

SECTION 4

OBSERVED TRAVEL TIMES

Speed and delay can be calculated using time, distance and volume data. Data collection consisted of travel time measurements taken in June 2004 between key intersections during three time periods; AM peak (7-9 a.m.), PM peak (4-6 p.m.) and mid-day (10 a.m. – 3:30 p.m.) hours. A minimum of four travel time measurements for the AM and PM periods and a minimum of two measurements for the mid-day period were recorded on at least two different days. Data was collected on weekdays only. This data was combined with travel times collected during Winter 2004 for OKI's regional Congestion Management System (CMS) study. The CMS study is designed to evaluate recurring congestion only. Congestion and delay due to accidents, adverse weather and other incidents are not represented. Key intersections were determined prior to the travel time measurements and entered into a database and mapped in OKI's Geographic Information System (GIS).

The precise time and vehicle position were automatically recorded in one-second intervals by a Global Positioning System (GPS) unit. No interface with the GPS unit was required during driving. At the office, the project manager transferred the GPS data to the OKI GIS. A subroutine matched each predefined intersection with the nearest measurement location. The arrival time at each intersection was exported to a database. The database calculates travel time and speed information along each section (between selected intersections).

The following details the data definitions and sources used in this analysis:

Distance

units: miles

source: OKI geographic information system, street centerline file

Optimal travel time

units: hours:minutes:seconds

source: Calculated by the formula $\text{distance}/(\text{optimal speed}/60)$. Optimal speed is from the OKI travel demand model and is calculated based on methodologies in the FHWA Highway Capacity Manual.

Average AM Runtime

units: hours:minutes:seconds

source: Average of observed weekday travel time, measured during the period of 7:00 a.m. to 9:00 a.m. Minimum of four observations.

Average MD Runtime

units: hours:minutes:seconds

source: Average of observed weekday travel time, measured during the period of 10:00 a.m. to 3:30 p.m. Minimum of two observations.

Average PM Runtime

units: hours:minutes:seconds

source: Observed weekday travel time, measured during the period of 4:00 p.m. to 6:00 p.m. Minimum of four observations.

Vehicle Delay

units: minutes

source: Calculated by subtracting optimal travel time from observed travel time. If optimal travel time is greater than observed travel time, delay per vehicle is 0. (Assumes all vehicles are affected equally)

Total Vehicle Daily Delay

units: hours per day

source: Calculated by multiplying the delay per vehicle for each time period by the estimated volume during that time period and summing across all three periods. For every facility evaluated, 2- way average annual daily traffic (AADT) was available for the majority of the links. The traffic volumes were divided by two in order to estimate directional AADT. The traffic volumes were not always collected in the same year. The collection year for traffic volumes ranged from 2000 to 2003. The most recent traffic volume available was always used. Where no traffic volumes were available, base year output from OKI's Travel Demand Model was used. Traffic volumes were multiplied by the proportion of travel by time period. The proportion of travel by time period was developed from permanent traffic counting stations located throughout the OI region for the years 1998-2002. The proportions of travel by time period are; 15% during AM Peak, 27% during Mid-day peak, and 11% during PM peak.

Average speed and delay information by road section were calculated. Delay is a measure of congestion that can include waiting time at signals, as well as delay caused by high traffic volume to capacity. Actual travel times are measured and compared to optimum travel times at optimal speeds from the OKI travel demand model. Based on the observed data, it was found that total travel time northbound, through the entire study area, averaged 13 minutes 46 seconds in the morning peak period and 14 minutes 46 seconds in the evening peak period, as compared to 11 minutes 29 seconds under optimal flow. Southbound travel time averaged 11 minutes 45 seconds in the morning peak and 14 minutes 9 seconds in the evening peak. For the section between KY2345 and I-471, both northbound and southbound evening peak periods experienced the highest delay per vehicle with 1.5 minutes of delay. That section also experienced the most total daily delay with 245 vehicle hours of daily delay northbound, and 161 vehicle hours of daily delay southbound. Total vehicle daily delay throughout the study corridor is over 800 hours. Details of the observed travel times can be found in Table 4-1. Figure 4-1 shows the total daily delay for each section.

Figure 4-2 provides a more detailed view of a travel time run. The speed plot displays the actual vehicle speed at each one-second location. Larger points represent slower travel speeds. Of course, speed is highly dependent upon signal timing, especially in the northern portion of the study corridor where there is a high concentration of signalized intersections. Viewing a series of these speed plots, over time, could indicate specific areas of concern.

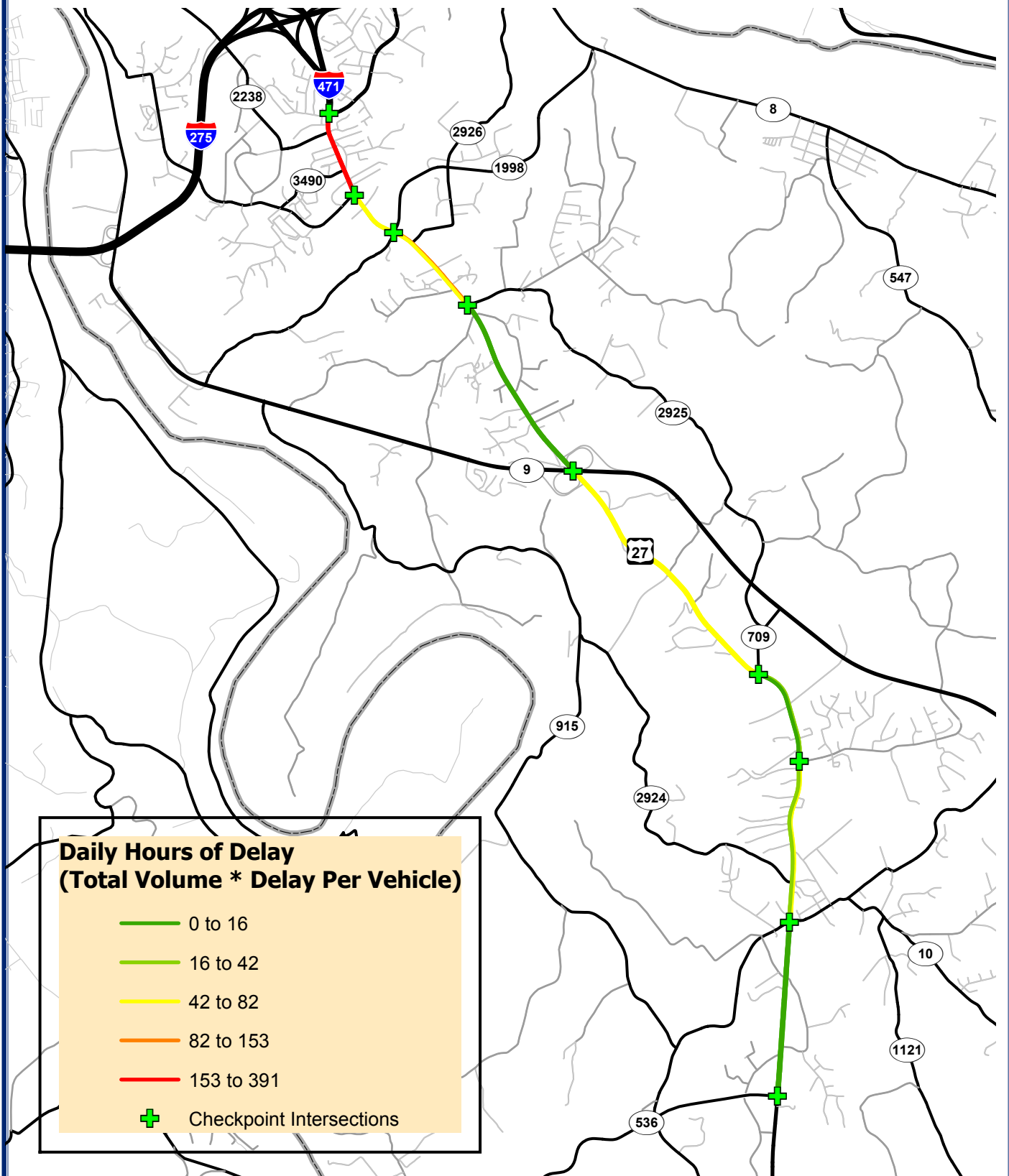
Table 4-1

Alexandria Pike - Travel Time Data by Section

Facility	Section Name	Dist	Optimal Speed*	Optimal Travel Time	Avg AM Runtime	AM Speed (MPH)	AM Veh Delay (mins)	Avg MD Runtime	MD Speed (MPH)	MD Veh Delay (mins)	Avg PM Runtime	PM Speed (MPH)	PM Veh Delay (mins)	Total Vehicle Daily Delay (hours)
Kentucky US27 NB														
US27	KY536 to KY10	1.20	46	0:01:34	0:01:35	46	0.01	0:01:38	44	0.07	0:01:37	45	0.05	4.78
US27	KY10 to Poplar Ridge Rd.	1.12	41	0:01:38	0:02:12	30	0.57	0:02:05	32	0.44	0:01:56	35	0.29	44.65
US27	Poplar Ridge Rd. to KY709	0.72	42	0:01:02	0:01:22	32	0.34	0:01:01	43	0.00	0:01:11	37	0.15	16.48
US27	KY709 to KY9	1.91	42	0:02:44	0:02:43	42	0.00	0:03:05	37	0.35	0:03:09	36	0.43	34.15
US27	KY9 to East Alexandria Pk.	1.36	41	0:01:59	0:01:54	43	0.00	0:02:03	40	0.06	0:02:03	40	0.07	5.16
US27	East Alexandria Pk. to KY1998	0.72	45	0:00:58	0:01:47	24	0.81	0:01:41	26	0.73	0:01:28	29	0.51	107.53
US27	KY1998 to KY2345	0.38	37	0:00:37	0:00:44	31	0.11	0:00:59	23	0.37	0:00:54	25	0.29	44.35
US27	KY2345 to I-471	0.59	37	0:00:57	0:01:29	24	0.53	0:02:23	15	1.42	0:02:27	14	1.49	243.67
Total				0:11:29	0:13:46			0:14:54			0:14:46			500.79
Kentucky US27 SB														
US27	I-471 to KY2345	0.59	37	0:00:58	0:01:17	28	0.33	0:01:43	21	0.75	0:02:27	15	1.49	161.41
US27	KY2345 to KY1998	0.38	37	0:00:37	0:01:00	23	0.37	0:00:43	32	0.09	0:01:03	22	0.42	36.85
US27	KY1998 to East Alexandria Pk.	0.71	45	0:00:57	0:01:10	37	0.22	0:01:10	37	0.22	0:01:16	34	0.32	36.68
US27	East Alexandria Pk. to KY9	1.36	41	0:01:59	0:01:42	48	0.00	0:01:49	45	0.00	0:01:53	43	0.00	0.00
US27	KY9 to KY709	1.91	42	0:02:44	0:02:27	47	0.00	0:03:18	35	0.57	0:03:14	36	0.50	50.83
US27	KY709 to Poplar Ridge Rd.	0.72	42	0:01:02	0:00:55	47	0.00	0:01:09	38	0.11	0:01:08	38	0.10	10.12
US27	Poplar Ridge Rd. to KY10	1.12	41	0:01:38	0:01:47	38	0.14	0:02:07	32	0.49	0:01:45	38	0.12	31.45
US27	KY10 to KY536	1.20	46	0:01:34	0:01:31	47	0.00	0:01:27	50	0.00	0:01:23	52	0.00	0.00
Total				0:11:29	0:11:51			0:13:25			0:14:09			327.34

*source of free-flow speed is OKI Travel Demand Model. In some cases free-flow speed may be greater than observed speed due to occasional inaccuracies in the link-level assumptions used to derive model speed.

Figure 4-1 Observed Daily Hours of Delay Alexandria Pike



**Daily Hours of Delay
(Total Volume * Delay Per Vehicle)**

- 0 to 16
- 16 to 42
- 42 to 82
- 82 to 153
- 153 to 391
- + Checkpoint Intersections

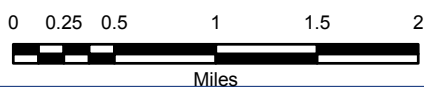
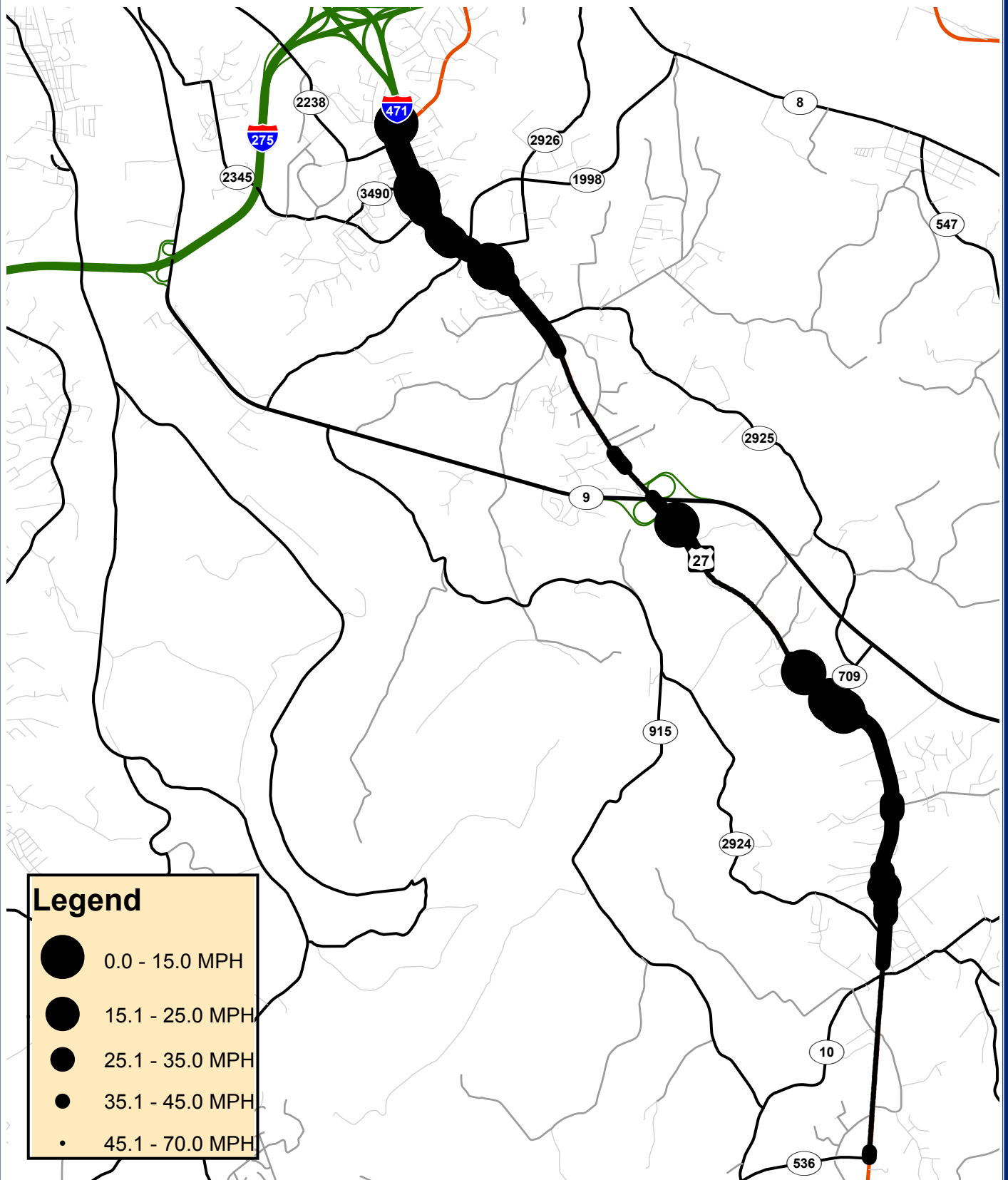


Figure 4-2
Speedplot of Southbound PM Peak at 1-Second Intervals
Alexandria Pike



Legend	
●	0.0 - 15.0 MPH
●	15.1 - 25.0 MPH
●	25.1 - 35.0 MPH
●	35.1 - 45.0 MPH
●	45.1 - 70.0 MPH

