Rappahannock-Rapidan Regional Commission
2009 Travel Time Survey

Rappahannock Rapidan
Regional Commission
420 Southridge Pkwy.
Suite 106
Culpeper, VA 22701
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Introduction

Travel time, or the time required to traverse a route between any two points, is a fundamental measure in transportation. Elements of a travel time study--operating speed, elapsed travel time and duration and frequency of delays are all performance measures that convey a broader picture of how traffic moves. Beginning with the 2007 study and continuing in 2008 and 2009, the Rappahannock Rapidan Commission (RRRC) initiated the travel time process for the Planning District Nine (Culpeper, Fauquier, Madison, Orange, Rappahannock counties) region.

The primary utility of the travel time study is to compare over time how traffic flows on a corridor. RRRC intends to perform these studies annually, choosing different corridors to review until a period of five years has elapsed. Therefore, data collected during the initial corridor analyses will serve as the base line for the future measurements. Starting in the sixth year of the study, the same corridor segments that were analyzed five years previous will be re-visited, i.e. segments that were driven in 2007 will be revisited in 2012, 2008 in 2013, 2009 in 2014 and so forth.

RRRC will use the travel time studies, in conjunction with other data such as traffic counts and level of service information, to create an overall Congestion Management System for the PD9 region. Congestion Management Systems are mandated by federal law for metropolitan planning areas and are a useful tool to evaluate and monitor traffic congestion.

Methodology

The "test vehicle" technique was used during this study. This method consists of a vehicle specifically dispatched to drive with the traffic stream for the express purpose of data collection. A stopwatch was started at the beginning of each test run to record the cumulative lapsed time between the starting and end points along each corridor segment. When the test vehicle was stopped or forced to travel slowly (10 miles per hour or below), a second stopwatch was used to measure the duration of each stop/delay. In addition, the location of each stop/delay was recorded. Two data collection runs were made in each direction during the morning (7 to 9 a.m.) and afternoon (4 to 6 p.m.) peak hours for each segment. As much as possible, the test car was driven at the legally posted speed limit and, on segments of four-lane divided highways, in the right lane.

The average travel characteristics are defined below:

Travel Time – Number of minutes needed to travel between two points. Travel time is equivalent to the addition of running time and stop/delay time *(see definitions below).*

*Running Tim*e – The time period when the vehicle is in motion.

Stop/Delay Time – The time period when vehicle has stopped moving or has almost stopped moving.

Average Travel Speed – The average speed of travel between two control points, including delays. The average travel speed is computed by taking the length of the highway segment under consideration and dividing it by the average travel time of that segment.

Average Running Speed – The average speed of travel between two control points only when the vehicle is in motion. The average running speed is computed by taking the length of the highway segment under consideration and dividing it by the average running time of that segment.

Study Corridor Segments

The third RRRC travel time study measured speed and delay along three corridors – Route 211 through portions of Rappahannock and Fauquier counties, as well as the Town of Warrenton; Route 17 in the southern part of Fauquier County; and Route 3 through portions of Culpeper and Orange counties. The segment lengths corresponded with sections delineated by the VDOT Traffic Engineering Division to perform their annual average daily traffic volume estimates.

The three segments measured were 18.9 miles on Route 211 between Route 522 east of Washington, VA and Broadview Avenue in Warrenton (Corridor A), 10.7 miles on Route 17 between Opal, VA and Morrisville, VA (Corridor B) and 18.0 miles on Route 3 from U.S. 29 Bypass to Route 20 (Corridor C). Taken together these segments are approximately 48 miles in length.

All three corridors can generally be described as rural highways. Corridors A and B are both primarily four-lane, divided highways with sections of those corridors four-lane, undivided, while corridor C features segments of four-lane, divided; four-lane, undivided; and two-lane. The three corridors were selected for study due to the potential for changing growth patterns in each area, including the potential development at Clevenger's Corner in Culpeper County within corridor A, future growth trends and potential transportation changes around Opal and Bealeton in corridor B, and growth and transportation changes in corridor C, including the expansion from two to four lanes from Stevensburg to Lignum in Culpeper County and future commercial development along Route 3 in Orange County.

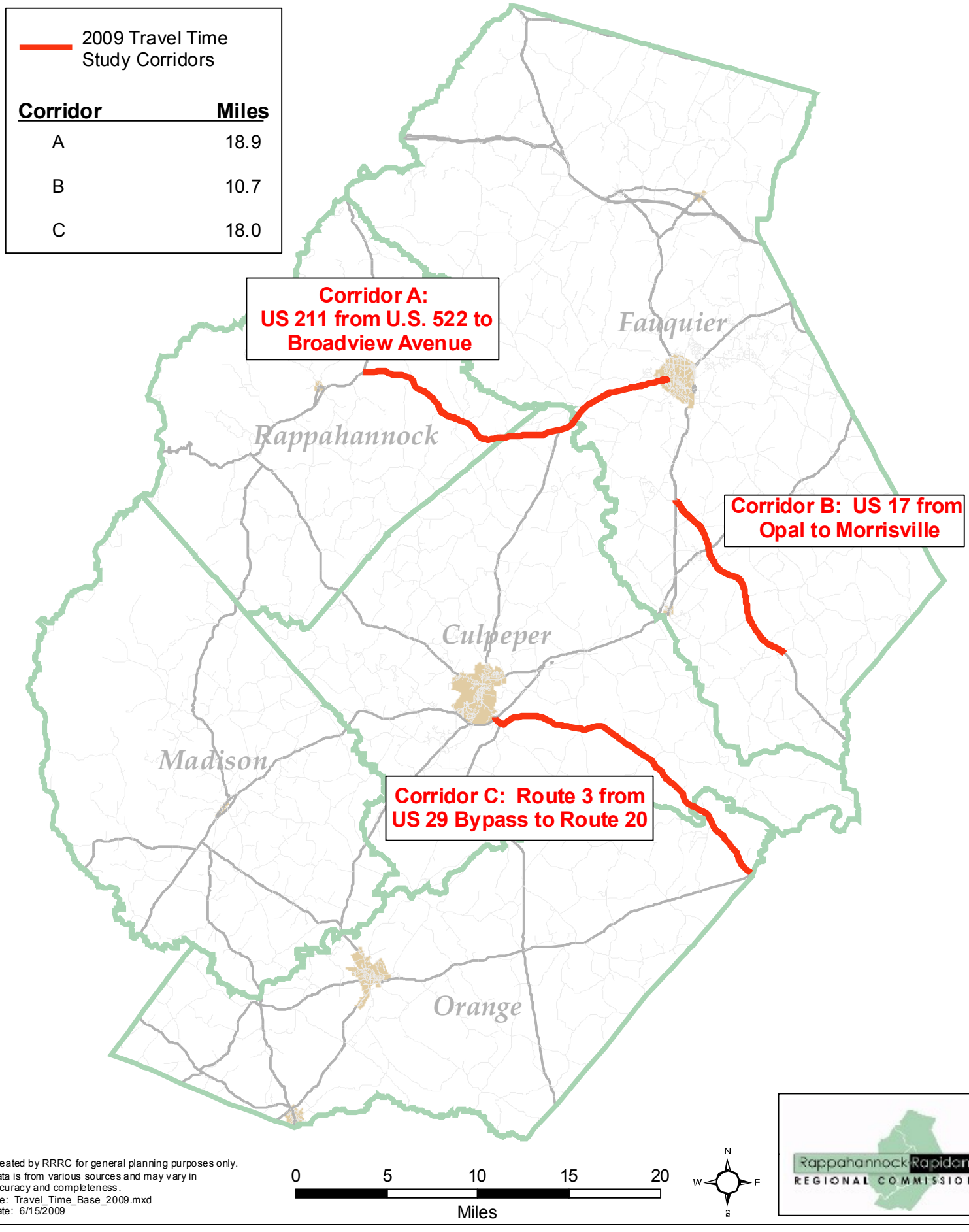
Each corridor segment contained varying speed limits. Thus, for each segment length, an average posted speed limit was computed. Calculations can be found in Table 1. In Corridor A, speed limits varied from 40 mph to 55 mph. The westbound segment with a 40 mph posted speed limit also was 3/10 of a mile longer than the eastbound 40 mph segment. In corridor B, speed limits varied from 45 mph to 55 mph. In addition, there was an active school zone in corridor B during the AM with a 2/10 mile segment of 35 mph speeds for both the eastbound and westbound directions. In corridor C, speed limits varied from 45 mph to 55 mph.

Results

The results of the travel time analysis are summarized in the following tables. Tables 2 through 7 detail the segment analyzed, segment length, travel time, running time, stop/delay time, average posted speed limit, average travel speed, average running speed, difference of average travel speed from posted speed limit during difference of average running speed from posted speed limit and average number of traffic signals per mile of segment analyzed. Tables 8 through 13 specifically delineate the stops/delay in each segment by cause, location, and time of the stop/delay. Delays in each segment corridor varied, with traffic signals the most prevalent cause for delay. Stop signs, yield markers, vehicle left turns on two-lane segments and school entrances also contributed delays.

In general, all three corridors perform very well at the present time. Traffic moves freely and without delay, except where there are traffic signals installed. The longest points of delay in each corridor were over 1 minute in length at traffic signals (see Tables 8-13), but no location resulted in a delay on every trip. There were no major differences noted between morning and afternoon peak hour trips, nor were there notable differences in stoppages in either the eastbound or westbound trips on each corridor. The longest delays in each corridor.

2009 RRRC Travel Time Study Corridors



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File: Travel_Time_Base_2009.mxd
Date: 6/15/2009

2009 RRRC Travel Time Study: Corridor A

Segment Length: 18.9 Miles

Avg Posted Speed Limit:
54.69 mph (East) | 54.17 mph (West)

Average Travel Time Through:

Rappahannock County: 9:54 (9.2 miles)

Culpeper County: 4:17 (3.9 miles)

Fauquier County: 5:48 (5.3 miles)

Town of Warrenton: 1:25 (0.5 miles)

Eastbound Trip Averages
AM Peak Average Travel Time: 21:43.5
AM Peak Average Travel Speed: 52.20 mph

AM Peak Average Running Time: 20:46
AM Peak Average Running Speed: 54.61 mph

PM Peak Average Travel Time: 21:29
PM Peak Average Travel Speed: 52.79 mph

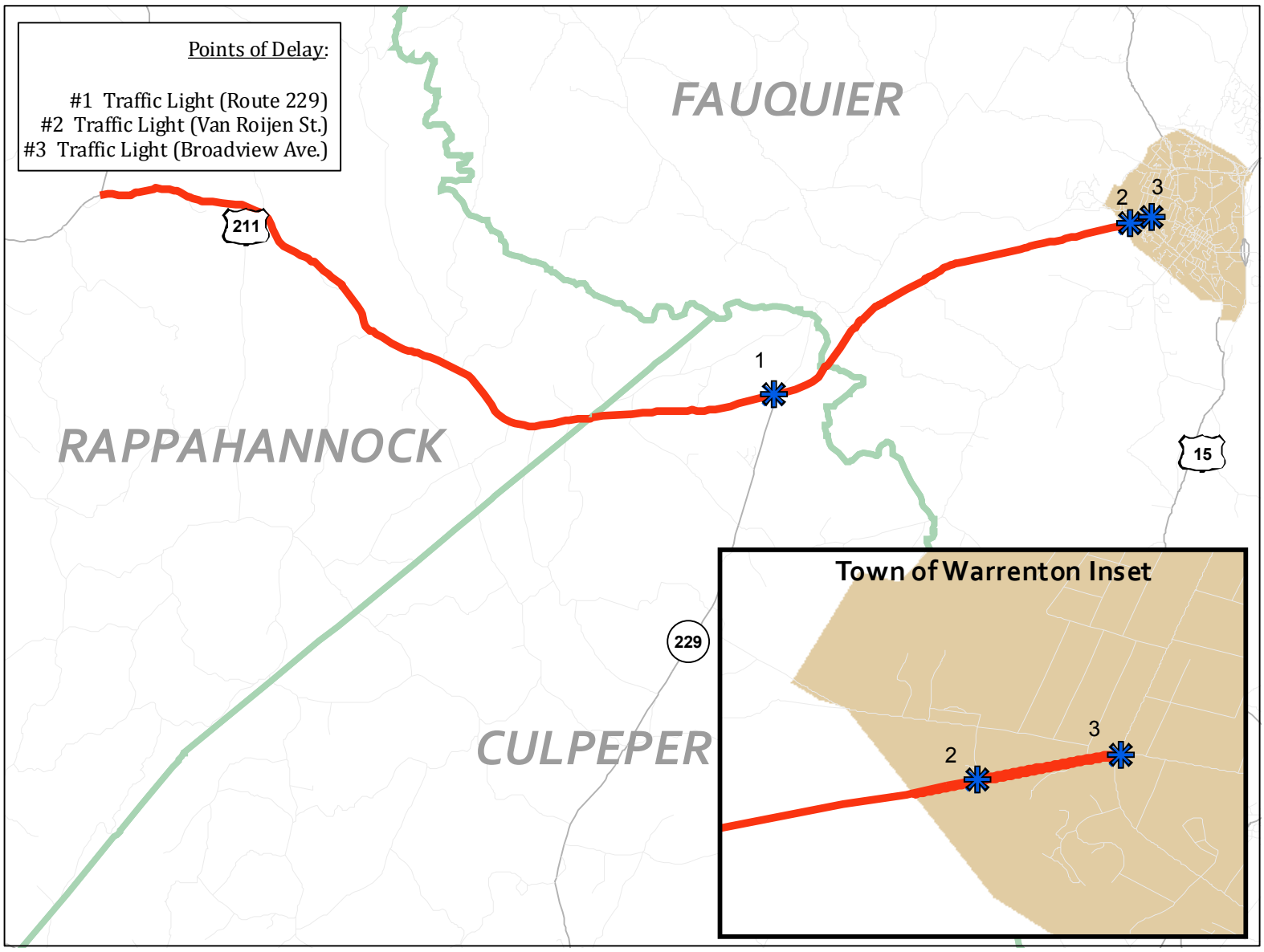
PM Peak Average Running Time: 20:44
PM Peak Average Running Speed: 54.70 mph

Westbound Trip Averages
AM Peak Average Travel Time: 21:01.5
AM Peak Average Travel Speed: 53.94 mph

AM Peak Average Running Time: 20:52
AM Peak Average Running Speed: 54.34 mph

PM Peak Average Travel Time: 21:18
PM Peak Average Travel Speed: 53.24 mph

PM Peak Average Running Time: 20:48.5
PM Peak Average Running Speed: 54.50 mph



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2009 RRRC Travel Time Study: Corridor C

Segment Length: 18.0 Miles

Avg Posted Speed Limit: 54.0 mph

Average Travel Time Through:

Culpeper County: 14:29 (13.2 miles)

Orange County: 6:23 (4.8 miles)

Eastbound Trip Averages
AM Peak Average Travel Time: 20:58.5
AM Peak Average Travel Speed: 51.49 mph

AM Peak Average Running Time: 20:08
AM Peak Average Running Speed: 53.64 mph

PM Peak Average Travel Time: 21:23
PM Peak Average Travel Speed: 50.51 mph

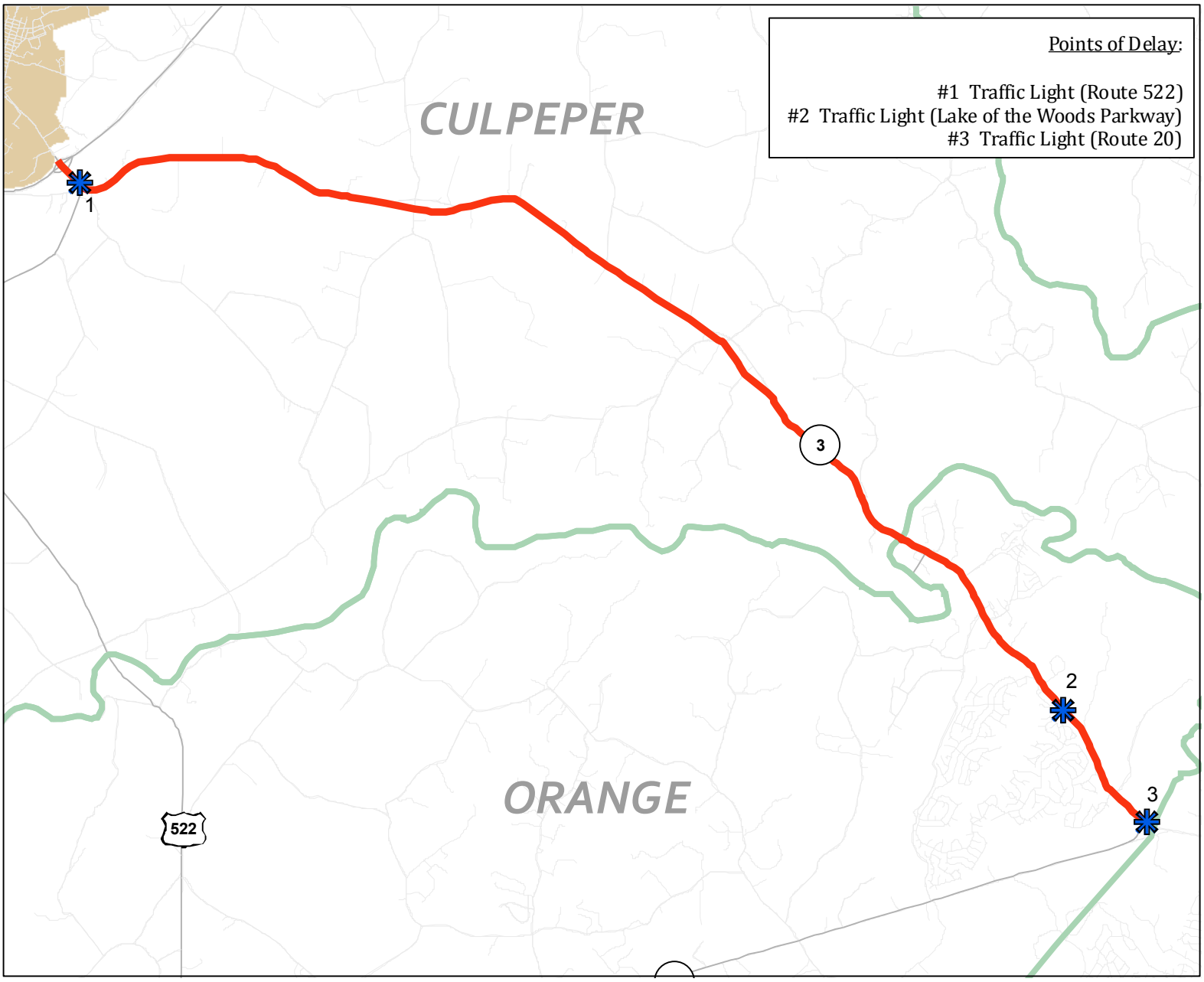
PM Peak Average Running Time: 20:10.5
PM Peak Average Running Speed: 53.53 mph

Westbound Trip Averages
AM Peak Average Travel Time: 20:30.5
AM Peak Average Travel Speed: 52.66 mph

AM Peak Average Running Time: 20:15
AM Peak Average Running Speed: 53.33 mph

PM Peak Average Travel Time: 20:37.5
PM Peak Average Travel Speed: 52.36 mph

PM Peak Average Running Time: 20:00.5
PM Peak Average Running Speed: 53.98 mph



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File: Travel_Time_2009_Corridor_C.mxd | Date: 6/15/2009

TABLE 1: AVERAGE POSTED SPEED LIMIT CALCULATIONS

	SEGMENT MILES AT x MPH				
	35	**40**	**45**	**55**	**AVG. POSTED SPEED LIMIT**
CORRIDOR A EASTBOUND	-	0.4	-	18.5	54.69
CORRIDOR A WESTBOUND	-	0.7	-	18.2	54.44
CORRIDOR B	-	-	1.8	8.9	53.32
CORRIDOR B "AM"	0.2	-	1.8	8.7	52.94
CORRIDOR C	-	-	1.8	16.2	54.00

Calculations were computed using the following equation, where "x" is equal to the total mileage of the corridor segment. Corridor C is used in this example:

$$(1.8/x)(45) + (16.2/x)(55)$$

TABLE 2
CORRIDOR SEGMENT "A" – ROUTE 211 FROM ROUTE 522 TO BROADVIEW AVENUE
AM PEAK (7:00 – 9:00 a.m.)

TRIP ID	Length (Miles)	Travel Time = Running Time+ Stopped/Delay Time (Minutes/ Seconds)	Running Time (Minutes/ Seconds)	Stop/Delay Time – 10 MPH or Lower (Minutes/Seconds)	Posted Speed Limit (MPH)	Avg. Travel Speed (MPH)	Avg. Running Speed (MPH)	Difference (+/-) of Average Travel Speed from Posted Speed Limit	Difference (+/-) of Average Running Speed from Posted Speed Limit
Eastbound 1	18.9	21:03	20:39	0:24	54.69	53.87	54.92	(-0.82)	(+0.23)
Eastbound 2	18.9	22:24	20:53	1:31	54.69	50.63	54.31	(-4.06)	(-0.38)
Eastbound AVERAGE	**18.9**	**21:43.5**	**20:46**	**0:57.5**	**54.69**	**52.20**	**54.61**	**(-2.49)**	**(-0.08)**
Westbound 1	18.9	20:50	20:50	-	54.44	54.43	54.43	(-0.01)	(-0.01)
Westbound 2	18.9	21:13	20:54	0:19	54.44	53.45	54.26	(-0.99)	(-0.18)
Westbound AVERAGE	**18.9**	**21:01.5**	**20:52**	**0:09.5**	**54.44**	**53.94**	**54.34**	**(-0.50)**	**(-0.10)**

Note: Eastbound Average speed differs due to shorter 40 mph segment near the Town of Warrenton.
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TABLE 3
CORRIDOR SEGMENT "A" – ROUTE 211 FROM ROUTE 522 TO BROADVIEW AVENUE
PM PEAK (4:00 – 6:00 p.m.)

TRIP ID	Length (Miles)	Travel Time = Running Time+ Stopped/Delay Time (Minutes/ Seconds)	Running Time (Minutes/ Seconds)	Stop/Delay Time – 10 MPH or Lower (Minutes/Seconds)	Posted Speed Limit (MPH)	Avg. Travel Speed (MPH)	Avg. Running Speed (MPH)	Difference (+/-) of Average Travel Speed from Posted Speed Limit	Difference (+/-) of Average Running Speed from Posted Speed Limit
Eastbound 1	18.9	20:43	20:43	-	54.69	54.74	54.74	(+0.05)	(+0.05)
Eastbound 2	18.9	22:15	20:45	1:30	54.69	50.97	54.65	(-3.72)	(-0.04)
Eastbound AVERAGE	**18.9**	**21:29**	**20:44**	**0:45**	**54.69**	**52.79**	**54.70**	**(-1.90)**	**(+0.01)**
Westbound 1	18.9	20:57	20:48	0:09	54.44	54.13	54.52	(-0.31)	(+0.08)
Westbound 2	18.9	21:39	20:49	0:50	54.44	52.38	54.47	(-2.06)	(+0.03)
Westbound AVERAGE	**18.9**	**21:18**	**20:48.5**	**0:29.5**	**54.44**	**53.24**	**54.50**	**(-1.20)**	**(+0.06)**

Note: Eastbound Average speed differs due to shorter 40 mph segment near the Town of Warrenton.

TABLE 4
CORRIDOR SEGMENT "B" – ROUTE 17 FROM OPAL TO MORRISVILLE
AM PEAK (7:00 – 9:00 a.m.)

TRIP ID	Length (Miles)	Travel Time = Running Time+ Stopped/Delay Time (Minutes/ Seconds)	Running Time (Minutes/ Seconds)	Stop/Delay Time – 10 MPH or Lower (Minutes/ Seconds)	Posted Speed Limit (MPH)	Average Travel Speed (MPH)	Average Runnin g Speed (MPH)	Difference (+/-) of Average Travel Speed from Posted Speed Limit	Difference (+/-) of Average Running Speed from Posted Speed Limit
Eastbound 1	10.7	14:24	12:31	1:53	52.94	44.58	51.29	(-8.36)	(-1.65)
Eastbound 2	10.7	12:29	12:29	-	52.94	51.43	51.43	(-1.51)	(-1.51)
Eastbound AVERAGE	**10.7**	**13:26.5**	**12:30**	**0:56.5**	**52.94**	**47.76**	**51.36**	**(-5.18)**	**(-1.58)**
Westbound 1	10.7	13:09	12:51	0:18	52.94	48.82	49.96	(-4.12)	(-2.98)
Westbound 2	10.7	12:59	12:49	0:10	52.94	49.45	50.09	(-3.49)	(-2.85)
Westbound AVERAGE	**10.7**	**13:04**	**12:50**	**0:14**	**52.94**	**49.13**	**50.03**	**(-3.81)**	**(-2.91)**

Notes: Corridor B AM Posted Speed Limit is less than PM Posted Speed Limit due to 0.2 mile school zone near Morrisville that was active during all trips.

TABLE 5
CORRIDOR SEGMENT "B" – ROUTE 17 FROM OPAL TO MORRISVILLE
PM PEAK (4:00 - 6:00 p.m.)

TRIP ID	Length (Miles)	Travel Time = Running Time+ Stopped/ Delay Time (Minutes/ Seconds)	Running Time (Minutes/ Seconds)	Stop/Delay Time – 10 MPH or Lower (Minutes/ Seconds)	Posted Speed Limit (MPH)	Average Travel Speed (MPH)	Average Running Speed (MPH)	Difference (+/-) of Average Travel Speed from Posted Speed Limit	Difference (+/-) of Average Running Speed from Posted Speed Limit
Eastbound 1	10.7	13:18	12:18	1:00	53.32	48.27	52.20	(-5.05)	(-1.12)
Eastbound 2	10.7	13:49	12:16	1:33	53.32	46.46	52.34	(-6.84)	(-0.98)
Eastbound AVERAGE	**10.7**	**13:33.5**	**12:17**	**1:16.5**	**53.32**	**47.35**	**52.27**	**(-5.97)**	**(-1.05)**
Westbound 1	10.7	13:19	12:22	0:57	53.32	48.21	51.91	(-5.11)	(-1.41)
Westbound 2	10.7	13:13	12:11	1:02	53.32	48.57	52.70	(-4.75)	(-0.62)
Westbound AVERAGE	**10.7**	**13:16**	**12:16.5**	**0:59.5**	**53.32**	**48.39**	**52.30**	**(-4.91)**	**(-1.02)**

Note: Corridor B AM Posted Speed Limit is less than PM Posted Speed Limit due to 0.2 mile school zone near Morrisville that was active during all trips.

TABLE 6
CORRIDOR SEGMENT "C" – ROUTE 3 FROM ROUTE 29 BYPASS TO ROUTE 20
AM PEAK (7:00 – 9:00 a.m.)

TRIP ID	Length (Miles)	Travel Time = Running Time+ Stopped/ Delay Time (Minutes/ Seconds)	Running Time (Minutes/ Seconds)	Stop/Delay Time – 10 MPH or Lower (Minutes/Seconds)	Posted Speed Limit (MPH)	Average Travel Speed (MPH)	Average Running Speed (MPH)	Difference (+/-) of Average Travel Speed from Posted Speed Limit	Difference (+/-) of Average Running Speed from Posted Speed Limit
Eastbound 1	18.0	20:49	20:01	0:48	54.0	51.88	53.95	(-2.12)	(-0.05)
Eastbound 2	18.0	21:08	20:15	0:53	54.0	51.10	53.33	(-2.90)	(-0.67)
Eastbound AVERAGE	**18.0**	**20:58.5**	**20:08**	**0:50.5**	**54.0**	**51.49**	**53.64**	**(-2.51)**	**(-0.36)**
Westbound 1	18.0	20:45	20:21	0:24	54.0	52.05	53.07	(-1.95)	(-0.93)
Westbound 2	18.0	20:16	20:09	0:07	54.0	53.29	53.60	(-0.71)	(-0.40)
Westbound AVERAGE	**18.0**	**20:30.5**	**20:15**	**0:15.5**	**54.0**	**52.66**	**53.33**	**(-1.34)**	**(-0.67)**

TABLE 7
CORRIDOR SEGMENT "C" – ROUTE 3 FROM ROUTE 29 BYPASS TO ROUTE 20
PM PEAK (4:00 – 6:00 p.m.)

TRIP ID	Length (Miles)	Travel Time = Running Time+ Stopped/ Delay Time (Minutes/ Seconds)	Running Time (Minutes/Seconds)	Stop/Delay Time – 10 MPH or Lower (Minutes/Seconds)	Posted Speed Limit (MPH)	Average Travel Speed (MPH)	Average Running Speed (MPH)	Difference (+/-) of Average Travel Speed from Posted Speed Limit	Difference (+/-) of Average Running Speed from Posted Speed Limit
Eastbound 1	18.0	21:15	20:12	1:03	54.0	50.82	53.47	(-3.18)	(-0.53)
Eastbound 2	18.0	21:31	20:09	1:22	54.0	50.19	53.60	(-3.81)	(-0.40)
Eastbound AVERAGE	**18.0**	**21:23**	**20:10.5**	**1:12.5**	**54.0**	**50.51**	**53.53**	**(-3.49)**	**(-0.47)**
Westbound 1	18.0	21:02	20:02	1:00	54.0	51.35	53.91	(-2.65)	(-0.09)
Westbound 2	18.0	20:11	19:59	0:12	54.0	53.51	54.05	(-0.49)	(+0.05)
Westbound AVERAGE	**18.0**	**20:37.5**	**20:00.5**	**0:36**	**54.0**	**52.36**	**53.98**	**(-1.64)**	**(-0.02)**

TABLE 8: CORRIDOR A | STOPS/DELAYS (10 MPH or Below) | AM Peak

TRIP ID	Jurisdiction	Stop/Delay Cause	Stop/Delay Location (Intersection)	Stopped/Delay Time (Minutes/Seconds)
Eastbound #1	Town of Warrenton	Traffic Signal	Broadview Avenue	0:24
Eastbound #2	Culpeper County	Traffic Signal	Route 229	0:21
	Town of Warrenton	Traffic Signal	Broadview Avenue	1:10
Westbound #1	-	-	-	-
Westbound #2	Town of Warrenton	Traffic Signal	Van Roijen Street	0:19

*Westbound delays at Broadview Ave. were not included in overall travel time. On trip #1, the delay was 2:07 and on trip #2, the delay was 0:32.

TABLE 9: CORRIDOR A | STOPS/DELAYS (10 MPH or Below) | PM Peak

TRIP ID	Jurisdiction	Stop/Delay Cause	Stop/Delay Location (Intersection)	Stopped/Delay Time (Minutes/Seconds)
Eastbound #1	-	-	-	-
Eastbound #2	Town of Warrenton	Traffic Signal	Broadview Avenue	1:30
Westbound #1	Town of Warrenton	Traffic Signal	Van Roijen Street	0:08
Westbound #2	Town of Warrenton	Traffic Signal	Van Roijen Street	0:50

*Westbound delays at Broadview Ave. were not included in overall travel time. On trip #1, there was no delay and on trip #2, the delay was 0:30.

TABLE 10: CORRIDOR B | STOPS/DELAYS (10 MPH or Below) | AM Peak

TRIP ID	Jurisdiction	Stop/Delay Cause	Stop/Delay Location (Intersection)	Stopped/Delay Time (Minutes/Seconds)
Eastbound #1	Fauquier County	Traffic Signal	Route 28	1:05
	Fauquier County	Traffic Signal	Remington Road/Station Drive	0:48
Eastbound #2	-	-	-	-
Westbound #1	Fauquier County	Traffic Signal	Village Center Drive	0:18
Westbound #2	Fauquier County	Traffic Signal	Village Center Drive	0:10

*Eastbound delays turning onto Route 17 at Opal were not included in overall travel time. On trip #1, the delay was 0:38 and on trip #2, the delay was 0:18.

TABLE 11: CORRIDOR B | STOPS/DELAYS (10 MPH or Below) | PM Peak

TRIP ID	Jurisdiction	Stop/Delay Cause	Stop/Delay Location (Intersection)	Stopped/Delay Time (Minutes/Seconds)
Eastbound #1	Fauquier County	Traffic Signal	Village Center Drive	0:19
	Fauquier County	Traffic Signal	Remington Road/Station Drive	0:41
Eastbound #2	Fauquier County	Traffic Signal	Route 28	1:25
	Fauquier County	Traffic Signal	Village Center Drive	0:08
Westbound #1	Fauquier County	Traffic Signal	Route 28	0:56
Westbound #2	Fauquier County	Traffic Signal	Route 28	1:02

*Eastbound delays turning onto Route 17 at Opal were not included in overall travel time. On trip #1, the delay was 2:22 (2 cycles) and on trip #2, the delay was 1:06.

TABLE 12: CORRIDOR C | STOPS/DELAYS (10 MPH or Below) | AM Peak

TRIP ID	Jurisdiction	Stop/Delay Cause	Stop/Delay Location (Intersection)	Stopped/Delay Time (Minutes/Seconds)
Eastbound #1	Orange County	Traffic Signal	Lake of the Woods Parkway	0:48
Eastbound #2	Orange County	Traffic Signal	Route 20	0:53
Westbound #1	Culpeper County	Traffic Signal	Route 522	0:24
Westbound #2	Orange County	Traffic Signal	Lake of the Woods Parkway	0:07

*Westbound delays at Route 20 were not included in overall travel time. On trip #1, there was no delay and on trip #2, the delay was 0:38.

TABLE 13: CORRIDOR C | STOPS/DELAYS (10 MPH or Below) | PM Peak

TRIP ID	Jurisdiction	Stop/Delay Cause	Stop/Delay Location (Intersection)	Stopped/Delay Time (Minutes/Seconds)
Eastbound #1	Culpeper County	Traffic Signal	Route 522	0:19
	Orange County	Traffic Signal	Route 20	0:44
Eastbound #2	Orange County	Traffic Signal	Lake of the Woods Parkway	1:15
	Orange County	Traffic Signal	Route 20	0:07
Westbound #1	Orange County	Traffic Signal	Lake of the Woods Parkway	1:00
Westbound #2	Orange County	Traffic Signal	Lake of the Woods Parkway	0:12

*Westbound delays at Route 20 were not included in overall travel time. There were no delays on PM westbound trips at Route 20.

DISCLAIMER

Prepared in cooperation with the US Department of Transportation, Federal Highway Administration, and the Virginia Department of Transportation

The contents of this report reflect the views of the Rappahannock-Rapidan Regional Commission (RRRC). The Commission is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the views or policies of the US Department of Transportation, Federal Highway Administration, or Virginia Department of Transportation. This report does not constitute a standard, specification, or regulation.