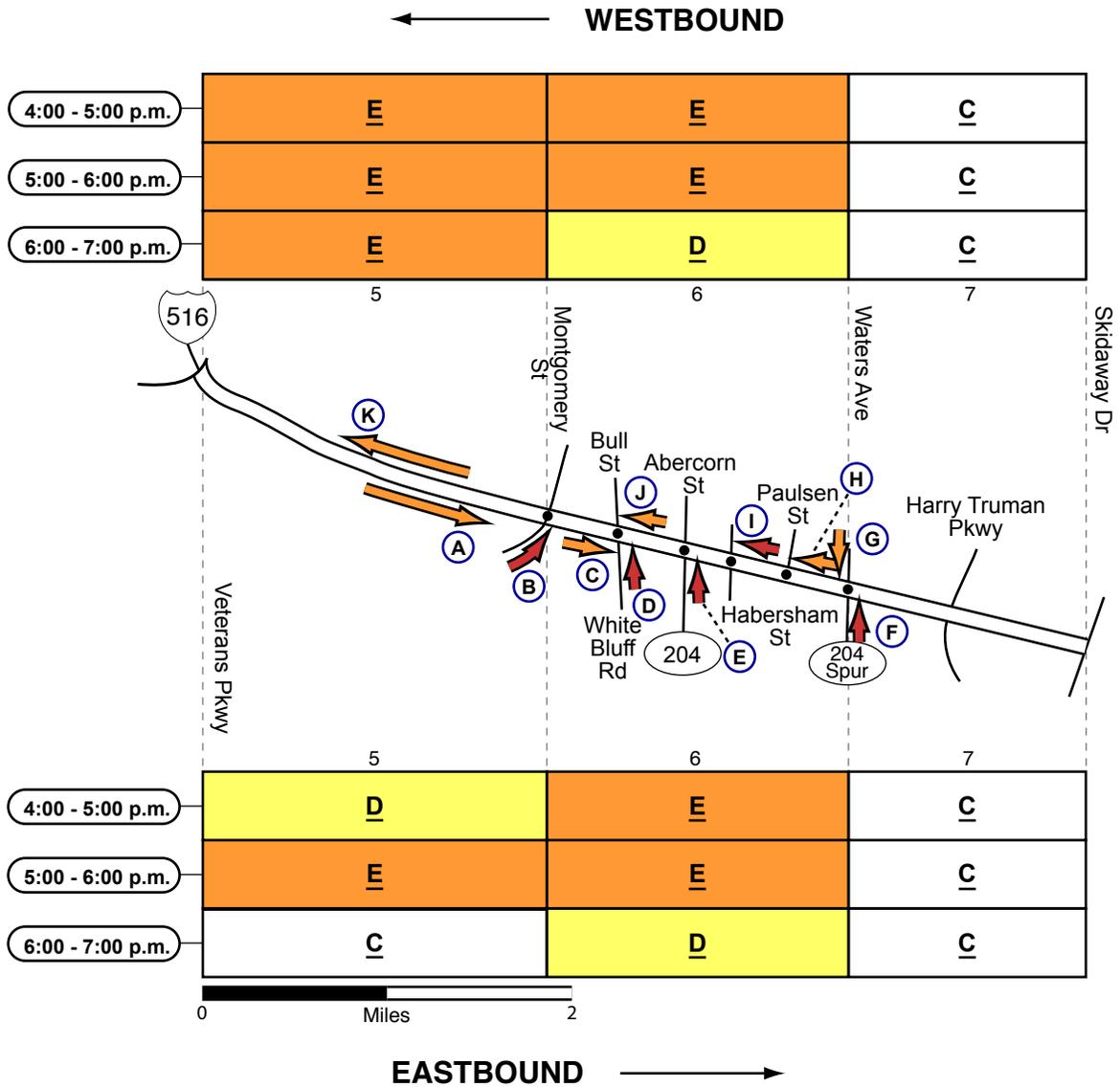
Frequency: Intermittent

Direction: Westbound

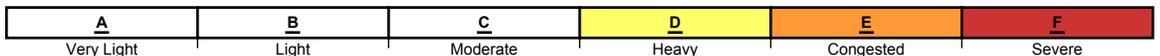
Platoon Population: 25 to 35 vpl

Number of Lanes: 2

SR 21 / Derenne Ave - Evening



Traffic Quality Rating



SR 21 / Derenne Ave - Evening**A**

Congestion Type: Platoons
Location: Approaching Montgomery St
Frequency: Intermittent
Direction: Eastbound
Platoon Population: 25 to 45 vpl
Number of Lanes: 3
Note: During one observation only, approximately 45 vehicles were queued at the signal at Montgomery St; congestion may have been exacerbated by downstream congestion at Bull St.

B

Congestion Type: Cross Road Signal Queue
Location: Montgomery St
Frequency: Between 4:30 and 5:00 p.m.
Direction: Northbound
Queue Population: 40 to 50 vpl
Number of Lanes: 2
Note: The head of the queue was found in the two left-turn lanes at the signal.

C

Congestion Type: Mainline Signal Queue
Location: Bull St
Frequency: Intermittent
Direction: Eastbound
Queue Population: 20 to 30 vpl
Number of Lanes: 3

D

Congestion Type: Cross Road Signal Queue
Location: White Bluff Rd
Frequency: Most Observations
Direction: Northbound
Queue Population: 20 to 40 vpl
Number of Lanes: 2

E

Congestion Type: Surveyed Cross Road Signal Queue
Location: SR 204
Frequency: Peak Hour
Direction: Northbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2
Note: Intermittently, congestion in the left-turn bay extended back into the mainline of SR 204.

F

Congestion Type: Surveyed Cross Road Signal Queue
Location: 204 Spur
Frequency: Peak Hour
Direction: Northbound
Queue Population: 20 to 30 vpl
Number of Lanes: 1
Note: During one observation only, an estimated 60 vehicles were queued at the signal.

G

Congestion Type: Surveyed Cross Road Signal Queue
Location: 204 Spur
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 40 vpl
Number of Lanes: 1

H

Congestion Type: Mainline Signal Queue
Location: Paulsen St
Frequency: One time only
Direction: Westbound
Queue Population: 20 to 25 vpl
Number of Lanes: 2

I

Congestion Type: Mainline Signal Queue
Location: Habersham St
Frequency: Peak Hour
Direction: Westbound
Queue Population: 20 to 40 vpl
Number of Lanes: 2
Note: During one observation, the head of the queue was found at the downstream signal at Abercorn St.

J

Congestion Type: Mainline Signal Queue
Location: Bull St
Frequency: Intermittent
Direction: Westbound
Queue Population: 20 to 30 vpl
Number of Lanes: 3

K

Congestion Type: Platoons
Location: Between Montgomery St & Veterans Parkway
Frequency: Most Observations
Direction: Westbound
Platoon Population: 25 to 45 vpl
Number of Lanes: 2

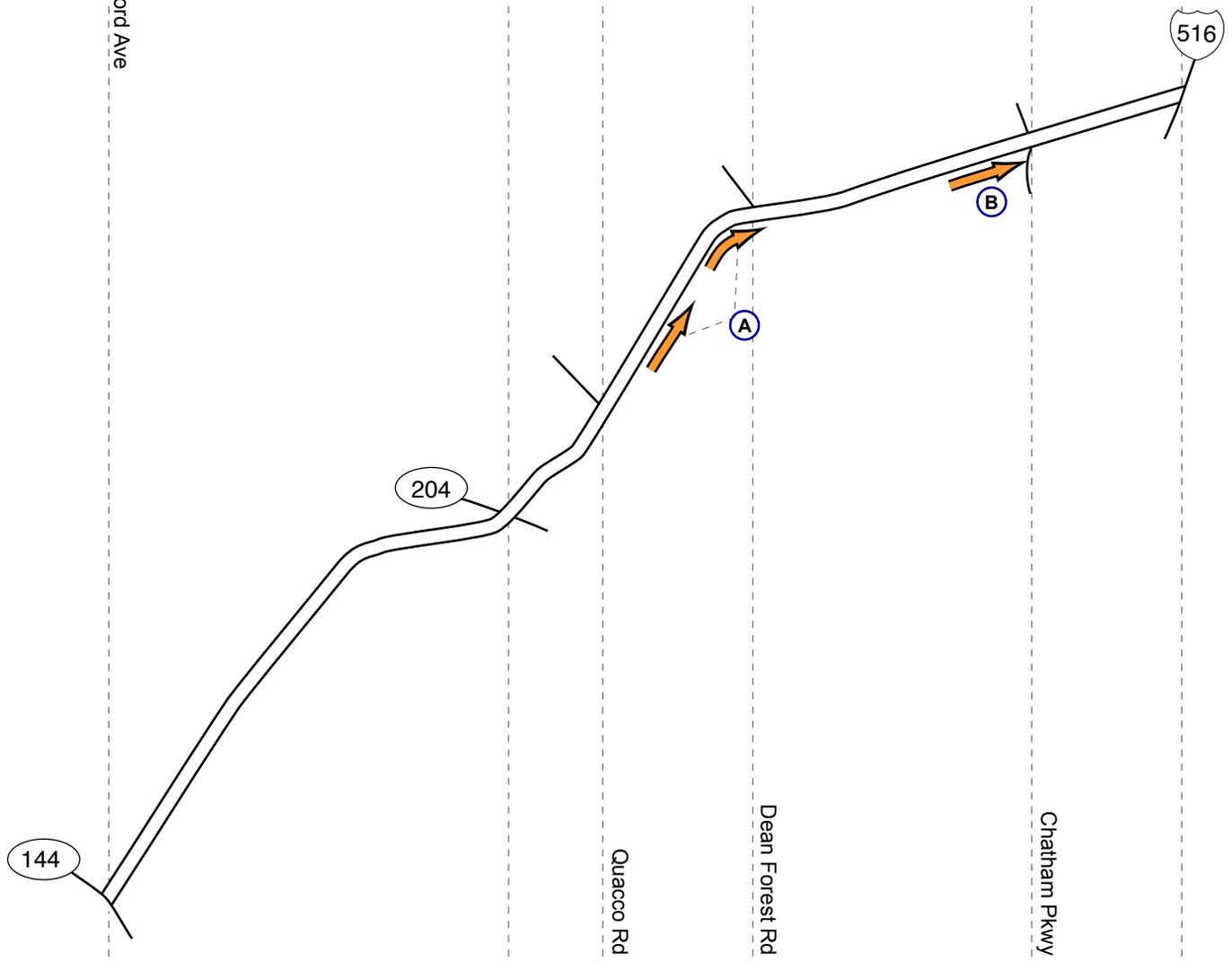
SR 25 / US 17 - Morning

← SOUTHBOUND

6:30 - 7:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
7:30 - 8:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
8:30 - 9:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>

5 4 3 2 1

Ford Ave



6:30 - 7:30 a.m.	<u>D</u>	<u>C</u>	<u>D</u>	<u>D</u>	<u>C</u>
7:30 - 8:30 a.m.	<u>D</u>	<u>D</u>	<u>E</u>	<u>E</u>	<u>D</u>
8:30 - 9:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>

0 3 Miles

→ NORTHBOUND

Traffic Quality Rating

<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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SR 25 / US 17 - Morning

A

Congestion Type: Platoons

Location: Between Quacco Rd & Dean Forest Rd

Frequency: Intermittent

Direction: Northbound

Platoon Population: 25 to 30 vpl

Number of Lanes: 2

B

Congestion Type: Platoons

Location: Between Dean Forsest Rd & Chatham Parkway

Frequency: Intermittent

Direction: Northbound

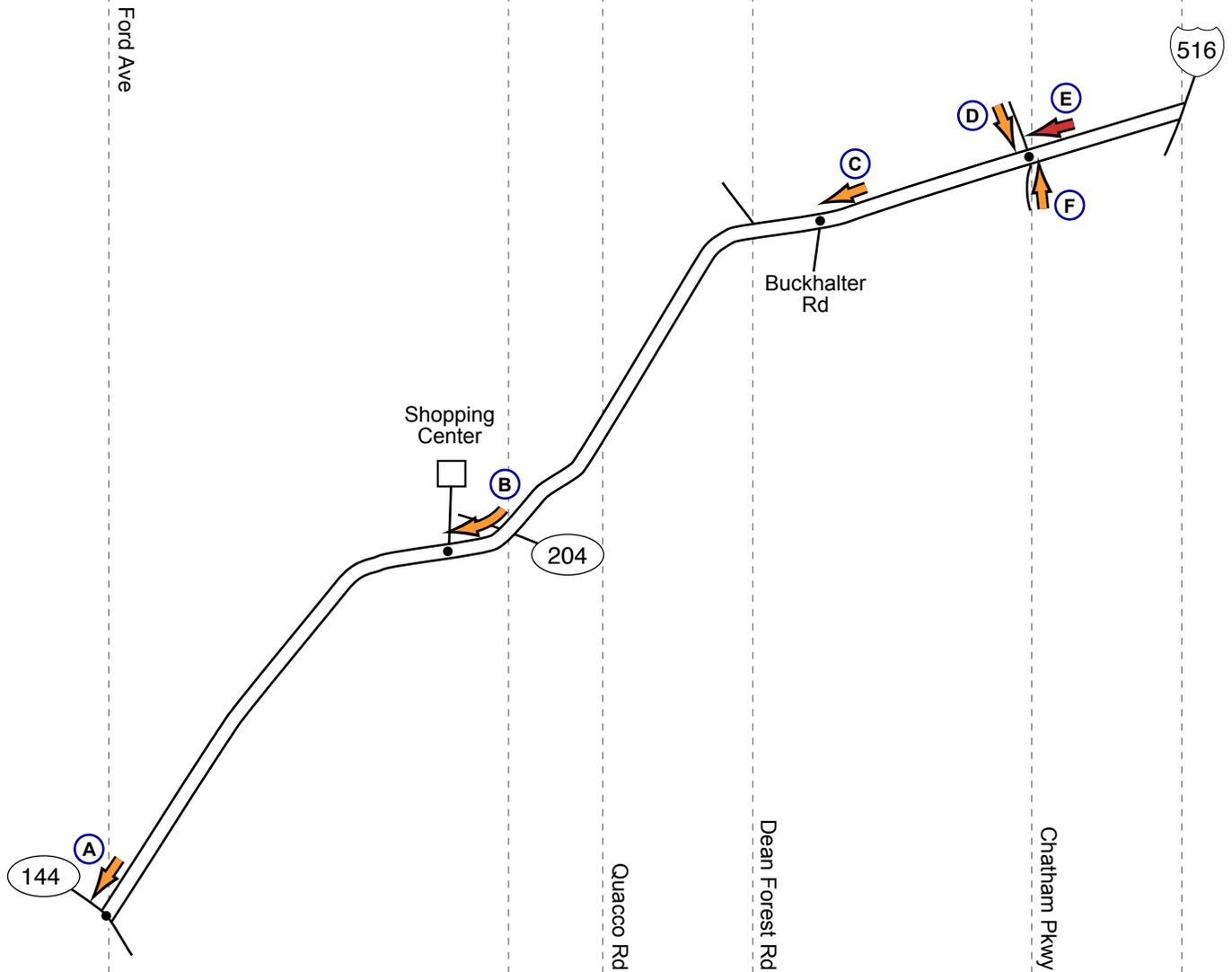
Platoon Population: 25 to 30 vpl

Number of Lanes: 2

SR 25 / US 17 - Evening

← SOUTHBOUND

4:00 - 5:00 p.m.	<u>D</u>	<u>D</u>	<u>D</u>	<u>D</u>	<u>E</u>
5:00 - 6:00 p.m.	<u>E</u>	<u>D</u>	<u>D</u>	<u>E</u>	<u>F</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>D</u>	<u>E</u>
	5	4	3	2	1



4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
	5	4	3	2	1

0 Miles 3
NORTHBOUND →

Traffic Quality Rating

<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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SR 25 / US 17 - Evening

A

Congestion Type: Left-Turn Queue
Location: SR 144 (Ford Ave)
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 25 vpl
Number of Lanes: 1

B

Congestion Type: Mainline Signal Queue/Platoons
Location: Shopping Center Entrance
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2

C

Congestion Type: Mainline Signal Queue/Platoons
Location: Buckhalter Ave
Frequency: Intermittent
Direction: Southbound
Queue Population: 25 to 30 vpl
Number of Lanes: 2

D

Congestion Type: Cross Road Signal Queue
Location: Chatham Parkway
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 40 vpl
Number of Lanes: 2

E

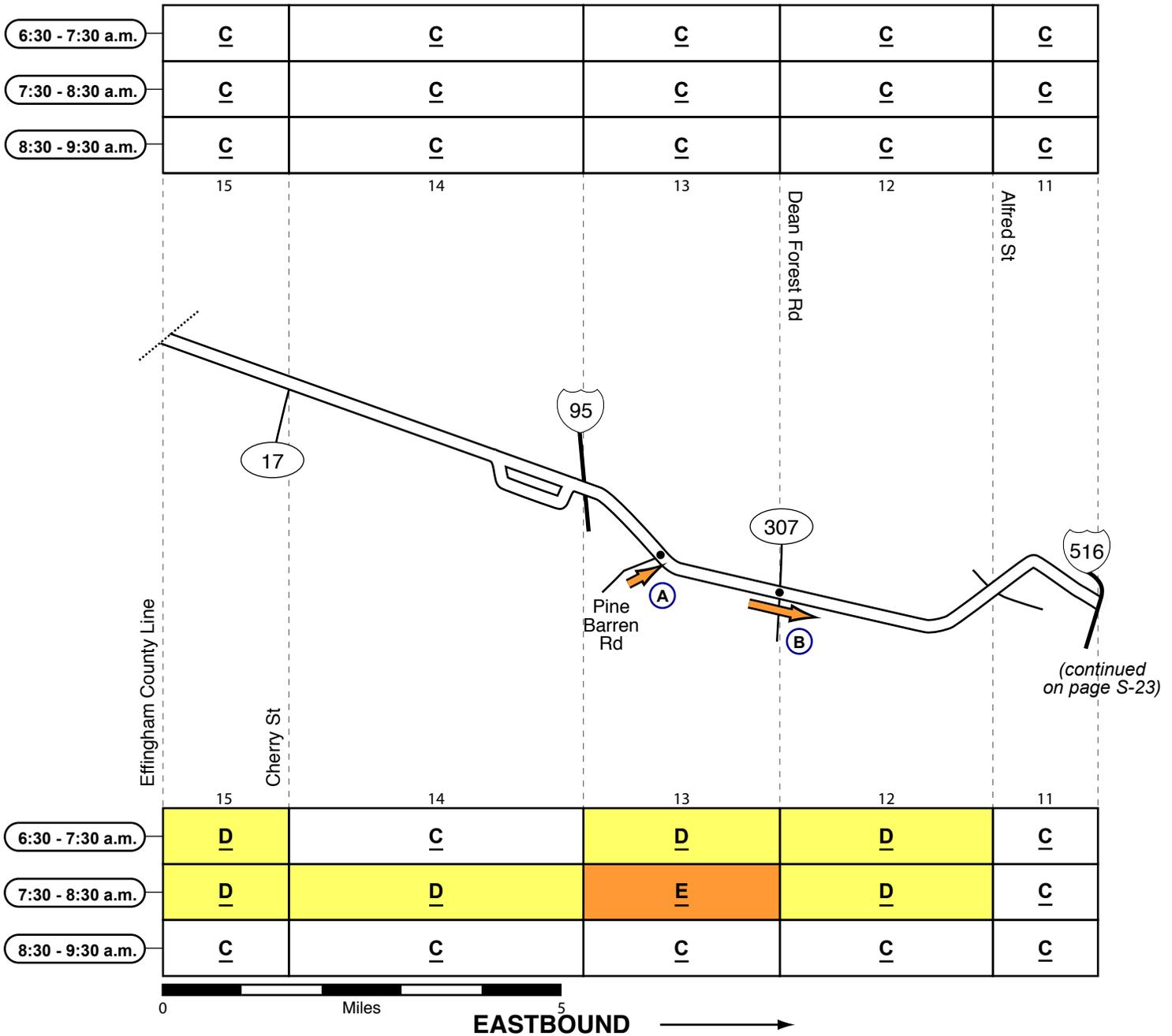
Congestion Type: Mainline Signal Queue
Location: Chatham Parkway
Frequency: On two of four surveyed evenings
Direction: Southbound
Queue Population: 20 to 40 vpl
Number of Lanes: 2
Note: On one day only, approximately 80 to 100 vehicles were queued at the signal.

F

Congestion Type: Cross Road Signal Queue
Location: Chatham Parkway
Frequency: Intermittent
Direction: Northbound
Queue Population: 20 to 40 vpl
Number of Lanes: 1
Note: The head of the queue was found in the left-turn bay at the signal; congestion typically extended back into the left lane of Chatham Parkway.

SR 26 / US 80 - Morning

← WESTBOUND



A
 Congestion Type: Cross Road Signal Queue
 Location: Pine Barren Rd
 Frequency: Intermittent
 Direction: Eastbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 1

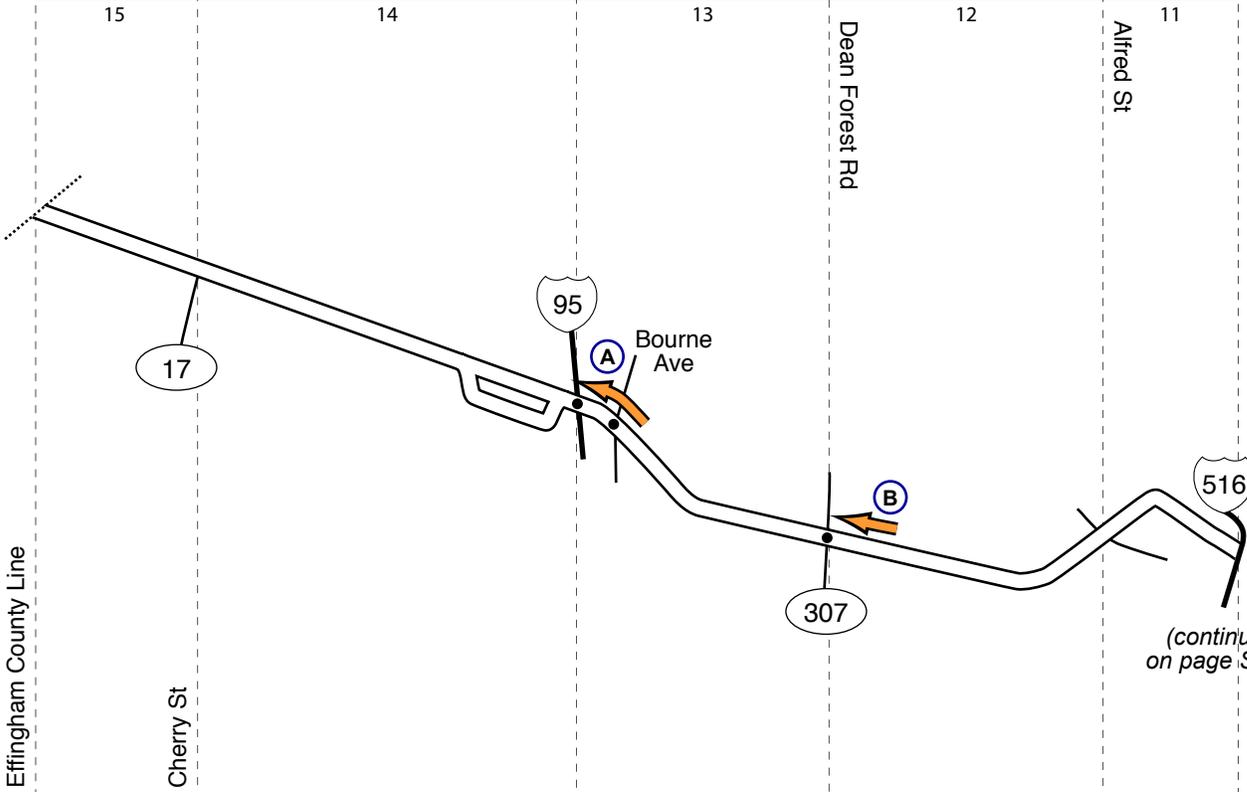
B
 Congestion Type: Mainline Signal Queue/Platoons
 Location: SR 307 (Dean Forest Rd)
 Frequency: Intermittent
 Direction: Eastbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 2

Traffic Quality Rating	<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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SR 26 / US 80 - Evening

← WESTBOUND

4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>D</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>D</u>	<u>D</u>	<u>E</u>	<u>E</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>



4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>



A
 Congestion Type: Mainline Signal Queues
 Location: I-95 & Bourne Ave
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 40 vpl
 Number of Lanes: 2

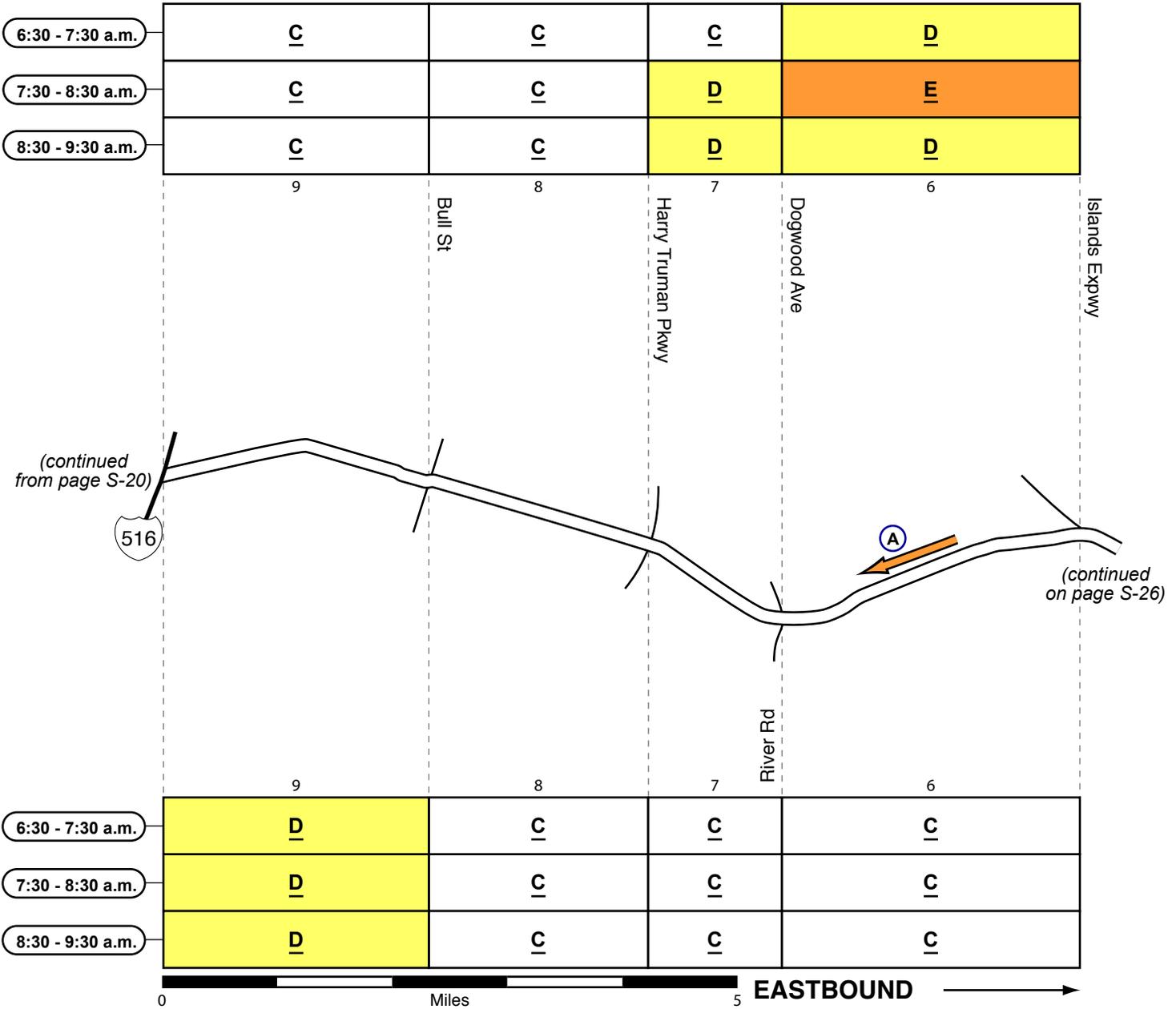
B
 Congestion Type: Mainline Signal Queue
 Location: SR 307 (Dean Forest Rd)
 Frequency: Intermittent
 Direction: Westbound
 Queue Population: 20 to 60 vpl
 Number of Lanes: 2

Traffic Quality Rating	<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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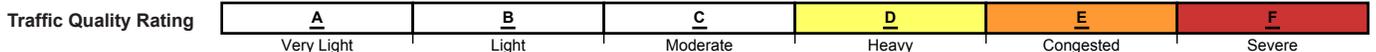
(continued on page S-24)

SR 26 / US 80 - Morning

← WESTBOUND



A
 Congestion Type: Platoons
 Location: Between Islands Expressway and Dogwood Ave
 Frequency: Intermittent
 Direction: Westbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2



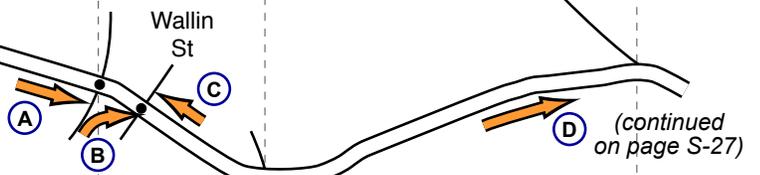
SR 26 / US 80 - Evening

← WESTBOUND

4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>E</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>D</u>	<u>C</u>	<u>D</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>

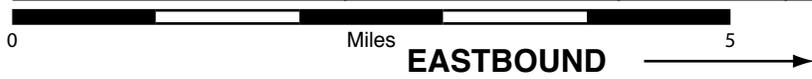
9 Bull St 8 Harry Truman Pkwy 7 Dogwood Ave 6 Islands Expwy

(continued from page S-21)



(continued on page S-27)

4:00 - 5:00 p.m.	<u>C</u>	<u>E</u>	<u>D</u>	<u>D</u>
5:00 - 6:00 p.m.	<u>D</u>	<u>D</u>	<u>D</u>	<u>E</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>D</u>



Traffic Quality Rating

<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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SR 26 / US 80 - Evening

A

Congestion Type: Mainline Signal Queue
Location: Harry S Truman Parkway
Frequency: One time only
Direction: Eastbound
Queue Population: 20 to 25 vpl
Number of Lanes: 2

B

Congestion Type: Exit Ramp Queue
Location: Harry Truman Pkwy
Frequency: Intermittent
Direction: Northbound
Queue Population: 20 to 25 vpl

C

Congestion Type: Mainline Signal Queue
Location: Wallin St
Frequency: Intermittent
Direction: Westbound
Queue Population: 20 to 25 vpl
Number of Lanes: 2

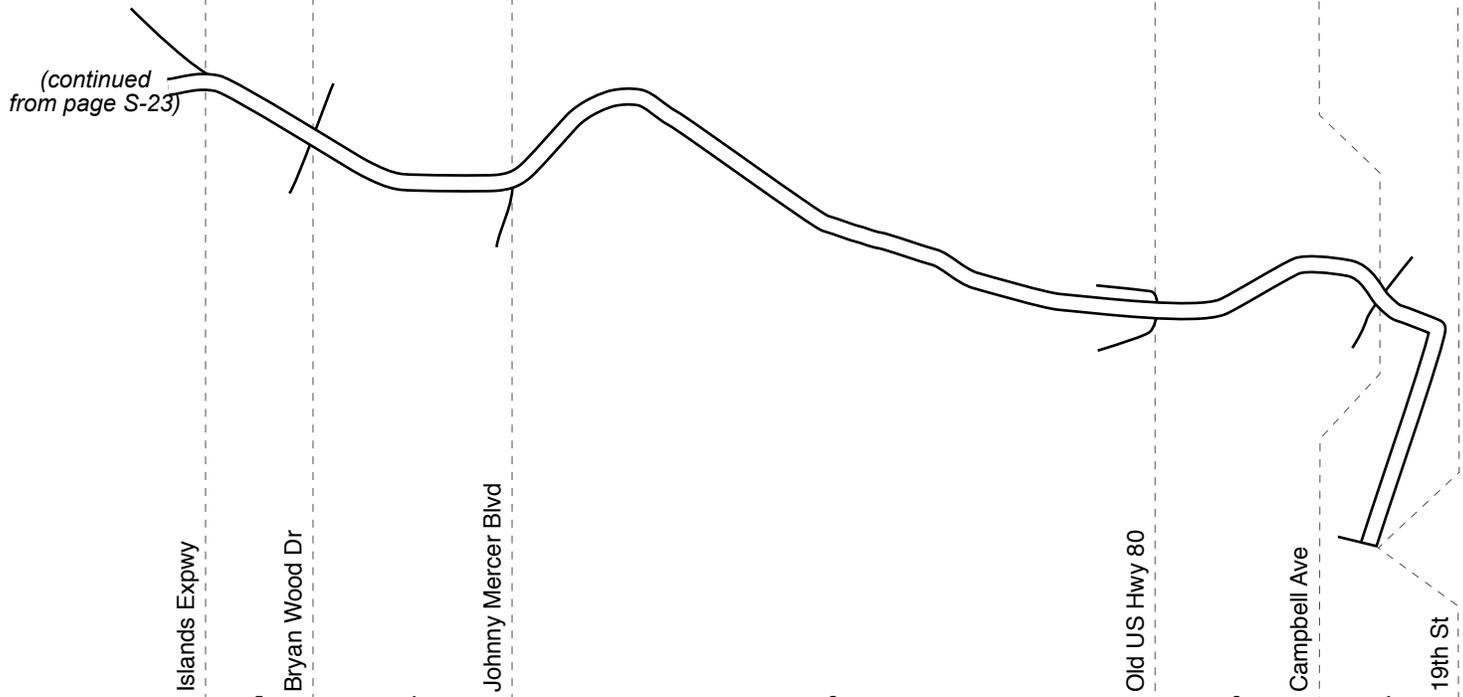
D

Congestion Type: Platoons
Location: Between River Dr & Islands Expressway
Frequency: Peak Hour
Direction: Eastbound
Platoon Population: 25 to 30 vpl
Number of Lanes: 2

SR 26 / US 80 - Morning

← WESTBOUND

6:30 - 7:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>B</u>	<u>B</u>
7:30 - 8:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>B</u>
8:30 - 9:30 a.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
	5	4	3	2	1



6:30 - 7:30 a.m.	<u>B</u>	<u>C</u>	<u>C</u>	<u>B</u>	<u>B</u>
7:30 - 8:30 a.m.	<u>B</u>	<u>B</u>	<u>C</u>	<u>B</u>	<u>B</u>
8:30 - 9:30 a.m.	<u>B</u>	<u>C</u>	<u>D</u>	<u>C</u>	<u>C</u>

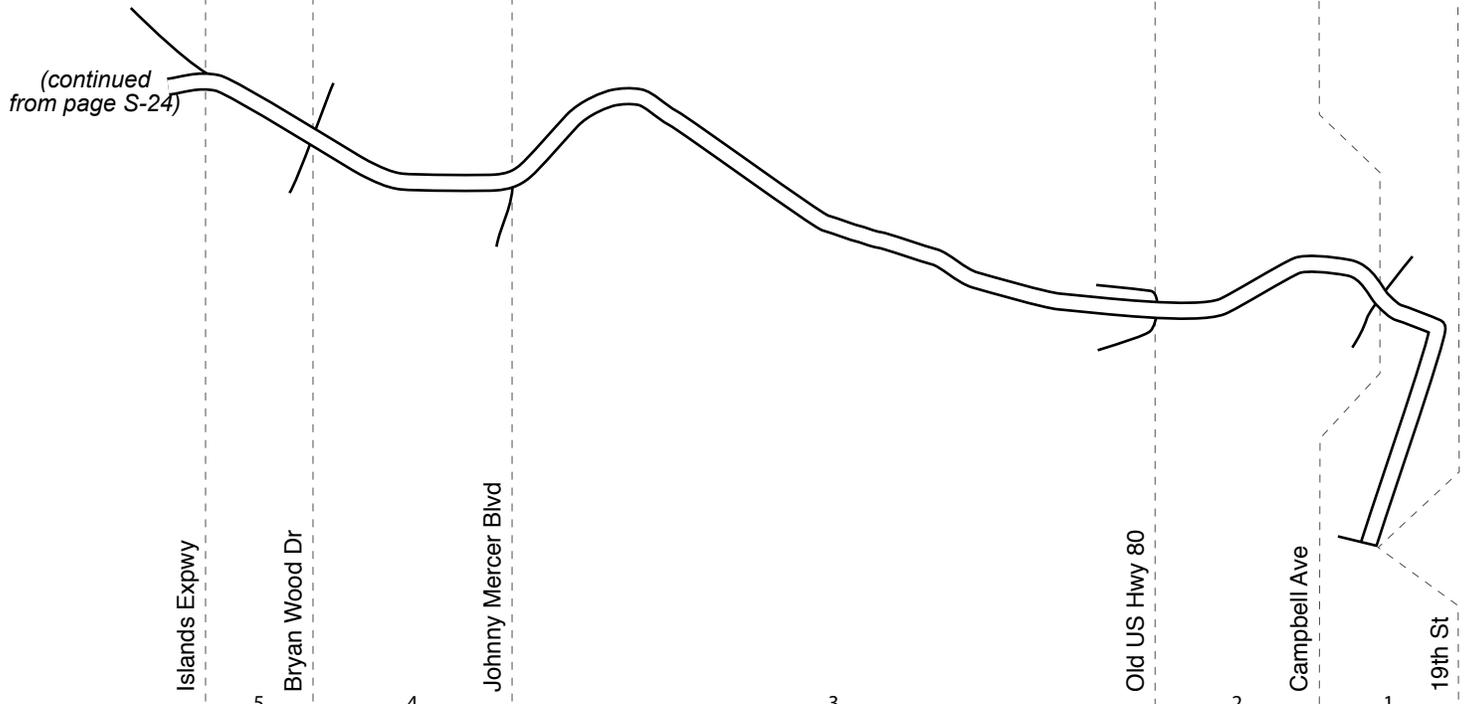


Traffic Quality Rating	<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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SR 26 / US 80 - Evening

← WESTBOUND

4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>		<u>C</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>C</u>		<u>C</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>		<u>C</u>	<u>C</u>	<u>C</u>
	5	4		3	2	1



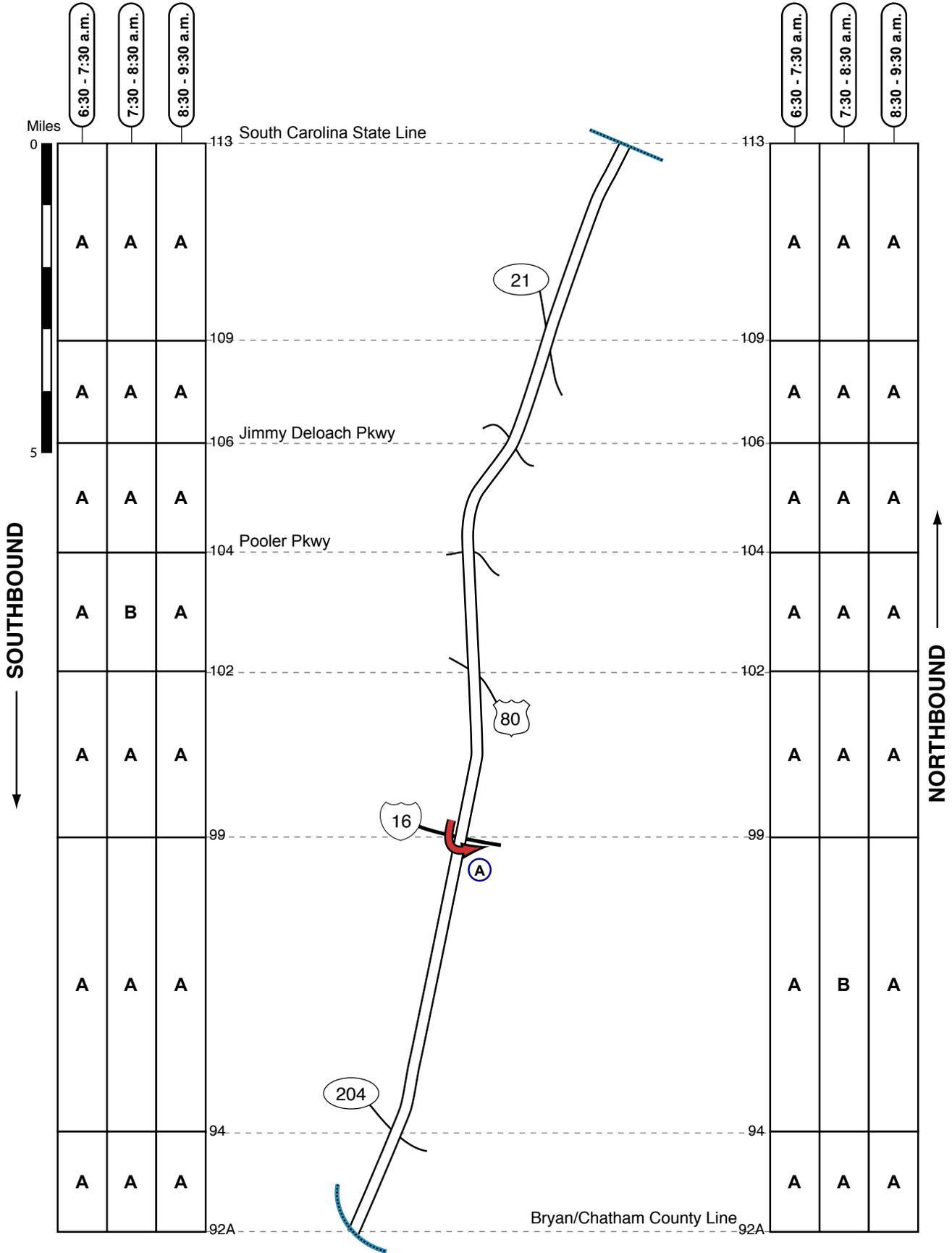
4:00 - 5:00 p.m.	<u>C</u>	<u>D</u>		<u>C</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>D</u>		<u>C</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>		<u>C</u>	<u>C</u>	<u>C</u>



Traffic Quality Rating

<u>A</u> Very Light	<u>B</u> Light	<u>C</u> Moderate	<u>D</u> Heavy	<u>E</u> Congested	<u>F</u> Severe
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I-95 - Morning



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

I-95 - Morning

A

Congestion Type: Exit Ramp Queue

Location: I-16

Frequency: Peak Hour

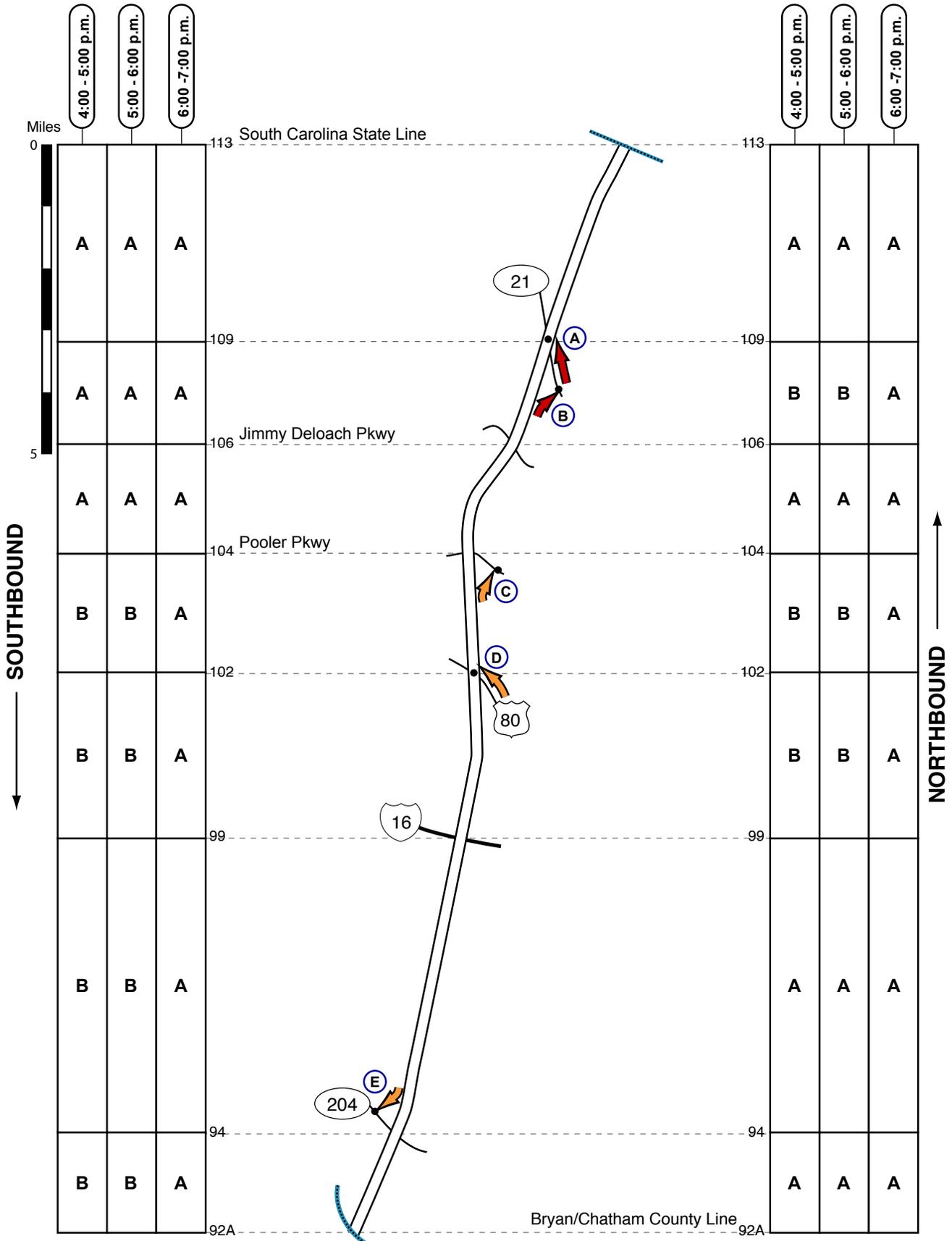
Direction: Southbound

Queue Population: 35 to 70 vpl

Number of Lanes: 1

Note: Congestion typically extended back into the right shoulder of I-95; thru-traffic on I-95 was able to bypass the queue without delay.

I-95 - Evening



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

I-95 - Evening

A

Congestion Type: Surveyed Cross Road Signal Queue

Location: SR 21

Frequency: Peak Hour

Direction: Northbound

Queue Population: 40 to 70 vpl

Number of Lanes: 2

Note: Congestion typically backed though the upstream signal at O'Leary Rd.

B

Congestion Type: Exit Ramp Queue

Location: SR 21

Frequency: Peak Hour

Direction: Northbound

Queue Population: 20 to 40 vpl

Number of Lanes: 2

C

Congestion Type: Exit Ramp Queue

Location: Pooler Parkway

Frequency: One time only

Direction: Northbound

Queue Population: 30 to 35 vpl

Number of Lanes: 1

D

Congestion Type: Surveyed Cross Road Signal Queue

Location: US 80

Frequency: Intermittent

Direction: Westbound

Queue Population: 20 to 40 vpl

Number of Lanes: 2

E

Congestion Type: Exit Ramp Queue

Location: SR 204

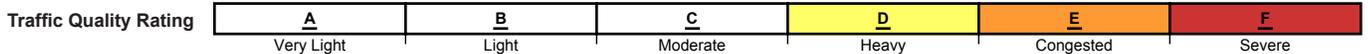
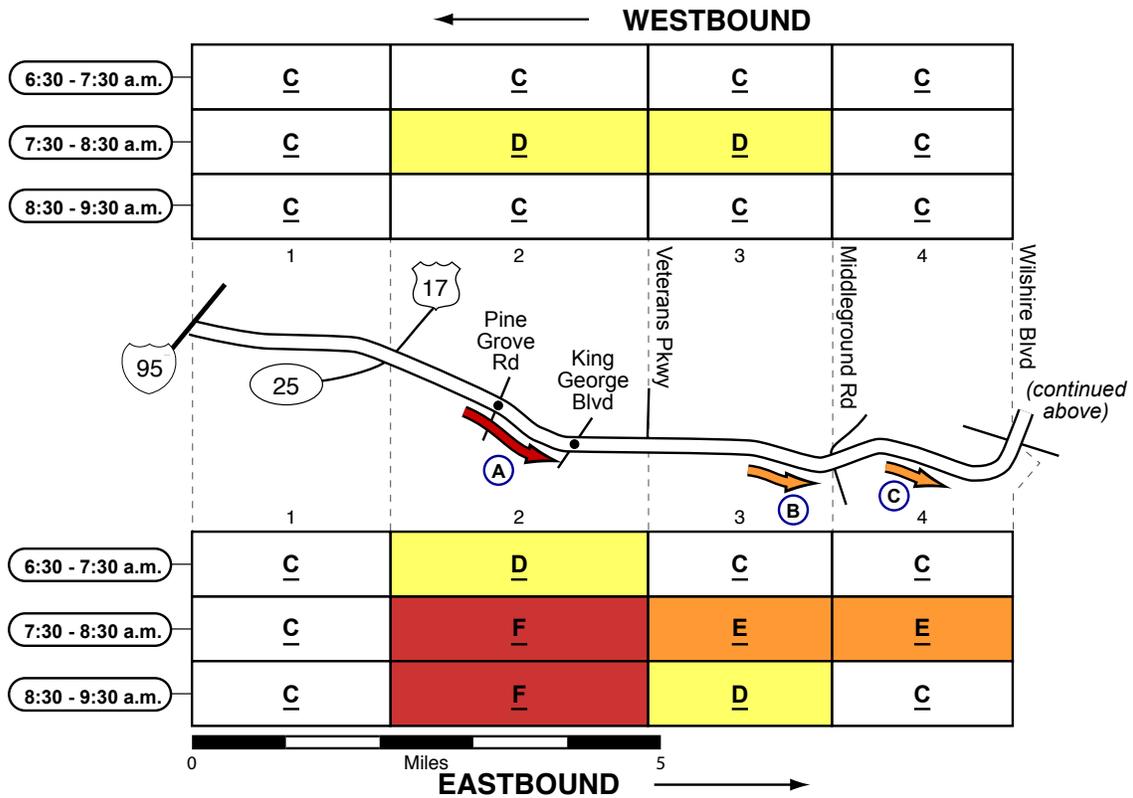
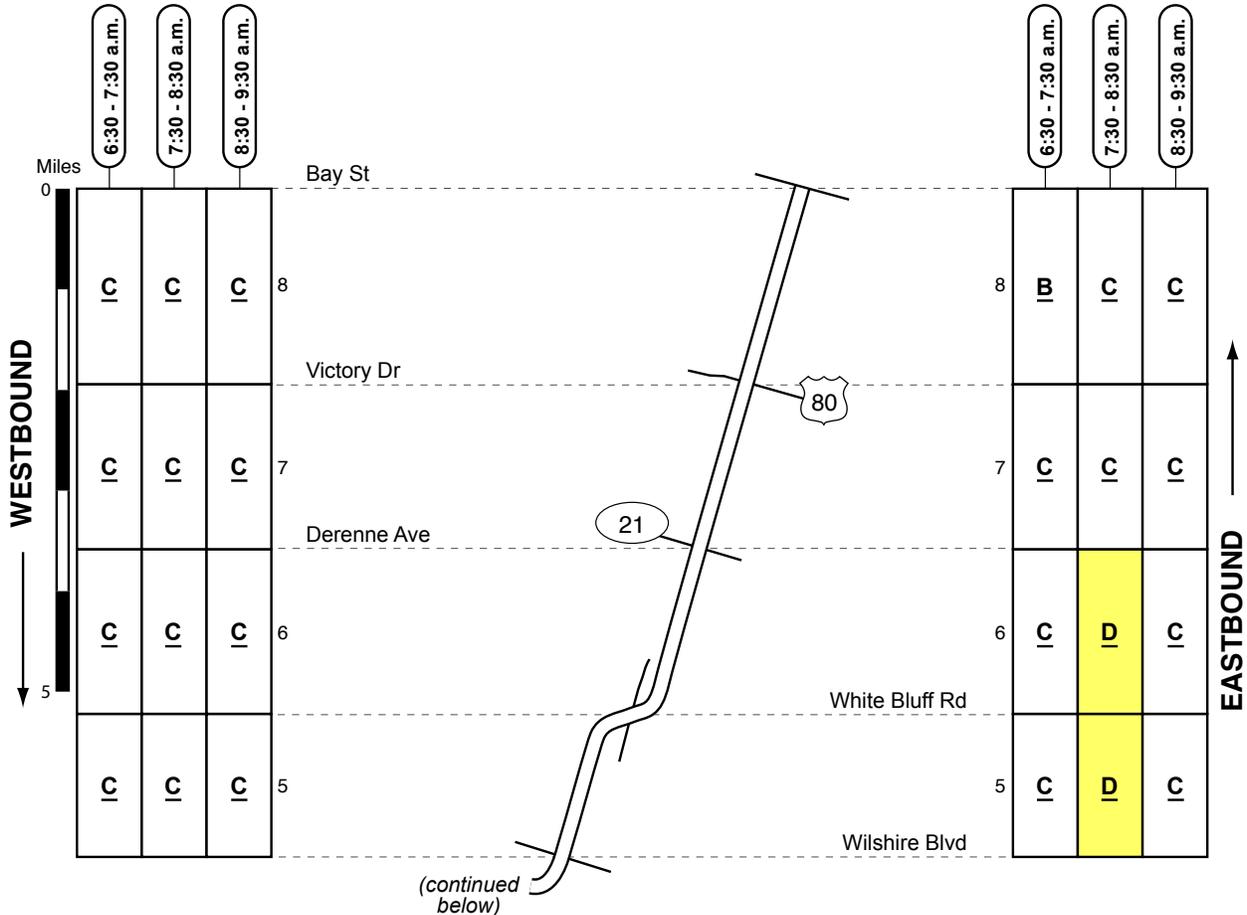
Frequency: Intermittent

Direction: Southbound

Queue Population: 20 to 25 vpl

Number of Lanes: 1

SR 204 - Morning



SR 204 - Morning

A

Congestion Type: Mainline Signal Queue

Location: King George Blvd

Frequency: Between 7:30 and 9:00 a.m.

Direction: Eastbound

Queue Population: 40 to 100 vpl

Number of Lanes: 2

Note: On three of four surveyed mornings, congestion backed through the upstream signal at Pine Grove Rd.

B

Congestion Type: Platoons

Location: Between Veterans Parkway & Middleground Rd

Frequency: Peak Hour

Direction: Eastbound

Platoon Population: 25 to 35 vpl

Number of Lanes: 2

C

Congestion Type: Platoons

Location: Between Middleground Rd & Wilshire Blvd

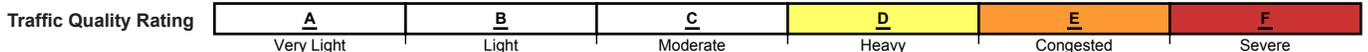
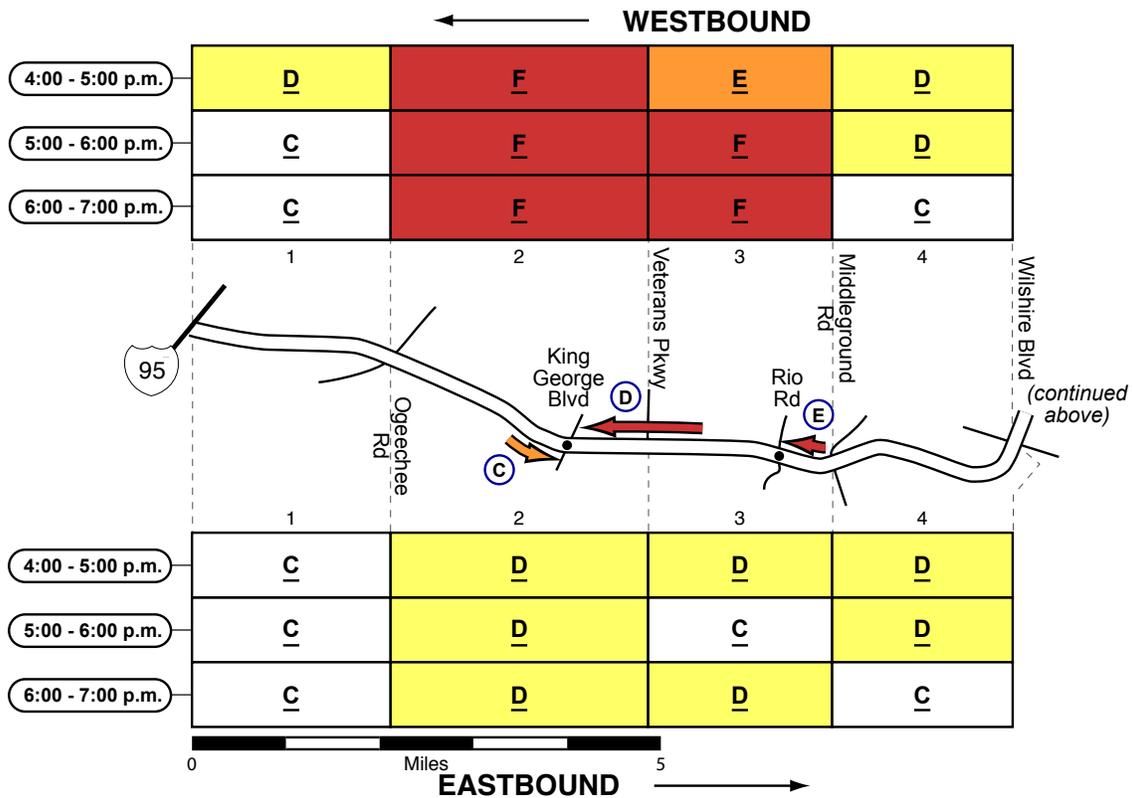
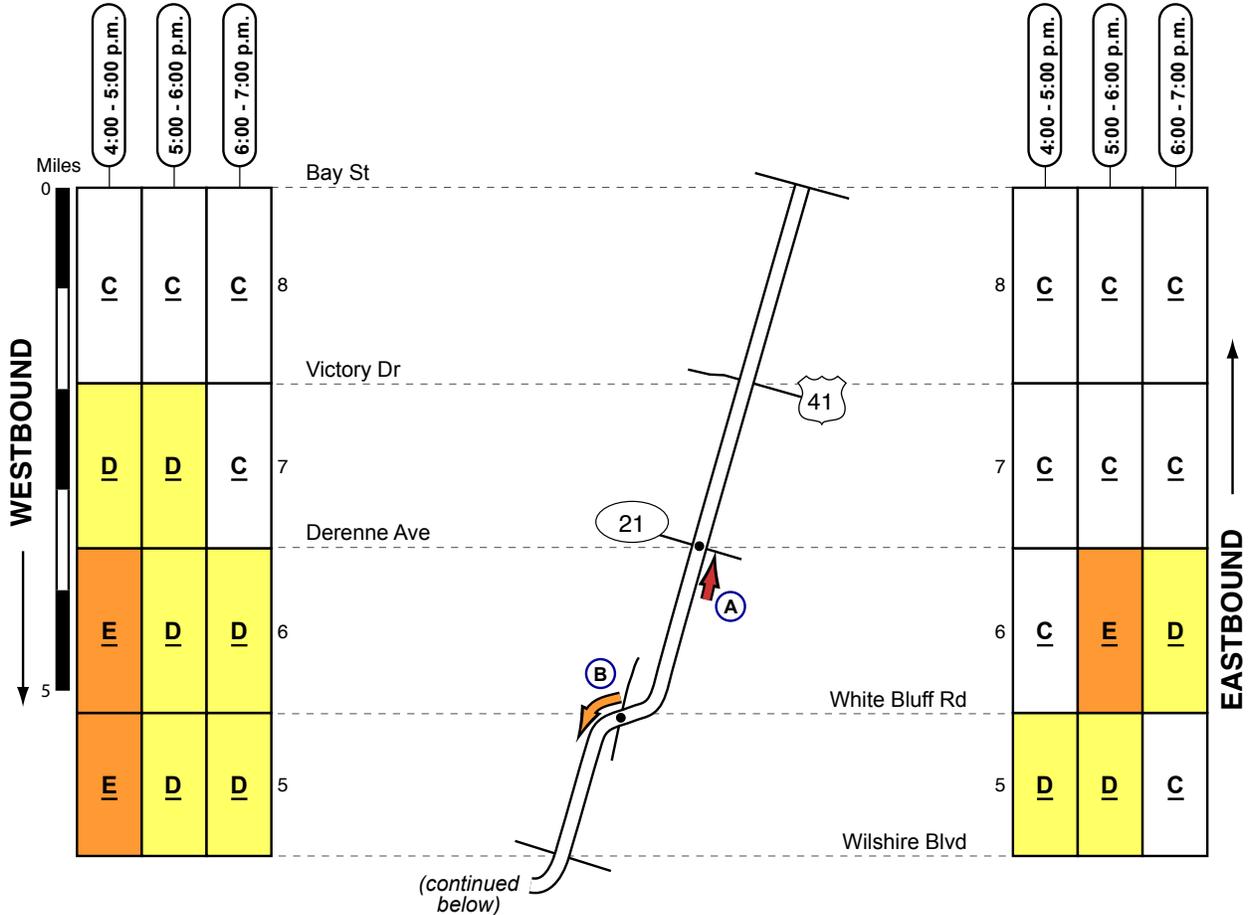
Frequency: Intermittent

Direction: Eastbound

Platoon Population: 25 to 30 vpl

Number of Lanes: 3

SR 204 - Evening



SR 204 - Evening

A

Congestion Type: Left-Turn Queue
Location: SR 21 (Derenne Ave)
Frequency: Peak Hour
Direction: Northbound
Queue Population: 20 to 30 vpl
Number of Lanes: 2
Note: Intermittently, congestion in the left-turn bay extended back into the mainline of SR 204.

B

Congestion Type: Mainline Signal Queue/Platoons
Location: White Bluff Rd
Frequency: Intermittent
Direction: Southbound
Queue Population: 20 to 40 vpl
Number of Lanes: 3

C

Congestion Type: Mainline Signal Queue
Location: King George Blvd
Frequency: One time only
Direction: Eastbound
Queue Population: 20 to 25 vpl
Number of Lanes: 2

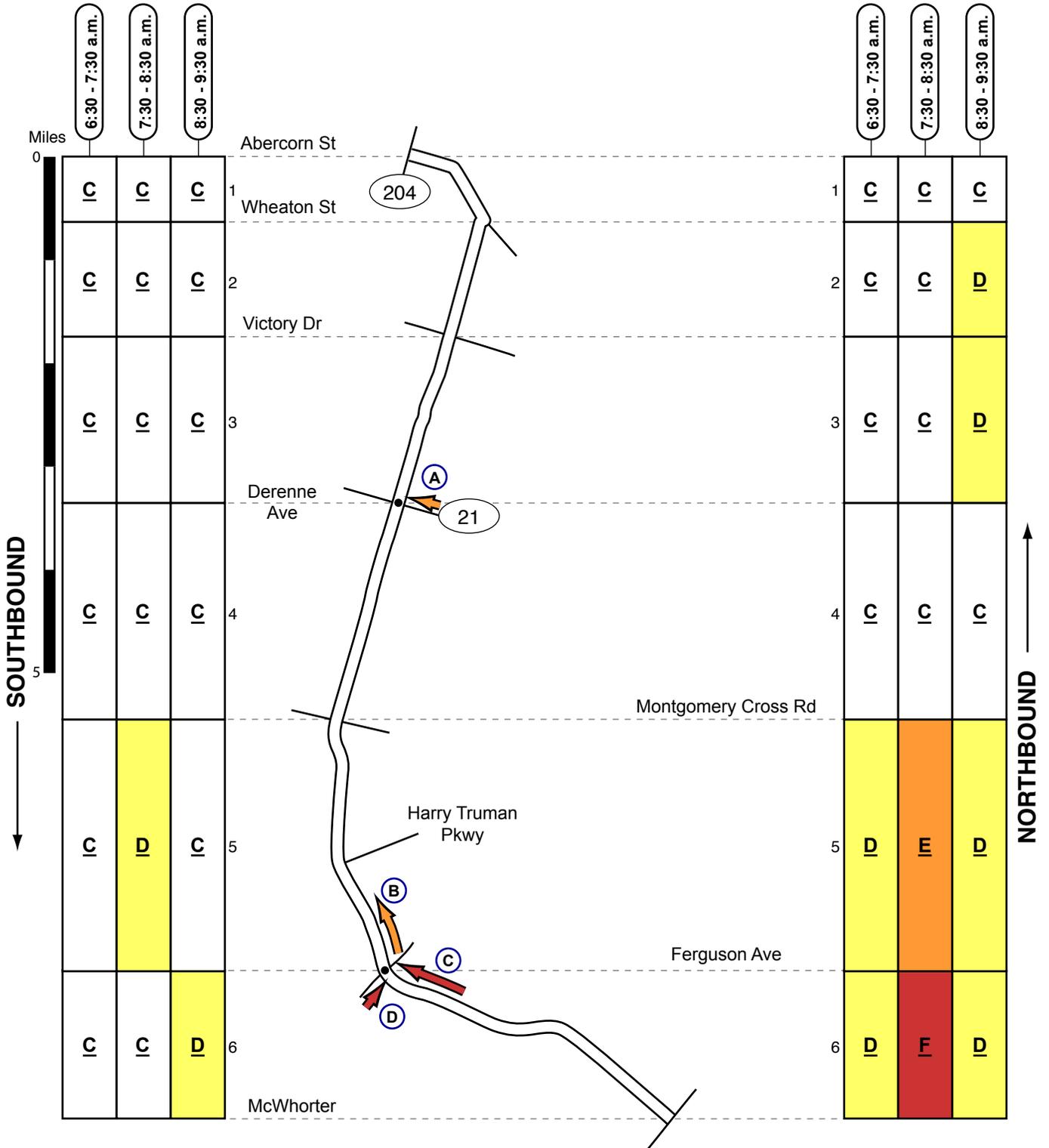
D

Congestion Type: Mainline Signal Queue
Location: King George Blvd
Frequency: Most Observations
Direction: Westbound
Queue Population: 50 to 250 vpl
Number of Lanes: 2
Note: During the peak period, a one to two mile zone of westbound congestion was found approaching the signal at King George Blvd; congestion was exacerbated by the merging associated with the Veterans Parkway interchange.

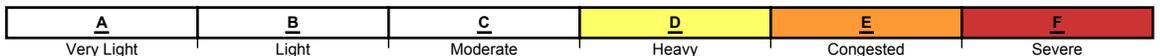
E

Congestion Type: Mainline Signal Queue
Location: Rio Rd
Frequency: Most Observations
Direction: Westbound
Queue Population: 20 to 40 vpl
Number of Lanes: 2

SR 204 Spur - Morning



Traffic Quality Rating



SR 204 Spur - Morning

A

Congestion Type: Surveyed Cross Road Signal Queue
Location: SR 21 (Derenne Ave)
Frequency: Intermittent
Direction: Westbound
Queue Population: 25 to 35 vpl
Number of Lanes: 2

B

Congestion Type: Platoons
Location: Between Ferguson Ave & Montgomery Cross Rd
Frequency: Peak Hour
Direction: Northbound
Platoon Population: 25 to 40 vpl
Number of Lanes: 1
Note: Queue discharge from the upstream signal at Ferguson Ave appeared to contribute to the congestion.

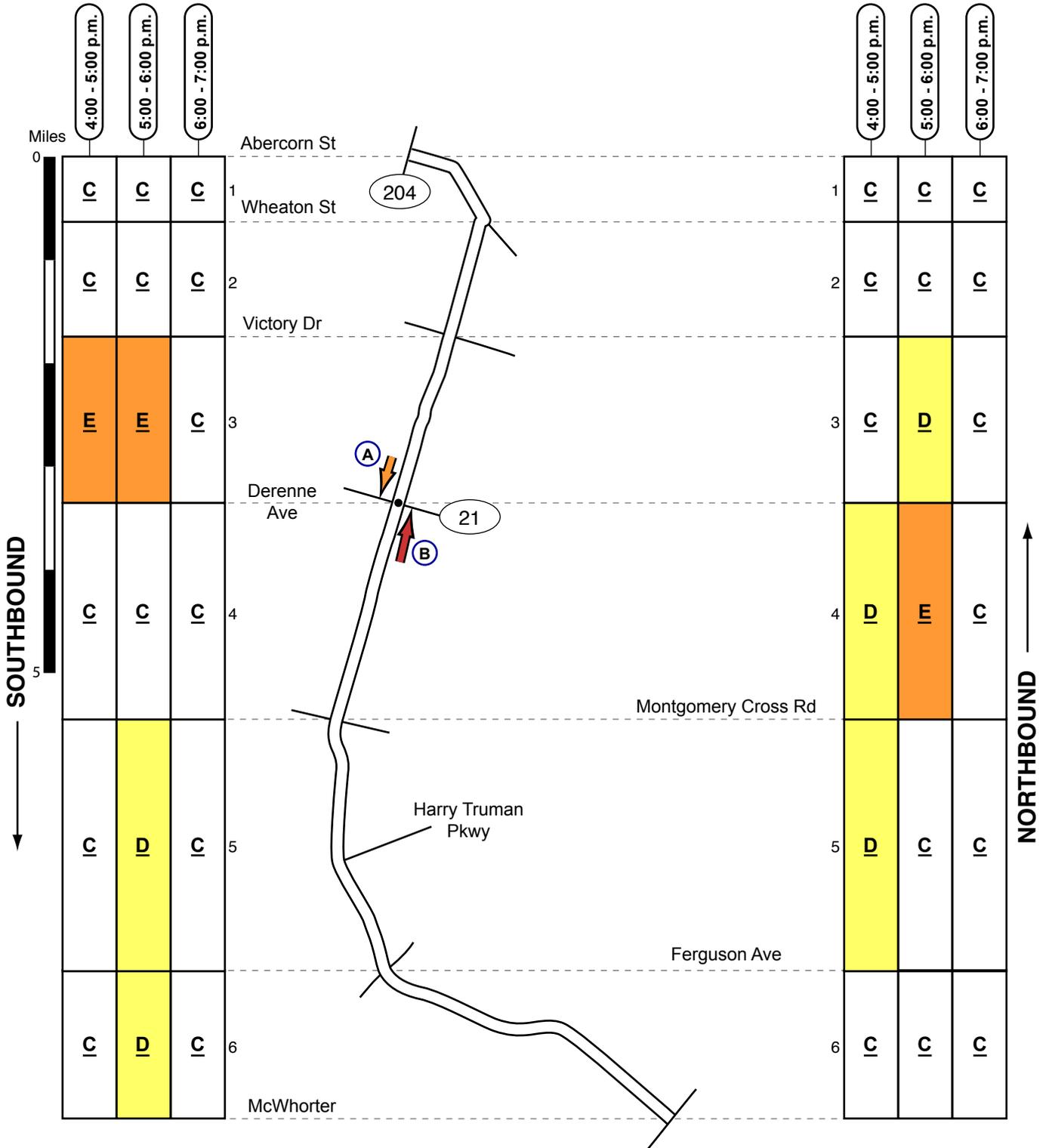
C

Congestion Type: Mainline Signal Queue
Location: Ferguson Ave
Frequency: Peak Hour
Direction: Northbound
Queue Population: 20 to 125 vpl
Number of Lanes: 1
Note: Congestion was most severe between 7:30 and 8:00 a.m.; when observed on two separate days, over 100 vehicles were queued at the signal.

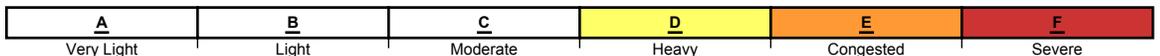
D

Congestion Type: Cross Road Signal Queue
Location: Ferguson Ave
Frequency: Peak Hour
Direction: Eastbound
Queue Population: 20 to 50 vpl
Number of Lanes: 1
Note: The head of the queue was found in the left-turn lane; congestion extended back into the mainline of Ferguson Ave.

SR 204 Spur - Evening



Traffic Quality Rating



SR 204 Spur - Evening

A

Congestion Type: Mainline Signal Queue

Location: Derenne Ave

Frequency: Intermittent

Direction: Southbound

Queue Population: 20 to 40 vpl

Number of Lanes: 1

B

Congestion Type: Mainline Signal Queue

Location: Derenne Ave

Frequency: Peak Hour

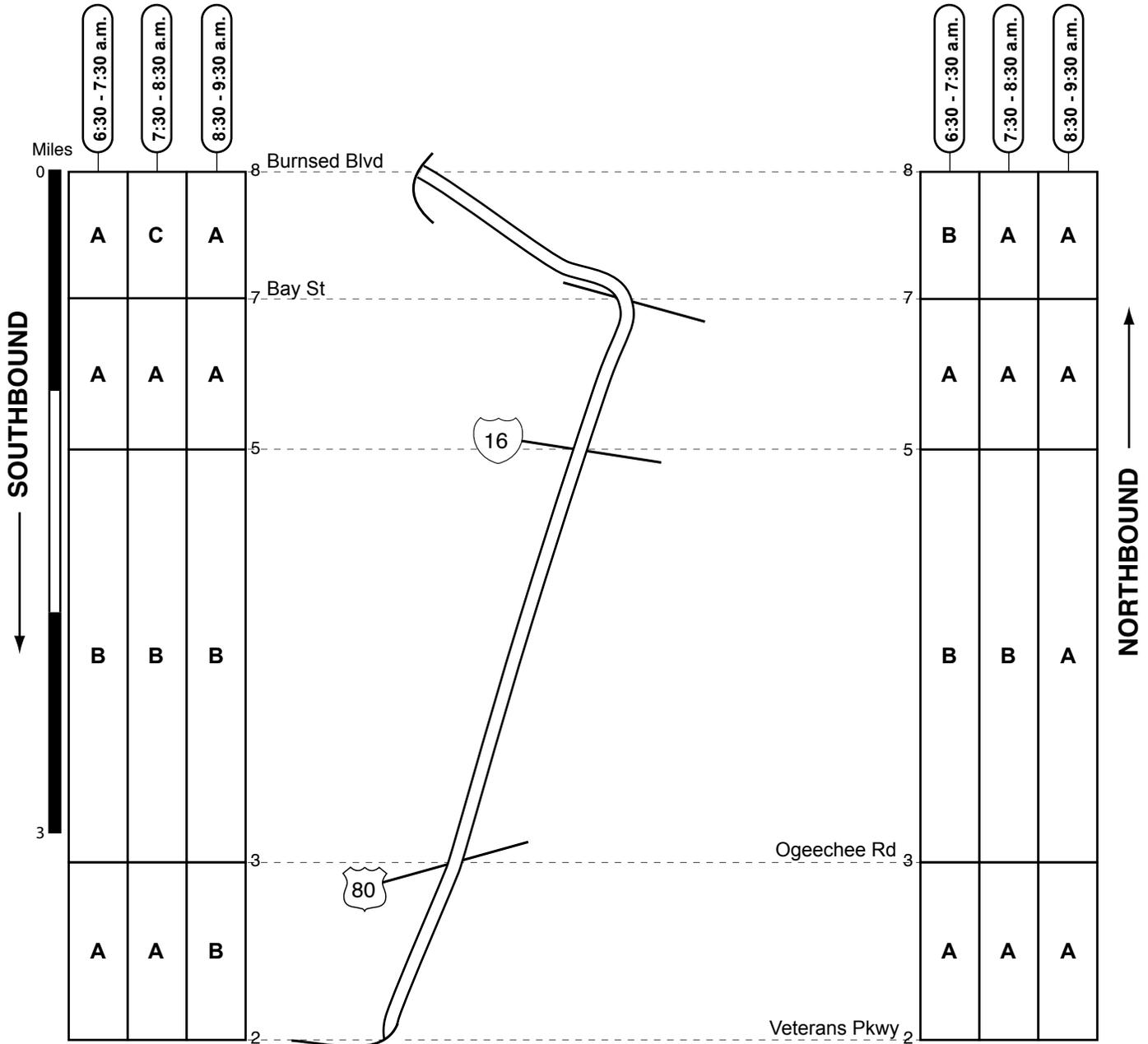
Direction: Northbound

Queue Population: 20 to 30 vpl

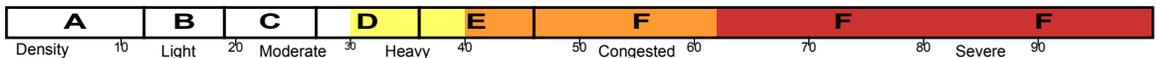
Number of Lanes: 1

Note: During one observation only, an estimated 60 vehicles were queued at the signal.

I-516 - Morning



Traffic Quality Rating



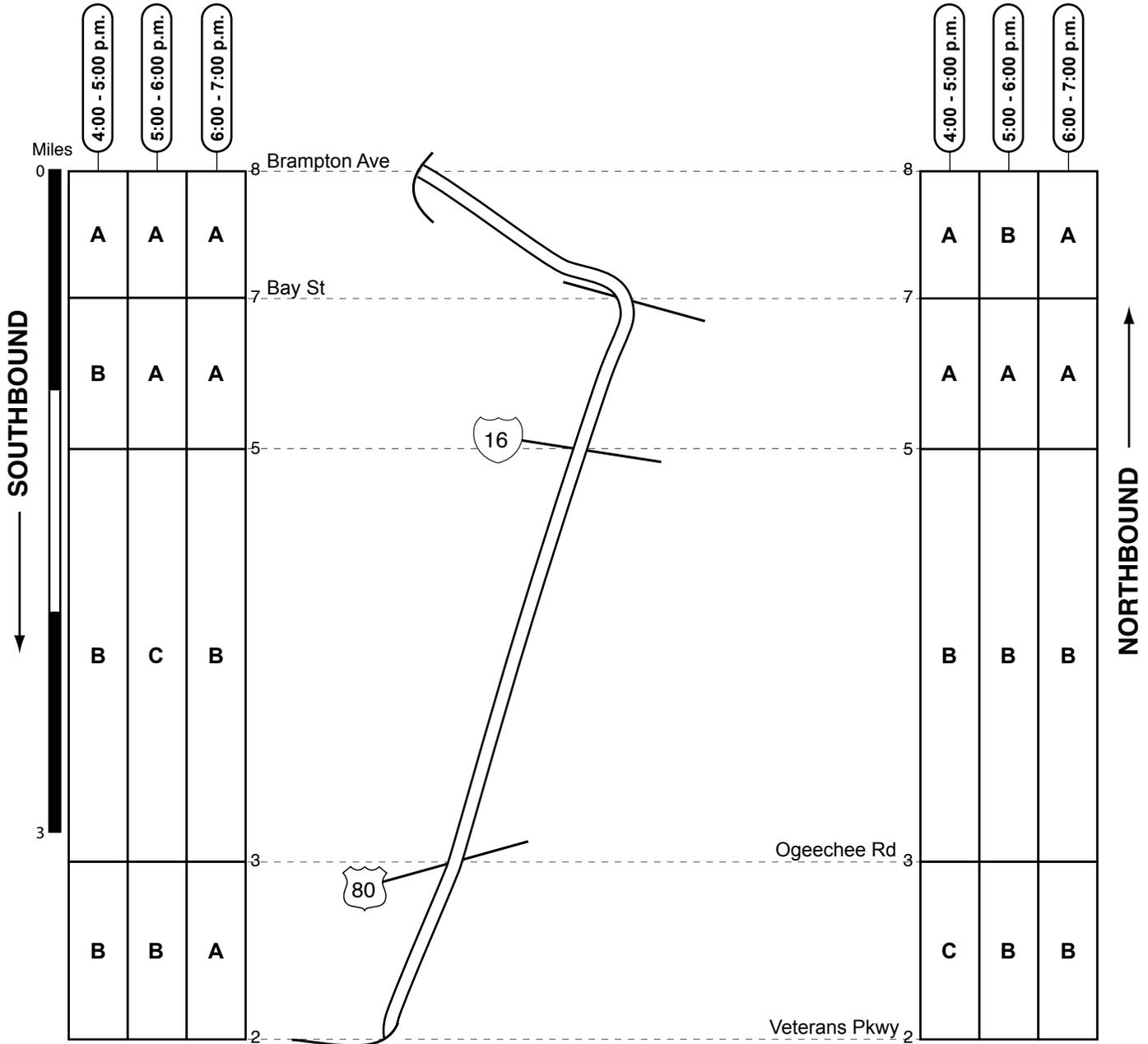
Superscripts: ¹ Type 1 nested congestion (some days, not others).

³ Type 3 nested congestion (present only in the first or second half-hour period).

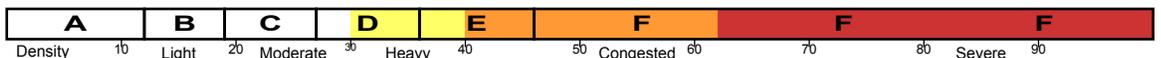
² Type 2 nested congestion (more severe in left or right-hand lanes).

⁴ Type 4 nested congestion (partial length of segment).

I-516 - Evening



Traffic Quality Rating



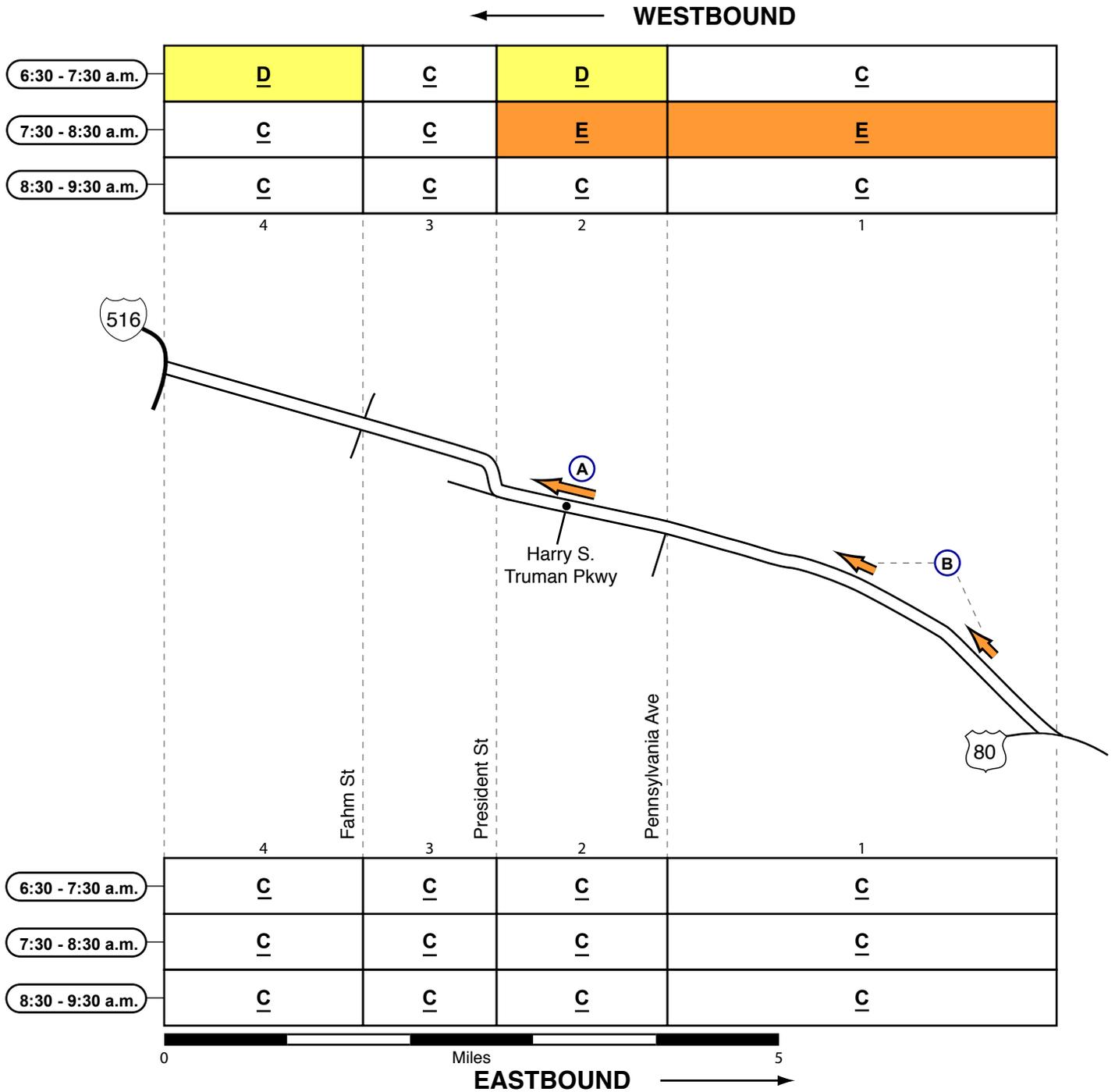
Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

Bay St / President St / Islands Expwy - Morning



A
 Congestion Type: Platoons
 Location: Between Pennsylvania Ave & Bay St
 Frequency: Intermittent
 Direction: Westbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

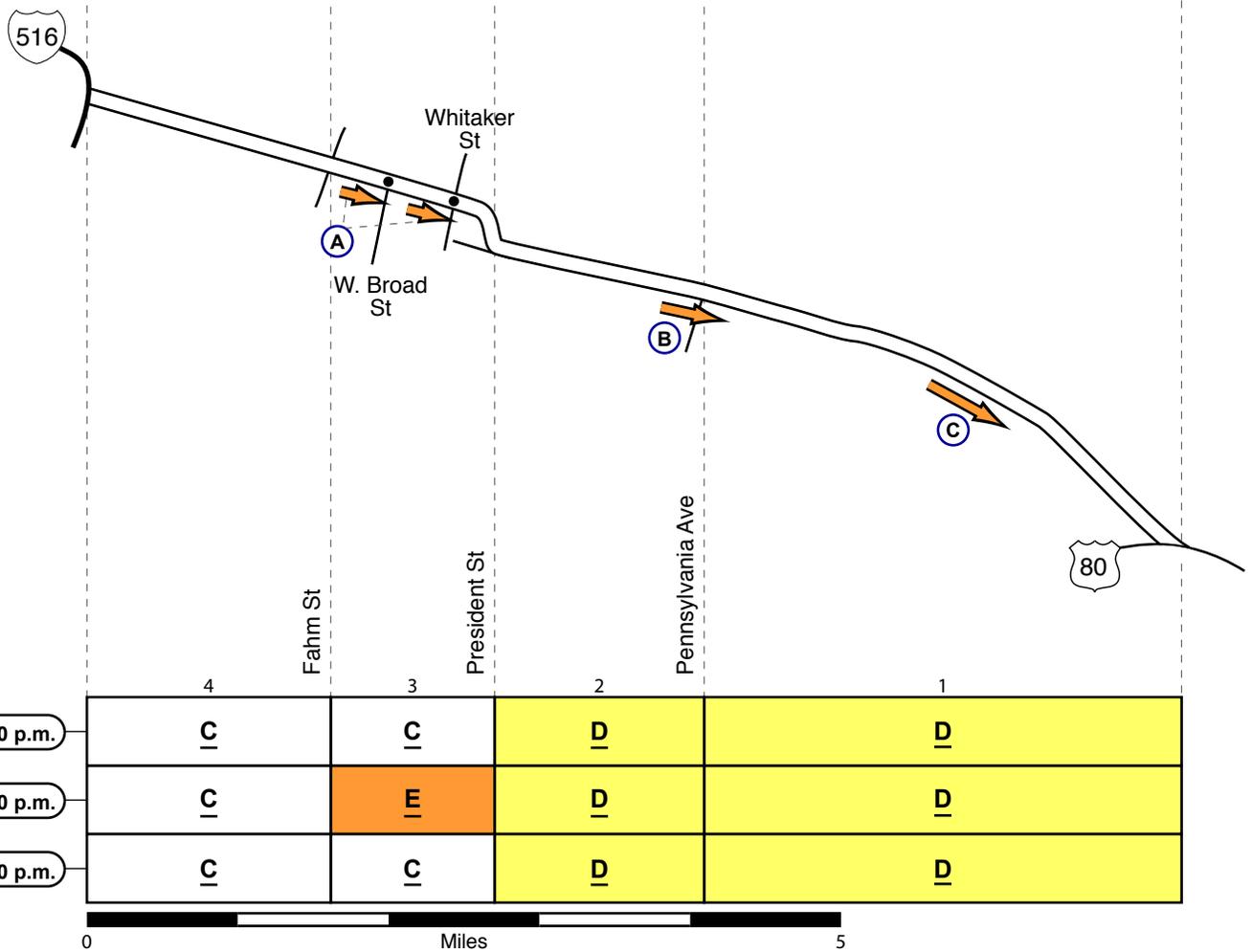
B
 Congestion Type: Platoons
 Location: Between SR 26/US 80 & Pennsylvania Ave
 Frequency: Intermittent
 Direction: Westbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

Traffic Quality Rating	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
	Very Light	Light	Moderate	Heavy	Congested	Severe

Bay St / President St / Islands Expwy - Evening

← WESTBOUND

4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>C</u>	<u>C</u>
	4	3	2	1



4:00 - 5:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>D</u>
5:00 - 6:00 p.m.	<u>C</u>	<u>E</u>	<u>D</u>	<u>D</u>
6:00 - 7:00 p.m.	<u>C</u>	<u>C</u>	<u>D</u>	<u>D</u>
	4	3	2	1

0 Miles 5

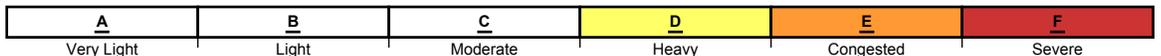
→ EASTBOUND

A
 Congestion Type: Mainline Signal Queues
 Location: Between Fahm St & President St
 Frequency: Intermittent
 Direction: Eastbound
 Queue Population: 20 to 25 vpl
 Number of Lanes: 2
 Note: When congested, vehicles were queued on Bay St approaching the signals at W. Broad St and Whitaker St.

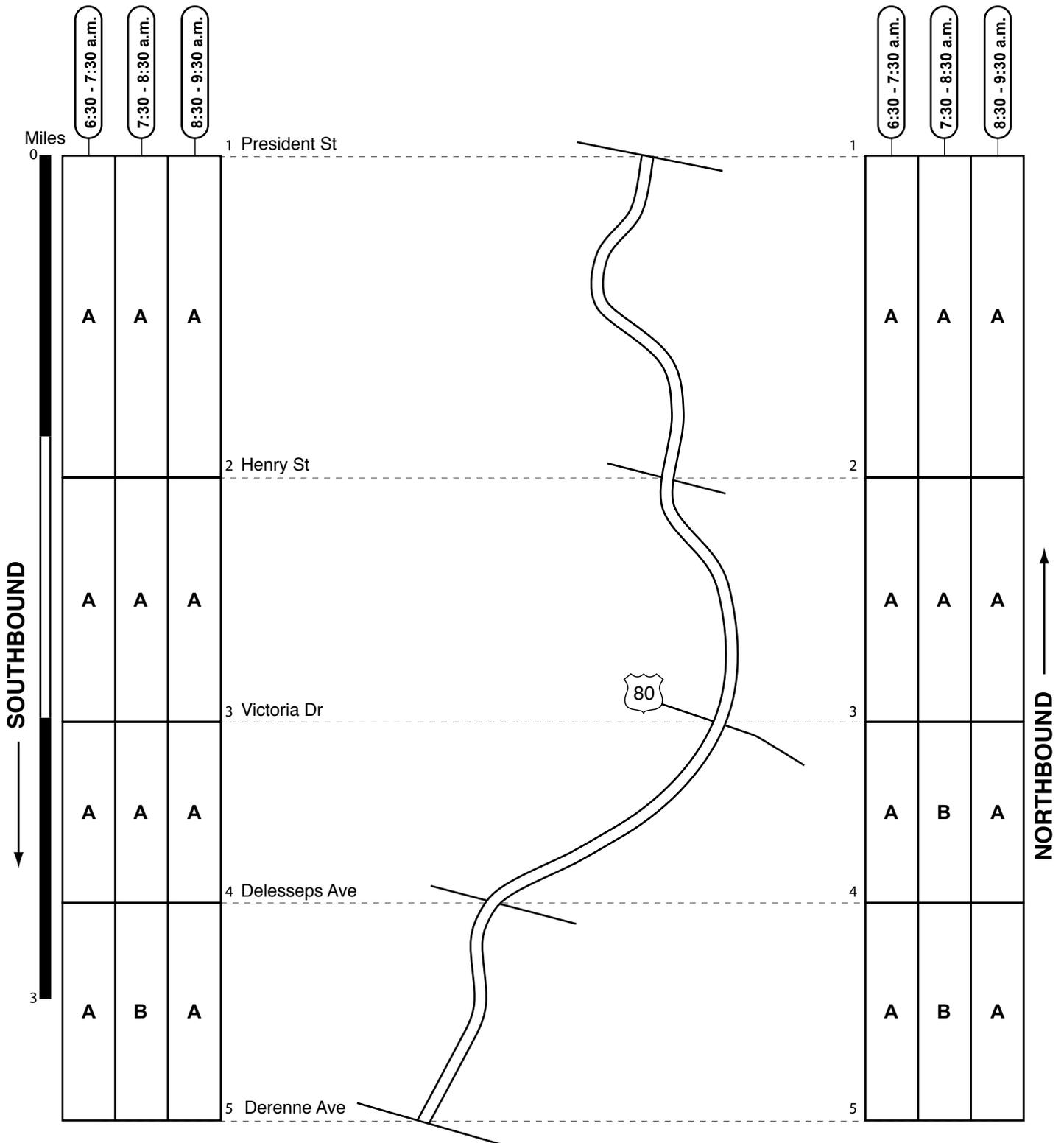
B
 Congestion Type: Platoons
 Location: Vicinity of Pennsylvania Ave
 Frequency: Intermittent
 Direction: Eastbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

C
 Congestion Type: Platoons
 Location: Between Pennsylvania Ave & SR 26/US 80
 Frequency: Intermittent
 Direction: Eastbound
 Platoon Population: 25 to 30 vpl
 Number of Lanes: 2

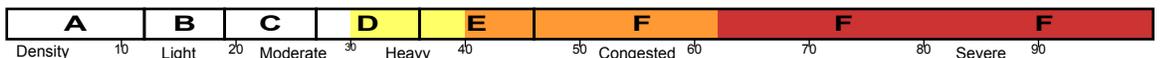
Traffic Quality Rating



Harry Truman Parkway - Morning



Traffic Quality Rating



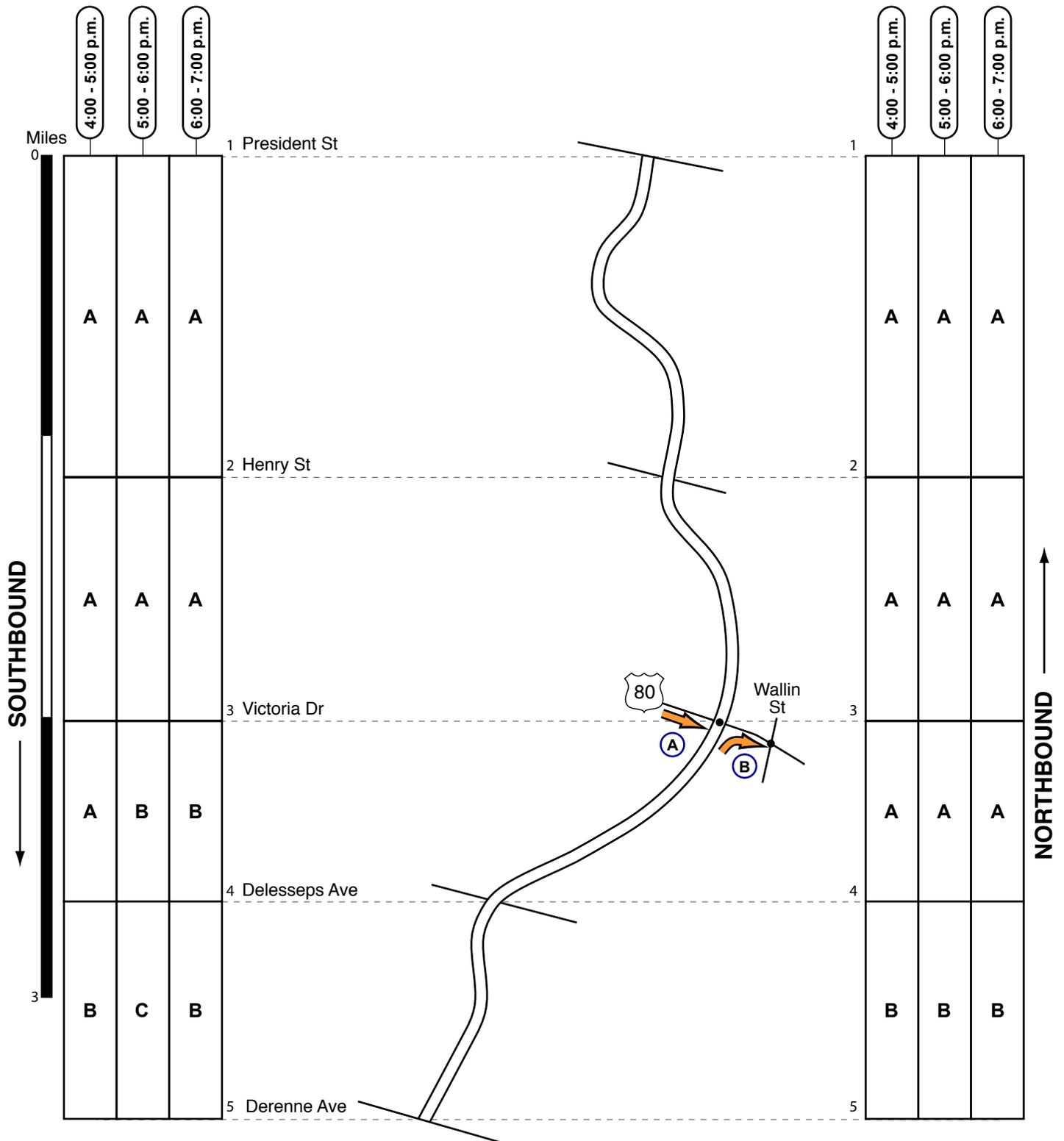
Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

Harry Truman Parkway - Evening



Traffic Quality Rating



Superscripts: ¹Type 1 nested congestion (some days, not others).

³Type 3 nested congestion (present only in the first or second half-hour period).

²Type 2 nested congestion (more severe in left or right-hand lanes).

⁴Type 4 nested congestion (partial length of segment).

Harry Truman Parkway - Evening

A

Congestion Type: Surveyed Cross Road Signal Queue

Location: US 80

Frequency: One time only

Direction: Eastbound

Queue Population: 20 to 25 vpl

Number of Lanes: 2

B

Congestion Type: Exit Ramp Queue

Location: US 80

Frequency: Intermittent

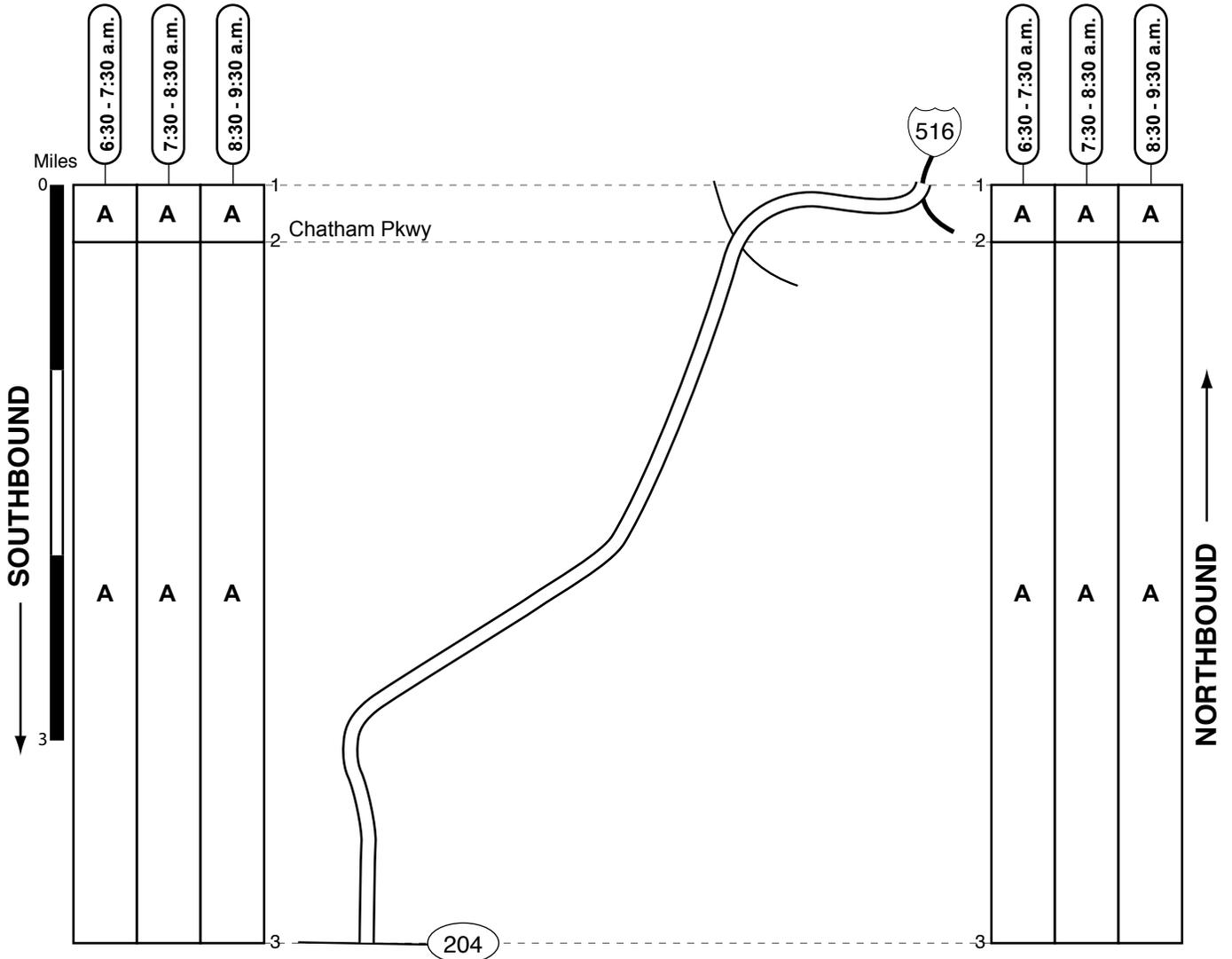
Direction: Northbound

Queue Population: 20 to 25 vpl

Number of Lanes:

Note: It appeared that the left of the two right-turn lanes was underutilized at the signal. Intermittently, weaving associated with the congested left-turn lane at Wallin St contributed to the congestion.

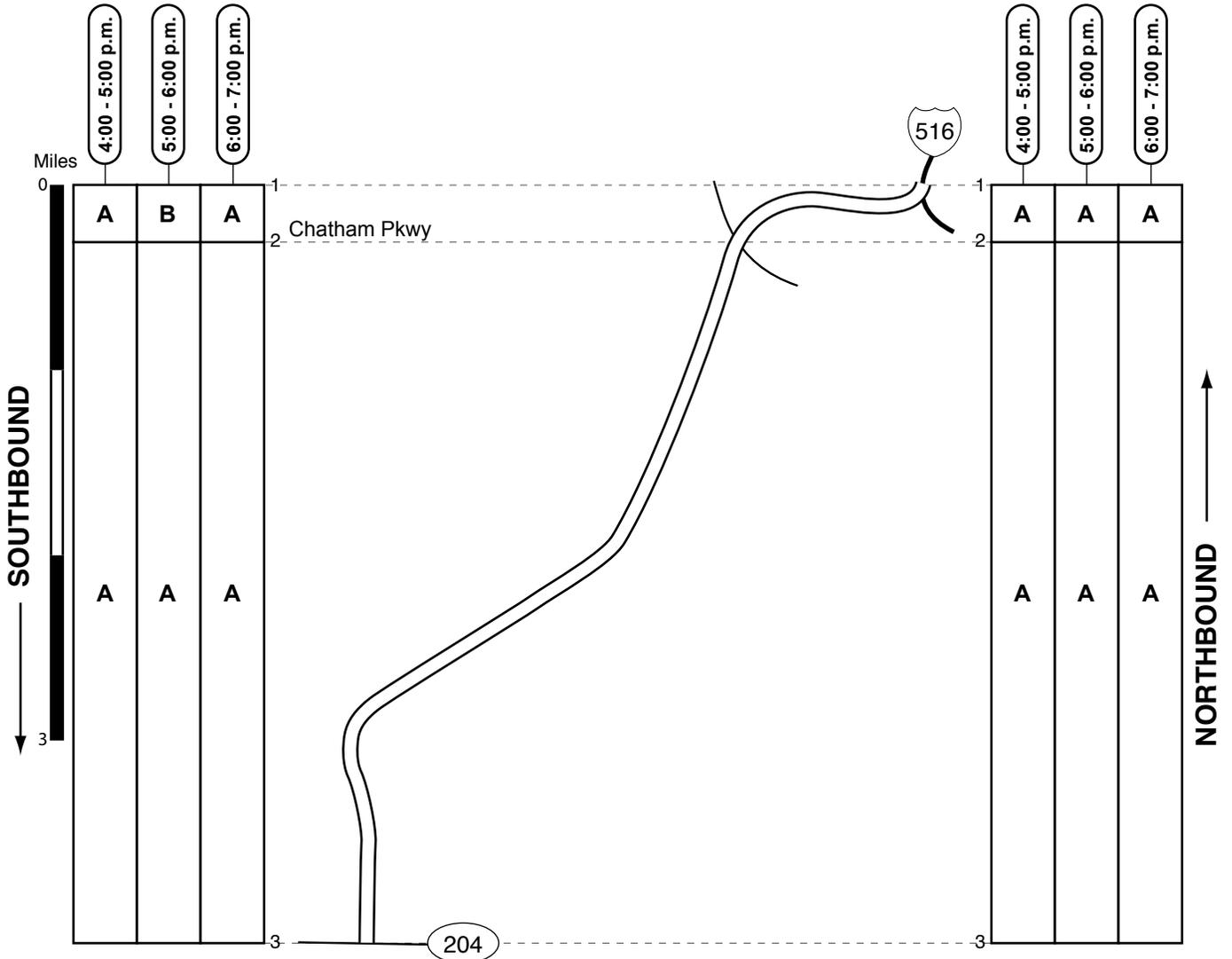
Veterans Parkway - Morning



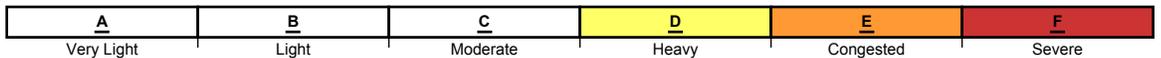
Traffic Quality Rating

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
Very Light	Light	Moderate	Heavy	Congested	Severe

Veterans Parkway - Evening



Traffic Quality Rating



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

On motorized vehicle 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 governmental 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:

<u>Vehicle type:</u>	<u>PCE’s:</u>
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 been 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.

While examining the photography, analysts also identified side streets and on/off ramps that were congested. Where these problems were recurring, descriptive narratives were prepared.

Note regarding nested congestion:

While examining the photography, analysts also identified a condition known as “nested congestion”. This occurs where density values calculated by the procedures described above do not reflect all of the congestion that was present in the photography. This happens because density values are averages, and where segments are only partly congested – for example, only traffic in the right lane is congested – the count of all vehicles in all lanes produces a density value that is below the threshold for “congestion”. In effect, counts from non-congested travel lanes “dilute” the counts from congested lanes. Actually, congestion can vary within a specific segment in one of four basic ways; therefore, four types of nested congestion are routinely identified:

Type 1: a segment is congested on some survey dates but not others;

Type 2: congestion is found in some travel lanes but not others;

Type 3: congestion is consistently found in just one 30-minute half of a given one-hour time slice (say from 5:00 to 5:30 p.m. when the final density value reflects 4:30 to 5:30 p.m.);

Type 4: congestion extends only for part of the length of a segment.

Because this is a macro-level survey program, the procedure is to produce one mathematically-derived performance rating per segment per hour per direction, for thousands of surveyed segments. Our analysis is limited to identifying locations where nested congestion was found, using a superscript to identify Types 1, 2, 3 and/or 4. Those superscripts can be found throughout the tables of this report.

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APPENDIX B

PROCEDURE FOR DETERMINING PERFORMANCE RATINGS: INTERRUPTED-FLOW ARTERIAL HIGHWAYS

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

On motorized vehicle 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 governmental 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.

Part One: Interrupted-flow highways (highways with traffic signals)

Summary

Density is not an appropriate performance measure for interrupted-flow arterials since density measurements will fluctuate widely with uneven flow caused by traffic signals. Accordingly, the defining parameter of HCM LOS on interrupted-flow highways is *average travel speed*, which is calculated from travel time. Travel time is commonly measured by inserting probe vehicles into a traffic stream (called “floating cars”), and recording travel times between key intersections; an alternative method is to record and match hundreds of license plate numbers at various points along a study corridor, and then calculate the associated travel times and speeds. These methods are widely used on commuter highways of all types, and have the advantage of providing actual HCM LOS on interrupted-flow highways – something that aerial photography cannot do on a large-scale basis.

Travel time methods are limited, however, in that they do not provide information regarding how heavily facilities are being used (that is normally accomplished with some form of volume determination). They also do not provide insight as to the underlying causes of congestion, or the degree to which congestion exists on cross streets or along merging routes. Aerial photography can provide this information, with the added benefit that the actual photographs can be used for inspection or documentation. For example, without traveling to the field, transportation specialists can view bottlenecks, look for causes, and sometimes even consider the feasibility of potential corrective actions. For example, is the problem caused by a specific turning movement within the intersection? Might it be feasible to add a turning lane? Are cross streets free of congestion (so we can consider adding “green” signal-time to the primary route)? How much worse has this become over the last three years? Should we include this site on our study list? The photographs then become supporting documentation for subsequent recommendations by engineers and funding decisions by elected officials.

Therefore, even though aerial photography cannot supply HCM LOS on interrupted-flow highways, the potential benefits of the approach are such that Skycomp was asked to develop a *surrogate* LOS performance measure – one that could be obtained cost-effectively from aerial photography, and could be used to monitor and document facility performance over time.

Surrogate LOS rating system developed by Skycomp.

Skycomp began by recognizing that the *HCM* supplies qualitative descriptions of the general nature of traffic flow associated with each LOS. For example, for LOS A, the *HCM* states:

“LOS A describes primarily free-flow operations at average travel speeds, [usually about 90% of the free flow speed for the given street class]. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Control delay at signalized intersections is minimal.” (*Travel-time definition highlighted in brackets.*)

At the other extreme, the *HCM* states:

“LOS F is characterized by urban street flow at extremely low speeds, [typically one-third to one-fourth of the free-flow speed]. Intersection congestion is likely at critical signalized locations, with high delays, high volumes and extensive queuing.”

Because aerial photographs show actual conditions on each highway link, they can be used to classify general levels of demand and congestion in a manner reasonably consistent with the six HCM descriptions. Skycomp developed and formalized such a system, which was introduced in 1995*. This rating system was developed under the following constraints:

- Like HCM LOS, the surrogate rating scale must consist of six classes labeled “A” through “F”. These classes must cover the full range of traffic conditions found on interrupted-flow highways, from empty to densely congested highways, with reasonable gradations in between. Ratings must be generally consistent with the qualitative descriptions of traffic flow associated with each LOS class in the HCM.
- The procedure must produce consistent results, so that different trained persons will generally assign the same ratings when analyzing with the same photographs.
- The procedure must produce ratings that are not sensitive to the time the photographs were taken relative to the signal cycle.

Definition of Surrogate LOS Performance Ratings

Skycomp’s system relies on assessing the nature of vehicle platoons and the extent of queuing found at signalized intersections. Accordingly, the six surrogate LOS performance ratings used in this survey of interrupted-flow highways are defined as follows. (Because they are surrogate LOS measures, they are underlined for differentiation from HCM LOS):

Surrogate LOS Performance Rating A:

— Very few vehicles are using the highway; the highway is virtually deserted. [*HCM qualitative description for LOS A: Vehicles are completely unimpeded in their ability to maneuver within the traffic stream; free-flow operations.*]

Surrogate LOS Performance Rating B:

— Traffic flow is light; there is little or no grouping of vehicles (“platooning”). [*HCM qualitative description for LOS B: reasonably unimpeded operations; ability to maneuver only slightly restricted.*]

Surrogate LOS Performance Rating C:

—Traffic flow is moderate (not heavy, not light). There are enough vehicles to form into distinct platoons, but platoon populations do not exceed 15 vehicles per lane. [*HCM qualitative description for LOS C: stable operations; some restrictions to ability to maneuver.*]

Surrogate LOS Performance Rating D:

—Traffic flow is heavy; there are many cars on the road. Significant queuing is found at signals, but all queued vehicles are expected to clear the signal on “green” (there are less than 20 vehicles per lane queued at all signals in the segment). Platoons contain at least 15 but do not exceed 25 vehicles per lane. [*HCM qualitative description for LOS D: borders on unstable flow where small increases in flow may cause substantial decreases in travel speed.*]

Surrogate LOS Performance Rating E:

— Traffic flow is congested. The segment may contain one or two signalized intersections with queues of more than 20 vehicles per lane (all vehicles may not clear on “green”). Platoon populations exceed 25 vehicles per lane. (On long one-lane segments, the movement of vehicles may resemble a funeral procession, with little opportunity for side-traffic to enter the roadway.) [*HCM qualitative description for LOS E: significant delays and low average travel speeds; typical causes include adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.*]

Surrogate LOS Performance Rating F:

— Traffic flow is severely congested. This involves vehicles backing through an upstream signal, or for the length of the segment; a series of closely-spaced intersections with more than 20 vehicles per lane queued at each; or the segment contains one severely congested intersection, with more than 40 vehicles per lane queued approaching the signal (it may take two or more signal cycles to clear the intersection). [*HCM qualitative description for LOS F: flow at extremely low speeds; high delays and extensive queuing likely at critical intersections.*]

These are the definitions that were used in evaluating the interrupted-flow highways for each of the surveys conducted in 2004 and 2008.

Photo analysis procedures

Prior to the beginning of photo analysis, each surveyed highway was segmented into sections between major intersections or crossroads (segments were normally two to three miles in length; however, some segments were as short as one mile or as long as five miles, depending primarily on the density of traffic signals).

LOS ratings were assigned one segment at a time, by direction, based on the parameters of the surrogate LOS system described above. For each segment, all associated photographs were laid out and oriented for simultaneous viewing. The analyst began by considering the segment a surrogate LOS C; from the photographs, a determination was then made if the conditions warranted that LOS rating. If so, the assignment of LOS C was made. If not, the analyst adjusted the LOS rating upward or downward as warranted by the conditions.

In the event that an incident or temporary roadwork significantly affected the rating, the evaluator attached a code that would later exclude the affected data from being compared to the results of other survey flights.

After a quality-control review by the senior analyst, all individual LOS ratings were digitized and entered into a computer database program for compilation and evaluation. LOS Ratings were printed by time slice and by day, so that unusual ratings could be identified. For example, if “B” or “C” LOS ratings were assigned on three days and an “E” LOS rating on one day, the photography was checked for possible error or incident. If the data were clearly atypical but a cause could not be identified, a code “u” (“unknown”) was attached to the data (like the incident and roadwork codes, this would flag the data for exclusion when determining predominant LOS ratings).

Skycomp's senior analyst then reviewed the photography at each bottleneck location (performance rating "E" or "E"), verified LOS ratings assigned by the analyst, and prepared a text entry summarizing details at the site. For example:

Summary detail note (US 78 - Morning):

Congestion Type: Signal Queue

Intersection: Wisteria Dr

Frequency: Most observations

Direction: Westbound

Queue Populations: 20 to 100 vehicles per lane

Number of Lanes: One

For each bottleneck, photographs were also selected that best illustrated the congestion that was found. Digital versions of these photos were then labeled as appropriate, and set aside for incorporation later into the interactive digital slide show.

Next, revisions were made to the database as appropriate; average LOS ratings were then generated for inclusion in the performance rating tables in Part One.

* (Skycomp developed its system to the HCM LOS descriptions that were current in 1995. The qualitative descriptions associated with each LOS rating were not materially revised in HCM 2000.)

APPENDIX C

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 (draft paper included in this appendix).

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?

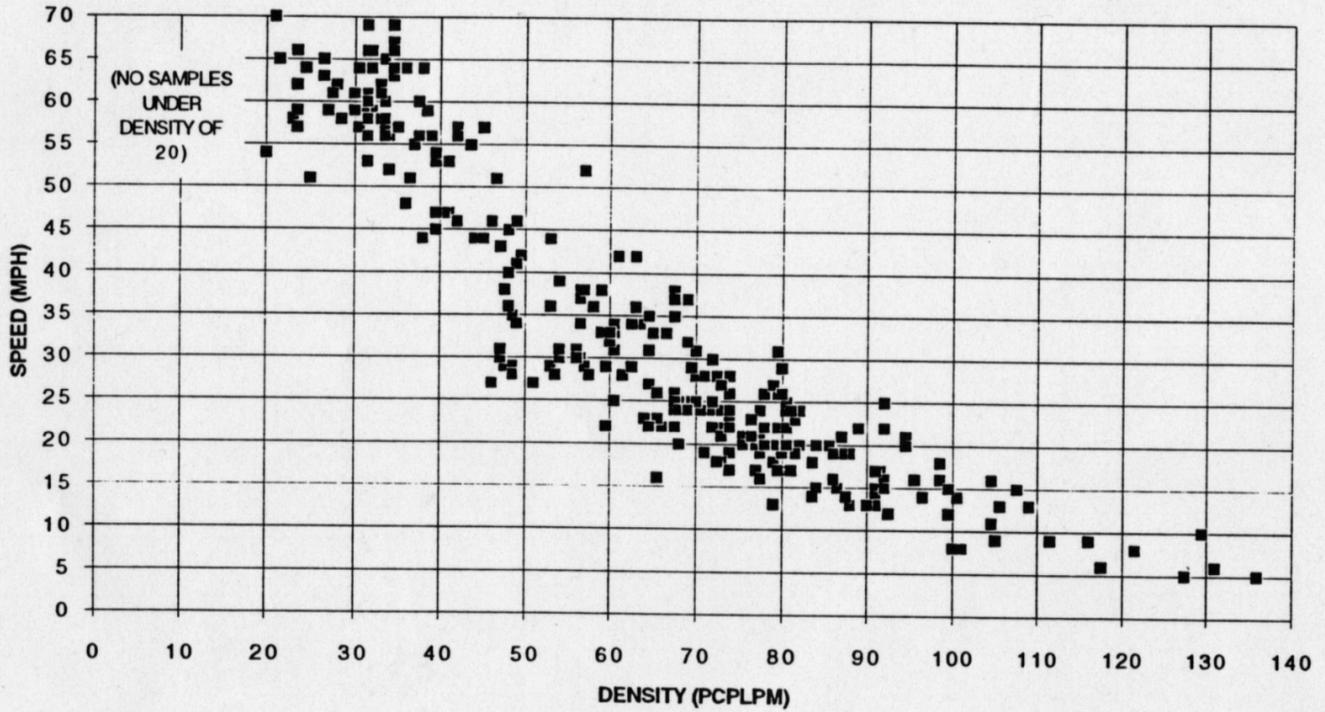
Also, in the event that the highway had four travel lanes in one direction, alternating samples were taken from both middle lanes.

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



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:

<u>Vehicle type:</u>	<u>PCE's:</u>
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
DRAFT -- 15 Feb 96

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 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.

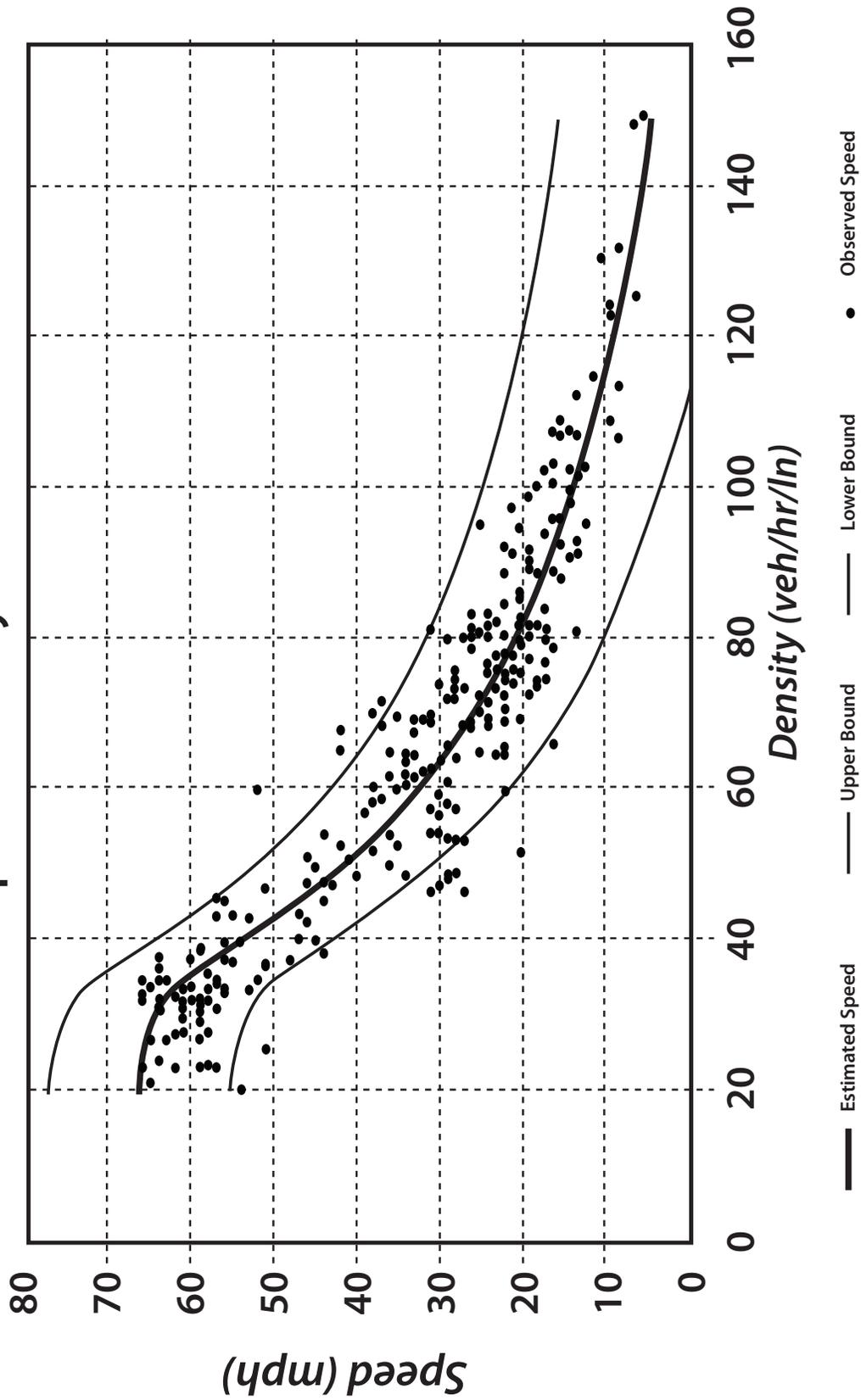
The procedure for calibration was as follows: 1) The model's equation was coded into a spreadsheet so that the shape could be defined by recognizable parameters: two points that the curve passes through, the free-flow speed, and the speed at capacity. By overlaying this curve with the scatter plot of 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.

Van Aerde Single Regime Model Speed-Density Calibration



Van Aerde Single Regime Model

