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**INDIANA FREEWAY TRAFFIC CHARACTERISTICS
AND DYNAMIC PREDICTION OF FREEWAY TRAFFIC FLOWS**

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Introduction

Traffic volumes on Indiana's roadways have increased significantly in the past years. During the period between 1989 and 1993, traffic volumes increased 20.2% on Indiana's urban interstate freeways and expressways, and 13.1% on rural interstates. The increasing traffic volumes have caused congestion and therefore additional costs to highway users. Basically, there are two options to alleviate traffic congestion. The first option is to add new highway lanes and the second one is to use the existing roadways more efficiently. Construction of new highways has been much limited by the budget and other restrictions. Therefore, efficient operation of the existing roadways is often the only practical solution to traffic delay and congestion problems.

Advanced traffic management systems (ATMS) are now being used or developed in many states to reduce traffic congestion or delay by using available advanced technologies. For ATMS, it is essential to have the ability to dynamically predict traffic flow characteristics using the real time data. The real time prediction of traffic volume, speed and congestion serves as the basis for a traffic control system to adjust traffic control strategies to avoid or reduce traffic delay.

Congestion occurs when traffic volume exceeds the highway capacity. The

Highway Capacity Manual provides typical highway capacity values. However, these values may not be representative of Indiana values. Thus, it is needed to find the capacity values of Indiana freeways in order to accurately predict congestion.

The objective of this study was to analyze Indiana freeway characteristics, find freeway capacities and to develop methods or models for real-time prediction of freeway traffic flow characteristics. In this report, the traffic characteristics of Indiana freeways are analyzed and discussed. Traffic measures are summarized in terms of average hourly traffic (AHT), average daily traffic (ADT), and average vehicle speed. Also presented are other traffic characteristics such as proportions of heavy vehicles, lane distributions, daily variations, and capacity values. A dynamic traffic prediction model was developed using the Kalman Predictor method in combination with the time series theory. With the prediction model, the traffic flow on a given freeway in the next time interval can be predicted using real time traffic data of the current and past one or several time intervals.

Findings and Implementations

Traffic data on Indiana freeways was recorded with WIM devices and traffic counters. The traffic measurements from the 18 WIM stations were utilized to analyze the traffic characteristics and those recorded with traffic counters were utilized to develop the model for dynamically predicting traffic flows. Traffic volumes on the 18 WIM stations were presented in terms of average hourly traffic (AHT) and average daily traffic (ADT) on each lane. Average traffic speeds for each lane of the 18 WIM stations were also calculated and presented. Proportions of heavy vehicles were expressed as the average heavy vehicle percentages (AHVP). Lane distributions of traffic flows were summarized. The traffic data showed that on four-lane freeways the driving lane sustained a greater portion of traffic than the passing lane. However, on six-lane freeways the traffic lane distributions did not follow an apparent pattern over the three lanes in each direction. To examine the traffic lane distribution patterns on four-lane freeways, the AHT ratios were used to assess the effect of traffic volume on lane distribution. An AHT ratio was defined as the ratio of the average hourly traffic on driving lane to the average hourly traffic on passing lane. It showed that AHT ratio and traffic volume had an inversely proportional relationship. As traffic volume increases, vehicles tend to spread more evenly over the available lanes. Under light traffic condition on four-lane freeways (two lanes in each direction), most vehicles travel in the driving lane and use the passing lane mainly for passing maneuvers.

Traffic volumes vary during the days of the week. Traffic volume variations by day of the week are affected by the locations and types of highways. To determine the volume variations, the traffic volume proportion of each day of the week was calculated as the percentage of the weekly traffic volume. Although the volume variations differ from site to site, traffic volume proportions on Fridays were greater

than average at all of the 18 WIM sites. The information of traffic volume variations by day of the week is important for highway agencies. For example, the information can be utilized to schedule highway maintenance and construction activities on the days with relatively light traffic, so that traffic delay and user cost can be minimized.

Traffic congestion occurs when traffic flow exceeds the capacity of the roadway. Consequently, during congestion vehicles travel at reduced speeds and with fluctuating traffic flow rates. Motorists endure considerably greater traffic delays under congested traffic conditions than under uncongested conditions. Based on the traffic data from the 18 WIM stations, the observed capacity values range from 1489 to 2006 pcphpl with an average value of 1767 pcphpl on four-lane freeways and range from 1463 to 2093 pcphpl with an average value of 1778 pcphpl on six-lane freeways.

Given the freeway capacity values, it was desired to develop methods for predicting traffic flow and congestion so that appropriate traffic control strategies could be applied to avoid traffic congestion and to reduce traffic delay. Such a method was developed in this study using the Kalman predictor in combination with the first-order autoregressive process of time series. The method provides significantly improved traffic flow predictions over using only the time series method. It predicts freeway traffic flow dynamically with each newly available traffic data. Dynamic traffic predictions with the developed model can be performed for individual lanes as well as for all the lanes of each travel direction. Therefore, the prediction model can be used as an efficient tool for real-time traffic control. This study showed that a dynamic prediction of traffic flow rate with this prediction model would also constitute a dynamic prediction of traffic congestion as long as the traffic capacity was given.

It is believed that the research results will provide INDOT important values of traffic measures for highway design, planning, and construction and enable INDOT to predict traffic flow conditions in real time and adaptively change traffic control strategies. The following suggestions should be considered for implementation of the research results.

1. The values of key traffic characteristics, such as traffic volume, speed, heavy vehicle percentage, lane distribution, daily variation, and capacity, should be considered in highway design and planning, traffic control, and construction activity scheduling. For example, the information of traffic volume variations by day of the week can be utilized to schedule highway maintenance and construction activities on the days with relatively light traffic, so that traffic delay and user cost can be minimized. The traffic volume and capacity values can be used for effective traffic control, traffic delay reduction and congestion management. Traffic volume and heavy vehicle proportion will be useful for pavement and bridge management.
2. Adaptive traffic control is an essential component of an Intelligent Transportation System (ITS). The real time prediction of traffic flow and congestion ability can be utilized in ITS program to enhance the capability and efficiency of freeway traffic control in Indiana.
3. INDOT should make effort to more efficiently utilize the WIM devices

installed on the Indiana highway system. There are 35 WIM stations on Indiana highways. Twenty of these WIM stations are on interstate highways. The WIM devices collect traffic data continuously and provide summarized traffic data, including vehicle weight, speed, flow rate, classification. The obvious advantage of WIM data is the availability of large amount of data. However, it was found during this study that WIM devices were not always reliable because of their frequent malfunctions. When a WIM device does not work properly, it usually can not be detected unless someone checks the collected data in detail. This is because an out-of-order WIM device often would not stop collecting data and the abnormality of the data can only be discovered by a careful review in its tabulated form. Although WIM devices can be set up to accommodate a number of data requirements, many data requirements of this study could not be satisfied because of lack of personnel who sufficiently know the WIM software to activate the required WIM functions. To solve these problems, it is needed for INDOT to effectively maintain the WIM devices and assure the quality WIM data. It is therefore recommended that INDOT develop systematic procedures to train personnel for effective use of WIM software and to monitor and maintain the installed WIM devices.

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16. Abstract <p>Traffic volumes on Indiana's roadways have increased significantly in the past years. During the period between 1989 and 1993, traffic volumes increased 20.2% on Indiana's urban interstate freeways and expressways, and 13.1% on rural interstates. The increasing traffic volumes have caused congestion and therefore additional costs to highway users. Basically, there are two options to alleviate traffic congestion. The first option is to add new highway lanes and the second one is to use the existing roadways more efficiently. Construction of new highways has been much limited by the budget and other restrictions. Therefore, efficient operation of the existing roadways is often the only practical solution to traffic delay and congestion problems.</p> <p>The objective of this study was to analyze Indiana freeway characteristics, find freeway capacities and to develop methods or models for real-time prediction of freeway traffic flow characteristics. In this report, the traffic characteristics of Indiana freeways are analyzed and discussed. Traffic measures are summarized in terms of average hourly traffic (AHT), average daily traffic (ADT), and average vehicle speed. Also presented are other traffic characteristics such as proportions of heavy vehicles, lane distributions, daily variations, and capacity values. A dynamic traffic prediction model was developed using the Kalman Predictor method in combination with the time series theory. With the prediction model, the traffic flow on a given freeway in the next time interval can be predicted using real time traffic data of the current and past one or several time intervals.</p> <p>Given the freeway capacity values, it was desired to develop methods for predicting traffic flow and congestion so that appropriate traffic control strategies could be applied to avoid traffic congestion and to reduce traffic delay. Such a method was developed in this study using the Kalman predictor in combination with the first-order autoregressive process of time series. The method provides significantly improved traffic flow predictions over using only the time series method. It predicts freeway traffic flow dynamically with each newly available traffic data. Dynamic traffic predictions with the developed model can be performed for individual lanes as well as for all the lanes of each travel direction. Therefore, the prediction model can be used as an efficient tool for real-time traffic control. This study showed that a dynamic prediction of traffic flow rate with this prediction model would also constitute a dynamic prediction of traffic congestion as long as the traffic capacity was given.</p> <p>It is believed that the research results will provide INDOT important values of traffic measures for highway design, planning, and construction and enable INDOT to predict traffic flow conditions in real time and adaptively change traffic control strategies. The following suggestions should be considered for implementation of the research results.</p> <ol style="list-style-type: none"> The values of key traffic characteristics, such as traffic volume, speed, heavy vehicle percentage, lane distribution, daily variation, and capacity, should be considered in highway design and planning, traffic control, and construction activity scheduling. For example, the information of traffic volume variations by day of the week can be utilized to schedule highway maintenance and construction activities on the days with relatively light traffic, so that traffic delay and user cost can be minimized. The traffic volume and capacity values can be used for effective traffic control, traffic delay reduction and congestion management. Traffic volume and heavy vehicle proportion will be useful for pavement and bridge management. Adaptive traffic control is an essential component of an Intelligent Transportation System (ITS). The real time prediction of traffic flow and congestion ability can be utilized in ITS program to enhance the capability and efficiency of freeway traffic control in Indiana. INDOT should make effort to more efficiently utilize the WIM devices installed on the Indiana highway system. There are 35 WIM stations on Indiana highways. Twenty of these WIM stations are on interstate highways. The WIM devices collect traffic data continuously and provide summarized traffic data, including vehicle weight, speed, flow rate, classification. The obvious advantage of WIM data is the availability of large amount of data. However, it was found during this study that WIM devices were not always reliable because of their frequent malfunctions. When a WIM device does not work properly, it usually can not be detected unless someone checks the collected data in detail. This is because an out-of-order WIM device often would not stop collecting data and the abnormality of the data can only be discovered by a careful review in its tabulated form. Although WIM devices can be set up to accommodate a number of data requirements, many data requirements of this study could not be satisfied because of lack of personnel who sufficiently know the WIM software to activate the required WIM functions. 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CHAPTER 1. INTRODUCTION

Traffic volumes on Indiana's roadways have increased significantly in the past years. During the period between 1989 and 1993, traffic volumes increased 20.2% on Indiana's urban interstate freeways and expressways, and 13.1% on rural interstates. The increasing traffic volumes have caused congestion and therefore additional costs to highway users. Basically, there are two options to alleviate traffic congestion. The first option is to add new highway lanes and the second one is to use the existing roadways more efficiently. Construction of new highways has been much limited by the budget and other restrictions. Therefore, efficient operation of the existing roadways is often the only practical solution to traffic delay and congestion problems.

Advanced traffic management systems (ATMS) are now being used or developed in many states to reduce traffic congestion or delay by using available advanced technologies. For ATMS, it is essential to have the ability to dynamically predict traffic flow characteristics using the real time data. The real time prediction of traffic volume, speed and congestion serves as the basis for a traffic control system to adjust traffic control strategies to avoid or reduce traffic delay.

Congestion occurs when traffic volume exceeds the highway capacity. The Highway Capacity Manual (TRB 1994) provides capacity values for various types of highways. However, these values may not be representative of Indiana values. Thus, it is needed to find the capacity values of Indiana freeways in order to accurately predict congestion.

The objective of this study was to analyze Indiana freeway characteristics, find freeway capacities and to develop methods or models for real-time prediction of freeway traffic flow characteristics. The research proposed to analyze traffic data from Indiana freeways, identify the methodologies for dynamic prediction, develop required analytical tools, define capacity values and formulate prediction models appropriate for Indiana freeway conditions.

This report summarizes the research activities and presents the research results. The traffic characteristics of Indiana freeways are analyzed and discussed. With a large amount of traffic data from 18 interstate Weigh-In-Motion (WIM) stations, traffic measures are summarized in terms of average hourly traffic (AHT), average daily traffic (ADT), and average vehicle speed. Presented are also other traffic characteristics such as proportions of heavy vehicles, lane distributions, daily variations, and capacity values. A dynamic traffic prediction model was developed using the Kalman Predictor method in combination with the time series theory. With the prediction model, the traffic flow on a given freeway in the next time interval (5 to 15 minutes) can be predicted using real time traffic data of the current and past one or several time intervals.

CHAPTER 2. DATA COLLECTION

It was originally planned to obtain traffic data from three sources: (1) collecting traffic data by the INDOT LaPorte District with the installed Autoscope video camera devices on the Borman Expressway (I-94/I-89); (2) using traffic counters to collect traffic data at select freeway sections; and (3) using traffic data from the Indian Weigh-In-Motion (WIM) devices. It was expected that the Autoscope devices would be operational in early 1997 and therefore would provide this study with detailed and accurate traffic data. However, because the installed Autoscope devices were never operational as promised, the LaPorte District personnel have not been able to provide the desired traffic data by the end of this study. Thus, the traffic data used in this study included only the data collected with traffic counters and the data from WIM stations.

Ten freeway sections across Indiana were selected for data collection. Traffic flow rate, vehicle speed and classification were recorded at 5-minute time intervals during high volume hours and at 1-hour intervals during low traffic volume hours. The vehicle counters were set up to classify the detected vehicles into three groups: (1) passenger cars, (2) heavy trucks and (3) buses. It was intended to catch traffic congestion information with the traffic counters. However, the collected traffic data indicated that no traffic congestion occurred at the selected locations. The traffic data collected with traffic counters, therefore, could not be used to analyze traffic congestion and freeway capacities. The traffic counter data was mainly used to develop the model of dynamic prediction of freeway traffic flow rates.

There are 35 WIM stations on Indiana highways. Twenty of these WIM stations are on interstate highways. Table 1 shows the locations of the twenty interstate WIM stations. The WIM devices collect traffic data continuously and provide summarized traffic data, including vehicle weight, speed, flow rate, classification. The obvious advantage of WIM data is the availability of large amount of data. However, it was found during this study that WIM devices were not always reliable because of their frequent malfunctions. When a WIM device does not work properly, it usually can not be detected unless someone checks the collected data in detail. This is because an out-of-order WIM device often would not stop collecting data and the abnormality of the data can only be discovered by careful review in its tabulated form.

WIM traffic data was collected from the 20 interstate WIM stations to study the traffic characteristics on Indiana freeways for 12 months. The traffic data covered a 13-month period, between January 1, 1998 to January 31, 1999, however, the data for March 1998 was not available because of problems with the WIM software. It was found that the two of the twenty stations, Site 444 on I-80/I-94 and Site 547 on I-65, did not properly function at all during the 13 months and therefore could not provide useful data for this study. The other eighteen WIM stations worked properly at least for one month during the 12 months. Thus, the traffic data from the 18 WIM stations was tabulated and analyzed in this study. The summarized WIM traffic data is shown in the tables listed in the Appendix. As can be seen in the Appendix, three of the 18 stations are on six-lane freeways and the rest are on four-lane freeways. In 17 of the 18 WIM stations, the WIM devices were set up to record traffic data in both directions. At Site 615, the WIM device was placed in only the east bound direction and, therefore, traffic data only on the east bound two lanes was recorded at the WIM station.

Table 1. Weigh-In-Motion Sites on Indiana Interstate Highways

Site Number	Road	Location
411	I-65	3.6 miles north of SR-114; Rensselaer
413	I-94	3.4 miles east of US-421; Michigan City
414	I-69	4.1 miles north of SR-18; Marion
415	I-69	3.5 miles north of US-6; Angola
444	I-80/I-94	0.9 mile east of SR-912; Gary
511	I-70	4.28 miles east of SR-9; Greenfield
512	I-65	1 mile south of SR-252; Edinburgh
513	I-74	0.6 mile east of SR-63; Covington
514	I-70	0.5 mile west of US-40; Richmond
544	I-70	0.7 mile east of US-41; Terre Haute
545	I-65	1.3 miles north of SR-25; Lafayette
546	I-465	0.7 mile north of I-70W; Indianapolis
547	I-65	0.6 mile south of Southport Road; Southport
548	I-465	1 mile south of US-36E; Indianapolis
613	I-164	2.25 mile east of US-41; Evansville
614	I-64	1.5 miles west of SR-57; Evansville
615	I-64	1.1 miles east of SR-161; Dale
616	I-64	1 mile west of SR-62/64; New Albany
617	I-74	0.8 mile east of US-52; Harrison
642	I-65	0.9 mile south of I-265; Clarksville

CHAPTER 3. TRAFFIC CHARACTERISTICS

The traffic data from the 18 WIM stations was used to analyze the traffic characteristics on Indiana freeways. The freeway traffic characteristics include traffic volume, speed, and traffic volume distributions over travel directions and roadway lanes.

3.1 Traffic Volumes and Speeds

Each table in the Appendix contains the average hourly and daily traffic volumes and average vehicle speed for Mondays through Sundays in each month when the WIM devices worked properly. The traffic data included in the Appendix can be used to further analyze the characteristics of the Indiana freeway traffic. For each of the 18 WIM stations, average hourly traffic (AHT) and average daily traffic (ADT) were calculated to show the magnitude of the traffic volumes at each site during the study period. These traffic measures can be used for planning of highway activities, measurement of current demand, and evaluation of existing traffic flow (Garber and Hoel 1999). ADT is defined as the average of 24-hour counts collected over a number of days greater than 1 but less than a year. If the counts were collected over a year, the average of 24-hour counts is called the Annual Average Daily Traffic (AADT). Although in this study the WIM data was collected over a 13-month period, the useable data for the 18 WIM stations was generally over a period of less than 12 months due to broken downs or malfunctions of the WIM devices. Although not true AADT, the calculated ADT values for most of the sites are believed to be close to AADT because of the long period of time covered by the traffic counts. The values of average hourly traffic (AHT) were obtained by dividing ADT value by 24. Presented in Table 2 are the ADT and AHT values for each lane and direction of the 18 WIM stations. Because each site has its own directional layout, Table 2 uses Lane 1

through Lane 4 for four-lane freeways and Lane 1 through Lane 6 for six-lane freeways to represent highway lanes. For four-lane freeways, Lane 1 and Lane 2 represent the traveling lane and passing lane, respectively, in one direction. Similarly, Lane 3 and Lane 4 represent the two lanes in the opposite direction. For six-lane freeways, Lane 1, Lane 2 and Lane 3 represent the right, middle, and left lanes, respectively, in one direction. Thus, Lane 4, Lane 5 and Lane 6 represent the three lanes in the opposite direction.

To examine the traffic volumes more clearly, only the AHT values are used in Table 3. The WIM sites in Table 3 are shown in groups according to the number of lanes of the roadways and, within each group, they are listed in the order of total hourly traffic, from large to small values. As can be seen, in the six-lane group, the total average hourly traffic volumes range from 1393 vehicles per hour (vph) to 5267 vph. Among the three sites with six-lane roadways, Site 546 on I-465 near Indianapolis had the highest total average hourly traffic. However, in terms of average hourly traffic volume on individual lanes, Site 548 on I-465 near Indianapolis has the highest average hourly traffic (824 vph on Lane 5).

In the group of four-lane freeways, Site 642 on I-65 near Louisville had the highest total AHT in terms of values of total, lane, and directional volumes. Other four-lane freeway WIM sites had total AHT ranging from 616 vph to 1579 vph. While in majority of these sites the total AHT values were around 1000 vph to 1500 vph, the total AHT values in Sites 614 and 513 were only 643 vph and 616 vph, respectively. It is easy to notice and understand that the high traffic volume sites are located in urban areas and the low traffic volume ones in rural areas.

Table 2. Average Hourly Traffic (AHT) and Average Daily Traffic (ADT)

Site	Traffic	Lane 1	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6	Direction 1	Direction 2	Total
411	AHT (vph)	254	159	444	215			413	660	1073
	ADT (vpd)	6097	3816	10664	5169			9912	15833	25745
413	AHT (vph)	179	203	50	274	255	43	432	961	1393
	ADT (vpd)	4300	4877	1208	6578	6127	1037	10385	23090	33475
414	AHT (vph)	327	131	385	140			458	525	983
	ADT (vpd)	7852	3132	9234	3365			10984	12599	23584
415	AHT (vph)	396	223	424	201			620	625	1244
	ADT (vpd)	9511	5365	10168	4817			14877	14985	29862
511	AHT (vph)	470	239	480	231			709	711	1420
	ADT (vpd)	11279	5730	11509	5554			17009	17062	34071
512	AHT (vph)	512	272	434	305			784	738	1523
	ADT (vpd)	12294	6535	10410	7315			18829	17725	36553
513	AHT (vph)	261	34	256	65			295	321	616
	ADT (vpd)	6268	818	6142	1556			7086	7698	14784
514	AHT (vph)	511	179	446	225			690	671	1361
	ADT (vpd)	12263	4297	10701	5412			16560	16113	32673
544	AHT (vph)	538	143	385	237			681	622	1303
	ADT (vpd)	12913	3414	9247	5690			16328	14937	31265
545	AHT (vph)	527	271	539	243			797	782	1579
	ADT (vpd)	12648	6494	12925	5832			19142	18757	37899
546	AHT (vph)	733	794	398	604	813	409	1925	3342	5267
	ADT (vpd)	17588	19060	9557	14494	19505	9808	46205	80204	126409
548	AHT (vph)	636	173	539	130	824	462	1347	2301	3648
	ADT (vpd)	15257	4137	12915	3119	19782	11067	32309	55210	87518
613	AHT (vph)	432	174	420	182			605	601	1207
	ADT (vpd)	10366	4163	10071	4365			14529	14436	28965
614	AHT (vph)	248	71	246	77			320	323	643
	ADT (vpd)	5956	1714	5898	1851			7670	7749	15419
615	AHT (vph)	383	210					593		593
	ADT (vpd)	9183	5041					14224		14224
616	AHT (vph)	392	213	469	219			606	689	1294
	ADT (vpd)	9419	5113	11269	5269			14532	16539	31071
617	AHT (vph)	469	298	508	162			768	670	1437
	ADT (vpd)	11269	7158	12185	3884			18427	16069	34496
642	AHT (vph)	1259	968	1231	878			2227	2109	4336
	ADT (vpd)	30211	23244	29533	21071			53455	50604	104059

Table 3. Average Hourly Traffic (AHT)

Site	Traffic	Lane 1	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6	Direction 1	Direction 2	Total
546	AHT (vph)	733	794	398	604	813	409	1925	3342	5267
548	AHT (vph)	636	173	539	130	824	462	1347	2301	3648
413	AHT (vph)	179	203	50	274	255	43	432	961	1393
642	AHT (vph)	1259	968	1231	878			2227	2109	4336
545	AHT (vph)	527	271	539	243			797	782	1579
512	AHT (vph)	512	272	434	305			784	738	1523
617	AHT (vph)	469	298	508	162			768	670	1437
511	AHT (vph)	470	239	480	231			709	711	1420
514	AHT (vph)	511	179	446	225			690	671	1361
544	AHT (vph)	538	143	385	237			681	622	1303
616	AHT (vph)	392	213	469	219			606	689	1294
415	AHT (vph)	396	223	424	201			620	625	1244
613	AHT (vph)	432	174	420	182			605	601	1207
411	AHT (vph)	254	159	444	215			413	660	1073
414	AHT (vph)	327	131	385	140			458	525	983
614	AHT (vph)	248	71	246	77			320	323	643
513	AHT (vph)	261	34	256	65			295	321	616
615	AHT (vph)	383	210					593		593

Average vehicle speeds were also calculated for all of the 18 WIM sites on interstate highways as shown in Table 4. Among the four-lane freeway sites, the highest average vehicle speed at the 18 WIM sites was 119 kilometers per hour (km/h) or 73 mph, which was recorded at Site 545 (on I-65, 1.3 miles north of SR-25). The lowest average speed on four-lane freeway sites was 88 km/h (55 mph) at Site 642 (on I-65, 0.9 mile south of I-265). It should be noted that the lowest average speed was recorded at the site with the highest average traffic volume in each lane. In this particular site, the lowest average speed occurred at the lane with an average traffic volume of 1259 vehicles per hour. This is a considerable high value in terms of average traffic volume in a lane, considering high volumes during the day and low volumes during the night. In fact, the original hourly traffic data showed that traffic volumes at this site during the day were often close to the capacity value of 2200 passenger cars per hour per lane recommended by the 1994 Highway Capacity Manual (TRB 1994) for four-lane freeway sections. The data also showed that during high volume hours the average vehicle speeds were relatively lower than during low vehicle hours. This indicates that vehicle speeds are significantly affected by traffic volumes, especially by near capacity volumes.

At one of the six-lane freeway sites, Site 548, the average vehicle speeds were generally lower than at other sites. It was only 62 km/h (39 mph) on the northbound traveling lane. This is because the site is located near an interchange and the northbound traveling lane was just before an exit ramp. Considering the moderate level of traffic volume at this six-lane freeway location, it is apparent that the low speed values at the site were caused mainly by the presence of the highway interchange.

Table 4. Average Vehicle Speeds

Site	Speed Unit	Lane 1	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6
411	Kilometers/Hour	111	110	108	112		
	Miles/Hour	69	69	67	70		
413	Kilometers/Hour	108	105	97	94	98	92
	Miles/Hour	67	65	61	58	61	57
414	Kilometers/Hour	102	113	107	114		
	Miles/Hour	64	70	67	71		
415	Kilometers/Hour	101	104	104	106		
	Miles/Hour	63	65	65	66		
511	Kilometers/Hour	98	107	98	109		
	Miles/Hour	64	70	64	72		
512	Kilometers/Hour	96	111	110	116		
	Miles/Hour	59	69	68	72		
513	Kilometers/Hour	101	109	105	110		
	Miles/Hour	63	68	65	68		
514	Kilometers/Hour	102	110	107	117		
	Miles/Hour	63	68	67	73		
544	Kilometers/Hour	98	111	95	103		
	Miles/Hour	61	69	59	64		
545	Kilometers/Hour	109	113	102	119		
	Miles/Hour	68	70	63	74		
546	Kilometers/Hour	96	102	110	96	91	109
	Miles/Hour	59	63	68	60	56	68
548	Kilometers/Hour	81	85	94	62	92	101
	Miles/Hour	51	53	59	39	57	63
613	Kilometers/Hour	93	95	94	96		
	Miles/Hour	58	59	58	60		
614	Kilometers/Hour	105	104	104	105		
	Miles/Hour	65	65	64	65		
615	Kilometers/Hour	104	100				
	Miles/Hour	64	62				
616	Kilometers/Hour	101	104	101	104		
	Miles/Hour	63	64	63	65		
617	Kilometers/Hour	97	97	103	89		
	Miles/Hour	60	60	64	55		
642	Kilometers/Hour	88	100	92	100		
	Miles/Hour	55	62	57	62		

As expected, on four-lane freeways the passing lanes generally had higher average vehicle speeds than the driving lanes. However, on six-lane freeways the lane with the highest average vehicle speed could be any of the three lanes in each direction. As can be seen in Table 4, the lane with the highest average speed varied from site to site among the three six-lane freeway locations.

3.2. The Characteristics of Freeway Traffic Flows

Proportions of Heavy Vehicles:

One of the factors that affect traffic conditions is the vehicle type. In this study, vehicles are divided into two groups: passenger cars and heavy vehicles. WIM devices classify vehicle types according to the number of axles and the configuration of axles of each detected passing vehicle. Heavy vehicles adversely impact traffic because they are larger and occupy more roadway space than passenger cars and they have poorer operating capabilities than passenger cars (TRB 1994). As defined in the 1994 Highway Capacity Manual (TRB 1994), heavy vehicles are the vehicles having more than four tires touching the pavement. Based on this definition of heavy vehicles, passenger cars in this study also include utility vehicles, pick-up trucks and vans. The average heavy vehicle percentages (AHVP) were calculated for each roadway lane of the freeway WIM stations as shown in Table 5. This table presents the available AHVP values along with the AHT values for each WIM site. Because the vehicle classification functions of the WIM devices at Sites 411 and 513 did not work properly, the AHVP values could not be obtained for these two sites.

Table 5. Average Hourly Traffic (AHT) and Average Heavy Vehicle Percentage (AHVP)

Site	Traffic	Lane 1	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6
411	AHT (vph)	254	159	444	215		
	AHVP (%)	NA	NA	NA	NA		
413	AHT (vph)	179	203	50	274	255	43
	AHVP (%)	58	37	8	72	32	26
414	AHT (vph)	327	131	385	140		
	AHVP (%)	47	30	43	23		
415	AHT (vph)	396	223	424	201		
	AHVP (%)	34	19	35	20		
511	AHT (vph)	470	239	480	231		
	AHVP (%)	46	23	47	22		
512	AHT (vph)	512	272	434	305		
	AHVP (%)	36	15	37	17		
513	AHT (vph)	261	34	256	65		
	AHVP (%)	NA	NA	NA	NA		
514	AHT (vph)	511	179	446	225		
	AHVP (%)	55	24	53	21		
544	AHT (vph)	538	143	385	237		
	AHVP (%)	51	30	45	29		
545	AHT (vph)	527	271	539	243		
	AHVP (%)	40	25	41	39		
546	AHT (vph)	733	794	398	604	813	409
	AHVP (%)	23	19	4	39	17	8
548	AHT (vph)	636	173	539	130	824	462
	AHVP (%)	31	56	2	32	34	6
613	AHT (vph)	432	174	420	182		
	AHVP (%)	11	4	13	6		
614	AHT (vph)	248	71	246	77		
	AHVP (%)	44	16	39	18		
615	AHT (vph)	383	210				
	AHVP (%)	36	16				
616	AHT (vph)	392	213	469	219		
	AHVP (%)	20	10	28	12		
617	AHT (vph)	469	298	508	162		
	AHVP (%)	29	7	22	18		
642	AHT (vph)	1259	968	1231	878		
	AHVP (%)	20	18	22	18		

The AHVP values in Table 5 indicate that, on each of the four-lane freeways, the driving lane always contains higher percentage of heavy vehicles than the passing lane. This phenomenon can be easily observed in reality that most heavy vehicles are slower than passenger cars and thus tend to use the driving lane more than the passing lane. However, on six-lane freeways, the distribution of heavy vehicles over the lanes may be different from that on four-lane freeways because there are three lanes available in each direction. As shown in Table 5, at one of the three six-lane sites (Site 548), the middle lane in both directions contains the highest heavy vehicle percentage. At the other two six-lane sites, the right lane has higher proportion of heavy vehicles than the middle lane and the left lane. In all cases, however, the left lane is always the lane with the lowest AHVP value.

As expected, the proportions of heavy vehicles vary from site to site. Site 613 has the lowest proportions of heavy vehicles (11%, 4%, 13% and 6% for lane 1 through lane 4, respectively) compared to other sites. The highest AHVP values (58% on the eastbound right lane and 72% on the westbound right lane) are found at Site 413, which is located on I-94 near the board between Indiana and Michigan. The high proportion of heavy vehicles at this particular site is attributed to the intensive cargo movements among the three neighboring states, Illinois, Indiana and Michigan. Except for Site 613, all other sites have AHVP values more than 20% on some or all of the lanes. Table 5 shows that the proportions of heavy vehicles are mostly in the range of 30% to 50% on the driving lanes of four-lane freeways as well as on the right and middle lanes of six-lane freeways. This indicates that the heavy vehicles on Indiana freeways are a significant portion of the traffic volumes. Therefore, the impact of heavy vehicles on freeway traffic conditions should be one of the major factors to consider in highway planning, design and operations.

Lane distributions of Traffic Flows:

When two or more lanes are available for traffic in a direction, traffic flows tend to spread over the available lanes. However, the lane distribution varies widely, depending on the number of available lanes, traffic regulations, traffic composition, speed, volume, and location. To illustrate the lane distribution patterns on Indiana freeways, the lane distributions were calculated for the 18 WIM stations as shown in Table 6 and Table 7. The lane distributions were obtained for each direction based on the average hourly traffic on the lanes. For example, at Site 411 in Direction 1, the AHT values are 254 vph and 159 vph for Lane 1 and Lane 2, respectively. Then the lane distribution for Direction 1 can be computed as follows:

$$\text{Lane 1: } \frac{254}{254 + 159} = 62\%$$

$$\text{Lane 2: } \frac{159}{254 + 159} = 38\%$$

It should be noted that at each site the total percentage for each direction is 100%. Table 6 clearly shows that on four-lane freeways the driving lane (Lane 1 or Lane 3) sustains a greater proportion of traffic than the corresponding passing lane (Lane 2 or Lane 4). However, as shown in Table 7, on six-lane freeways the traffic lane distributions do not follow an apparent pattern over the three lanes in each direction.

Table 6. Average Traffic Distribution on Four-Lane Freeways

Site	Direction 1		Direction 2	
	Lane 1	Lane 2	Lane 3	Lane 4
411	62%	38%	68%	32%
414	72%	28%	74%	26%
415	65%	35%	68%	32%
511	66%	34%	68%	32%
512	66%	34%	59%	41%
513	88%	12%	80%	20%
514	74%	26%	66%	34%
544	79%	21%	62%	38%
545	66%	34%	69%	31%
613	73%	27%	71%	29%
614	81%	19%	79%	21%
615	65%	35%		
616	64%	36%	69%	31%
617	61%	39%	76%	24%
642	57%	43%	58%	42%

Table 7. Average Traffic Distribution on Six-Lane Freeways

Site	Direction 1			Direction 2		
	Lane 1	Lane 2	Lane 3	Lane 4	Lane 5	Lane 6
413	41%	47%	12%	48%	45%	7%
546	38%	41%	21%	33%	45%	22%
548	47%	13%	40%	10%	58%	32%

It was observed that on four-lane freeways vehicles tend to distribute more evenly over the roadway lanes when traffic volume is high. That is, the proportion of vehicles on the passing lane would increase as the total traffic volume increases. Therefore, it is believed that traffic volume affects traffic lane distribution.

To examine the traffic lane distribution patterns in relation to traffic volumes on four-lane freeways, the AHT ratios were calculated using the average hourly traffic data. Table 8 presents the AHT ratios of the 15 WIM stations on four-lane freeways. An AHT ratio is defined as the ratio of the average hourly traffic on the driving lane (AHT1) to the average hourly traffic on the passing lane (AHT2). Thus, an AHT ratio of 1.0 means that the driving lane and the passing lane have equal traffic volumes. A larger value of the AHT ratio indicates a larger proportion of the traffic volume on the driving lane. In order to show the effect of traffic volume on lane distribution, the WIM sites are listed in the order of the total AHT values in Table 8, starting from the top with the site with the largest total AHT value. As can be seen in the table, Site 642 is listed as the first site because it has the largest total AHT (2227 vph). Similarly, Site 513 is in the last row with the smallest total AHT (295 vph). It is interesting to see that the site with the largest total AHT value (Site 642) has the smallest AHT ratio (1.3) and the site with the smallest total AHT value (Site 513) has the largest AHT ratio (7.7). Although a pattern of “a larger total AHT corresponding a smaller AHT ratio” is not strictly followed by the data in Table 8, a general tendency of such a pattern can still be seen in the table. It should be pointed out that Table 8 presents the values of total AHT and AHT ratios of different sites and, therefore, in addition to traffic volume the lane distributions are also affected by other factors such as the geometric characteristics of highway locations. It is thus believed that the effects of the

additional factors have resulted in some exceptions in Table 8 that in some of the sites a larger total AHT value has a larger corresponding AHT ratio.

Table 8. Average Hourly Traffic (AHT) and AHT Ratio

Site	Total AHT	AHT1	AHT2	AHT Ratio
642	2227	1259	968	1.3
545	797	527	271	1.9
512	784	512	272	1.9
617	768	469	298	1.6
511	709	470	239	2.0
514	690	511	179	2.9
544	681	538	143	3.8
415	620	396	223	1.8
616	606	392	213	1.8
613	605	432	174	2.5
615	593	383	210	1.8
414	458	327	131	2.5
411	413	254	159	1.6
614	320	248	71	3.5
513	295	261	34	7.7

Note: AHT1 = Average Hourly Traffic on Driving Lane

AHT2 = Average Hourly Traffic on Passing Lane

$$\text{AHT Ratio} = \frac{\text{AHT1}}{\text{AHT2}}$$

To focus on the effect of traffic volume on lane distribution, the relationship between traffic volume and lane distribution at a single location should be examined. Site 414 (on I-69, 4.1 miles north of SR-18) was selected and the 24-hour traffic data on April 1, 1998 in the southbound direction was used to examine the lane distribution patterns in relation to the traffic

volume changes. Figure 1 plots the total AHT values and AHT ratios over the 24-hour period. Each of the values of the total AHT is divided by 10, so that the patterns of the traffic volumes and AHT ratios can be shown more clearly with similar scales in the same graph. The figure shows that during the 24-hour period, with a few exceptions, the AHT ratio increases as the total AHT decreases and the ratio decreases as the AHT increases.

To illustrate the general pattern of the AHT ratio, a scatter plot of total AHT values versus AHT ratios is drawn in Figure 2. This plot clearly depicts the inversely proportional relationship between AHT ratio and traffic volume. It indicates that as traffic volume increases, vehicles tend to spread more evenly over the available lanes. Under light traffic condition on four-lane freeways (two lanes in each direction), most vehicles travel in the driving lane and use the passing lane mainly for passing maneuvers.

Daily Variations of Traffic Volume:

Traffic volumes vary during the days of the week. Traffic volume variations by day of the week are affected by the locations and types of highways. To determine the volume variations, the traffic volume proportion of each day of the week was calculated as the percentage of the weekly traffic volume. The daily percentages of traffic volume for the 18 WIM stations are shown in Table 9. If traffic is evenly distributed to the seven days of the week, the average traffic volume should be about 14.3% for each day. Therefore, a daily traffic volume greater than 14.3% of the weekly volume is above average. In Table 9, all the percentage values above average are shown with bold fonts to indicate the above average proportions.

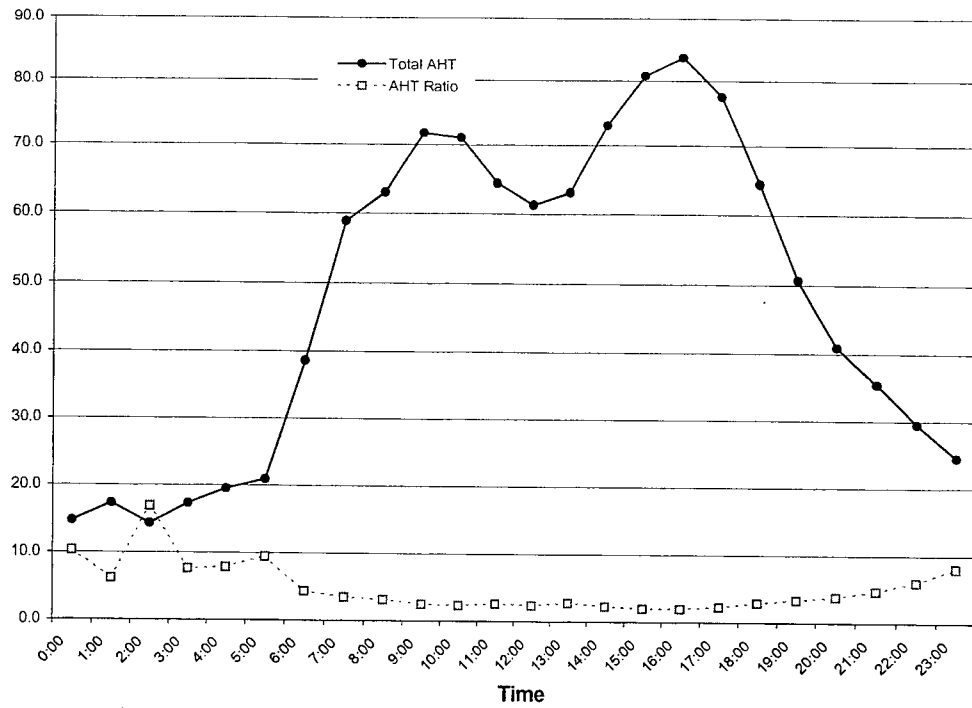


Figure 1. Values of Total AHT (in 10 vph) and AHT Ratio during 24 hours

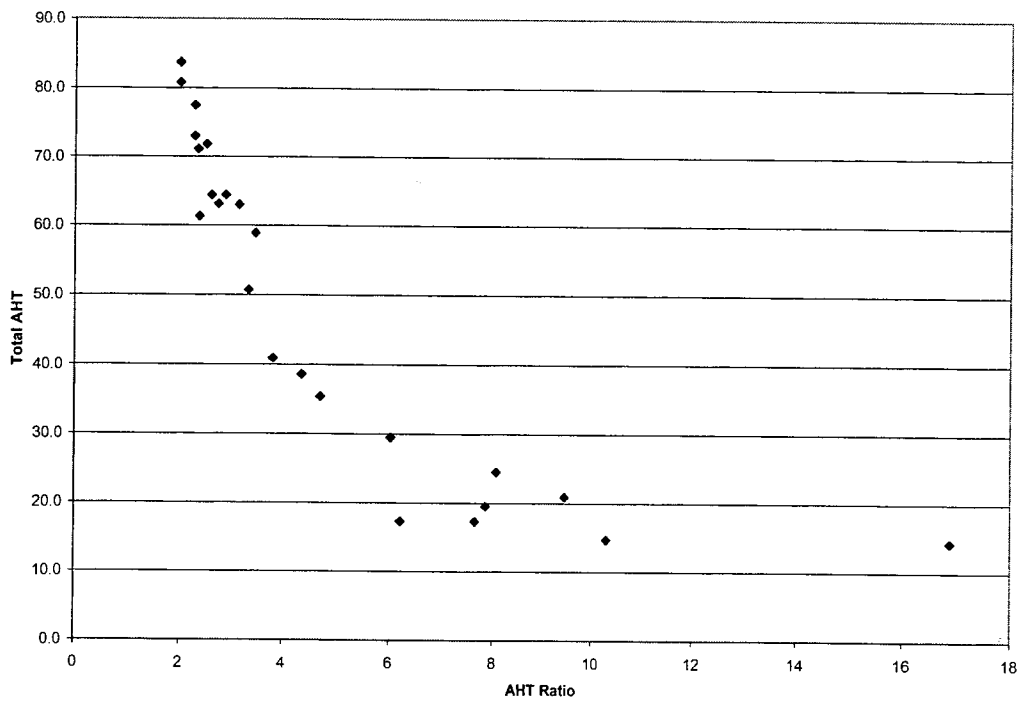


Figure 2. Plot of Total AHT (in 10 vph) Values versus AHT Ratios

Table 9. Traffic Volume Variations by Day of Week

Site	Day	Direction 1	Direction 2	Total	% of Week
411	Sunday	12864	16746	29610	17%
	Monday	8544	14424	22968	13%
	Tuesday	6954	13962	20916	12%
	Wednesday	7086	14346	21432	12%
	Thursday	8118	15744	23862	13%
	Friday	11976	19608	31584	18%
	Saturday	11358	15930	27288	15%
413	Sunday	9768	12048	21816	13%
	Monday	9408	13344	22752	13%
	Tuesday	10056	14544	24600	14%
	Wednesday	10752	14016	24768	15%
	Thursday	12936	15504	28440	17%
	Friday	12072	16296	28368	17%
	Saturday	8040	10896	18936	11%
414	Sunday	10432	13112	23544	14%
	Monday	10088	11584	21672	13%
	Tuesday	9984	11684	21668	13%
	Wednesday	10688	12252	22940	14%
	Thursday	11564	12868	24432	15%
	Friday	13356	14504	27860	17%
	Saturday	10588	12056	22644	14%
415	Sunday	14839	13865	28704	14%
	Monday	14688	14119	28807	14%
	Tuesday	14465	14349	28814	14%
	Wednesday	14637	14458	29095	14%
	Thursday	14880	15274	30154	14%
	Friday	16961	17962	34923	17%
	Saturday	13735	15147	28882	14%
511	Sunday	17268	15876	33144	14%
	Monday	16124	15608	31732	13%
	Tuesday	16228	16648	32876	14%
	Wednesday	16736	16848	33584	14%
	Thursday	17980	17892	35872	15%
	Friday	19020	20276	39296	17%
	Saturday	15512	15956	31468	13%
512	Sunday	16680	17995	34675	14%
	Monday	17765	18758	36523	14%
	Tuesday	17635	16526	34162	13%
	Wednesday	17621	16123	33744	13%
	Thursday	19186	17712	36898	14%
	Friday	21422	18648	40070	16%
	Saturday	21384	18144	39528	15%

(to be continued)

Table 9 (continued).

Site	Day	Direction 1	Direction 2	Total	% of Week
513	Sunday	6600	7800	14400	14%
	Monday	6912	7560	14472	14%
	Tuesday	6888	7344	14232	14%
	Wednesday	6864	7416	14280	14%
	Thursday	7440	8088	15528	15%
	Friday	8304	8952	17256	17%
	Saturday	6528	6720	13248	13%
514	Sunday	16920	14928	31848	14%
	Monday	16176	14832	31008	14%
	Tuesday	15912	15840	31752	14%
	Wednesday	16440	16344	32784	14%
	Thursday	17400	17304	34704	15%
	Friday	17616	18168	35784	16%
	Saturday	15456	15264	30720	13%
544	Sunday	14901	15312	30213	14%
	Monday	14777	14181	28958	13%
	Tuesday	15813	14211	30024	14%
	Wednesday	16529	14657	31186	14%
	Thursday	16303	15027	31330	14%
	Friday	19395	16769	36165	17%
	Saturday	16642	14434	31077	14%
545	Sunday	20051	18667	38717	15%
	Monday	17725	17333	35059	13%
	Tuesday	17763	17469	35232	13%
	Wednesday	18605	18256	36861	14%
	Thursday	19155	18840	37995	14%
	Friday	22392	22371	44763	17%
	Saturday	18336	18328	36664	14%
546	Sunday	35691	35043	70735	11%
	Monday	45689	44088	89777	14%
	Tuesday	48418	45168	93586	15%
	Wednesday	47962	45302	93264	15%
	Thursday	50311	47040	97351	15%
	Friday	53355	50458	103814	17%
	Saturday	41561	38712	80273	13%
548	Sunday	20388	24456	44844	10%
	Monday	33744	34932	68676	15%
	Tuesday	39288	41196	80484	17%
	Wednesday	38040	39276	77316	16%
	Thursday	36960	37992	74952	16%
	Friday	34860	34872	69732	15%
	Saturday	25896	28392	54288	12%

(to be continued)

Table 9 (continued).

Site	Day	Direction 1	Direction 2	Total	% of Week
613	Sunday	11796	12285	24081	12%
	Monday	14775	14538	29313	14%
	Tuesday	14685	14538	29223	14%
	Wednesday	14703	14568	29271	14%
	Thursday	15045	14805	29850	15%
	Friday	16545	16155	32700	16%
	Saturday	14109	14067	28176	14%
614	Sunday	6994	7402	14395	13%
	Monday	7675	7766	15442	14%
	Tuesday	7488	7406	14894	14%
	Wednesday	7608	7459	15067	14%
	Thursday	7901	7790	15691	14%
	Friday	8866	9005	17870	16%
	Saturday	7507	7800	15307	14%
615	Sunday	14301		14301	14%
	Monday	13917		13917	14%
	Tuesday	13629		13629	14%
	Wednesday	13827		13827	14%
	Thursday	14436		14436	14%
	Friday	15387		15387	15%
	Saturday	14256		14256	14%
616	Sunday	12909	14153	27062	12%
	Monday	14246	16395	30641	14%
	Tuesday	14616	17009	31625	15%
	Wednesday	15048	16906	31954	15%
	Thursday	15494	17061	32554	15%
	Friday	15936	18686	34622	16%
	Saturday	13272	15528	28800	13%
617	Sunday	19325	16469	35794	15%
	Monday	17174	14914	32088	13%
	Tuesday	17016	15058	32074	13%
	Wednesday	17602	15221	32822	14%
	Thursday	18230	15835	34066	14%
	Friday	20232	17429	37661	16%
	Saturday	19416	17434	36850	15%
642	Sunday	44784	44520	89304	12%
	Monday	56664	53472	110136	15%
	Tuesday	58488	54984	113472	16%
	Wednesday	55368	53064	108432	15%
	Thursday	54840	51504	106344	15%
	Friday	57096	52776	109872	15%
	Saturday	46632	43920	90552	12%

The information of traffic volume variations by day of the week is important for highway agencies. For example, the information can be utilized to schedule highway maintenance and construction activities on the days with relatively light traffic, so that traffic delay and user cost can be minimized. Since the 18 WIM stations are spread over Indiana, the values in Table 9 should be a good representation of the traffic volume variations of Indian interstate highways. Therefore, the traffic percentages at each site in Table 9 may be used to represent the volume variations of the surrounding areas if needed. Although the volume variations differ from site to site, it is interesting to see that traffic volume proportions on Fridays are greater than average at all of the 18 WIM sites. Figure 3 plotted the number of sites with higher than average volume on each day of the week. As illustrated in the figure, all of the 18 sites have higher than average traffic volumes on Fridays, eight sites on Thursdays, and only two sites on Mondays or Sundays.

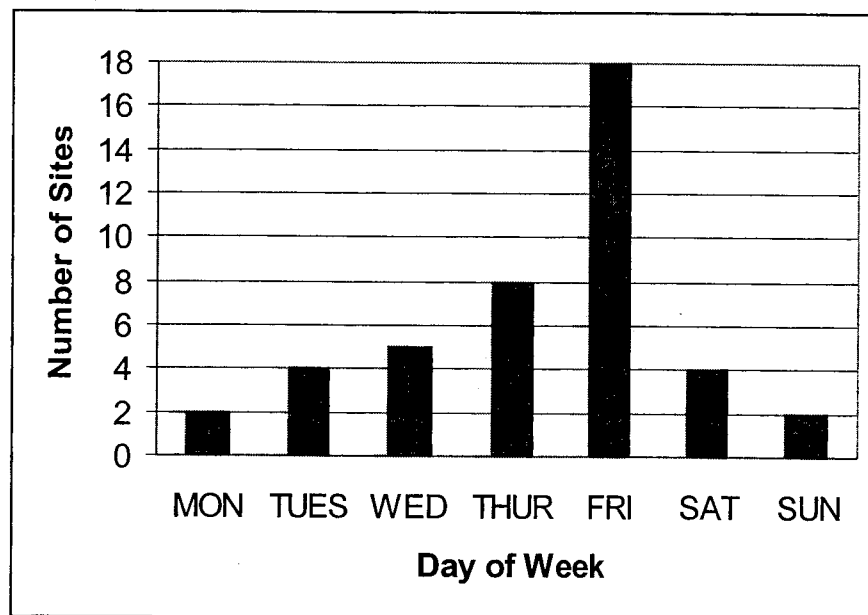


Figure 3. Number of Sites with Higher than Average Daily Traffic

Capacity Values:

Capacity is defined in terms of the maximum rate of flow that can be accommodated by a given traffic facility under prevailing conditions (TRB 1994). Traffic congestion occurs when traffic flow exceeds the capacity of the roadway. Consequently, during congestion vehicles travel at reduced speeds and with fluctuating traffic flow rates. Motorists endure considerably greater traffic delays under congested traffic conditions than under uncongested conditions. The reported maximum one-way volumes in the 1994 Highway Capacity Manual range from 3304 vph to 4124 vph for four-lane freeways, and from 4776 vph to 5596 vph for six-lane freeways. The Manual recommends a rate of flow of 2,200 passenger cars per hour per lane (pcphpl) for freeways with two lanes in one direction and 2,300 pcphpl for freeways with three or more lanes in one direction as the basic capacity of such facilities under ideal conditions.

It was observed that traffic flows changed from uncongested to congested conditions always with a sharp speed drop. Therefore, freeway capacity is identified in this study as the maximum observed hourly volume before a substantial speed drop. To express freeway capacity in passenger cars per hour, the traffic flow rate was converted to hourly volume and the adjustment factors from the 1994 Highway Capacity Manual were used to convert heavy vehicles to passenger car equivalents. The WIM data indicates that traffic congestion was recorded at Sites 546, 548 and 642. The observed capacity values are presented in Tables 10 and 11. On four-lane freeways, the observed capacity values range from 1489 to 2006 pcphpl with an average value of 1767 pcphpl. The observed capacity values on individual lanes of six-lane freeways range from 1463 to 2093 pcphpl with an average value of 1778 pcphpl. These capacity values are lower than those recommended by the 1994 Highway Capacity Manual, which are 2200 pcphpl and 2300 pcphpl for four-lane and six-lane freeways, respectively. This can be

attributed to the fact that the volumes from WIM data in this study were the actual observed hourly traffic volumes and the volume values in the Highway Capacity Manual were obtained from the 15-minute traffic flow rates. This is because when a peak 15-minute traffic flow rate is converted to hourly volume, the converted value is always greater than the observed hourly volume.

Table 10. Observed Capacity Values on Four-Lane Freeways

Driving Lane (pcphpl)	Passing Lane (pcphpl)	Total (pcphpl)	Average (pcphpl)
2006	1570	3576	1788
1995	1611	3606	1803
1985	1489	3474	1737
1940	1539	3479	1740
Grand Average			1767

Table 11. Observed Capacity Values on Six-Lane Freeways

Right Lane (pcphpl)	Middle Lane (pcphpl)	Left Lane (pcphpl)	Total (pcphpl)	Average (pcphpl)
1767	1828	1463	5058	1686
1800	1631	1743	5174	1725
1986	1748	2039	5773	1924
Grand Average				1778

CHAPTER 4. DYNAMIC PREDICTION OF TRAFFIC FLOW AND TRAFFIC CONGESTION

4.1. Traffic Flow Prediction Using Time Series

Given the capacity values, it was desired to develop methods for predicting traffic flow and congestion so that appropriate traffic control strategies could be applied to avoid traffic congestion and to reduce traffic delay. Traffic flow rate constantly changes with time on any given highway sections. To predict traffic conditions, the relationship between traffic flow and time must be studied. The time series theory (Cryer 1986, Bowerman and O'Connell 1979) is a frequently used tool to study the traffic and time relationship. One of the time series models is the *autoregressive process* $\{Z(t)\}$. A p th-order autoregressive process, AR(p), satisfies the following equation (Bowerman and O'Connell 1979):

$$Z(t) = \phi_1 Z(t-1) + \phi_2 Z(t-2) + \dots + \phi_p Z(t-p) + \varepsilon_t \quad (1)$$

where:

$Z(t)$ = value of the process Z at time t ;

ϕ_i = unknown parameters; $i = 1, 2, 3, \dots, p$

ε_t = a random variable with zero mean and variance σ_w^2 .

This equation requires that the mean of the series has been subtracted out so that $Z(t)$ has a zero mean. This time series implies that the current value of the series $Z(t)$ is a linear combination of the p most recent past values of itself plus an error term ε_t .

To develop a model of dynamically predicting traffic flow rates, traffic data was recorded with traffic counters on I-65 at about 1 mile south of SR-47. The data was collected in the northbound direction at 5-minute intervals from 15:00 to 20:00 on May 16, 1996. Figure 4 shows the observed traffic flow rates in order of time.

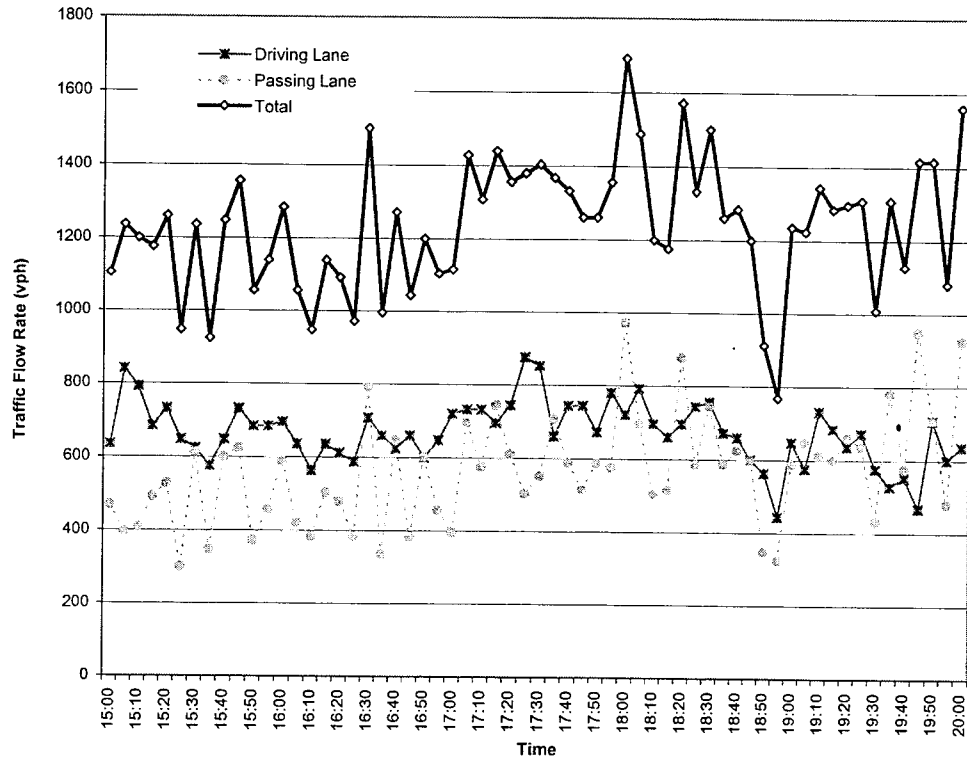


Figure 4. Observed Traffic Flow on I-65

With the traffic flow data, an AR(1) model was fitted using the MINITAB (Minitab 1996) computer software. The AR(1) equation for the traffic flow rate is expressed as follows:

$$f(t) = \phi_1 f(t-1) + \varepsilon_t \tag{2}$$

In Equation 2, $f(t)$ denotes the traffic flow rate at time t . As expressed by the equation, the traffic flow rate at time t , $f(t)$, can be predicted from the traffic flow rate observed at the most recent

past time point $t-1$, $f(t-1)$. It should be noted that the mean of the series of traffic flow rates must be subtracted from $f(t)$ as required by the autoregressive model of Equation 1. The actual prediction is then the calculated $f(t)$ plus the mean. If $f(t-1)$ is given, then $f(t)$ can be predicted as:

$$\hat{f}(t | t-1) = \bar{\phi}_1 f(t-1) \quad (3)$$

In this equation, $\bar{\phi}_1$ is the estimate of ϕ_1 , and $\hat{f}(t | t-1)$ is the predicted value of $f(t)$ based on the most recent observed traffic flow rate, $f(t-1)$. Through this equation, predictions of traffic flow rates at the given location were calculated from 15:00 to 20:00 at 5-minute intervals. For comparison, plotted in Figures 5, 6 and 7 are the predicted and observed values of the traffic flow rates.

The curves in the three figures indicate that the predicted values followed the patterns of the observed traffic flows. The accuracy of the time series predictions is reflected by the values of residuals. In this case, a residual is the difference between the observed traffic flow rate and the traffic flow rate predicted by the time series model, that is, $\text{residual} = f(t) - \hat{f}(t | t-1)$. The residuals of the time series predictions are listed in Table 12 for all data points during the eight-hour period. To examine the magnitudes of the residuals, the absolute values of the residuals were used to calculate the statistics. As shown in Table 12, for the driving lane the absolute values of residuals have a mean of 66.04, a standard deviation of 51.74, and a minimum of 1.04, and a maximum of 240.71. The corresponding values are 161.20, 126.50, 0.50 and 462.10 for the passing lane, and are 173.40, 141.00, 2.20 and 529.70 for the total volumes of the two lanes. Although these values are not extremely unacceptable, they certainly suggest the needs for improvement in the accuracy of the time series predictions.

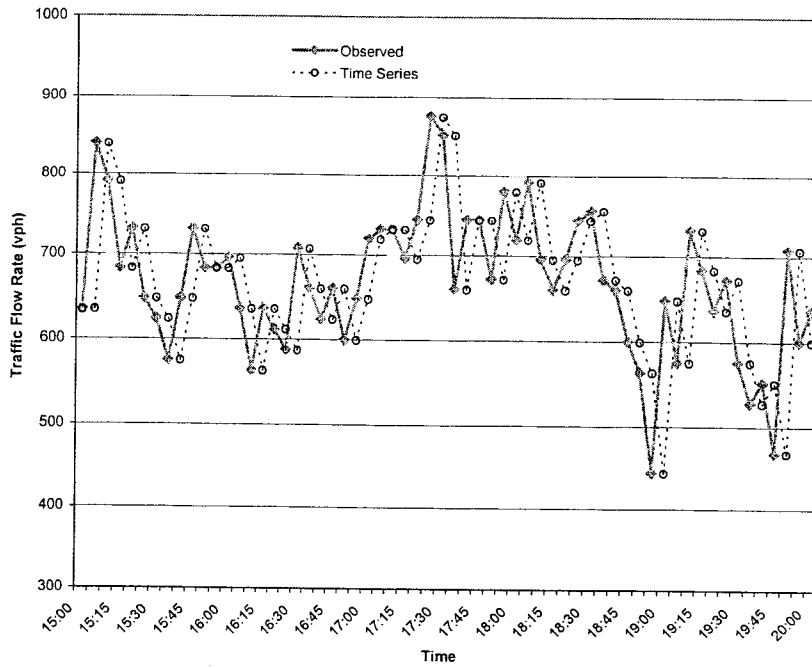


Figure 5. Observed and Time Series Predicted Traffic Flow on Driving Lane

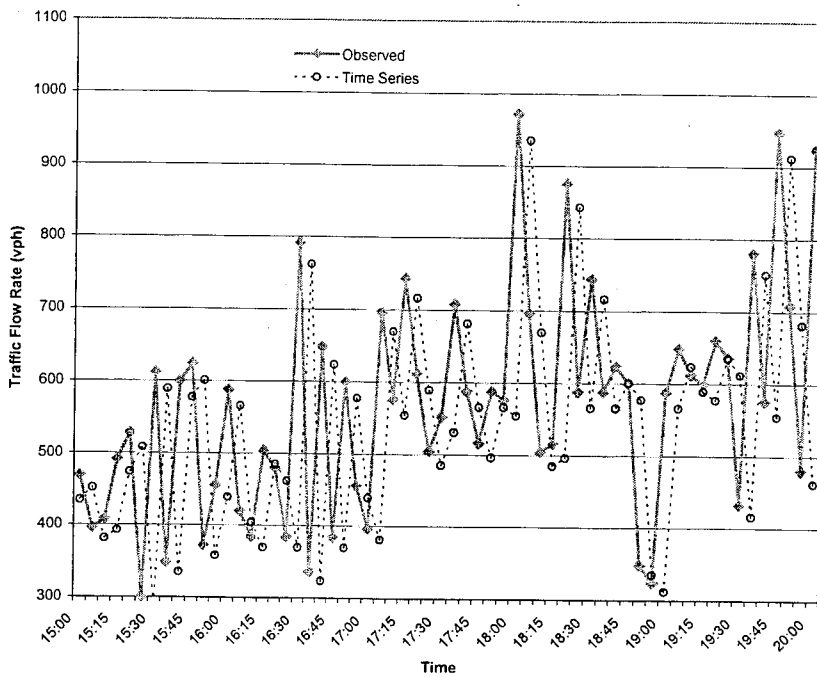


Figure 6. Observed and Time Series Predicted Traffic Flow on Passing Lane

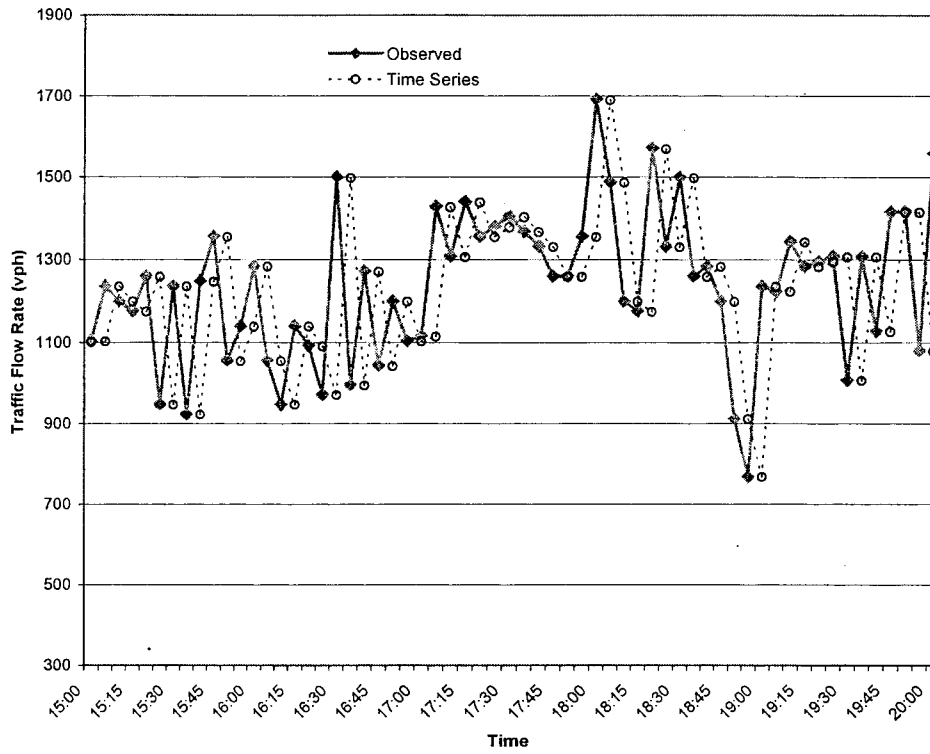


Figure 7. Observed and Time Series Predicted Two Lane Total Traffic Flow

Table 12. Comparison of Observed and Time Series Predicted Traffic Flow Rates

Time	Driving Lane			Passing Lane			Total		
	Observed	Predicted	Residual	Observed	Predicted	Residual	Observed	Predicted	Residual
15:00	635	633.1	1.9	469	434.3	34.7	1104	1100.1	3.9
15:05	840	634	206	396	451.3	-55.3	1236	1102.1	134
15:10	792	838.7	-46.7	408	381.1	26.9	1200	1233.8	-33.8
15:15	684	790.8	-106.8	492	392.6	99.4	1176	1197.9	-21.9
15:20	732	683	49	528	473.4	54.6	1260	1173.9	86.1
15:25	648	730.9	-82.9	300	508.1	-208.1	948	1257.8	-309.8
15:30	624	647	-23	612	288.7	323.3	1236	946.3	289.7
15:35	576	623.1	-47.1	348	588.9	-240.9	924	1233.8	-309.8
15:40	648	575.1	72.9	600	334.9	265.1	1248	922.4	325.6
15:45	732	647	85	624	577.4	46.6	1356	1245.8	110.2
15:50	684	730.9	-46.9	372	600.5	-228.5	1056	1353.6	-297.6
15:55	684	683	1	456	358	98	1140	1054.1	85.9
16:00	696	683	13	588	438.8	149.2	1284	1138	146
16:05	636	694.9	-58.9	420	565.8	-145.8	1056	1281.7	-225.7
16:10	564	635	-71	384	404.2	-20.2	948	1054.1	-106.1
16:15	636	563.1	72.9	504	369.5	134.5	1140	946.3	193.7
16:20	612	635	-23	480	485	-5	1092	1138	-46
16:25	588	611.1	-23.1	384	461.9	-77.9	972	1090.1	-118.1
16:30	708	587.1	120.9	792	369.5	422.5	1500	970.3	529.7
16:35	660	706.9	-46.9	336	762.1	-426.1	996	1497.4	-501.3
16:40	624	659	-35	648	323.3	324.7	1272	994.2	277.8
16:45	660	623.1	36.9	384	623.5	-239.5	1044	1269.8	-225.7
16:50	600	659	-59	600	369.5	230.5	1200	1042.2	157.8
16:55	648	599.1	48.9	456	577.4	-121.4	1104	1197.9	-93.9
17:00	720	647	73	396	438.8	-42.8	1116	1102.1	14
17:05	732	718.9	13.1	696	381.1	314.9	1428	1114	314
17:10	732	730.9	1.1	576	669.7	-93.7	1308	1425.5	-117.5
17:15	696	730.9	-34.9	744	554.3	189.7	1440	1305.7	134.3
17:20	744	694.9	49.1	612	715.9	-103.9	1356	1437.5	-81.5
17:25	876	742.9	133.1	504	588.9	-84.9	1380	1353.6	26.4
17:30	852	874.7	-22.7	552	485	67	1404	1377.6	26.4
17:35	660	850.7	-190.7	708	531.2	176.8	1368	1401.5	-33.5
17:40	744	659	85	588	681.3	-93.3	1332	1365.6	-33.6
17:45	744	742.9	1.1	516	565.8	-49.8	1260	1329.6	-69.6
17:50	672	742.9	-70.9	588	496.5	91.5	1260	1257.8	2.2
17:55	780	671	109	576	565.8	10.2	1356	1257.8	98.2
18:00	720	778.8	-58.8	972	554.3	417.7	1692	1353.6	338.4

Table 12. (continued)

Time	Driving Lane			Passing Lane			Total		
	Observed	Predicted	Residual	Observed	Predicted	Residual	Observed	Predicted	Residual
18:05	792	718.9	73.1	696	935.3	-239.3	1488	1689	-201
18:10	696	790.8	-94.8	504	669.7	-165.7	1200	1485.4	-285.4
18:15	660	694.9	-34.9	516	485	31	1176	1197.9	-21.9
18:20	696	659	37	876	496.5	379.5	1572	1173.9	398.1
18:25	744	694.9	49.1	588	842.9	-254.9	1332	1569.2	-237.2
18:30	756	742.9	13.1	744	565.8	178.2	1500	1329.6	170.4
18:35	672	754.9	-82.9	588	715.9	-127.9	1260	1497.4	-237.3
18:40	660	671	-11	624	565.8	58.2	1284	1257.8	26.2
18:45	600	659	-59	600	600.5	-0.5	1200	1281.7	-81.7
18:50	564	599.1	-35.1	348	577.4	-229.4	912	1197.9	-285.9
18:55	444	563.1	-119.1	324	334.9	-10.9	768	910.4	-142.4
19:00	648	443.3	204.7	588	311.8	276.2	1236	766.6	469.4
19:05	576	647	-71	648	565.8	82.2	1224	1233.8	-9.8
19:10	732	575.1	156.9	612	623.5	-11.5	1344	1221.8	122.2
19:15	684	730.9	-46.9	600	588.9	11.1	1284	1341.6	-57.6
19:20	636	683	-47	660	577.4	82.6	1296	1281.7	14.3
19:25	672	635	37	636	635.1	0.9	1308	1293.7	14.3
19:30	576	671	-95	432	612	-180	1008	1305.7	-297.7
19:35	528	575.1	-47.1	780	415.7	364.3	1308	1006.2	301.8
19:40	552	527.2	24.8	576	750.6	-174.6	1128	1305.7	-177.7
19:45	468	551.2	-83.2	948	554.3	393.7	1416	1126	290
19:50	708	467.3	240.7	708	912.2	-204.2	1416	1413.5	2.5
19:55	600	706.9	-106.9	480	681.3	-201.3	1080	1413.5	-333.5
20:00	636	599.1	36.9	924	461.9	462.1	1560	1078.1	481.9
	Statistics of absolute values of residuals: Mean=66.04 StDev=51.74 Min=1.04 Max=240.71			Statistics of absolute values of residuals: Mean=161.20 StDev=126.50 Min=0.50 Max=462.10			Statistics of absolute values of residuals: Mean=173.40 StDev=141.00 Min=2.20 Max=529.70		

4.2. Traffic Flow Prediction Using Kalman Predictor

One of the applications of control theory is to use the Kalman predictor (Bozic 1979) in recursive predictions of random signal processes. For example, the signal model can be a first-order autoregressive process:

$$x(t+1) = a x(t) + w_t \quad (4)$$

The observation (or measurement) is affected by additive random error v_t :

$$y(t) = c x(t) + v_t \quad (5)$$

where v_t is a random variable with zero mean and variance σ_v^2 .

The Kalman predictor for the above signal model can be expressed as follows:

Predictor equation:

$$\hat{x}(t+1|t) = a \hat{x}(t|t-1) + k(t)[y(t) - c\hat{x}(t|t-1)] \quad (6)$$

Predictor gain:

$$k(t) = \frac{a c p(t|t-1)}{c^2 p(t|t-1) + \sigma_v^2} \quad (7)$$

Prediction mean-square error:

$$p(t+1|t) = \frac{a}{c} k(t) \sigma_v^2 + \sigma_w^2 \quad (8)$$

Equations 6, 7 and 8 are called one-step Kalman predictor of the signal process expressed by Equations 4 and 5. The Kalman method yields the estimate of $x(t+1)$, i.e. the signal at time $t+1$,

given the measured data $x(t)$ and the previous estimate $\hat{x}(t|t-1)$ at time t . It can be proved (Bozic 1979) that this one-step prediction estimate, denoted as $\hat{x}(t+1|t)$, is an optimum estimate because the Kalman recursive prediction process minimizes the mean-square prediction error $E[x(t+1) - \hat{x}(t+1|t)]^2$.

Some features of the Kalman predictor, such as recursive, continuously incorporating the most recent real-time data, and optimum prediction, are exactly the desirable functions for an efficient traffic flow prediction model. To use the Kalman predictor in traffic flow prediction, the AR(1) time series model as in Equation 3 can be used as the traffic flow model, that is:

$$f(t+1) = \phi f(t) + \varepsilon_t \quad (9)$$

Equation 9 is the first-order autoregressive process for the traffic flow. In addition, the observation (or measurement) of the traffic flow, $m(t)$, is affected by additive random error v_t :

$$m(t) = \beta f(t) + v_t \quad (10)$$

Equation 10 is related to the accuracy of the traffic data measurement devices used in data collection. The one step Kalman recursive prediction equations can then be readily obtained from Equations 6 through 8:

Predictor equation:

$$\hat{f}(t+1|t) = \phi \hat{f}(t|t-1) + k(t)[m(t) - \beta \hat{f}(t|t-1)] \quad (11)$$

Predictor gain:

$$k(t) = \frac{\phi \beta p(t|t-1)}{\beta^2 p(t|t-1) + \sigma_v^2} \quad (12)$$

Prediction mean-square error:

$$p(t+1|t) = \frac{\phi}{\beta} k(t) \sigma_v^2 + \sigma_e^2 \quad (13)$$

With Equations 9 through 13, traffic flow rate at $t+1$, $f(t+1)$, can be predicted as $\hat{f}(t+1|t)$ for each observed data at time t , $f(t)$. Since Equation 9 is a time series model of the first order autoregressive process, this Kalman predictor model is a combination of the time series and the Kalman predictor. It was expected that this prediction model would improve the prediction accuracy over the time series model as defined in Equation 9. To verify this, the Kalman predictor model was also applied to the traffic flow data described in Figure 4. The predicted traffic flow rates from the Kalman predictor along with the corresponding observed values and the values from the time series method are plotted in Figures 8, 9 and 10.

As shown in the figure, most of the predicted values from the Kalman model are closer to the observed values than the predicted values from the time series model. This indicates that the Kalman method indeed improved the prediction accuracy over the time series method. The differences in the prediction accuracy of the two methods can be more clearly described by plotting their corresponding residual values into the same graph, as shown in Figures 11, 12 and 13. The residual graph distinctly shows that the most residuals of the Kalman predictions are considerably smaller than those of the time series predictions. Therefore, the improvement of the Kalman predictor over the time series method in traffic flow prediction is apparent and significant.

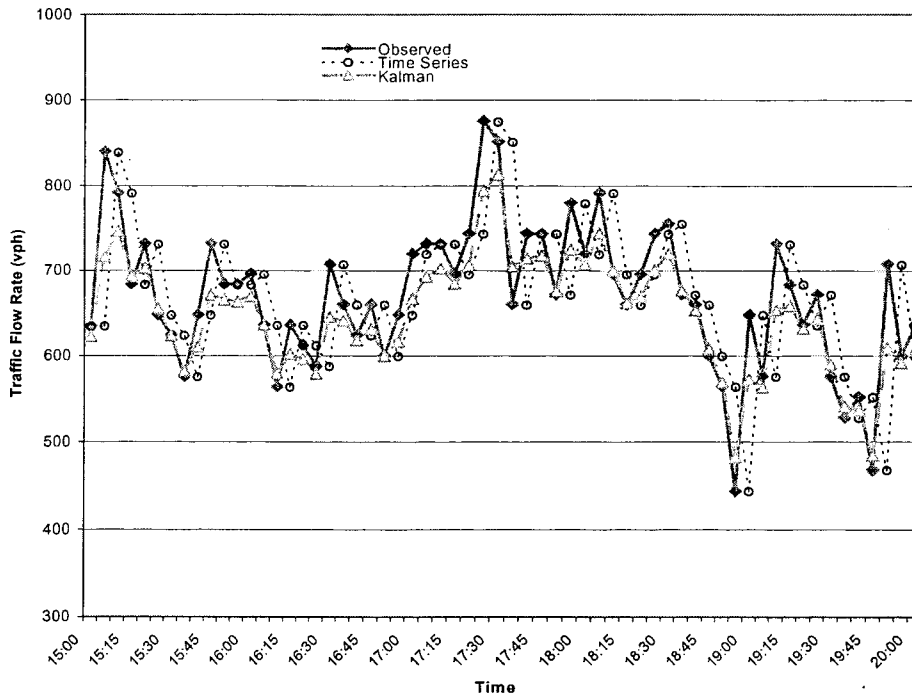


Figure 8. Observed and Kalman and Time Series Predicted Traffic Flow on Driving Lane

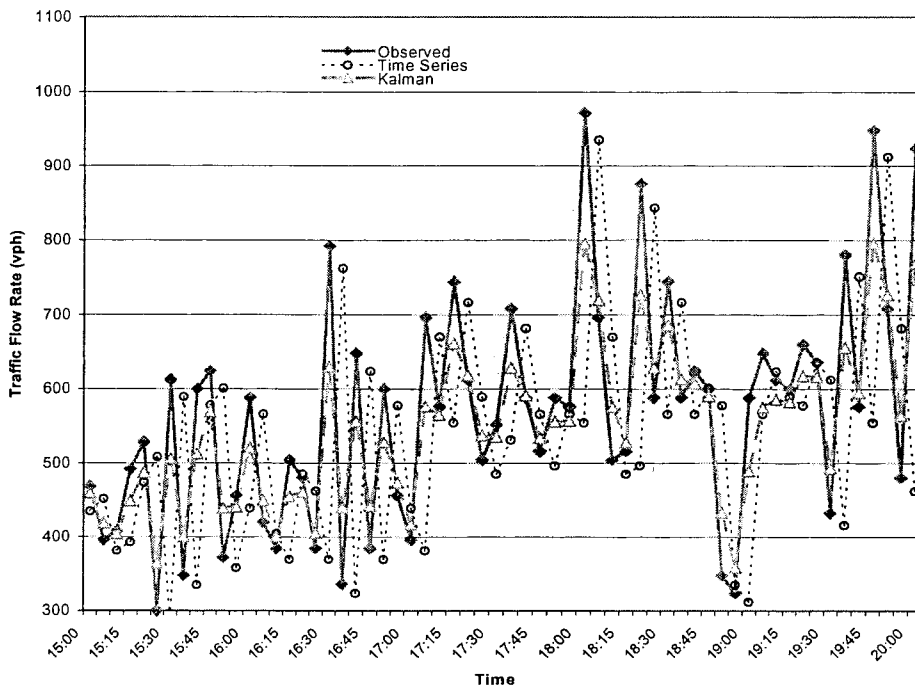


Figure 9. Observed and Kalman and Time Series Predicted Traffic Flow on Passing Lane

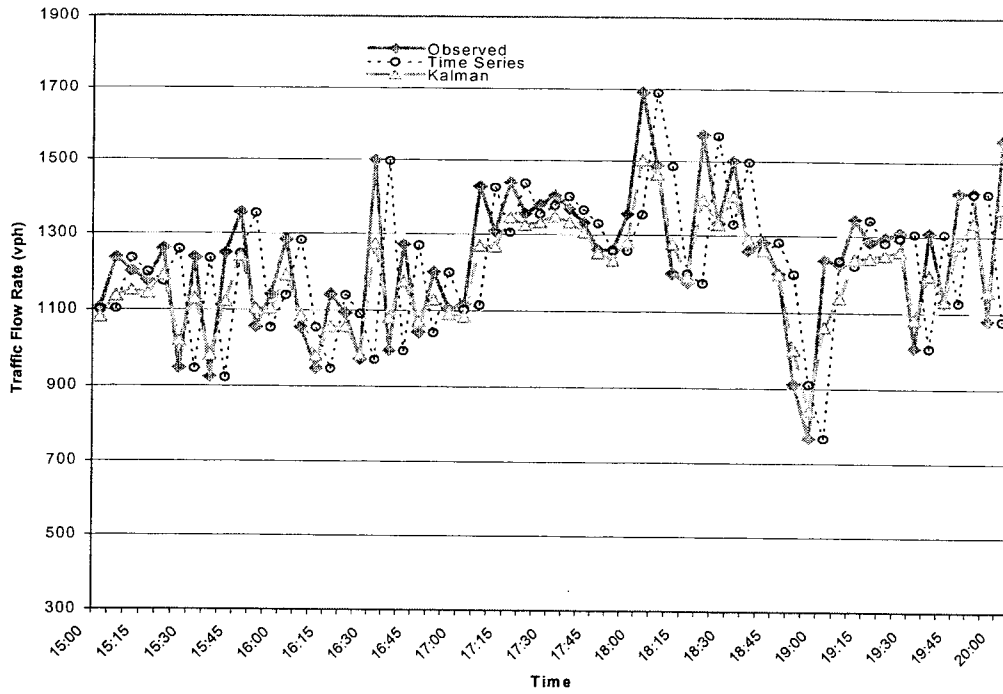


Figure 10. Observed and Kalman and Time Series Predicted Two Lane Total Traffic Flow

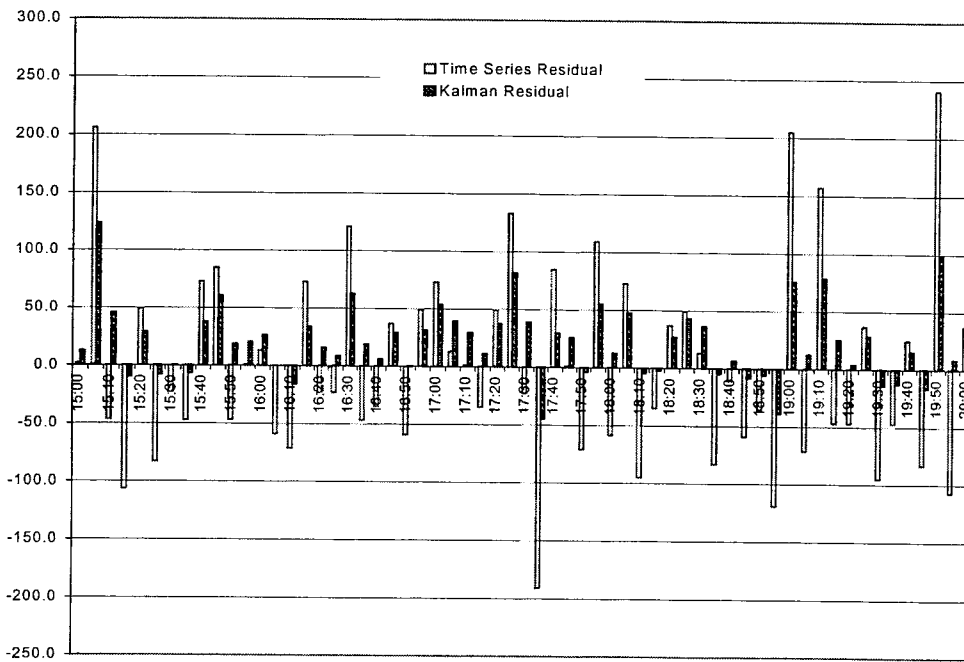


Figure 11. Residuals of Kalman and Time Series Predictions on Driving Lane

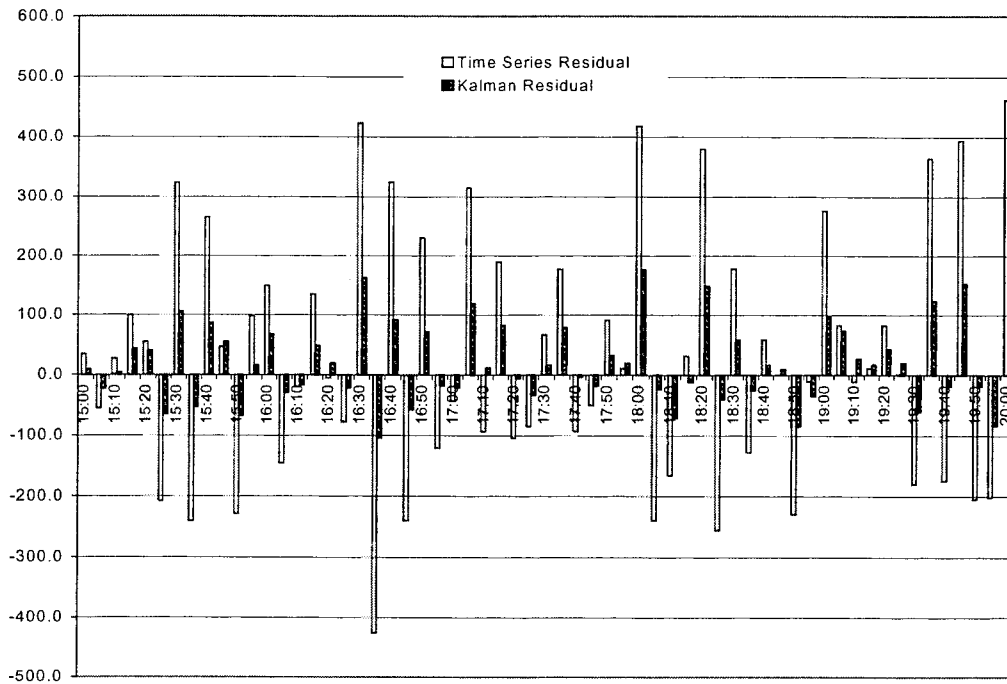


Figure 12. Residuals of Kalman and Time Series Predictions on Passing Lane

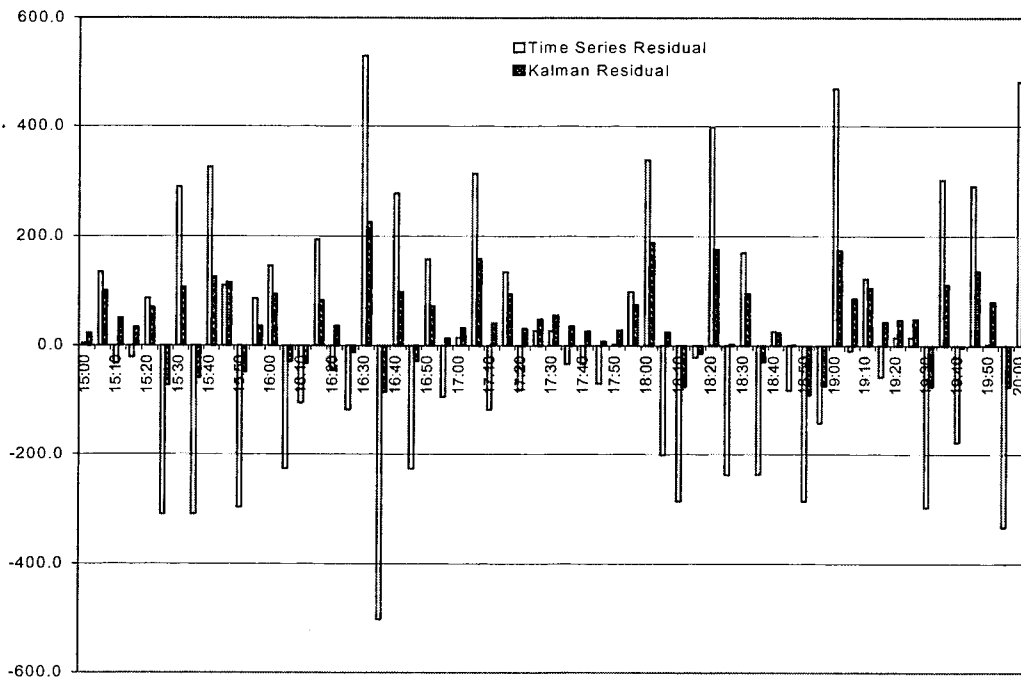


Figure 13. Residuals of Kalman and Time Series Predictions of Two Lane Total Traffic Flow

For a quantitative comparison, the residual values of the time series and Kalman predictions are presented in Table 13. In addition, the differences between the absolute values of the time series and the Kalman residuals are also included in the table. Because there are positive and negative residuals, the use of the absolute values of the residuals is to compare the magnitudes of the residuals from the two prediction methods. The magnitude of a residual is the difference between the observed value and the predicted value. Therefore, a more accurate prediction yields a smaller magnitude of residual. If the absolute value of time series residual (TR) minus the absolute of the Kalman residual (KR) is positive, i.e., $\text{abs}(\text{TR}) - \text{abs}(\text{KR}) > 0$, then the magnitude of time series residual is greater than the Kalman residual, indicating the time series prediction is less accurate than the Kalman prediction.

As shown in the last column of Table 13, there are 53 positive values and 8 negative values of $\text{abs}(\text{TR}) - \text{abs}(\text{KR})$ for the driving lane, 53 positive and 8 negative ones for the passing lane, and 49 positive and 13 negative ones for the two lane total. This indicates that 53 out of the 81 Kalman predictions are more accurate than the time series predictions for the driving lane and the passing lane, and 49 out of the 81 Kalman predictions for the total traffic volumes of the two lanes. The statistics of the absolute values of the residuals were also calculated for the predictions from the two methods. Table 13 indicates that the Kalman predictions have smaller values of mean, standard deviation, minimum and maximum of the absolute residuals than the time series predictions. Compared to the time series predictions, the Kalman predictions reduced the mean of the absolute residual values by $(66.04 - 28.37) / 66.04 = 57.0\%$, $(161.20 - 54.36) / 161.20 = 66.3\%$, and $(173.4 - 69.52) / 173.4 = 59.9\%$, and the standard deviation by $(51.74 - 25.36) / 51.74 = 51.0\%$, $(126.5 - 44.36) / 126.5 = 64.9\%$, and $(141.0 - 50.92) / 141.0 = 63.9\%$ for the driving lane, passing lane, and two lane total, respectively. These large reductions in the values

of the mean and standard deviation represent a significant improvement in the traffic flow predictions.

Table 13. Comparison of Time Series and Kalman Predictions

Time	Driving Lane			Passing Lane			Total		
	Time Residual (TR)	Kalman Residual (KR)	Abs(TR)-Abs(KR)	Time Residual (TR)	Kalman Residual (KR)	Abs(TR)-Abs(KR)	Time Residual (TR)	Kalman Residual (KR)	Abs(TR)-Abs(KR)
15:00	1.9	12.7	-10.8	34.7	9.38	25.3	3.9	22.08	-18.2
15:05	206.0	123.5	82.5	-55.3	-23.25	32.1	134.0	100.22	33.7
15:10	-46.7	45.7	1.1	26.9	3.71	23.2	-33.8	49.37	-15.6
15:15	-106.8	-10.1	96.7	99.4	43.25	56.1	-21.9	33.18	-11.3
15:20	49.0	29.0	20.0	54.6	40.58	14.0	86.1	69.59	16.5
15:25	-82.9	-7.9	75.0	-208.1	-64.94	143.1	-309.8	-72.79	237.0
15:30	-23.0	0.4	22.6	323.3	105.74	217.6	289.7	106.17	183.5
15:35	-47.1	-6.5	40.6	-240.9	-52.93	188.0	-309.8	-59.42	250.4
15:40	72.9	37.8	35.1	265.1	87.34	177.8	325.6	125.09	200.5
15:45	85.0	60.7	24.3	46.6	54.62	-8.0	110.2	115.33	-5.1
15:50	-46.9	18.5	28.4	-228.5	-67.26	161.2	-297.6	-48.77	248.8
15:55	1.0	20.7	-19.6	98.0	15.46	82.6	85.9	36.13	49.7
16:00	13.0	26.3	-13.3	149.2	67.56	81.6	146.0	93.85	52.2
16:05	-58.9	0.0	58.9	-145.8	-29.61	116.2	-225.7	-29.65	196.1
16:10	-71.0	-16.0	55.1	-20.2	-17.15	3.0	-106.1	-33.13	73.0
16:15	72.9	33.9	38.9	134.5	49	85.5	193.7	82.92	110.8
16:20	-23.0	16.0	7.0	-5.0	19.06	-14.1	-46.0	35.06	10.9
16:25	-23.1	8.7	14.3	-77.9	-21.44	56.4	-118.1	-12.71	105.4
16:30	120.9	62.9	58.0	422.5	162.13	260.4	529.7	225.01	304.7
16:35	-46.9	18.8	28.1	-426.1	-104.49	321.6	-501.3	-85.66	415.7
16:40	-35.0	6.0	29.0	324.7	91.49	233.2	277.8	97.47	180.3
16:45	36.9	29.1	7.9	-239.5	-57.61	181.9	-225.7	-28.52	197.2
16:50	-59.0	0.3	58.7	230.5	71.94	158.6	157.8	72.25	85.6
16:55	48.9	31.2	17.7	-121.4	-18.15	103.2	-93.9	13.09	80.8
17:00	73.0	53.5	19.5	-42.8	-21.66	21.1	14.0	31.82	-17.9
17:05	13.1	39.4	-26.3	314.9	119.26	195.7	314.0	158.68	155.3
17:10	1.1	29.6	-28.4	-93.7	11.24	82.5	-117.5	40.8	76.7
17:15	-34.9	11.5	23.4	189.7	82.71	107.0	134.3	94.19	40.1
17:20	49.1	37.4	11.7	-103.9	-6.41	97.5	-81.5	30.98	50.5
17:25	133.1	81.6	51.5	-84.9	-33.22	51.7	26.4	48.41	-22.0
17:30	-22.7	38.9	-16.2	67.0	16.63	50.4	26.4	55.48	-29.0
17:35	-190.7	-44.8	145.9	176.8	79.49	97.3	-33.5	34.73	-1.2
17:40	85.0	29.7	55.3	-93.3	-3.57	89.7	-33.6	26.16	7.4
17:45	1.1	26.1	-25.0	-49.8	-18.28	31.5	-69.6	7.85	61.8
17:50	-70.9	-3.9	66.9	91.5	32.09	59.4	2.2	28.17	-25.9
17:55	109.0	55.0	54.0	10.2	19.12	-8.9	98.2	74.11	24.1
18:00	-58.8	12.5	46.3	417.7	176.54	241.2	338.4	189.05	149.3

(to be continued)

Table 13. (continued)

Time	Driving Lane			Passing Lane			Total		
	Time Residual (TR) 	Kalman Residual (KR)	Abs(TR)-Abs(KR)	Time Residual (TR) 	Kalman Residual (KR)	Abs(TR)-Abs(KR)	Time Residual (TR) 	Kalman Residual (KR)	Abs(TR)-Abs(KR)
18:05	73.1	47.8	25.3	-239.3	-23.72	215.6	-201.0	24.1	176.9
18:10	-94.8	-4.3	90.5	-165.7	-71.56	94.2	-285.4	-75.87	209.5
18:15	-34.9	-2.1	32.9	31.0	-12.22	18.8	-21.9	-14.28	7.6
18:20	37.0	26.8	10.2	379.5	149.14	230.3	398.1	175.9	222.2
18:25	49.1	43.2	5.9	-254.9	-40.79	214.2	-237.2	2.38	234.8
18:30	13.1	36.0	-22.9	178.2	58.48	119.7	170.4	94.48	75.9
18:35	-82.9	-4.7	78.1	-127.9	-25.15	102.8	-237.3	-29.87	207.5
18:40	-11.0	6.9	4.1	58.2	16.59	41.6	26.2	23.46	2.8
18:45	-59.0	-8.1	50.9	-0.5	9.19	-8.7	-81.7	1.09	80.6
18:50	-35.1	-5.4	29.7	-229.4	-84.93	144.4	-285.9	-90.34	195.5
18:55	-119.1	-38.6	80.6	-10.9	-34.74	-23.9	-142.4	-73.33	69.1
19:00	204.7	75.6	129.1	276.2	98.52	177.7	469.4	174.08	295.3
19:05	-71.0	12.9	58.1	82.2	72.95	9.2	-9.8	85.82	-76.0
19:10	156.9	78.6	78.3	-11.5	26.22	-14.7	122.2	104.77	17.4
19:15	-46.9	25.2	21.6	11.1	17.38	-6.3	-57.6	42.62	15.0
19:20	-47.0	4.1	42.9	82.6	42.49	40.2	14.3	46.59	-32.3
19:25	37.0	28.6	8.3	0.9	19.72	-18.8	14.3	48.33	-34.0
19:30	-95.0	-14.0	81.0	-180.0	-61.1	118.9	-297.7	-75.08	222.6
19:35	-47.1	-12.9	34.2	364.3	124.18	240.1	301.8	111.28	190.5
19:40	24.8	15.2	9.6	-174.6	-18.69	155.9	-177.7	-3.45	174.2
19:45	-83.2	-16.7	66.5	393.7	152.67	241.1	290.0	136.01	154.0
19:50	240.7	98.7	142.0	-204.2	-18.89	185.3	2.5	79.79	-77.3
19:55	-106.9	8.5	98.5	-201.3	-83.84	117.4	-333.5	-75.36	258.1
20:00	36.9	29.6	7.4	462.1	154.78	307.3	481.9	184.33	297.6
	Statistics of absolute values of residuals:			Statistics of absolute values of residuals:			Statistics of absolute values of residuals:		
		<u>Time Series</u>	<u>Kalman</u>		<u>Time Series</u>	<u>Kalman</u>		<u>Time Series</u>	<u>Kalman</u>
	Mean	66.04	28.37	Mean	161.20	54.36	Mean	173.40	69.52
	StDev	51.74	25.36	StDev	126.50	44.36	StDev	141.00	50.92
	Min	1.04	0.04	Min	0.50	3.57	Min	2.20	1.09
	Max	240.71	123.47	Max	462.10	176.54	Max	529.70	225.01

To statistically compare the predictions of the two methods, paired t-tests were performed. Since a t-test requires the data follow a normal distribution, the Anderson-Darling normality test (Minitab 1996) was used to check if the absolute values of the residuals follow a normal distribution. The normality tests indicate none of the data sets follows a normal distribution at a level of $\alpha = 0.05$. Then the data sets were transformed by square root of the absolute values of the residuals, i.e., $r'_{1i} = \sqrt{abs(TR)}$ and $r'_{2i} = \sqrt{abs(KR)}$. The Anderson-Darling normality tests on the transferred data yielded p-values greater than $\alpha = 0.05$. Therefore, the transformed data sets are normally distributed at a level of $\alpha = 0.05$ and the paired t-tests can be applied to compare them. The paired t-tests were used to test if the difference between the mean of r'_{1i} (μ_1) and the mean of r'_{2i} (μ_2) is zero or greater than zero. The hypotheses to be tested are as follows:

$$H_0: \mu_1 - \mu_2 = 0$$

$$H_a: \mu_1 - \mu_2 > 0$$

If the Type I error is controlled at $\alpha = 0.05$, then the p-value of the paired t-test can be compared to the α value according to the decision rule:

If p-value $\geq \alpha$, conclude H_0 .

If p-value $< \alpha$, conclude H_a .

All of the p-values of the paired t-tests are 0.000 for the driving lane, passing lane and two lane total, which is less than $\alpha = 0.05$. Therefore, H_a is concluded, i.e., the mean difference is greater than zero or μ_1 is significantly greater than μ_2 . This implies that the Kalman predictor in

combination with the time series method provides much better predictions of traffic flow rates than the time series method.

4.3. Prediction of Traffic Congestion

Once the traffic capacity is known, the dynamic prediction of traffic flow rates discussed above constitutes a dynamic prediction of traffic congestion. From Table 10, it can be found that the traffic capacity of four –lane freeway in Indiana is 1767 passenger cars per hour per lane (pcphpl). Thus, the traffic congestion at this location can be predicted with the Kalman predictor method at each step of the prediction according to the following criteria:

If $\hat{f}(t+1|t) < 1767$ passenger cars per hour per lane, then no congestion at time t+1 is predicted;

If $\hat{f}(t+1|t) \geq 1767$ passenger cars per hour, then congestion at time t+1 is predicted.

This study showed that using the Kalman predictor in combination with the first-order autoregressive process of time series provided significantly improved traffic flow predictions over using only the time series method. This Kalman predictor model predicts the traffic flow dynamically with each newly available traffic data. Therefore, it can be used as an efficient tool for real-time freeway traffic control and can be applied in such areas as the Intelligent Transportation Systems. A dynamic prediction of traffic flow rate with the Kalman predictor constitutes a dynamic prediction of traffic congestion as long as the traffic capacity is given.

CHAPTER 5. CONCLUSIONS AND IMPLEMENTATION SUGGESTIONS

Traffic data on Indiana freeways was recorded with WIM devices and traffic counters. The traffic measurements from the 18 WIM stations were utilized to analyze the traffic characteristics and those recorded with traffic counters were utilized to develop the model for dynamically predicting traffic flows. Traffic volumes on the 18 WIM stations were presented in terms of average hourly traffic (AHT) and average daily traffic (ADT) on each lane. Average traffic speeds for each lane of the 18 WIM stations were also calculated and presented. Proportions of heavy vehicles were expressed as the average heavy vehicle percentages (AHVP). Lane distributions of traffic flows were summarized. The traffic data showed that on four-lane freeways the driving lane sustained a greater portion of traffic than the passing lane. However, on six-lane freeways the traffic lane distributions did not follow an apparent pattern over the three lanes in each direction. To examine the traffic lane distribution patterns on four-lane freeways, the AHT ratios were used to assess the effect of traffic volume on lane distribution. An AHT ratio was defined as the ratio of the average hourly traffic on driving lane to the average hourly traffic on passing lane. It showed that AHT ratio and traffic volume had an inversely proportional relationship. As traffic volume increases, vehicles tend to spread more evenly over the available lanes. Under light traffic condition on four-lane freeways (two lanes in each direction), most vehicles travel in the driving lane and use the passing lane mainly for passing maneuvers.

Traffic volumes vary during the days of the week. Traffic volume variations by day of the week are affected by the locations and types of highways. To determine the volume

variations, the traffic volume proportion of each day of the week was calculated as the percentage of the weekly traffic volume. Although the volume variations differ from site to site, traffic volume proportions on Fridays were greater than average at all of the 18 WIM sites. All of the 18 sites have higher than average traffic volumes on Fridays, eight sites on Thursdays, and only two sites on Mondays or Sundays. The information of traffic volume variations by day of the week is important for highway agencies. For example, the information can be utilized to schedule highway maintenance and construction activities on the days with relatively light traffic, so that traffic delay and user cost can be minimized.

Capacity is defined in terms of the maximum rate of flow that can be accommodated by a given traffic facility under prevailing conditions (TRB 1994). Traffic congestion occurs when traffic flow exceeds the capacity of the roadway. Consequently, during congestion vehicles travel at reduced speeds and with fluctuating traffic flow rates. Motorists endure considerably greater traffic delays under congested traffic conditions than under uncongested conditions. Based on the traffic data from the 18 WIM stations, the observed capacity values range from 1489 to 2006 pcphpl with an average value of 1767 pcphpl on four-lane freeways and range from 1463 to 2093 pcphpl with an average value of 1778 pcphpl on six-lane freeways.

Given the freeway capacity values, it was desired to develop methods for predicting traffic flow and congestion so that appropriate traffic control strategies could be applied to avoid traffic congestion and to reduce traffic delay. Such a method was developed in this study using the Kalman predictor in combination with the first-order autoregressive process of time series. The method provides significantly improved traffic flow predictions over using only the time series method. It predicts freeway traffic flow dynamically with each newly available traffic data. Dynamic traffic predictions with the developed model can be performed for individual

lanes as well as for all the lanes of each travel direction. Therefore, the prediction model can be used as an efficient tool for real-time traffic control. This study showed that a dynamic prediction of traffic flow rate with this prediction model would also constitute a dynamic prediction of traffic congestion as long as the traffic capacity was given.

This study provides the values of key traffic characteristics on Indiana freeways and the ability to dynamically predict traffic flows. It is believed that the research results will provide INDOT important values of traffic measures for highway design, planning, and construction and enable INDOT to predict traffic flow conditions in real time and adaptively change traffic control strategies. The following suggestions should be considered for implementation of the research results.

1. The values of key traffic characteristics, such as traffic volume, speed, heavy vehicle percentage, lane distribution, daily variation, and capacity, should be considered in highway design and planning, traffic control, and construction activity scheduling. For example, the information of traffic volume variations by day of the week can be utilized to schedule highway maintenance and construction activities on the days with relatively light traffic, so that traffic delay and user cost can be minimized. The traffic volume and capacity values can be used for effective traffic control, traffic delay reduction and congestion management. Traffic volume and heavy vehicle proportion will be useful for pavement and bridge management.

2. Adaptive traffic control is an essential component of an Intelligent Transportation System (ITS). The real time prediction of traffic flow and congestion ability can be utilized in ITS program to enhance the capability and efficiency of freeway traffic control in Indiana.
3. INDOT should make effort to more efficiently utilize the WIM devices installed on the Indiana highway system. There are 35 WIM stations on Indiana highways. Twenty of these WIM stations are on interstate highways. The WIM devices collect traffic data continuously and provide summarized traffic data, including vehicle weight, speed, flow rate, classification. The obvious advantage of WIM data is the availability of large amount of data. However, it was found during this study that WIM devices were not always reliable because of their frequent malfunctions. When a WIM device does not work properly, it usually can not be detected unless someone checks the collected data in detail. This is because an out-of-order WIM device often would not stop collecting data and the abnormality of the data can only be discovered by a careful review in its tabulated form. Although WIM devices can be set up to accommodate a number of data requirements, many data requirements of this study could not be satisfied because of lack of personnel who sufficiently know the WIM software to activate the required WIM functions. To solve these problems, it is needed for INDOT to effectively maintain the WIM devices and assure the quality WIM data. It is therefore recommended that INDOT develop systematic procedures to train personnel for effective use of WIM software and to monitor and maintain the installed WIM devices.

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APPENDIX: Summarized Traffic Data from WIM Stations

Site 411 on I-65, February 1998						
	Mean Hourly Volume (vph)	Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound	
Sundays	Mean Hourly Volume (vph)	259	180	355	170	
	Mean Daily Volume (vpd)	6207	4311	8524	4080	
	Mean Speed (km/h) (mph)	115 72	118 73	111 69	118 73	
Mondays	Mean Hourly Volume (vph)	153	110	336	120	
	Mean Daily Volume (vpd)	3677	2632	8074	2881	
	Mean Speed (km/h) (mph)	115 71	117 72	109 68	116 72	
Tuesdays	Mean Hourly Volume (vph)	121	94	347	105	
	Mean Daily Volume (vpd)	2914	2263	8320	2524	
	Mean Speed (km/h) (mph)	114 71	116 72	108 67	115 72	
Wednesdays	Mean Hourly Volume (vph)	119	100	343	112	
	Mean Daily Volume (vpd)	2853	2391	8244	2680	
	Mean Speed (km/h) (mph)	113 70	116 72	108 67	115 72	
Thursdays	Mean Hourly Volume (vph)	137	129	362	123	
	Mean Daily Volume (vpd)	3284	3092	8692	2956	
	Mean Speed (km/h) (mph)	114 71	115 72	108 67	116 72	
Fridays	Mean Hourly Volume (vph)	212	211	416	200	
	Mean Daily Volume (vpd)	5088	5053	9989	4802	
	Mean Speed (km/h) (mph)	114 71	117 73	109 68	117 73	
Saturdays	Mean Hourly Volume (vph)	240	136	358	140	
	Mean Daily Volume (vpd)	5759	3254	8585	3361	
	Mean Speed (km/h) (mph)	115 71	117 73	111 69	118 73	
Monthly	Mean Hourly Volume (vph)	177	137	360	139	
	Mean Daily Volume (vpd)	4255	3285	8632	3326	
	Mean Speed (km/h) (mph)	114 71	116 72	109 68	116 72	

Site 411 on I-65, April 1998		Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)	353	161	414	245
	Mean Daily Volume (vpd)	8482	3869	9930	5887
	Mean Speed (km/h)	115	117	112	118
	(mph)	72	73	70	73
Mondays	Mean Hourly Volume (vph)	202	103	386	159
	Mean Daily Volume (vpd)	4859	2474	9253	3813
	Mean Speed (km/h)	113	113	107	115
	(mph)	70	70	67	71
Tuesdays	Mean Hourly Volume (vph)	148	79	391	131
	Mean Daily Volume (vpd)	3563	1888	9384	3143
	Mean Speed (km/h)	114	113	108	115
	(mph)	71	70	67	72
Wednesdays	Mean Hourly Volume (vph)	149	93	404	148
	Mean Daily Volume (vpd)	3565	2221	9695	3562
	Mean Speed (km/h)	114	116	108	116
	(mph)	71	72	67	72
Thursdays	Mean Hourly Volume (vph)	183	166	439	211
	Mean Daily Volume (vpd)	4388	3985	10527	5069
	Mean Speed (km/h)	113	115	108	115
	(mph)	70	71	67	72
Fridays	Mean Hourly Volume (vph)	265	225	499	296
	Mean Daily Volume (vpd)	6353	5409	11979	7112
	Mean Speed (km/h)	115	117	111	118
	(mph)	71	73	69	73
Saturdays	Mean Hourly Volume (vph)	304	142	406	183
	Mean Daily Volume (vpd)	7303	3397	9733	4400
	Mean Speed (km/h)	115	118	111	118
	(mph)	72	73	69	73
Monthly	Mean Hourly Volume (vph)	234	143	423	200
	Mean Daily Volume (vpd)	5606	3427	10146	4811
	Mean Speed (km/h)	114	116	109	116
	(mph)	71	72	68	72

Site 411 on I-65, May 1998		Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)	337	115	406	201
	Mean Daily Volume (vpd)	8097	2764	9744	4829
	Mean Speed (km/h) (mph)	114 71	116 72	112 70	118 74
Mondays	Mean Hourly Volume (vph)	248	79	398	164
	Mean Daily Volume (vpd)	5961	1891	9558	3925
	Mean Speed (km/h) (mph)	115 71	116 72	110 69	117 73
Tuesdays	Mean Hourly Volume (vph)	163	53	397	137
	Mean Daily Volume (vpd)	3919	1261	9528	3288
	Mean Speed (km/h) (mph)	115 71	114 71	109 68	116 72
Wednesdays	Mean Hourly Volume (vph)	157	51	407	147
	Mean Daily Volume (vpd)	3766	1214	9764	3517
	Mean Speed (km/h) (mph)	114 71	117 73	109 68	116 72
Thursdays	Mean Hourly Volume (vph)	172	31	430	178
	Mean Daily Volume (vpd)	4133	748	10311	4275
	Mean Speed (km/h) (mph)	114 71	116 72	109 68	116 72
Fridays	Mean Hourly Volume (vph)	273	147	506	309
	Mean Daily Volume (vpd)	6547	3533	12133	7406
	Mean Speed (km/h) (mph)	114 71	116 72	110 68	117 73
Saturdays	Mean Hourly Volume (vph)	301	90	433	219
	Mean Daily Volume (vpd)	7219	2171	10387	5261
	Mean Speed (km/h) (mph)	114 71	114 71	110 69	117 73
Monthly	Mean Hourly Volume (vph)	242	84	426	197
	Mean Daily Volume (vpd)	5809	2007	10234	4725
	Mean Speed (km/h) (mph)	114 71	116 72	110 68	117 73

Site 411 on I-65, June 1998		Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)	467	272	590	410
	Mean Daily Volume (vpd)	11217	6528	14167	9849
	Mean Speed (km/h) (mph)	103 64	93 58	104 65	101 63
Mondays	Mean Hourly Volume (vph)	331	198	541	300
	Mean Daily Volume (vpd)	7946	4759	12985	7202
	Mean Speed (km/h) (mph)	100 62	92 57	102 64	99 62
Tuesdays	Mean Hourly Volume (vph)	295	206	541	278
	Mean Daily Volume (vpd)	7073	4952	12985	6664
	Mean Speed (km/h) (mph)	98 61	92 57	102 63	99 61
Wednesdays	Mean Hourly Volume (vph)	295	217	545	285
	Mean Daily Volume (vpd)	7086	5198	13079	6843
	Mean Speed (km/h) (mph)	98 61	93 58	102 64	99 62
Thursdays	Mean Hourly Volume (vph)	322	213	568	313
	Mean Daily Volume (vpd)	7729	5104	13623	7502
	Mean Speed (km/h) (mph)	99 62	92 57	103 64	100 62
Fridays	Mean Hourly Volume (vph)	410	253	634	408
	Mean Daily Volume (vpd)	9831	6073	15210	9800
	Mean Speed (km/h) (mph)	102 63	94 58	104 65	103 64
Saturdays	Mean Hourly Volume (vph)	442	238	573	343
	Mean Daily Volume (vpd)	10610	5710	13749	8230
	Mean Speed (km/h) (mph)	103 64	94 58	104 65	101 63
Monthly	Mean Hourly Volume (vph)	362	226	568	331
	Mean Daily Volume (vpd)	8700	5433	13639	7941
	Mean Speed (km/h) (mph)	100 62	93 58	103 64	100 62

Site 413 on I-94, January 1999		Right Lane East Bound	Middle Lane East Bound	Left Lane East Bound	Right Lane West Bound	Middle Lane West Bound	Left Lane West Bound
Sundays	Mean Hourly Volume (vph)	145	202	60	219	233	50
	Mean Daily Volume (vpd)	3481	4840	1436	5248	5593	1211
	Mean Speed (km/h) (mph)	103 64	106 66	94 58	96 60	99 62	83 51
Mondays	Mean Hourly Volume (vph)	188	174	30	277	247	32
	Mean Daily Volume (vpd)	4502	4185	728	6649	5920	757
	Mean Speed (km/h) (mph)	109 68	105 65	89 56	91 57	96 59	85 53
Tuesdays	Mean Hourly Volume (vph)	196	189	34	321	257	28
	Mean Daily Volume (vpd)	4707	4534	827	7708	6167	675
	Mean Speed (km/h) (mph)	110 68	106 66	97 60	94 59	99 61	92 57
Wednesdays	Mean Hourly Volume (vph)	209	208	31	311	244	29
	Mean Daily Volume (vpd)	5020	5001	738	7458	5864	694
	Mean Speed (km/h) (mph)	109 68	103 64	93 58	92 57	97 60	91 56
Thursdays	Mean Hourly Volume (vph)	280	211	48	327	275	44
	Mean Daily Volume (vpd)	6730	5072	1143	7853	6603	1066
	Mean Speed (km/h) (mph)	108 67	108 67	107 67	97 60	102 63	103 64
Fridays	Mean Hourly Volume (vph)	160	254	89	295	315	69
	Mean Daily Volume (vpd)	3834	6091	2134	7084	7563	1662
	Mean Speed (km/h) (mph)	111 69	107 66	105 65	97 60	101 63	99 61
Saturdays	Mean Hourly Volume (vph)	108	178	49	196	216	42
	Mean Daily Volume (vpd)	2581	4272	1170	4716	5192	1004
	Mean Speed (km/h) (mph)	106 66	100 62	96 60	91 56	95 59	95 59
Monthly	Mean Hourly Volume (vph)	179	203	50	274	255	43
	Mean Daily Volume (vpd)	4300	4877	1208	6578	6127	1037
	Mean Speed (km/h) (mph)	108 67	105 65	97 61	94 58	98 61	92 57

Site 414 on I-69, January 1998

		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	220	74	282	84
	Mean Daily Volume (vpd)	5290	1777	6766	2026
	Mean Speed (km/h) (mph)	111 69	114 71	109 67	115 72
Mondays	Mean Hourly Volume (vph)	272	88	300	76
	Mean Daily Volume (vpd)	6521	2124	7201	1817
	Mean Speed (km/h) (mph)	109 68	115 72	108 67	117 73
Tuesdays	Mean Hourly Volume (vph)	290	91	307	81
	Mean Daily Volume (vpd)	6952	2190	7363	1939
	Mean Speed (km/h) (mph)	109 68	115 71	106 66	115 72
Wednesdays	Mean Hourly Volume (vph)	287	97	327	89
	Mean Daily Volume (vpd)	6886	2340	7838	2139
	Mean Speed (km/h) (mph)	108 67	115 71	105 66	115 72
Thursdays	Mean Hourly Volume (vph)	262	91	303	87
	Mean Daily Volume (vpd)	6288	2173	7268	2082
	Mean Speed (km/h) (mph)	108 67	112 69	106 66	115 71
Fridays	Mean Hourly Volume (vph)	314	123	340	111
	Mean Daily Volume (vpd)	7527	2950	8151	2656
	Mean Speed (km/h) (mph)	110 68	115 72	108 67	117 72
Saturdays	Mean Hourly Volume (vph)	262	83	281	72
	Mean Daily Volume (vpd)	6280	2000	6752	1735
	Mean Speed (km/h) (mph)	110 69	115 71	108 67	117 73
Monthly	Mean Hourly Volume (vph)	273	93	306	86
	Mean Daily Volume (vpd)	6551	2237	7339	2066
	Mean Speed (km/h) (mph)	109 68	114 71	107 67	116 72

Site 414 on I-69, February 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	260	85	319	108
	Mean Daily Volume (vpd)	6230	2034	7667	2584
	Mean Speed (km/h)	112	114	109	115
	(mph)	69	71	68	71
Mondays	Mean Hourly Volume (vph)	283	84	321	78
	Mean Daily Volume (vpd)	6800	2013	7701	1881
	Mean Speed (km/h)	110	114	108	115
	(mph)	68	71	67	72
Tuesdays	Mean Hourly Volume (vph)	299	91	317	84
	Mean Daily Volume (vpd)	7176	2186	7598	2010
	Mean Speed (km/h)	108	114	107	116
	(mph)	67	71	66	72
Wednesdays	Mean Hourly Volume (vph)	325	104	323	95
	Mean Daily Volume (vpd)	7811	2486	7749	2288
	Mean Speed (km/h)	109	114	104	116
	(mph)	68	71	65	72
Thursdays	Mean Hourly Volume (vph)	338	106	353	98
	Mean Daily Volume (vpd)	8115	2543	8468	2348
	Mean Speed (km/h)	109	115	106	115
	(mph)	68	71	66	71
Fridays	Mean Hourly Volume (vph)	373	159	386	139
	Mean Daily Volume (vpd)	8946	3818	9259	3330
	Mean Speed (km/h)	110	115	108	117
	(mph)	68	72	67	73
Saturdays	Mean Hourly Volume (vph)	316	99	316	91
	Mean Daily Volume (vpd)	7591	2386	7576	2185
	Mean Speed (km/h)	111	116	109	117
	(mph)	69	72	68	73
Monthly	Mean Hourly Volume (vph)	313	104	333	99
	Mean Daily Volume (vpd)	7524	2495	8002	2375
	Mean Speed (km/h)	110	115	107	116
	(mph)	68	71	67	72

Site 414 on I-69, April 1998					
Sundays	Mean Hourly Volume (vph)	Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
	Mean Daily Volume (vpd)	339	8135	106	418
Mean Speed (km/h)		113	114	109	117
	(mph)	70	71	68	73
Mondays	Mean Hourly Volume (vph)	317	91	379	122
	Mean Daily Volume (vpd)	7602	2195	9092	2937
Mean Speed (km/h)		111	115	108	117
	(mph)	69	72	67	73
Tuesdays	Mean Hourly Volume (vph)	314	90	364	114
	Mean Daily Volume (vpd)	7525	2166	8741	2739
Mean Speed (km/h)		110	115	107	116
	(mph)	68	71	66	72
Wednesdays	Mean Hourly Volume (vph)	331	97	375	130
	Mean Daily Volume (vpd)	7939	2321	8990	3119
Mean Speed (km/h)		110	115	107	116
	(mph)	68	72	66	72
Thursdays	Mean Hourly Volume (vph)	360	135	399	149
	Mean Daily Volume (vpd)	8652	3247	9572	3573
Mean Speed (km/h)		110	116	107	116
	(mph)	68	72	66	72
Fridays	Mean Hourly Volume (vph)	425	189	437	175
	Mean Daily Volume (vpd)	10190	4525	10478	4196
Mean Speed (km/h)		111	116	108	117
	(mph)	69	72	67	73
Saturdays	Mean Hourly Volume (vph)	332	88	392	135
	Mean Daily Volume (vpd)	7976	2121	9419	3232
Mean Speed (km/h)		112	116	109	118
	(mph)	70	72	68	73
Monthly	Mean Hourly Volume (vph)	346	114	394	144
	Mean Daily Volume (vpd)	8293	2739	9461	3465
Mean Speed (km/h)		111	115	108	117
	(mph)	69	72	67	73

Site 414 on I-69, May 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	221	113	367	149
	Mean Daily Volume (vpd)	5305	2712	8801	3586
Mondays	Mean Speed (km/h)	110	117	108	116
	Mean Speed (mph)	69	73	67	72
Tuesdays	Mean Hourly Volume (vph)	191	90	353	108
	Mean Daily Volume (vpd)	4584	2171	8466	2589
Wednesdays	Mean Speed (km/h)	110	115	108	114
	Mean Speed (mph)	68	71	67	71
Thursdays	Mean Hourly Volume (vph)	176	99	369	112
	Mean Daily Volume (vpd)	4221	2366	8861	2696
Fridays	Mean Speed (km/h)	113	116	107	117
	Mean Speed (mph)	70	72	67	73
Saturdays	Mean Hourly Volume (vph)	235	113	386	135
	Mean Daily Volume (vpd)	5648	2710	9260	3249
Monthly	Mean Speed (km/h)	112	115	107	117
	Mean Speed (mph)	70	72	67	73
Sundays	Mean Hourly Volume (vph)	260	148	409	150
	Mean Daily Volume (vpd)	6228	3543	9811	3607
Mondays	Mean Speed (km/h)	112	115	107	116
	Mean Speed (mph)	69	72	66	72
Tuesdays	Mean Hourly Volume (vph)	229	188	443	187
	Mean Daily Volume (vpd)	5499	4503	10631	4497
Wednesdays	Mean Speed (km/h)	113	116	108	117
	Mean Speed (mph)	70	72	67	73
Thursdays	Mean Hourly Volume (vph)	222	112	380	126
	Mean Daily Volume (vpd)	5321	2698	9120	3015
Fridays	Mean Speed (km/h)	105	117	108	118
	Mean Speed (mph)	65	72	67	73
Saturdays	Mean Hourly Volume (vph)	217	125	387	141
	Mean Daily Volume (vpd)	5206	3005	9295	3376
Monthly	Mean Speed (km/h)	110	116	108	116
	Mean Speed (mph)	69	72	67	72

Site 414 on I-69, August 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	479	247	506	274
	Mean Daily Volume (vpd)	11493	5924	12132	6564
Mondays	Mean Speed (km/h)	87	101	104	102
	(mph)	54	63	64	63
	Mean Hourly Volume (vph)	453	200	474	206
Tuesdays	Mean Daily Volume (vpd)	10868	4805	11366	4933
	Mean Speed (km/h)	86	100	104	101
	(mph)	53	62	64	62
Wednesdays	Mean Hourly Volume (vph)	395	193	480	214
	Mean Daily Volume (vpd)	9478	4633	11520	5132
	Mean Speed (km/h)	86	99	103	101
Thursdays	(mph)	53	62	64	63
	Mean Hourly Volume (vph)	465	206	491	220
	Mean Daily Volume (vpd)	11165	4937	11777	5272
Fridays	Mean Speed (km/h)	86	100	103	101
	(mph)	53	62	64	63
	Mean Hourly Volume (vph)	482	221	508	235
Saturdays	Mean Daily Volume (vpd)	11579	5312	12201	5647
	Mean Speed (km/h)	86	101	104	102
	(mph)	53	63	64	63
Monthly	Mean Hourly Volume (vph)	475	265	533	275
	Mean Daily Volume (vpd)	11399	6369	12788	6605
	Mean Speed (km/h)	86	102	104	103
Monthly	(mph)	54	64	65	64
	Mean Hourly Volume (vph)	471	219	489	227
	Mean Daily Volume (vpd)	11299	5246	11728	5449
Monthly	Mean Speed (km/h)	87	101	104	101
	(mph)	54	62	65	63
	Mean Hourly Volume (vph)	461	222	496	236
Monthly	Mean Daily Volume (vpd)	11058	5318	11912	5657
	Mean Speed (km/h)	86	100	104	101
	(mph)	54	62	64	63

Site 414 on I-69, October 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	329	135	399	183
	Mean Daily Volume (vpd)	7898	3251	9570	4391
Mondays	Mean Speed (km/h)	86	115	108	116
	Mean Speed (mph)	53	71	67	72
Tuesdays	Mean Hourly Volume (vph)	357	96	371	108
	Mean Daily Volume (vpd)	8573	2297	8896	2586
Wednesdays	Mean Speed (km/h)	86	116	108	117
	Mean Speed (mph)	53	72	67	73
Thursdays	Mean Hourly Volume (vph)	358	100	373	106
	Mean Daily Volume (vpd)	8591	2395	8958	2549
Fridays	Mean Speed (km/h)	86	115	108	117
	Mean Speed (mph)	53	71	67	72
Saturdays	Mean Hourly Volume (vph)	310	102	379	113
	Mean Daily Volume (vpd)	7435	2453	9091	2708
Monthly	Mean Speed (km/h)	86	116	108	116
	Mean Speed (mph)	53	72	67	72
Sundays	Mean Hourly Volume (vph)	375	113	398	128
	Mean Daily Volume (vpd)	9006	2702	9548	3079
Mondays	Mean Speed (km/h)	85	117	108	117
	Mean Speed (mph)	53	73	67	73
Tuesdays	Mean Hourly Volume (vph)	425	174	428	172
	Mean Daily Volume (vpd)	10200	4164	10270	4135
Wednesdays	Mean Speed (km/h)	86	117	107	117
	Mean Speed (mph)	54	72	67	73
Thursdays	Mean Hourly Volume (vph)	306	137	379	126
	Mean Daily Volume (vpd)	7352	3294	9108	3034
Fridays	Mean Speed (km/h)	88	117	109	117
	Mean Speed (mph)	55	72	67	73
Saturdays	Mean Hourly Volume (vph)	353	125	391	136
	Mean Daily Volume (vpd)	8480	3000	9394	3253
Monthly	Mean Speed (km/h)	86	116	108	117
	Mean Speed (mph)	54	72	67	73

Site 415 on I-69, January 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	287	81	281	74
	Mean Daily Volume (vpd)	6893	1935	6753	1785
	Mean Speed (km/h) (mph)	92 57	101 63	110 68	115 72
Mondays	Mean Hourly Volume (vph)	357	118	344	95
	Mean Daily Volume (vpd)	8577	2841	8266	2276
	Mean Speed (km/h) (mph)	96 59	101 63	109 68	116 72
Tuesdays	Mean Hourly Volume (vph)	367	115	352	99
	Mean Daily Volume (vpd)	8808	2759	8450	2366
	Mean Speed (km/h) (mph)	96 60	101 63	108 67	115 72
Wednesdays	Mean Hourly Volume (vph)	364	119	359	108
	Mean Daily Volume (vpd)	8742	2861	8615	2593
	Mean Speed (km/h) (mph)	95 59	101 63	107 67	114 71
Thursdays	Mean Hourly Volume (vph)	338	110	340	102
	Mean Daily Volume (vpd)	8121	2635	8162	2450
	Mean Speed (km/h) (mph)	92 57	101 62	107 66	113 70
Fridays	Mean Hourly Volume (vph)	390	141	398	136
	Mean Daily Volume (vpd)	9370	3379	9549	3272
	Mean Speed (km/h) (mph)	93 58	103 64	108 67	115 72
Saturdays	Mean Hourly Volume (vph)	319	87	324	87
	Mean Daily Volume (vpd)	7659	2085	7784	2095
	Mean Speed (km/h) (mph)	94 58	101 63	110 68	117 72
Monthly	Mean Hourly Volume (vph)	347	110	344	101
	Mean Daily Volume (vpd)	8317	2648	8252	2424
	Mean Speed (km/h) (mph)	94 58	101 63	109 67	115 72

Site 415 on I-69, February 1998						
	Mean Hourly Volume (vph)	Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound	
Sundays	Mean Hourly Volume (vph)	310	93	317	90	
	Mean Daily Volume (vpd)	7439	2242	7600	2168	
	Mean Speed (km/h)	94	97	111	117	
	(mph)	58	60	69	72	
Mondays	Mean Hourly Volume (vph)	361	116	364	102	
	Mean Daily Volume (vpd)	8667	2782	8736	2451	
	Mean Speed (km/h)	96	100	110	116	
	(mph)	60	62	68	72	
Tuesdays	Mean Hourly Volume (vph)	359	118	365	104	
	Mean Daily Volume (vpd)	8620	2826	8760	2492	
	Mean Speed (km/h)	97	102	109	116	
	(mph)	60	63	68	72	
Wednesdays	Mean Hourly Volume (vph)	369	123	372	110	
	Mean Daily Volume (vpd)	8845	2950	8916	2630	
	Mean Speed (km/h)	97	101	109	116	
	(mph)	60	63	68	72	
Thursdays	Mean Hourly Volume (vph)	380	131	389	121	
	Mean Daily Volume (vpd)	9112	3155	9327	2912	
	Mean Speed (km/h)	97	102	109	116	
	(mph)	60	64	68	72	
Fridays	Mean Hourly Volume (vph)	417	163	426	157	
	Mean Daily Volume (vpd)	10001	3914	10232	3778	
	Mean Speed (km/h)	97	101	110	117	
	(mph)	60	63	68	73	
Saturdays	Mean Hourly Volume (vph)	341	93	350	93	
	Mean Daily Volume (vpd)	8194	2228	8390	2221	
	Mean Speed (km/h)	96	100	111	118	
	(mph)	60	62	69	73	
Monthly	Mean Hourly Volume (vph)	362	120	369	111	
	Mean Daily Volume (vpd)	8697	2871	8852	2664	
	Mean Speed (km/h)	96	100	110	116	
	(mph)	60	62	68	72	

Site 415 on I-69, June 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	377	366	588	258
	Mean Daily Volume (vpd)	9056	8774	14114	6199
	Mean Speed (km/h) (mph)	98 61	98 61	100 62	95 59
Mondays	Mean Hourly Volume (vph)	401	327	566	218
	Mean Daily Volume (vpd)	9621	7858	13584	5237
	Mean Speed (km/h) (mph)	99 61	98 61	99 62	93 58
Tuesdays	Mean Hourly Volume (vph)	387	313	574	213
	Mean Daily Volume (vpd)	9278	7504	13786	5123
	Mean Speed (km/h) (mph)	97 61	98 61	99 61	93 58
Wednesdays	Mean Hourly Volume (vph)	403	324	584	223
	Mean Daily Volume (vpd)	9665	7785	14026	5341
	Mean Speed (km/h) (mph)	99 61	99 61	98 61	93 58
Thursdays	Mean Hourly Volume (vph)	392	339	610	236
	Mean Daily Volume (vpd)	9408	8143	14646	5658
	Mean Speed (km/h) (mph)	98 61	99 61	100 62	94 59
Fridays	Mean Hourly Volume (vph)	410	358	708	284
	Mean Daily Volume (vpd)	9828	8587	16990	6822
	Mean Speed (km/h) (mph)	98 61	100 62	97 60	94 59
Saturdays	Mean Hourly Volume (vph)	349	311	627	257
	Mean Daily Volume (vpd)	8373	7463	15045	6177
	Mean Speed (km/h) (mph)	97 60	98 61	97 61	93 58
Monthly	Mean Hourly Volume (vph)	389	333	606	240
	Mean Daily Volume (vpd)	9327	7994	14538	5753
	Mean Speed (km/h) (mph)	98 61	98 61	99 61	94 58

Site 415 on I-69, July 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	428	230	465	135
	Mean Daily Volume (vpd)	10265	5526	11161	3229
	Mean Speed (km/h) (mph)	107 66	110 69	103 64	112 69
Mondays	Mean Hourly Volume (vph)	375	185	446	95
	Mean Daily Volume (vpd)	8996	4442	10708	2277
	Mean Speed (km/h) (mph)	106 66	110 68	106 66	115 71
Tuesdays	Mean Hourly Volume (vph)	370	177	453	96
	Mean Daily Volume (vpd)	8877	4250	10882	2307
	Mean Speed (km/h) (mph)	105 65	112 70	106 66	114 71
Wednesdays	Mean Hourly Volume (vph)	358	170	467	103
	Mean Daily Volume (vpd)	8590	4069	11209	2483
	Mean Speed (km/h) (mph)	106 66	107 66	106 66	114 71
Thursdays	Mean Hourly Volume (vph)	388	208	509	130
	Mean Daily Volume (vpd)	9305	5000	12219	3118
	Mean Speed (km/h) (mph)	106 66	112 70	106 66	114 71
Fridays	Mean Hourly Volume (vph)	410	230	565	158
	Mean Daily Volume (vpd)	9846	5517	13565	3795
	Mean Speed (km/h) (mph)	106 66	108 67	96 60	105 65
Saturdays	Mean Hourly Volume (vph)	360	170	493	127
	Mean Daily Volume (vpd)	8649	4078	11841	3043
	Mean Speed (km/h) (mph)	107 66	108 67	106 66	114 71
Monthly	Mean Hourly Volume (vph)	384	196	488	122
	Mean Daily Volume (vpd)	9221	4713	11720	2916
	Mean Speed (km/h) (mph)	106 66	109 68	104 65	112 70

Site 415 on I-69, August 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	497	357	468	287
	Mean Daily Volume (vpd)	11934	8565	11221	6881
	Mean Speed (km/h) (mph)	101 63	104 65	99 61	97 61
Mondays	Mean Hourly Volume (vph)	458	290	456	243
	Mean Daily Volume (vpd)	10987	6956	10945	5831
	Mean Speed (km/h) (mph)	100 62	103 64	101 63	99 62
Tuesdays	Mean Hourly Volume (vph)	458	281	476	243
	Mean Daily Volume (vpd)	10992	6748	11419	5825
	Mean Speed (km/h) (mph)	100 62	103 64	101 63	99 62
Wednesdays	Mean Hourly Volume (vph)	466	293	490	246
	Mean Daily Volume (vpd)	11188	7022	11764	5905
	Mean Speed (km/h) (mph)	101 63	104 64	102 63	100 62
Thursdays	Mean Hourly Volume (vph)	475	303	508	267
	Mean Daily Volume (vpd)	11401	7283	12184	6406
	Mean Speed (km/h) (mph)	101 63	104 65	102 63	101 62
Fridays	Mean Hourly Volume (vph)	488	354	540	366
	Mean Daily Volume (vpd)	11707	8485	12970	8783
	Mean Speed (km/h) (mph)	101 63	105 65	100 62	100 62
Saturdays	Mean Hourly Volume (vph)	454	290	503	296
	Mean Daily Volume (vpd)	10893	6967	12065	7095
	Mean Speed (km/h) (mph)	101 63	104 65	102 64	100 62
Monthly	Mean Hourly Volume (vph)	471	310	490	278
	Mean Daily Volume (vpd)	11297	7438	11758	6668
	Mean Speed (km/h) (mph)	101 63	104 64	101 63	100 62

Site 415 on I-69, September 1998							
	Mean Hourly Volume (vph)	Mean Daily Volume (vpd)	Mean Speed (km/h)	Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	466	11177		313	387	332	7979
	102	63		100	99	99	61
	478			313	403	323	7742
Mondays	11469			7520	9672		
	103	64		101	100	99	62
	459	11014		282	410	305	7326
Tuesdays	102	64		100	100	99	62
	451			296	424	311	
	10824			7100	10186	7453	
Wednesdays	102	63		100	100	99	61
	472			314	440	347	
	11325			7543	10568	8336	
Thursdays	103	64		102	101	100	62
	521			364	454	435	
	12507			8727	10896	10429	
Fridays	104	64		103	97	96	60
	453			285	417	348	
	10877			6848	10003	8351	
Saturdays	103	64		101	98	96	60
	470			308	419	341	
	11287			7400	10059	8175	
Monthly	103	64		101	99	98	61
				63	62	61	

Site 415 on I-69, October 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	335	188	136	226
	Mean Daily Volume (vpd)	8043	4508	3266	5424
	Mean Speed (km/h) (mph)	110 68	116 72	107 67	111 69
Mondays	Mean Hourly Volume (vph)	338	167	280	183
	Mean Daily Volume (vpd)	8107	3999	6731	4386
	Mean Speed (km/h) (mph)	109 68	115 71	107 67	111 69
Tuesdays	Mean Hourly Volume (vph)	355	178	297	198
	Mean Daily Volume (vpd)	8514	4271	7133	4759
	Mean Speed (km/h) (mph)	109 68	114 71	107 67	111 69
Wednesdays	Mean Hourly Volume (vph)	345	188	225	195
	Mean Daily Volume (vpd)	8277	4510	5409	4678
	Mean Speed (km/h) (mph)	108 67	114 71	106 66	110 68
Thursdays	Mean Hourly Volume (vph)	329	161	261	195
	Mean Daily Volume (vpd)	7902	3872	6263	4675
	Mean Speed (km/h) (mph)	110 68	115 72	107 66	110 68
Fridays	Mean Hourly Volume (vph)	436	265	319	293
	Mean Daily Volume (vpd)	10463	6366	7656	7023
	Mean Speed (km/h) (mph)	110 68	115 71	107 66	111 69
Saturdays	Mean Hourly Volume (vph)	328	166	300	196
	Mean Daily Volume (vpd)	7880	3976	7200	4699
	Mean Speed (km/h) (mph)	109 67	114 71	108 67	110 69
Monthly	Mean Hourly Volume (vph)	351	187	250	213
	Mean Daily Volume (vpd)	8434	4493	5999	5120
	Mean Speed (km/h) (mph)	110 68	115 71	107 67	110 69

Site 511 on I-70, April 1998						
	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound	
Sundays	Mean Daily Volume (vpd)	446	221	429	148	
	Mean Speed (km/h) (mph)	10699	5298	10305	3552	
Mondays	Mean Hourly Volume (vph)	103	113	106	119	
	Mean Daily Volume (vpd)	64	70	66	74	
Tuesdays	Mean Hourly Volume (vph)	453	181	449	152	
	Mean Daily Volume (vpd)	10878	4346	10765	3642	
Wednesdays	Mean Hourly Volume (vph)	103	112	105	119	
	Mean Daily Volume (vpd)	64	70	65	74	
Thursdays	Mean Hourly Volume (vph)	449	182	457	161	
	Mean Daily Volume (vpd)	10779	4369	10965	3868	
Fridays	Mean Hourly Volume (vph)	102	112	104	117	
	Mean Daily Volume (vpd)	63	70	64	73	
Saturdays	Mean Hourly Volume (vph)	463	194	469	151	
	Mean Daily Volume (vpd)	11119	4665	11252	3629	
Monthly	Mean Hourly Volume (vph)	102	112	103	117	
	Mean Daily Volume (vpd)	63	70	64	73	
Sundays	Mean Hourly Volume (vph)	473	220	485	160	
	Mean Daily Volume (vpd)	11348	5268	11640	3843	
Mondays	Mean Hourly Volume (vph)	102	112	103	118	
	Mean Daily Volume (vpd)	64	70	64	73	
Tuesdays	Mean Hourly Volume (vph)	493	244	520	263	
	Mean Daily Volume (vpd)	11834	5847	12486	6304	
Wednesdays	Mean Hourly Volume (vph)	103	113	104	117	
	Mean Daily Volume (vpd)	64	70	65	73	
Thursdays	Mean Hourly Volume (vph)	420	165	431	151	
	Mean Daily Volume (vpd)	10078	3955	10333	3634	
Fridays	Mean Hourly Volume (vph)	104	113	105	118	
	Mean Daily Volume (vpd)	65	70	65	73	
Saturdays	Mean Hourly Volume (vph)	458	201	464	169	
	Mean Daily Volume (vpd)	10982	4829	11133	4048	
Monthly	Mean Hourly Volume (vph)	103	112	104	118	
	Mean Daily Volume (vpd)	64	70	65	73	

Site 511 on I-70, May 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	450	244	431	193
	Mean Daily Volume (vpd)	10804	5861	10349	4622
	Mean Speed (km/h) (mph)	104 64	111 69	105 65	116 72
Mondays	Mean Hourly Volume (vph)	469	221	442	192
	Mean Daily Volume (vpd)	11250	5298	10608	4597
	Mean Speed (km/h) (mph)	104 65	111 69	105 65	117 72
Tuesdays	Mean Hourly Volume (vph)	470	200	474	209
	Mean Daily Volume (vpd)	11284	4793	11388	5014
	Mean Speed (km/h) (mph)	103 64	112 69	104 64	116 72
Wednesdays	Mean Hourly Volume (vph)	482	220	488	225
	Mean Daily Volume (vpd)	11560	5282	11712	5399
	Mean Speed (km/h) (mph)	103 64	111 69	103 64	116 72
Thursdays	Mean Hourly Volume (vph)	501	254	500	235
	Mean Daily Volume (vpd)	12032	6104	12002	5646
	Mean Speed (km/h) (mph)	102 64	111 69	103 64	116 72
Fridays	Mean Hourly Volume (vph)	519	276	538	295
	Mean Daily Volume (vpd)	12449	6618	12923	7089
	Mean Speed (km/h) (mph)	103 64	112 70	103 64	116 72
Saturdays	Mean Hourly Volume (vph)	447	193	457	207
	Mean Daily Volume (vpd)	10735	4635	10970	4965
	Mean Speed (km/h) (mph)	104 64	112 70	104 65	116 72
Monthly	Mean Hourly Volume (vph)	476	230	476	223
	Mean Daily Volume (vpd)	11434	5531	11421	5355
	Mean Speed (km/h) (mph)	103 64	112 69	104 65	116 72

Site 511 on I-70, June 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	484	273	469	263
	Mean Daily Volume (vpd)	11622	6546	11262	6313
	Mean Speed (km/h) (mph)	104 65	113 70	105 65	116 72
Mondays	Mean Hourly Volume (vph)	469	223	468	228
	Mean Daily Volume (vpd)	11255	5349	11234	5477
	Mean Speed (km/h) (mph)	103 64	112 70	104 64	115 72
Tuesdays	Mean Hourly Volume (vph)	488	228	489	247
	Mean Daily Volume (vpd)	11712	5474	11732	5935
	Mean Speed (km/h) (mph)	103 64	112 70	102 64	114 71
Wednesdays	Mean Hourly Volume (vph)	496	240	500	254
	Mean Daily Volume (vpd)	11908	5750	11990	6106
	Mean Speed (km/h) (mph)	103 64	112 70	103 64	115 71
Thursdays	Mean Hourly Volume (vph)	505	267	505	279
	Mean Daily Volume (vpd)	12110	6402	12119	6695
	Mean Speed (km/h) (mph)	102 64	112 69	102 64	114 71
Fridays	Mean Hourly Volume (vph)	541	316	553	355
	Mean Daily Volume (vpd)	12979	7578	13282	8509
	Mean Speed (km/h) (mph)	104 64	113 70	103 64	115 71
Saturdays	Mean Hourly Volume (vph)	485	232	486	258
	Mean Daily Volume (vpd)	11638	5561	11660	6191
	Mean Speed (km/h) (mph)	105 65	114 71	104 65	116 72
Monthly	Mean Hourly Volume (vph)	494	252	494	267
	Mean Daily Volume (vpd)	11859	6044	11865	6405
	Mean Speed (km/h) (mph)	103 64	113 70	103 64	115 71

Site 511 on I-70, July 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	496	307	482	289
	Mean Daily Volume (vpd)	11896	7356	11559	6934
	Mean Speed (km/h) (mph)	104 65	114 71	105 65	117 73
Mondays	Mean Hourly Volume (vph)	494	236	493	247
	Mean Daily Volume (vpd)	11865	5676	11837	5920
	Mean Speed (km/h) (mph)	104 65	114 71	104 65	116 72
Tuesdays	Mean Hourly Volume (vph)	487	225	499	256
	Mean Daily Volume (vpd)	11684	5395	11982	6134
	Mean Speed (km/h) (mph)	103 64	113 70	103 64	115 71
Wednesdays	Mean Hourly Volume (vph)	497	252	512	273
	Mean Daily Volume (vpd)	11933	6038	12288	6556
	Mean Speed (km/h) (mph)	103 64	113 70	103 64	115 72
Thursdays	Mean Hourly Volume (vph)	541	304	547	323
	Mean Daily Volume (vpd)	12975	7287	13134	7761
	Mean Speed (km/h) (mph)	104 64	113 70	103 64	115 72
Fridays	Mean Hourly Volume (vph)	550	328	569	383
	Mean Daily Volume (vpd)	13193	7869	13666	9186
	Mean Speed (km/h) (mph)	103 64	113 70	104 65	116 72
Saturdays	Mean Hourly Volume (vph)	459	216	457	214
	Mean Daily Volume (vpd)	11016	5183	10968	5138
	Mean Speed (km/h) (mph)	104 65	114 71	105 65	116 72
Monthly	Mean Hourly Volume (vph)	507	271	514	290
	Mean Daily Volume (vpd)	12178	6508	12328	6963
	Mean Speed (km/h) (mph)	104 64	113 71	104 64	116 72

Site 511 on I-70, August 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	498	302	481	240
	Mean Daily Volume (vpd)	11941	7259	11534	5759
	Mean Speed (km/h) (mph)	105 65	114 71	105 65	114 71
Mondays	Mean Hourly Volume (vph)	492	238	492	203
	Mean Daily Volume (vpd)	11798	5700	11798	4873
	Mean Speed (km/h) (mph)	104 64	114 71	104 64	115 72
Tuesdays	Mean Hourly Volume (vph)	489	244	493	257
	Mean Daily Volume (vpd)	11736	5859	11823	6168
	Mean Speed (km/h) (mph)	99 61	109 68	99 62	111 69
Wednesdays	Mean Hourly Volume (vph)	508	263	522	219
	Mean Daily Volume (vpd)	12197	6304	12533	5267
	Mean Speed (km/h) (mph)	103 64	113 70	102 63	109 68
Thursdays	Mean Hourly Volume (vph)	530	288	533	270
	Mean Daily Volume (vpd)	12730	6910	12803	6487
	Mean Speed (km/h) (mph)	103 64	113 70	103 64	116 72
Fridays	Mean Hourly Volume (vph)	543	311	563	362
	Mean Daily Volume (vpd)	13038	7472	13512	8676
	Mean Speed (km/h) (mph)	104 65	114 71	104 64	116 72
Saturdays	Mean Hourly Volume (vph)	500	274	511	297
	Mean Daily Volume (vpd)	12008	6585	12264	7124
	Mean Speed (km/h) (mph)	105 65	114 71	104 65	116 72
Monthly	Mean Hourly Volume (vph)	507	274	512	262
	Mean Daily Volume (vpd)	12179	6577	12280	6296
	Mean Speed (km/h) (mph)	103 64	113 70	103 64	114 71

Site 511 on I-70, October 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	354	242	387	157
	Mean Daily Volume (vpd)	8494	5809	9291	3773
	Mean Speed (km/h) (mph)	105 65	114 71	105 65	116 72
Mondays	Mean Hourly Volume (vph)	372	183	396	140
	Mean Daily Volume (vpd)	8925	4398	9495	3362
	Mean Speed (km/h) (mph)	104 65	114 71	105 65	116 72
Tuesdays	Mean Hourly Volume (vph)	402	193	440	180
	Mean Daily Volume (vpd)	9643	4623	10557	4321
	Mean Speed (km/h) (mph)	103 64	114 71	103 64	113 70
Wednesdays	Mean Hourly Volume (vph)	375	194	418	181
	Mean Daily Volume (vpd)	9005	4664	10044	4347
	Mean Speed (km/h) (mph)	103 64	113 71	103 64	112 70
Thursdays	Mean Hourly Volume (vph)	397	215	437	199
	Mean Daily Volume (vpd)	9527	5166	10487	4773
	Mean Speed (km/h) (mph)	103 64	113 70	103 64	115 71
Fridays	Mean Hourly Volume (vph)	404	230	451	217
	Mean Daily Volume (vpd)	9696	5528	10827	5214
	Mean Speed (km/h) (mph)	104 65	114 71	104 65	115 72
Saturdays	Mean Hourly Volume (vph)	328	159	379	141
	Mean Daily Volume (vpd)	7864	3828	9091	3396
	Mean Speed (km/h) (mph)	104 65	114 71	104 65	111 69
Monthly	Mean Hourly Volume (vph)	377	204	418	177
	Mean Daily Volume (vpd)	9043	4890	10024	4255
	Mean Speed (km/h) (mph)	104 64	114 71	104 64	114 71

Site 512 on I-65, April 1998						
	Mean Hourly Volume (vph)	Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound	
Sundays	Mean Hourly Volume (vph)	438	110	550	468	
	Mean Daily Volume (vpd)	10522	2650	13199	11229	
	Mean Speed (km/h)	91	112	112	118	
	(mph)	57	70	69	73	
Mondays	Mean Hourly Volume (vph)	465	132	473	276	
	Mean Daily Volume (vpd)	11170	3159	11345	6617	
	Mean Speed (km/h)	99	109	111	117	
	(mph)	61	68	69	73	
Tuesdays	Mean Hourly Volume (vph)	484	162	454	247	
	Mean Daily Volume (vpd)	11621	3893	10907	5937	
	Mean Speed (km/h)	98	108	110	116	
	(mph)	61	67	68	72	
Wednesdays	Mean Hourly Volume (vph)	493	149	467	267	
	Mean Daily Volume (vpd)	11838	3566	11206	6412	
	Mean Speed (km/h)	95	110	109	115	
	(mph)	59	68	68	71	
Thursdays	Mean Hourly Volume (vph)	530	214	479	307	
	Mean Daily Volume (vpd)	12731	5142	11500	7373	
	Mean Speed (km/h)	93	111	109	115	
	(mph)	58	69	68	71	
Fridays	Mean Hourly Volume (vph)	607	228	507	353	
	Mean Daily Volume (vpd)	14564	5475	12169	8463	
	Mean Speed (km/h)	97	111	110	115	
	(mph)	60	69	68	72	
Saturdays	Mean Hourly Volume (vph)	503	164	514	338	
	Mean Daily Volume (vpd)	12069	3926	12345	8119	
	Mean Speed (km/h)	96	112	111	117	
	(mph)	59	70	69	73	
Monthly	Mean Hourly Volume (vph)	504	167	490	319	
	Mean Daily Volume (vpd)	12100	4009	11770	7656	
	Mean Speed (km/h)	96	110	110	116	
	(mph)	59	69	68	72	

Site 512 on I-65, May 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	437	215	470	347
	Mean Daily Volume (vpd)	10477	5167	11279	8320
	Mean Speed (km/h)	91	112	111	117
	(mph)	56	70	69	73
Mondays	Mean Hourly Volume (vph)	467	219	444	299
	Mean Daily Volume (vpd)	11218	5262	10666	7186
	Mean Speed (km/h)	96	112	111	117
	(mph)	60	70	69	73
Tuesdays	Mean Hourly Volume (vph)	473	225	415	238
	Mean Daily Volume (vpd)	11352	5406	9967	5714
	Mean Speed (km/h)	98	109	109	115
	(mph)	61	68	68	71
Wednesdays	Mean Hourly Volume (vph)	497	245	428	258
	Mean Daily Volume (vpd)	11931	5889	10276	6187
	Mean Speed (km/h)	98	110	110	116
	(mph)	61	69	68	72
Thursdays	Mean Hourly Volume (vph)	517	288	426	304
	Mean Daily Volume (vpd)	12404	6910	10221	7291
	Mean Speed (km/h)	97	110	106	113
	(mph)	60	68	66	70
Fridays	Mean Hourly Volume (vph)	577	393	487	333
	Mean Daily Volume (vpd)	13856	9435	11689	7988
	Mean Speed (km/h)	94	108	110	116
	(mph)	58	67	68	72
Saturdays	Mean Hourly Volume (vph)	507	275	435	246
	Mean Daily Volume (vpd)	12168	6590	10447	5909
	Mean Speed (km/h)	92	112	111	117
	(mph)	57	70	69	73
Monthly	Mean Hourly Volume (vph)	497	269	446	291
	Mean Daily Volume (vpd)	11939	6446	10697	6987
	Mean Speed (km/h)	95	111	110	116
	(mph)	59	69	68	72

Site 512 on I-65, June 1998						
	Mean Hourly Volume (vph)	Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound	
Sundays	Mean Daily Volume (vpd)	487	280	418	329	
	Mean Speed (km/h) (mph)	11694	6726	10043	7906	
Mondays	Mean Hourly Volume (vph)	91	113	111	117	
	Mean Daily Volume (vpd)	56	70	69	73	
Tuesdays	Mean Hourly Volume (vph)	506	280	431	330	
	Mean Speed (km/h) (mph)	12138	6717	10344	7931	
Wednesdays	Mean Hourly Volume (vph)	95	113	110	117	
	Mean Daily Volume (vpd)	59	70	69	72	
Thursdays	Mean Hourly Volume (vph)	501	262	426	257	
	Mean Speed (km/h) (mph)	12015	6276	10215	6160	
Fridays	Mean Hourly Volume (vph)	97	112	109	115	
	Mean Daily Volume (vpd)	61	70	68	72	
Saturdays	Mean Hourly Volume (vph)	500	260	366	256	
	Mean Speed (km/h) (mph)	11992	6230	8783	6147	
Monthly	Mean Hourly Volume (vph)	99	113	110	116	
	Mean Daily Volume (vpd)	62	70	69	72	
Sundays	Mean Hourly Volume (vph)	525	295	510	291	
	Mean Speed (km/h) (mph)	12601	7072	12250	6996	
Monday	Mean Hourly Volume (vph)	99	113	110	116	
	Mean Daily Volume (vpd)	62	70	68	72	
Tuesday	Mean Hourly Volume (vph)	563	376	462	342	
	Mean Speed (km/h) (mph)	13508	9032	11100	8215	
Wednesday	Mean Hourly Volume (vph)	95	112	109	116	
	Mean Daily Volume (vpd)	59	70	68	72	
Thursday	Mean Hourly Volume (vph)	571	396	431	325	
	Mean Speed (km/h) (mph)	13694	9512	10356	7798	
Friday	Mean Hourly Volume (vph)	96	113	111	116	
	Mean Daily Volume (vpd)	59	71	69	72	
Saturday	Mean Hourly Volume (vph)	521	305	436	305	
	Mean Speed (km/h) (mph)	12500	7328	10461	7311	
Monthly	Mean Hourly Volume (vph)	96	113	110	116	
	Mean Daily Volume (vpd)	60	70	68	72	

Site 512 on I-65, August 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	494	307	363	285
	Mean Daily Volume (vpd)	11858	7378	8706	6841
	Mean Speed (km/h) (mph)	91 57	113 70	110 68	117 73
Mondays	Mean Hourly Volume (vph)	534	331	469	446
	Mean Daily Volume (vpd)	12822	7940	11248	10698
	Mean Speed (km/h) (mph)	94 58	114 71	111 69	118 73
Tuesdays	Mean Hourly Volume (vph)	526	290	419	275
	Mean Daily Volume (vpd)	12635	6949	10058	6596
	Mean Speed (km/h) (mph)	98 61	112 70	110 68	117 72
Wednesdays	Mean Hourly Volume (vph)	520	275	426	275
	Mean Daily Volume (vpd)	12483	6606	10213	6608
	Mean Speed (km/h) (mph)	100 62	113 70	110 68	116 72
Thursdays	Mean Hourly Volume (vph)	541	307	436	292
	Mean Daily Volume (vpd)	12991	7366	10471	7000
	Mean Speed (km/h) (mph)	100 62	113 70	110 68	116 72
Fridays	Mean Hourly Volume (vph)	550	335	427	309
	Mean Daily Volume (vpd)	13203	8028	10240	7410
	Mean Speed (km/h) (mph)	97 60	113 70	110 68	117 73
Saturdays	Mean Hourly Volume (vph)	588	425	427	375
	Mean Daily Volume (vpd)	14104	10207	10243	8995
	Mean Speed (km/h) (mph)	95 59	113 70	110 69	117 73
Monthly	Mean Hourly Volume (vph)	537	327	423	327
	Mean Daily Volume (vpd)	12876	7852	10158	7843
	Mean Speed (km/h) (mph)	96 60	113 70	110 68	117 73

Site 512 on I-65, September 1998		Driving Lane South Bound	Passing Lane South Bound	Driving Lane North Bound	Passing Lane North Bound
Sundays	Mean Hourly Volume (vph)	470	237	292	227
	Mean Daily Volume (vpd)	11275	5690	7003	5447
	Mean Speed (km/h) (mph)	91 56	111 69	110 68	117 72
Mondays	Mean Hourly Volume (vph)	496	271	388	352
	Mean Daily Volume (vpd)	11902	6501	9313	8441
	Mean Speed (km/h) (mph)	94 58	113 70	110 69	117 73
Tuesdays	Mean Hourly Volume (vph)	511	240	416	296
	Mean Daily Volume (vpd)	12252	5755	9976	7113
	Mean Speed (km/h) (mph)	99 62	109 68	110 68	116 72
Wednesdays	Mean Hourly Volume (vph)	505	227	383	233
	Mean Daily Volume (vpd)	12127	5448	9199	5594
	Mean Speed (km/h) (mph)	99 62	105 65	107 67	113 70
Thursdays	Mean Hourly Volume (vph)	478	302	406	239
	Mean Daily Volume (vpd)	11467	7255	9749	5730
	Mean Speed (km/h) (mph)	96 60	110 69	107 67	111 69
Fridays	Mean Hourly Volume (vph)	491	343	378	287
	Mean Daily Volume (vpd)	11792	8228	9081	6880
	Mean Speed (km/h) (mph)	95 59	109 68	109 68	116 72
Saturdays	Mean Hourly Volume (vph)	562	464	337	352
	Mean Daily Volume (vpd)	13488	11126	8097	8454
	Mean Speed (km/h) (mph)	94 59	111 69	102 64	112 70
Monthly	Mean Hourly Volume (vph)	502	293	373	282
	Mean Daily Volume (vpd)	12053	7040	8962	6778
	Mean Speed (km/h) (mph)	96 59	109 68	108 67	115 71

Site 513 on I-74, April 1998					Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)		259	16	254	71		
	Mean Daily Volume (vpd)		6206	382	6098	1696		
	Mean Speed (km/h) (mph)		105 65	106 66	107 66	111 69		
Mondays	Mean Hourly Volume (vph)		257	31	253	62		
	Mean Daily Volume (vpd)		6177	747	6083	1480		
	Mean Speed (km/h) (mph)		102 63	111 69	105 65	110 68		
Tuesdays	Mean Hourly Volume (vph)		246	41	248	58		
	Mean Daily Volume (vpd)		5894	988	5950	1381		
	Mean Speed (km/h) (mph)		101 63	110 69	104 65	109 68		
Wednesdays	Mean Hourly Volume (vph)		257	29	250	59		
	Mean Daily Volume (vpd)		6175	707	6000	1413		
	Mean Speed (km/h) (mph)		100 62	108 67	104 64	108 67		
Thursdays	Mean Hourly Volume (vph)		272	38	266	71		
	Mean Daily Volume (vpd)		6525	901	6395	1714		
	Mean Speed (km/h) (mph)		100 62	109 68	103 64	108 67		
Fridays	Mean Hourly Volume (vph)		293	53	289	84		
	Mean Daily Volume (vpd)		7041	1267	6930	2011		
	Mean Speed (km/h) (mph)		100 62	111 69	105 65	111 69		
Saturdays	Mean Hourly Volume (vph)		242	30	230	50		
	Mean Daily Volume (vpd)		5814	730	5510	1200		
	Mean Speed (km/h) (mph)		102 64	109 67	106 66	110 68		
Monthly	Mean Hourly Volume (vph)		261	34	256	65		
	Mean Daily Volume (vpd)		6268	818	6142	1556		
	Mean Speed (km/h) (mph)		101 63	109 68	105 65	110 68		

Site 514 on I-70, April 1998						
	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound	
Sundays	Mean Hourly Volume (vph)	483	222	403	219	
	Mean Daily Volume (vpd)	11585	5321	9676	5258	
	Mean Speed (km/h)	103	111	108	118	
	(mph)	64	69	67	73	
Mondays	Mean Hourly Volume (vph)	509	165	427	191	
	Mean Daily Volume (vpd)	12226	3957	10248	4573	
	Mean Speed (km/h)	102	111	108	118	
	(mph)	64	69	67	73	
Tuesdays	Mean Hourly Volume (vph)	512	151	452	208	
	Mean Daily Volume (vpd)	12298	3620	10844	5001	
	Mean Speed (km/h)	101	110	108	117	
	(mph)	63	68	67	73	
Wednesdays	Mean Hourly Volume (vph)	522	163	461	220	
	Mean Daily Volume (vpd)	12520	3914	11064	5284	
	Mean Speed (km/h)	101	110	108	117	
	(mph)	63	68	67	73	
Thursdays	Mean Hourly Volume (vph)	536	189	469	252	
	Mean Daily Volume (vpd)	12858	4543	11264	6052	
	Mean Speed (km/h)	101	110	106	117	
	(mph)	63	68	66	73	
Fridays	Mean Hourly Volume (vph)	530	204	474	283	
	Mean Daily Volume (vpd)	12720	4904	11378	6800	
	Mean Speed (km/h)	101	109	105	115	
	(mph)	63	68	65	71	
Saturdays	Mean Hourly Volume (vph)	478	166	428	208	
	Mean Daily Volume (vpd)	11471	3981	10266	4991	
	Mean Speed (km/h)	103	111	107	118	
	(mph)	64	69	67	73	
Monthly	Mean Hourly Volume (vph)	511	179	446	225	
	Mean Daily Volume (vpd)	12263	4297	10701	5412	
	Mean Speed (km/h)	102	110	107	117	
	(mph)	63	68	67	73	

Site 544 on I-70, April 1998					Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)		462	99	388	240		
	Mean Daily Volume (vpd)		11086	2387	9316	5749		
	Mean Speed (km/h) (mph)		101 63	114 71	95 59	107 66		
Mondays	Mean Hourly Volume (vph)		466	102	378	195		
	Mean Daily Volume (vpd)		11181	2445	9072	4681		
	Mean Speed (km/h) (mph)		98 61	113 70	94 58	105 65		
Tuesdays	Mean Hourly Volume (vph)		495	108	382	195		
	Mean Daily Volume (vpd)		11873	2599	9177	4679		
	Mean Speed (km/h) (mph)		96 59	112 70	93 58	103 64		
Wednesdays	Mean Hourly Volume (vph)		514	115	385	205		
	Mean Daily Volume (vpd)		12335	2749	9246	4927		
	Mean Speed (km/h) (mph)		95 59	112 70	93 58	103 64		
Thursdays	Mean Hourly Volume (vph)		519	150	404	240		
	Mean Daily Volume (vpd)		12454	3593	9702	5752		
	Mean Speed (km/h) (mph)		96 60	112 70	93 58	104 65		
Fridays	Mean Hourly Volume (vph)		595	171	414	253		
	Mean Daily Volume (vpd)		14289	4113	9944	6069		
	Mean Speed (km/h) (mph)		98 61	113 70	93 58	104 65		
Saturdays	Mean Hourly Volume (vph)		516	109	379	199		
	Mean Daily Volume (vpd)		12380	2628	9098	4784		
	Mean Speed (km/h) (mph)		99 61	113 70	94 58	105 65		
Monthly	Mean Hourly Volume (vph)		510	123	390	219		
	Mean Daily Volume (vpd)		12243	2942	9370	5246		
	Mean Speed (km/h) (mph)		98 61	113 70	94 58	104 65		

Site 544 on I-70, May 1998						
	Mean Hourly Volume (vph)	Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound	
Sundays	Mean Hourly Volume (vph)	452	111	405	231	
	Mean Daily Volume (vpd)	10859	2669	9713	5538	
	Mean Speed (km/h)	99	106	98	105	
	(mph)	61	66	61	65	
Mondays	Mean Hourly Volume (vph)	481	109	401	219	
	Mean Daily Volume (vpd)	11548	2618	9620	5264	
	Mean Speed (km/h)	101	112	98	105	
	(mph)	63	70	61	65	
Tuesdays	Mean Hourly Volume (vph)	476	146	391	202	
	Mean Daily Volume (vpd)	11418	3502	9379	4855	
	Mean Speed (km/h)	96	109	96	101	
	(mph)	60	68	59	63	
Wednesdays	Mean Hourly Volume (vph)	483	187	409	223	
	Mean Daily Volume (vpd)	11590	4484	9812	5347	
	Mean Speed (km/h)	91	109	98	103	
	(mph)	56	68	61	64	
Thursdays	Mean Hourly Volume (vph)	479	125	368	220	
	Mean Daily Volume (vpd)	11493	3001	8842	5269	
	Mean Speed (km/h)	84	96	83	88	
	(mph)	52	60	52	55	
Fridays	Mean Hourly Volume (vph)	612	185	442	278	
	Mean Daily Volume (vpd)	14684	4448	10609	6669	
	Mean Speed (km/h)	98	112	96	103	
	(mph)	61	69	60	64	
Saturdays	Mean Hourly Volume (vph)	547	131	416	228	
	Mean Daily Volume (vpd)	13121	3152	9974	5482	
	Mean Speed (km/h)	100	112	97	104	
	(mph)	62	70	60	65	
Monthly	Mean Hourly Volume (vph)	508	141	406	231	
	Mean Daily Volume (vpd)	12197	3376	9743	5535	
	Mean Speed (km/h)	96	108	95	102	
	(mph)	60	67	59	63	

Site 544 on I-70, June 1998					
		Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	495	133	407	256
	Mean Daily Volume (vpd)	11879	3198	9760	6149
	Mean Speed (km/h) (mph)	101 63	113 70	98 61	106 66
Mondays	Mean Hourly Volume (vph)	481	109	365	193
	Mean Daily Volume (vpd)	11533	2622	8759	4626
	Mean Speed (km/h) (mph)	99 61	113 70	97 60	105 65
Tuesdays	Mean Hourly Volume (vph)	534	125	406	221
	Mean Daily Volume (vpd)	12815	3004	9737	5303
	Mean Speed (km/h) (mph)	99 61	112 70	98 61	104 65
Wednesdays	Mean Hourly Volume (vph)	558	138	408	230
	Mean Daily Volume (vpd)	13387	3321	9801	5520
	Mean Speed (km/h) (mph)	98 61	112 69	97 61	104 65
Thursdays	Mean Hourly Volume (vph)	552	142	421	254
	Mean Daily Volume (vpd)	13257	3400	10096	6103
	Mean Speed (km/h) (mph)	97 60	113 70	96 60	103 64
Fridays	Mean Hourly Volume (vph)	650	194	452	301
	Mean Daily Volume (vpd)	15611	4665	10853	7219
	Mean Speed (km/h) (mph)	97 60	113 70	95 59	103 64
Saturdays	Mean Hourly Volume (vph)	561	146	398	225
	Mean Daily Volume (vpd)	13454	3508	9549	5391
	Mean Speed (km/h) (mph)	99 62	113 70	97 60	105 65
Monthly	Mean Hourly Volume (vph)	543	138	405	234
	Mean Daily Volume (vpd)	13020	3302	9714	5624
	Mean Speed (km/h) (mph)	98 61	113 70	97 60	104 65

Site 544 on I-70, July 1998						
	Mean Hourly Volume (vph)	Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound	
Sundays	Mean Hourly Volume (vph)	522	153	414	292	
	Mean Daily Volume (vpd)	12516	3679	9945	7006	
	Mean Speed (km/h) (mph)	103 64	113 70	99 61	106 66	
Mondays	Mean Hourly Volume (vph)	535	133	398	241	
	Mean Daily Volume (vpd)	12850	3196	9547	5794	
	Mean Speed (km/h) (mph)	101 63	113 70	97 61	104 65	
Tuesdays	Mean Hourly Volume (vph)	553	140	392	226	
	Mean Daily Volume (vpd)	13263	3354	9414	5428	
	Mean Speed (km/h) (mph)	100 62	112 69	97 60	103 64	
Wednesdays	Mean Hourly Volume (vph)	549	145	379	219	
	Mean Daily Volume (vpd)	13187	3477	9086	5252	
	Mean Speed (km/h) (mph)	100 62	112 70	95 59	102 64	
Thursdays	Mean Hourly Volume (vph)	606	182	443	304	
	Mean Daily Volume (vpd)	14532	4367	10621	7302	
	Mean Speed (km/h) (mph)	100 62	112 70	97 60	104 65	
Fridays	Mean Hourly Volume (vph)	652	209	447	324	
	Mean Daily Volume (vpd)	15637	5019	10720	7776	
	Mean Speed (km/h) (mph)	101 63	113 70	98 61	105 65	
Saturdays	Mean Hourly Volume (vph)	530	139	384	212	
	Mean Daily Volume (vpd)	12712	3332	9219	5089	
	Mean Speed (km/h) (mph)	102 63	113 70	98 61	105 65	
Monthly	Mean Hourly Volume (vph)	568	160	410	263	
	Mean Daily Volume (vpd)	13631	3833	9833	6301	
	Mean Speed (km/h) (mph)	101 63	112 70	97 60	104 65	

Site 544 on I-70, August 1998		Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	529	164	420	292
	Mean Daily Volume (vpd)	12704	3929	10079	7007
	Mean Speed (km/h) (mph)	103 64	113 70	99 61	106 66
Mondays	Mean Hourly Volume (vph)	533	130	391	230
	Mean Daily Volume (vpd)	12787	3129	9385	5528
	Mean Speed (km/h) (mph)	101 63	112 70	98 61	104 65
Tuesdays	Mean Hourly Volume (vph)	566	150	390	242
	Mean Daily Volume (vpd)	13582	3593	9364	5806
	Mean Speed (km/h) (mph)	100 62	112 69	97 60	103 64
Wednesdays	Mean Hourly Volume (vph)	572	153	410	253
	Mean Daily Volume (vpd)	13722	3662	9841	6079
	Mean Speed (km/h) (mph)	99 62	112 70	97 60	103 64
Thursdays	Mean Hourly Volume (vph)	590	161	406	262
	Mean Daily Volume (vpd)	14154	3872	9749	6290
	Mean Speed (km/h) (mph)	100 62	112 70	95 59	101 63
Fridays	Mean Hourly Volume (vph)	646	215	436	297
	Mean Daily Volume (vpd)	15497	5153	10471	7125
	Mean Speed (km/h) (mph)	100 62	112 70	97 60	104 65
Saturdays	Mean Hourly Volume (vph)	603	180	425	255
	Mean Daily Volume (vpd)	14464	4329	10192	6110
	Mean Speed (km/h) (mph)	102 63	113 70	98 61	105 65
Monthly	Mean Hourly Volume (vph)	575	164	411	261
	Mean Daily Volume (vpd)	13793	3937	9870	6272
	Mean Speed (km/h) (mph)	101 63	112 70	97 60	104 65

Site 544 on I-70, September 1998						
		Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound	
Sundays	Mean Hourly Volume (vph)	471	121	368	218	
	Mean Daily Volume (vpd)	11312	2905	8821	5233	
	Mean Speed (km/h)	96	106	93	99	
	(mph)	59	66	58	62	
Mondays	Mean Hourly Volume (vph)	517	131	400	244	
	Mean Daily Volume (vpd)	12398	3152	9599	5847	
	Mean Speed (km/h)	101	112	98	105	
	(mph)	63	70	61	65	
Tuesdays	Mean Hourly Volume (vph)	531	134	389	206	
	Mean Daily Volume (vpd)	12755	3211	9340	4944	
	Mean Speed (km/h)	98	111	97	104	
	(mph)	61	69	60	64	
Wednesdays	Mean Hourly Volume (vph)	556	132	402	222	
	Mean Daily Volume (vpd)	13339	3172	9636	5339	
	Mean Speed (km/h)	98	112	97	104	
	(mph)	61	69	60	64	
Thursdays	Mean Hourly Volume (vph)	486	124	360	211	
	Mean Daily Volume (vpd)	11665	2974	8633	5069	
	Mean Speed (km/h)	85	96	83	88	
	(mph)	53	60	51	55	
Fridays	Mean Hourly Volume (vph)	637	195	444	302	
	Mean Daily Volume (vpd)	15288	4681	10651	7244	
	Mean Speed (km/h)	100	112	97	104	
	(mph)	62	70	60	65	
Saturdays	Mean Hourly Volume (vph)	576	146	403	216	
	Mean Daily Volume (vpd)	13816	3498	9667	5185	
	Mean Speed (km/h)	101	112	98	105	
	(mph)	63	70	61	66	
Monthly	Mean Hourly Volume (vph)	540	141	395	231	
	Mean Daily Volume (vpd)	12959	3378	9474	5540	
	Mean Speed (km/h)	97	109	94	101	
	(mph)	60	68	59	63	

Site 544 on I-70, November 1998		Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	498	136	276	259
	Mean Daily Volume (vpd)	11949	3257	6618	6204
	Mean Speed (km/h) (mph)	96 60	114 71	92 57	106 66
Mondays	Mean Hourly Volume (vph)	480	103	274	207
	Mean Daily Volume (vpd)	11530	2480	6581	4960
	Mean Speed (km/h) (mph)	96 59	113 70	87 54	103 64
Tuesdays	Mean Hourly Volume (vph)	529	125	296	207
	Mean Daily Volume (vpd)	12695	3004	7097	4957
	Mean Speed (km/h) (mph)	94 59	112 70	90 56	103 64
Wednesdays	Mean Hourly Volume (vph)	557	162	298	232
	Mean Daily Volume (vpd)	13363	3890	7145	5571
	Mean Speed (km/h) (mph)	92 57	110 68	90 56	104 65
Thursdays	Mean Hourly Volume (vph)	518	121	293	197
	Mean Daily Volume (vpd)	12442	2912	7044	4729
	Mean Speed (km/h) (mph)	95 59	113 70	92 57	105 65
Fridays	Mean Hourly Volume (vph)	554	142	269	232
	Mean Daily Volume (vpd)	13304	3419	6462	5557
	Mean Speed (km/h) (mph)	96 59	112 70	90 56	105 65
Saturdays	Mean Hourly Volume (vph)	541	129	258	212
	Mean Daily Volume (vpd)	12991	3100	6199	5091
	Mean Speed (km/h) (mph)	95 59	113 71	90 56	106 66
Monthly	Mean Hourly Volume (vph)	523	131	280	221
	Mean Daily Volume (vpd)	12551	3132	6726	5314
	Mean Speed (km/h) (mph)	95 59	112 70	90 56	104 65

Site 545 on I-65, April 1998						
	Mean Hourly Volume (vph)	Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound	
Sundays	Mean Daily Volume (vpd)	543	382	502	259	
	Mean Speed (km/h) (mph)	13026	9156	12047	6226	
Mondays	Mean Hourly Volume (vph)	111	115	103	120	
	Mean Daily Volume (vpd)	69	72	64	75	
Tuesdays	Mean Hourly Volume (vph)	515	249	518	230	
	Mean Daily Volume (vpd)	12369	5969	12442	5528	
Wednesdays	Mean Hourly Volume (vph)	110	114	101	118	
	Mean Daily Volume (vpd)	68	71	63	73	
Thursdays	Mean Hourly Volume (vph)	506	233	522	218	
	Mean Daily Volume (vpd)	12150	5593	12525	5242	
Fridays	Mean Hourly Volume (vph)	109	112	102	117	
	Mean Daily Volume (vpd)	68	70	63	73	
Saturdays	Mean Hourly Volume (vph)	521	241	532	227	
	Mean Daily Volume (vpd)	12495	5773	12756	5448	
Monthly	Mean Hourly Volume (vph)	109	112	101	118	
	Mean Daily Volume (vpd)	68	70	63	73	
Sundays	Mean Hourly Volume (vph)	538	281	565	283	
	Mean Daily Volume (vpd)	12901	6745	13564	6791	
Mondays	Mean Hourly Volume (vph)	108	112	101	118	
	Mean Daily Volume (vpd)	67	70	63	73	
Tuesdays	Mean Hourly Volume (vph)	584	370	623	381	
	Mean Daily Volume (vpd)	14024	8871	14944	9149	
Wednesdays	Mean Hourly Volume (vph)	109	111	102	119	
	Mean Daily Volume (vpd)	68	69	63	74	
Thursdays	Mean Hourly Volume (vph)	522	282	519	237	
	Mean Daily Volume (vpd)	12516	6776	12451	5678	
Fridays	Mean Hourly Volume (vph)	110	114	102	120	
	Mean Daily Volume (vpd)	68	71	63	74	
Saturdays	Mean Hourly Volume (vph)	532	289	541	262	
	Mean Daily Volume (vpd)	12778	6929	12980	6286	
Monthly	Mean Hourly Volume (vph)	109	113	102	119	
	Mean Daily Volume (vpd)	68	70	63	74	

Site 545 on I-65, May 1998					Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)		508	344	484	237		
	Mean Daily Volume (vpd)		12181	8260	11611	5682		
Mondays	Mean Speed (km/h)		110	113	104	120		
	(mph)		68	70	64	74		
	Mean Hourly Volume (vph)		526	288	514	232		
Tuesdays	Mean Daily Volume (vpd)		12623	6908	12342	5570		
	Mean Speed (km/h)		110	114	103	119		
	(mph)		69	71	64	74		
Wednesdays	Mean Hourly Volume (vph)		510	242	508	244		
	Mean Daily Volume (vpd)		12237	5800	12184	5861		
	Mean Speed (km/h)		108	113	102	117		
Thursdays	(mph)		67	70	64	73		
	Mean Hourly Volume (vph)		528	248	537	240		
	Mean Daily Volume (vpd)		12684	5947	12887	5762		
Fridays	Mean Speed (km/h)		109	113	102	117		
	(mph)		68	70	64	73		
	Mean Hourly Volume (vph)		547	282	558	269		
Saturdays	Mean Daily Volume (vpd)		13136	6766	13385	6454		
	Mean Speed (km/h)		109	112	103	118		
	(mph)		68	70	64	73		
Monthly	Mean Hourly Volume (vph)		593	372	615	386		
	Mean Daily Volume (vpd)		14234	8925	14766	9258		
	Mean Speed (km/h)		110	113	102	118		
Monthly	(mph)		68	70	63	73		
	Mean Hourly Volume (vph)		513	268	536	271		
	Mean Daily Volume (vpd)		12311	6440	12872	6497		
Monthly	Mean Speed (km/h)		109	114	102	118		
	(mph)		68	71	64	74		
	Mean Hourly Volume (vph)		533	295	537	271		
Monthly	Mean Daily Volume (vpd)		12785	7091	12885	6508		
	Mean Speed (km/h)		109	113	103	118		
	(mph)		68	70	64	73		

Site 545 on I-65, June 1998		Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)	526	353	544	329
	Mean Daily Volume (vpd)	12632	8476	13068	7896
	Mean Speed (km/h)	112	115	106	119
	Mean Speed (mph)	70	71	66	74
Mondays	Mean Hourly Volume (vph)	514	245	538	254
	Mean Daily Volume (vpd)	12329	5879	12913	6091
	Mean Speed (km/h)	110	113	103	118
	Mean Speed (mph)	68	70	64	73
Tuesdays	Mean Hourly Volume (vph)	527	241	537	230
	Mean Daily Volume (vpd)	12648	5793	12890	5516
	Mean Speed (km/h)	109	113	102	117
	Mean Speed (mph)	68	70	64	73
Wednesdays	Mean Hourly Volume (vph)	558	278	555	257
	Mean Daily Volume (vpd)	13400	6666	13313	6165
	Mean Speed (km/h)	109	112	103	118
	Mean Speed (mph)	68	70	64	73
Thursdays	Mean Hourly Volume (vph)	514	270	512	252
	Mean Daily Volume (vpd)	12335	6470	12290	6048
	Mean Speed (km/h)	102	104	96	109
	Mean Speed (mph)	63	65	60	68
Fridays	Mean Hourly Volume (vph)	621	416	625	381
	Mean Daily Volume (vpd)	14892	9988	14991	9146
	Mean Speed (km/h)	110	112	104	118
	Mean Speed (mph)	69	70	64	73
Saturdays	Mean Hourly Volume (vph)	533	304	546	274
	Mean Daily Volume (vpd)	12784	7287	13099	6577
	Mean Speed (km/h)	112	114	105	119
	Mean Speed (mph)	69	71	65	74
Monthly	Mean Hourly Volume (vph)	542	299	551	281
	Mean Daily Volume (vpd)	13016	7185	13231	6747
	Mean Speed (km/h)	109	112	103	117
	Mean Speed (mph)	68	70	64	73

Site 545 on I-65, July 1998				Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)		537	377	570	355	
	Mean Daily Volume (vpd)		12888	9042	13690	8521	
	Mean Speed (km/h) (mph)		107 67	115 72	92 57	120 74	
Mondays	Mean Hourly Volume (vph)		545	270	564	246	
	Mean Daily Volume (vpd)		13082	6489	13544	5902	
	Mean Speed (km/h) (mph)		106 66	114 71	89 55	119 74	
Tuesdays	Mean Hourly Volume (vph)		550	250	566	204	
	Mean Daily Volume (vpd)		13199	5990	13588	4888	
	Mean Speed (km/h) (mph)		107 67	113 70	91 57	118 74	
Wednesdays	Mean Hourly Volume (vph)		565	265	571	218	
	Mean Daily Volume (vpd)		13556	6359	13709	5243	
	Mean Speed (km/h) (mph)		107 66	113 70	91 57	119 74	
Thursdays	Mean Hourly Volume (vph)		568	344	577	273	
	Mean Daily Volume (vpd)		13622	8247	13849	6556	
	Mean Speed (km/h) (mph)		106 66	113 70	87 54	119 74	
Fridays	Mean Hourly Volume (vph)		600	427	612	377	
	Mean Daily Volume (vpd)		14409	10240	14679	9059	
	Mean Speed (km/h) (mph)		106 66	114 71	84 52	119 74	
Saturdays	Mean Hourly Volume (vph)		522	275	539	238	
	Mean Daily Volume (vpd)		12532	6609	12929	5717	
	Mean Speed (km/h) (mph)		109 68	114 71	94 58	119 74	
Monthly	Mean Hourly Volume (vph)		557	318	573	275	
	Mean Daily Volume (vpd)		13379	7637	13748	6593	
	Mean Speed (km/h) (mph)		107 66	114 71	90 56	119 74	

Site 545 on I-65, August 1998						
		Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound	
Sundays	Mean Hourly Volume (vph)	540	383	548	311	
	Mean Daily Volume (vpd)	12951	9184	13156	7468	
	Mean Speed (km/h) (mph)	109 68	115 72	92 57	120 74	
Mondays	Mean Hourly Volume (vph)	517	250	531	217	
	Mean Daily Volume (vpd)	12409	6001	12740	5211	
	Mean Speed (km/h) (mph)	108 67	114 71	90 56	119 74	
Tuesdays	Mean Hourly Volume (vph)	555	258	567	213	
	Mean Daily Volume (vpd)	13315	6190	13619	5100	
	Mean Speed (km/h) (mph)	107 67	114 71	91 57	119 74	
Wednesdays	Mean Hourly Volume (vph)	562	258	577	229	
	Mean Daily Volume (vpd)	13493	6194	13855	5504	
	Mean Speed (km/h) (mph)	107 67	114 71	91 56	119 74	
Thursdays	Mean Hourly Volume (vph)	579	282	589	251	
	Mean Daily Volume (vpd)	13902	6771	14143	6033	
	Mean Speed (km/h) (mph)	107 66	114 71	90 56	119 74	
Fridays	Mean Hourly Volume (vph)	616	381	633	341	
	Mean Daily Volume (vpd)	14789	9140	15180	8176	
	Mean Speed (km/h) (mph)	107 66	114 71	88 55	119 74	
Saturdays	Mean Hourly Volume (vph)	531	284	556	265	
	Mean Daily Volume (vpd)	12735	6818	13353	6355	
	Mean Speed (km/h) (mph)	109 68	115 72	92 57	120 74	
Monthly	Mean Hourly Volume (vph)	557	300	572	262	
	Mean Daily Volume (vpd)	13370	7202	13722	6285	
	Mean Speed (km/h) (mph)	108 67	114 71	91 56	119 74	

Site 545 on I-65, September 1998					Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound	
Sundays	Mean Hourly Volume (vph)		476		297		494		241
	Mean Daily Volume (vpd)		11433		7122		11857		5786
	Mean Speed (km/h) (mph)		110 68		115 72		94 58		120 74
Mondays	Mean Hourly Volume (vph)		509		256		528		214
	Mean Daily Volume (vpd)		12226		6135		12668		5133
	Mean Speed (km/h) (mph)		108 67		114 71		93 58		120 74
Tuesdays	Mean Hourly Volume (vph)		524		203		536		174
	Mean Daily Volume (vpd)		12576		4874		12856		4173
	Mean Speed (km/h) (mph)		107 67		114 71		92 57		119 74
Wednesdays	Mean Hourly Volume (vph)		531		207		539		180
	Mean Daily Volume (vpd)		12751		4966		12948		4318
	Mean Speed (km/h) (mph)		107 66		113 70		92 57		119 74
Thursdays	Mean Hourly Volume (vph)		551		240		555		211
	Mean Daily Volume (vpd)		13216		5758		13319		5073
	Mean Speed (km/h) (mph)		107 66		114 71		91 56		119 74
Fridays	Mean Hourly Volume (vph)		610		366		629		330
	Mean Daily Volume (vpd)		14633		8779		15098		7908
	Mean Speed (km/h) (mph)		108 67		112 70		90 56		120 74
Saturdays	Mean Hourly Volume (vph)		516		255		535		234
	Mean Daily Volume (vpd)		12385		6110		12838		5627
	Mean Speed (km/h) (mph)		109 68		115 71		93 58		120 74
Monthly	Mean Hourly Volume (vph)		531		257		545		223
	Mean Daily Volume (vpd)		12740		6160		13071		5352
	Mean Speed (km/h) (mph)		108 67		114 71		92 57		119 74

Site 545 on I-65, October 1998						
	Mean Hourly Volume (vph)	Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound	
Sundays	Mean Hourly Volume (vph)	520	355	529	283	
	Mean Daily Volume (vpd)	12475	8520	12695	6801	
	Mean Speed (km/h)	107	115	92	120	
	(mph)	66	72	57	75	
Mondays	Mean Hourly Volume (vph)	506	215	521	184	
	Mean Daily Volume (vpd)	12135	5153	12495	4421	
	Mean Speed (km/h)	107	115	92	120	
	(mph)	66	71	57	74	
Tuesdays	Mean Hourly Volume (vph)	517	199	534	174	
	Mean Daily Volume (vpd)	12415	4776	12808	4184	
	Mean Speed (km/h)	106	114	91	119	
	(mph)	66	71	57	74	
Wednesdays	Mean Hourly Volume (vph)	532	205	541	182	
	Mean Daily Volume (vpd)	12768	4911	12995	4374	
	Mean Speed (km/h)	104	112	89	118	
	(mph)	65	70	56	73	
Thursdays	Mean Hourly Volume (vph)	551	228	560	209	
	Mean Daily Volume (vpd)	13223	5473	13449	5008	
	Mean Speed (km/h)	106	113	90	119	
	(mph)	66	71	56	74	
Fridays	Mean Hourly Volume (vph)	580	317	604	309	
	Mean Daily Volume (vpd)	13917	7617	14495	7424	
	Mean Speed (km/h)	105	114	88	119	
	(mph)	65	71	55	74	
Saturdays	Mean Hourly Volume (vph)	523	253	545	250	
	Mean Daily Volume (vpd)	12547	6073	13081	5996	
	Mean Speed (km/h)	106	114	90	120	
	(mph)	66	71	56	75	
Monthly	Mean Hourly Volume (vph)	535	256	551	232	
	Mean Daily Volume (vpd)	12847	6142	13219	5566	
	Mean Speed (km/h)	106	114	90	119	
	(mph)	66	71	56	74	

Site 545 on I-65, November 1998		Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)	510	342	516	292
	Mean Daily Volume (vpd)	12241	8216	12380	7002
	Mean Speed (km/h) (mph)	106 66	115 72	91 56	121 75
Mondays	Mean Hourly Volume (vph)	492	190	503	172
	Mean Daily Volume (vpd)	11807	4572	12061	4121
	Mean Speed (km/h) (mph)	105 66	114 71	90 56	120 75
Tuesdays	Mean Hourly Volume (vph)	520	208	534	181
	Mean Daily Volume (vpd)	12480	4998	12810	4341
	Mean Speed (km/h) (mph)	105 65	114 71	90 56	120 74
Wednesdays	Mean Hourly Volume (vph)	560	271	574	252
	Mean Daily Volume (vpd)	13440	6495	13780	6043
	Mean Speed (km/h) (mph)	105 65	113 70	88 55	119 74
Thursdays	Mean Hourly Volume (vph)	532	236	554	214
	Mean Daily Volume (vpd)	12768	5668	13298	5140
	Mean Speed (km/h) (mph)	105 65	114 71	90 56	121 75
Fridays	Mean Hourly Volume (vph)	560	296	591	279
	Mean Daily Volume (vpd)	13437	7102	14173	6697
	Mean Speed (km/h) (mph)	105 65	114 71	89 55	120 75
Saturdays	Mean Hourly Volume (vph)	517	260	545	247
	Mean Daily Volume (vpd)	12407	6249	13082	5936
	Mean Speed (km/h) (mph)	106 66	115 71	90 56	121 75
Monthly	Mean Hourly Volume (vph)	526	258	543	234
	Mean Daily Volume (vpd)	12612	6199	13026	5608
	Mean Speed (km/h) (mph)	105 66	114 71	90 56	120 75

Site 545 on I-65, January 1999		Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)	360	166	365	141
	Mean Daily Volume (vpd)	8637	3974	8758	3379
	Mean Speed (km/h) (mph)	104 64	114 71	88 55	120 74
Mondays	Mean Hourly Volume (vph)	421	139	413	121
	Mean Daily Volume (vpd)	10112	3339	9914	2906
	Mean Speed (km/h) (mph)	104 64	108 67	86 53	116 72
Tuesdays	Mean Hourly Volume (vph)	457	161	467	142
	Mean Daily Volume (vpd)	10962	3858	11214	3414
	Mean Speed (km/h) (mph)	103 64	111 69	85 53	116 72
Wednesdays	Mean Hourly Volume (vph)	484	163	491	144
	Mean Daily Volume (vpd)	11625	3923	11784	3448
	Mean Speed (km/h) (mph)	105 65	113 70	90 56	119 74
Thursdays	Mean Hourly Volume (vph)	482	158	485	148
	Mean Daily Volume (vpd)	11559	3793	11629	3547
	Mean Speed (km/h) (mph)	104 64	111 69	89 55	120 74
Fridays	Mean Hourly Volume (vph)	478	210	478	195
	Mean Daily Volume (vpd)	11465	5050	11483	4671
	Mean Speed (km/h) (mph)	99 62	110 68	82 51	115 72
Saturdays	Mean Hourly Volume (vph)	377	141	395	141
	Mean Daily Volume (vpd)	9038	3384	9472	3392
	Mean Speed (km/h) (mph)	98 61	109 68	81 51	115 71
Monthly	Mean Hourly Volume (vph)	429	163	435	148
	Mean Daily Volume (vpd)	10301	3905	10440	3546
	Mean Speed (km/h) (mph)	102 64	111 69	85 53	117 73

Site 546 on I-465, January 1998		Right Lane South Bound	Middle Lane South Bound	Left Lane South Bound	Right Lane North Bound	Middle Lane North Bound	Left Lane North Bound
Sundays	Mean Hourly Volume (vph)	507	532	178	419	552	191
	Mean Daily Volume (vpd)	12158	12774	4275	10061	13249	4584
	Mean Speed (km/h) (mph)	98 61	103 64	110 68	98 61	90 56	108 67
Mondays	Mean Hourly Volume (vph)	667	712	340	564	732	349
	Mean Daily Volume (vpd)	16002	17099	8154	13537	17571	8366
	Mean Speed (km/h) (mph)	96 59	101 63	109 68	95 59	88 55	107 67
Tuesdays	Mean Hourly Volume (vph)	695	748	355	583	754	351
	Mean Daily Volume (vpd)	16669	17949	8529	13995	18090	8428
	Mean Speed (km/h) (mph)	96 59	101 63	109 68	95 59	88 55	107 66
Wednesdays	Mean Hourly Volume (vph)	687	738	350	572	737	365
	Mean Daily Volume (vpd)	16481	17708	8398	13733	17683	8771
	Mean Speed (km/h) (mph)	95 59	101 63	109 68	94 59	88 55	107 66
Thursdays	Mean Hourly Volume (vph)	655	706	329	557	716	340
	Mean Daily Volume (vpd)	15713	16939	7893	13378	17185	8165
	Mean Speed (km/h) (mph)	95 59	101 63	109 67	95 59	88 55	107 67
Fridays	Mean Hourly Volume (vph)	730	800	401	618	815	408
	Mean Daily Volume (vpd)	17531	19194	9623	14836	19568	9800
	Mean Speed (km/h) (mph)	96 59	102 63	110 68	96 59	88 55	108 67
Saturdays	Mean Hourly Volume (vph)	590	650	245	500	654	229
	Mean Daily Volume (vpd)	14161	15610	5869	11995	15692	5496
	Mean Speed (km/h) (mph)	96 60	102 63	110 68	97 60	88 55	108 67
Monthly	Mean Hourly Volume (vph)	648	700	315	546	710	319
	Mean Daily Volume (vpd)	15548	16791	7550	13100	17041	7663
	Mean Speed (km/h) (mph)	96 60	102 63	109 68	96 59	88 55	108 67

Site 546 on I-465, February 1998		Right Lane South Bound	Middle Lane South Bound	Left Lane South Bound	Right Lane North Bound	Middle Lane North Bound	Left Lane North Bound
Sundays	Mean Hourly Volume (vph)	516	531	174	427	553	191
	Mean Daily Volume (vpd)	12388	12738	4174	10257	13271	4584
Mondays	Mean Speed (km/h)	98	103	111	98	88	109
	Mean Speed (mph)	61	64	69	61	54	67
Tuesdays	Mean Hourly Volume (vph)	675	729	335	569	729	330
	Mean Daily Volume (vpd)	16205	17489	8047	13656	17493	7927
Wednesdays	Mean Speed (km/h)	97	103	110	96	87	109
	Mean Speed (mph)	61	64	69	60	54	68
Thursdays	Mean Hourly Volume (vph)	735	803	388	579	767	364
	Mean Daily Volume (vpd)	17631	19278	9314	13893	18419	8726
Fridays	Mean Speed (km/h)	96	102	110	96	87	109
	Mean Speed (mph)	60	63	68	59	54	67
Saturdays	Mean Hourly Volume (vph)	711	766	385	598	771	389
	Mean Daily Volume (vpd)	17059	18384	9248	14354	18504	9333
Monthly	Mean Speed (km/h)	95	101	109	94	86	107
	Mean Speed (mph)	59	63	68	58	54	66
Sundays	Mean Hourly Volume (vph)	718	776	380	600	779	395
	Mean Daily Volume (vpd)	17227	18620	9125	14393	18692	9485
Mondays	Mean Speed (km/h)	96	102	110	94	87	107
	Mean Speed (mph)	60	63	68	59	54	66
Tuesdays	Mean Hourly Volume (vph)	775	836	438	658	862	461
	Mean Daily Volume (vpd)	18601	20055	10505	15781	20693	11069
Wednesdays	Mean Speed (km/h)	96	102	110	96	87	108
	Mean Speed (mph)	60	64	68	59	54	67
Thursdays	Mean Hourly Volume (vph)	642	699	273	533	706	268
	Mean Daily Volume (vpd)	15407	16764	6561	12790	16935	6423
Fridays	Mean Speed (km/h)	97	103	110	97	87	109
	Mean Speed (mph)	60	64	68	60	54	68
Saturdays	Mean Hourly Volume (vph)	687	740	345	572	746	350
	Mean Daily Volume (vpd)	16497	17769	8277	13723	17908	8396
Monthly	Mean Speed (km/h)	97	102	110	96	87	108
	Mean Speed (mph)	60	64	68	60	54	67

Site 546 on I-465, April 1998									
		Right Lane South Bound	Middle Lane South Bound	Left Lane South Bound	Right Lane North Bound	Middle Lane North Bound	Left Lane North Bound		
Sundays	Mean Hourly Volume (vph)	622	653	256	510	717	323		
	Mean Daily Volume (vpd)	14928	15676	6143	12236	17206	7756		
	Mean Speed (km/h) (mph)	97 60	103 64	111 69	99 61	90 56	111 69		
Mondays	Mean Hourly Volume (vph)	736	791	406	627	840	436		
	Mean Daily Volume (vpd)	17666	18988	9741	15047	20162	10464		
	Mean Speed (km/h) (mph)	96 59	102 63	110 68	96 60	90 56	110 69		
Tuesdays	Mean Hourly Volume (vph)	767	835	428	634	855	451		
	Mean Daily Volume (vpd)	18403	20035	10262	15205	20531	10828		
	Mean Speed (km/h) (mph)	95 59	101 63	109 68	96 60	89 56	110 68		
Wednesdays	Mean Hourly Volume (vph)	740	800	409	622	820	422		
	Mean Daily Volume (vpd)	17762	19212	9822	14930	19689	10134		
	Mean Speed (km/h) (mph)	95 59	101 63	109 68	96 59	89 55	109 68		
Thursdays	Mean Hourly Volume (vph)	783	860	463	666	882	481		
	Mean Daily Volume (vpd)	18793	20642	11109	15989	21159	11542		
	Mean Speed (km/h) (mph)	95 59	101 63	109 68	95 59	89 55	108 67		
Fridays	Mean Hourly Volume (vph)	829	896	504	671	907	508		
	Mean Daily Volume (vpd)	19893	21496	12089	16111	21765	12197		
	Mean Speed (km/h) (mph)	96 59	102 63	110 69	95 59	89 55	109 68		
Saturdays	Mean Hourly Volume (vph)	657	726	303	540	753	313		
	Mean Daily Volume (vpd)	15771	17432	7268	12957	18074	7508		
	Mean Speed (km/h) (mph)	97 60	103 64	111 69	97 61	89 55	110 69		
Monthly	Mean Hourly Volume (vph)	735	797	398	612	827	421		
	Mean Daily Volume (vpd)	17646	19125	9555	14692	19837	10108		
	Mean Speed (km/h) (mph)	96 59	102 63	110 68	96 60	89 55	109 68		

Site 546 on I-465, May 1998		Right Lane South Bound	Middle Lane South Bound	Left Lane South Bound	Right Lane North Bound	Middle Lane North Bound	Left Lane North Bound
Sundays	Mean Hourly Volume (vph)	619	649	276	517	716	306
	Mean Daily Volume (vpd)	14849	15586	6619	12399	17181	7355
	Mean Speed (km/h) (mph)	96 60	103 64	110 68	98 61	93 58	111 69
Mondays	Mean Hourly Volume (vph)	706	766	367	590	810	400
	Mean Daily Volume (vpd)	16954	18374	8816	14171	19435	9602
	Mean Speed (km/h) (mph)	97 60	103 64	111 69	97 60	93 58	110 69
Tuesdays	Mean Hourly Volume (vph)	762	836	438	613	829	423
	Mean Daily Volume (vpd)	18277	20069	10523	14724	19892	10145
	Mean Speed (km/h) (mph)	96 59	102 63	110 68	97 60	93 58	111 69
Wednesdays	Mean Hourly Volume (vph)	771	842	444	643	868	460
	Mean Daily Volume (vpd)	18513	20210	10658	15442	20840	11037
	Mean Speed (km/h) (mph)	95 59	101 63	110 68	96 60	92 57	110 68
Thursdays	Mean Hourly Volume (vph)	828	893	497	647	886	493
	Mean Daily Volume (vpd)	19865	21423	11937	15519	21266	11834
	Mean Speed (km/h) (mph)	94 58	101 63	109 68	95 59	92 57	108 67
Fridays	Mean Hourly Volume (vph)	847	917	528	684	937	540
	Mean Daily Volume (vpd)	20319	22008	12662	16409	22494	12962
	Mean Speed (km/h) (mph)	94 59	101 63	109 68	95 59	92 57	110 68
Saturdays	Mean Hourly Volume (vph)	685	749	318	559	782	331
	Mean Daily Volume (vpd)	16452	17981	7637	13412	18765	7943
	Mean Speed (km/h) (mph)	96 60	102 63	110 68	97 60	92 57	110 68
Monthly	Mean Hourly Volume (vph)	740	801	403	604	828	416
	Mean Daily Volume (vpd)	17764	19225	9681	14484	19880	9993
	Mean Speed (km/h) (mph)	95 59	102 63	110 68	97 60	93 57	110 68

Site 546 on I-465, June 1998		Right Lane South Bound	Middle Lane South Bound	Left Lane South Bound	Right Lane North Bound	Middle Lane North Bound	Left Lane North Bound
Sundays	Mean Hourly Volume (vph)	632	681	289	522	722	323
	Mean Daily Volume (vpd)	15160	16345	6942	12519	17316	7748
	Mean Speed (km/h) (mph)	96 60	102 64	110 69	98 61	94 58	111 69
Mondays	Mean Hourly Volume (vph)	742	806	429	643	849	459
	Mean Daily Volume (vpd)	17799	19332	10291	15425	20370	11023
	Mean Speed (km/h) (mph)	94 58	101 63	108 67	96 60	93 58	110 68
Tuesdays	Mean Hourly Volume (vph)	773	850	437	648	857	451
	Mean Daily Volume (vpd)	18548	20410	10494	15548	20567	10834
	Mean Speed (km/h) (mph)	95 59	101 63	110 68	95 59	92 57	109 68
Wednesdays	Mean Hourly Volume (vph)	784	846	439	583	818	437
	Mean Daily Volume (vpd)	18810	20308	10534	13985	19633	10494
	Mean Speed (km/h) (mph)	96 60	102 63	110 69	96 59	93 58	109 68
Thursdays	Mean Hourly Volume (vph)	840	899	505	649	884	485
	Mean Daily Volume (vpd)	20154	21578	12119	15569	21206	11651
	Mean Speed (km/h) (mph)	94 58	101 62	109 68	95 59	92 57	110 68
Fridays	Mean Hourly Volume (vph)	894	952	555	728	970	570
	Mean Daily Volume (vpd)	21466	22848	13323	17462	23277	13670
	Mean Speed (km/h) (mph)	94 58	100 62	109 68	95 59	92 57	109 68
Saturdays	Mean Hourly Volume (vph)	710	782	342	582	787	340
	Mean Daily Volume (vpd)	17036	18771	8217	13963	18877	8166
	Mean Speed (km/h) (mph)	96 59	102 64	110 69	97 60	94 58	110 68
Monthly	Mean Hourly Volume (vph)	765	829	426	624	841	437
	Mean Daily Volume (vpd)	18371	19896	10225	14965	20188	10490
	Mean Speed (km/h) (mph)	95 59	101 63	109 68	96 60	93 58	110 68

Site 546 on I-465, July 1998		Right Lane South Bound	Middle Lane South Bound	Left Lane South Bound	Right Lane North Bound	Middle Lane North Bound	Left Lane North Bound
Sundays	Mean Hourly Volume (vph)	651	701	293	532	744	333
	Mean Daily Volume (vpd)	15614	16828	7030	12777	17865	7984
Monday	Mean Speed (km/h)	96	103	111	98	95	111
	Mean Speed (mph)	60	64	69	61	59	69
Monday	Mean Hourly Volume (vph)	757	840	442	639	855	437
	Mean Daily Volume (vpd)	18156	20163	10616	15341	20520	10477
Tuesday	Mean Speed (km/h)	95	102	110	97	94	111
	Mean Speed (mph)	59	63	68	60	58	69
Tuesday	Mean Hourly Volume (vph)	794	883	480	659	884	466
	Mean Daily Volume (vpd)	19055	21196	11526	15826	21216	11184
Wednesday	Mean Speed (km/h)	94	101	110	96	94	110
	Mean Speed (mph)	59	63	68	60	58	69
Wednesday	Mean Hourly Volume (vph)	791	869	479	672	903	502
	Mean Daily Volume (vpd)	18983	20860	11497	16122	21673	12044
Thursday	Mean Speed (km/h)	94	101	109	95	93	109
	Mean Speed (mph)	59	63	68	59	58	68
Thursday	Mean Hourly Volume (vph)	835	912	513	693	947	541
	Mean Daily Volume (vpd)	20047	21898	12302	16626	22724	12988
Friday	Mean Speed (km/h)	95	102	110	95	93	109
	Mean Speed (mph)	59	63	68	59	58	68
Friday	Mean Hourly Volume (vph)	850	923	529	703	958	550
	Mean Daily Volume (vpd)	20407	22150	12688	16861	22996	13196
Saturday	Mean Speed (km/h)	95	102	110	96	93	109
	Mean Speed (mph)	59	63	68	60	58	68
Saturday	Mean Hourly Volume (vph)	690	772	350	578	791	351
	Mean Daily Volume (vpd)	16567	18537	8407	13870	18991	8414
Monthly	Mean Speed (km/h)	95	102	111	97	94	110
	Mean Speed (mph)	59	64	69	60	58	68
Monthly	Mean Hourly Volume (vph)	780	856	455	650	883	470
	Mean Daily Volume (vpd)	18711	20545	10929	15604	21199	11288
Monthly	Mean Speed (km/h)	95	102	110	96	94	110
	Mean Speed (mph)	59	63	68	60	58	68

Site 546 on I-465, August 1998		Right Lane South Bound	Middle Lane South Bound	Left Lane South Bound	Right Lane North Bound	Middle Lane North Bound	Left Lane North Bound
Sundays	Mean Hourly Volume (vph)	652	700	298	525	747	351
	Mean Daily Volume (vpd)	15658	16810	7154	12608	17930	8423
	Mean Speed (km/h) (mph)	96 60	102 64	110 69	98 61	95 59	111 69
Mondays	Mean Hourly Volume (vph)	777	843	460	655	875	471
	Mean Daily Volume (vpd)	18653	20232	11031	15714	20998	11300
	Mean Speed (km/h) (mph)	95 59	102 63	110 68	97 60	94 58	110 68
Tuesdays	Mean Hourly Volume (vph)	795	864	456	652	885	469
	Mean Daily Volume (vpd)	19086	20735	10938	15649	21234	11244
	Mean Speed (km/h) (mph)	95 59	102 63	110 68	96 60	94 58	110 68
Wednesdays	Mean Hourly Volume (vph)	801	868	469	654	894	483
	Mean Daily Volume (vpd)	19218	20827	11267	15696	21449	11593
	Mean Speed (km/h) (mph)	95 59	101 63	109 68	96 59	93 58	110 68
Thursdays	Mean Hourly Volume (vph)	844	916	522	668	918	493
	Mean Daily Volume (vpd)	20259	21982	12519	16042	22037	11832
	Mean Speed (km/h) (mph)	93 58	100 62	108 67	96 59	93 58	110 68
Fridays	Mean Hourly Volume (vph)	865	923	570	683	939	547
	Mean Daily Volume (vpd)	20772	22152	13680	16381	22537	13120
	Mean Speed (km/h) (mph)	94 58	101 63	109 68	95 59	93 58	109 68
Saturdays	Mean Hourly Volume (vph)	738	799	402	554	775	365
	Mean Daily Volume (vpd)	17706	19169	9650	13285	18591	8765
	Mean Speed (km/h) (mph)	95 59	101 63	109 68	95 59	92 57	108 67
Monthly	Mean Hourly Volume (vph)	774	836	445	621	853	447
	Mean Daily Volume (vpd)	18578	20067	10684	14893	20483	10720
	Mean Speed (km/h) (mph)	95 59	101 63	109 68	96 60	93 58	110 68

Site 548 on I-465, November 1998		Right Lane South Bound	Middle Lane South Bound	Left Lane South Bound	Right Lane North Bound	Middle Lane North Bound	Left Lane North Bound
Sundays	Mean Hourly Volume (vph)	619	120	366	95	821	373
	Mean Daily Volume (vpd)	14862	2869	8792	2285	19714	8957
	Mean Speed (km/h) (mph)	88 55	91 57	102 63	68 42	99 62	111 69
Mondays	Mean Hourly Volume (vph)	883	230	713	173	1004	616
	Mean Daily Volume (vpd)	21192	5519	17104	4141	24091	14785
	Mean Speed (km/h) (mph)	83 52	86 53	96 60	64 40	94 58	105 65
Tuesdays	Mean Hourly Volume (vph)	832	229	748	194	1034	698
	Mean Daily Volume (vpd)	19964	5505	17963	4644	24821	16758
	Mean Speed (km/h) (mph)	85 53	88 55	99 61	66 41	95 59	105 65
Wednesdays	Mean Hourly Volume (vph)	843	250	790	198	1080	730
	Mean Daily Volume (vpd)	20226	5991	18962	4754	25924	17523
	Mean Speed (km/h) (mph)	83 52	86 53	98 61	66 41	96 59	108 67
Thursdays	Mean Hourly Volume (vph)	800	215	676	171	984	613
	Mean Daily Volume (vpd)	19198	5155	16219	4099	23624	14710
	Mean Speed (km/h) (mph)	86 53	88 55	99 62	67 42	97 60	109 68
Fridays	Mean Hourly Volume (vph)	826	210	721	150	992	629
	Mean Daily Volume (vpd)	19829	5042	17305	3602	23814	15096
	Mean Speed (km/h) (mph)	85 53	87 54	98 61	66 41	94 59	106 66
Saturdays	Mean Hourly Volume (vph)	675	151	468	95	928	424
	Mean Daily Volume (vpd)	16201	3621	11236	2284	22269	10164
	Mean Speed (km/h) (mph)	87 54	89 55	101 63	68 42	98 61	111 69
Monthly	Mean Hourly Volume (vph)	782	199	635	152	974	577
	Mean Daily Volume (vpd)	18757	4779	15232	3639	23381	13840
	Mean Speed (km/h) (mph)	85 53	88 55	99 61	66 41	96 60	108 67

Site 548 on I-465, January 1999									
		Right Lane	Middle Lane	Left Lane	Right Lane	Middle Lane	Left Lane	Right Lane	Left Lane
		South Bound	South Bound	South Bound	North Bound	North Bound	North Bound	North Bound	North Bound
Sundays	Mean Hourly Volume (vph)	322	68	204	66	513	170		
	Mean Daily Volume (vpd)	7729	1640	4907	1574	12304	4090		
	Mean Speed (km/h) (mph)	80 50	85 53	93 58	59 36	90 56	95 59		
Mondays	Mean Hourly Volume (vph)	411	143	432	105	667	346		
	Mean Daily Volume (vpd)	9869	3421	10361	2525	16014	8297		
	Mean Speed (km/h) (mph)	71 44	77 48	84 52	59 37	85 53	87 54		
Tuesdays	Mean Hourly Volume (vph)	607	218	640	156	870	481		
	Mean Daily Volume (vpd)	14563	5234	15362	3736	20873	11534		
	Mean Speed (km/h) (mph)	79 49	84 52	92 57	63 39	91 57	100 62		
Wednesdays	Mean Hourly Volume (vph)	552	184	551	137	713	415		
	Mean Daily Volume (vpd)	13241	4417	13235	3282	17121	9948		
	Mean Speed (km/h) (mph)	74 46	81 50	88 55	55 34	84 52	97 60		
Thursdays	Mean Hourly Volume (vph)	628	207	554	153	785	460		
	Mean Daily Volume (vpd)	15062	4980	13299	3676	18834	11036		
	Mean Speed (km/h) (mph)	78 49	82 51	91 57	60 37	88 54	99 62		
Fridays	Mean Hourly Volume (vph)	511	135	502	99	652	384		
	Mean Daily Volume (vpd)	12266	3249	12053	2364	15643	9213		
	Mean Speed (km/h) (mph)	75 46	79 49	87 54	56 35	85 53	91 56		
Saturdays	Mean Hourly Volume (vph)	451	105	308	72	605	242		
	Mean Daily Volume (vpd)	10834	2518	7399	1734	14520	5813		
	Mean Speed (km/h) (mph)	78 48	84 52	90 56	57 35	84 52	90 56		
Monthly	Mean Hourly Volume (vph)	490	146	442	108	674	346		
	Mean Daily Volume (vpd)	11757	3494	10598	2599	16183	8294		
	Mean Speed (km/h) (mph)	77 48	82 51	89 56	58 36	87 54	94 58		

Site 613 on I-164, January 1998		Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	252	45	262	45
	Mean Daily Volume (vpd)	6038	1071	6284	1073
	Mean Speed (km/h)	99	104	98	109
	(mph)	62	65	61	68
Mondays	Mean Hourly Volume (vph)	347	96	346	82
	Mean Daily Volume (vpd)	8319	2301	8313	1969
	Mean Speed (km/h)	98	95	98	109
	(mph)	61	59	61	68
Tuesdays	Mean Hourly Volume (vph)	347	99	345	83
	Mean Daily Volume (vpd)	8339	2386	8276	2002
	Mean Speed (km/h)	98	96	97	106
	(mph)	61	60	60	66
Wednesdays	Mean Hourly Volume (vph)	353	101	353	88
	Mean Daily Volume (vpd)	8469	2424	8474	2121
	Mean Speed (km/h)	98	100	97	108
	(mph)	61	62	60	67
Thursdays	Mean Hourly Volume (vph)	340	92	344	82
	Mean Daily Volume (vpd)	8167	2199	8249	1974
	Mean Speed (km/h)	98	102	97	109
	(mph)	61	63	60	68
Fridays	Mean Hourly Volume (vph)	391	114	392	98
	Mean Daily Volume (vpd)	9384	2747	9416	2351
	Mean Speed (km/h)	98	103	98	109
	(mph)	61	64	61	68
Saturdays	Mean Hourly Volume (vph)	333	68	342	64
	Mean Daily Volume (vpd)	7993	1628	8200	1532
	Mean Speed (km/h)	99	105	98	110
	(mph)	61	66	61	68
Monthly	Mean Hourly Volume (vph)	339	88	342	78
	Mean Daily Volume (vpd)	8138	2115	8213	1868
	Mean Speed (km/h)	98	101	98	109
	(mph)	61	63	61	67

Site 613 on I-164, February 1998		Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	269	50	280	50
	Mean Daily Volume (vpd)	6454	1201	6725	1189
	Mean Speed (km/h) (mph)	99 62	105 65	98 61	110 68
Mondays	Mean Hourly Volume (vph)	352	98	351	83
	Mean Daily Volume (vpd)	8455	2343	8434	1994
	Mean Speed (km/h) (mph)	98 61	98 61	97 61	108 67
Tuesdays	Mean Hourly Volume (vph)	351	100	348	88
	Mean Daily Volume (vpd)	8433	2403	8358	2101
	Mean Speed (km/h) (mph)	94 58	97 60	94 58	102 63
Wednesdays	Mean Hourly Volume (vph)	338	97	338	82
	Mean Daily Volume (vpd)	8116	2329	8113	1971
	Mean Speed (km/h) (mph)	89 55	92 57	89 55	100 62
Thursdays	Mean Hourly Volume (vph)	322	89	325	77
	Mean Daily Volume (vpd)	7737	2131	7793	1858
	Mean Speed (km/h) (mph)	93 58	94 58	93 58	101 63
Fridays	Mean Hourly Volume (vph)	373	108	376	94
	Mean Daily Volume (vpd)	8957	2587	9025	2245
	Mean Speed (km/h) (mph)	94 59	98 61	95 59	104 65
Saturdays	Mean Hourly Volume (vph)	352	75	359	68
	Mean Daily Volume (vpd)	8450	1798	8622	1629
	Mean Speed (km/h) (mph)	99 61	104 65	98 61	110 68
Monthly	Mean Hourly Volume (vph)	337	88	340	77
	Mean Daily Volume (vpd)	8086	2113	8153	1855
	Mean Speed (km/h) (mph)	95 59	98 61	95 59	105 65

Site 613 on I-164, April 1998							
	Mean Hourly Volume (vph)	Mean Daily Volume (vpd)	Mean Speed (km/h) (mph)	Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays		288		54	306		59
		6902		1305	7335		1426
		96		105	98		104
		60		65	61		65
Mondays		370		107	373		90
		8872		2566	8955		2166
		95		99	97		103
		59		61	60		64
Tuesdays		373		110	377		91
		8948		2629	9051		2184
		95		99	98		104
		59		62	61		65
Wednesdays		373		109	373		92
		8955		2626	8962		2201
		95		102	97		104
		59		63	60		64
Thursdays		385		114	387		99
		9239		2727	9285		2369
		95		100	97		104
		59		62	61		65
Fridays		409		119	413		104
		9809		2853	9909		2503
		95		104	98		103
		59		65	61		64
Saturdays		348		75	362		70
		8356		1801	8676		1674
		95		105	98		104
		59		65	61		65
Monthly		365		99	371		87
		8758		2384	8905		2091
		95		102	98		104
		59		63	61		64

Site 613 on I-164, May 1998					Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound	
Sundays	Mean Hourly Volume (vph)		382		156		403		158
	Mean Daily Volume (vpd)		9164		3737		9676		3783
	Mean Speed (km/h) (mph)		91 57		90 56		94 58		90 56
Mondays	Mean Hourly Volume (vph)		442		191		453		180
	Mean Daily Volume (vpd)		10619		4580		10874		4328
	Mean Speed (km/h) (mph)		92 57		92 57		94 58		91 57
Tuesdays	Mean Hourly Volume (vph)		424		196		419		173
	Mean Daily Volume (vpd)		10167		4715		10048		4147
	Mean Speed (km/h) (mph)		91 56		92 57		92 57		90 56
Wednesdays	Mean Hourly Volume (vph)		393		186		397		174
	Mean Daily Volume (vpd)		9425		4454		9517		4167
	Mean Speed (km/h) (mph)		90 56		91 56		91 57		90 56
Thursdays	Mean Hourly Volume (vph)		450		199		462		195
	Mean Daily Volume (vpd)		10795		4771		11082		4681
	Mean Speed (km/h) (mph)		91 56		92 57		93 58		92 57
Fridays	Mean Hourly Volume (vph)		522		229		519		207
	Mean Daily Volume (vpd)		12536		5492		12460		4968
	Mean Speed (km/h) (mph)		92 57		94 58		94 58		93 58
Saturdays	Mean Hourly Volume (vph)		453		181		460		169
	Mean Daily Volume (vpd)		10871		4346		11029		4060
	Mean Speed (km/h) (mph)		92 57		92 57		94 58		91 57
Monthly	Mean Hourly Volume (vph)		440		191		446		179
	Mean Daily Volume (vpd)		10549		4579		10711		4302
	Mean Speed (km/h) (mph)		91 57		92 57		93 58		91 57

Site 613 on I-164, June 1998						
	Mean Hourly Volume (vph)	Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound	
Sundays	Mean Daily Volume (vpd)	413	187	437	190	
	Mean Speed (km/h)	9924	4497	10492	4563	
	(mph)	91	89	92	89	
Mondays	Mean Hourly Volume (vph)	56	55	57	55	
	Mean Daily Volume (vpd)	509	232	506	220	
	Mean Speed (km/h)	12227	5580	12141	5280	
Tuesdays	Mean Speed (mph)	91	91	93	90	
	Mean Hourly Volume (vph)	511	237	516	223	
	Mean Daily Volume (vpd)	12268	5698	12376	5358	
Wednesdays	Mean Speed (km/h)	91	91	93	90	
	Mean Speed (mph)	56	57	58	56	
	Mean Hourly Volume (vph)	515	241	489	257	
Thursdays	Mean Daily Volume (vpd)	12368	5794	11730	6167	
	Mean Speed (km/h)	91	91	92	90	
	Mean Speed (mph)	57	57	57	56	
Fridays	Mean Hourly Volume (vph)	523	244	527	230	
	Mean Daily Volume (vpd)	12562	5851	12648	5527	
	Mean Speed (km/h)	91	92	92	90	
Saturdays	Mean Speed (mph)	57	57	57	56	
	Mean Hourly Volume (vph)	553	257	554	239	
	Mean Daily Volume (vpd)	13277	6180	13287	5747	
Monthly	Mean Speed (km/h)	91	92	93	91	
	Mean Speed (mph)	56	57	58	57	
	Mean Hourly Volume (vph)	493	213	503	200	
Monthly	Mean Daily Volume (vpd)	11839	5110	12083	4807	
	Mean Speed (km/h)	91	91	93	90	
	Mean Speed (mph)	57	56	58	56	
Monthly	Mean Hourly Volume (vph)	503	231	505	223	
	Mean Daily Volume (vpd)	12078	5537	12118	5348	
	Mean Speed (km/h)	91	91	92	90	
Monthly	Mean Speed (mph)	56	57	57	56	

Site 613 on I-164, July 1998		Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	493	255	515	260
	Mean Daily Volume (vpd)	11822	6110	12365	6235
	Mean Speed (km/h) (mph)	89 55	86 53	90 56	85 53
Mondays	Mean Hourly Volume (vph)	581	304	529	347
	Mean Daily Volume (vpd)	13951	7307	12688	8333
	Mean Speed (km/h) (mph)	89 55	88 55	89 55	86 54
Tuesdays	Mean Hourly Volume (vph)	577	304	532	336
	Mean Daily Volume (vpd)	13857	7302	12758	8058
	Mean Speed (km/h) (mph)	89 55	88 55	89 55	86 54
Wednesdays	Mean Hourly Volume (vph)	590	311	549	340
	Mean Daily Volume (vpd)	14155	7458	13170	8160
	Mean Speed (km/h) (mph)	89 55	88 55	89 55	87 54
Thursdays	Mean Hourly Volume (vph)	605	316	603	306
	Mean Daily Volume (vpd)	14515	7591	14468	7343
	Mean Speed (km/h) (mph)	89 55	88 55	90 56	87 54
Fridays	Mean Hourly Volume (vph)	627	324	624	307
	Mean Daily Volume (vpd)	15043	7767	14984	7361
	Mean Speed (km/h) (mph)	89 56	89 55	91 56	87 54
Saturdays	Mean Hourly Volume (vph)	561	279	561	272
	Mean Daily Volume (vpd)	13467	6694	13473	6525
	Mean Speed (km/h) (mph)	89 55	87 54	90 56	86 54
Monthly	Mean Hourly Volume (vph)	579	301	562	310
	Mean Daily Volume (vpd)	13902	7217	13492	7449
	Mean Speed (km/h) (mph)	89 55	88 55	90 56	87 54

Site 613 on I-164, August 1998						
	Mean Hourly Volume (vph)	Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound	
Sundays	Mean Daily Volume (vpd)	387	148	407	153	
	Mean Speed (km/h) (mph)	9298	3548	9760	3671	
Mondays	Mean Hourly Volume (vph)	93	92	94	92	
	Mean Daily Volume (vpd)	58	57	58	57	
Tuesdays	Mean Hourly Volume (vph)	457	198	289	352	
	Mean Daily Volume (vpd)	10971	4742	6935	8439	
Wednesdays	Mean Hourly Volume (vph)	92	94	90	91	
	Mean Daily Volume (vpd)	57	59	56	57	
Thursdays	Mean Hourly Volume (vph)	470	200	351	316	
	Mean Daily Volume (vpd)	11287	4796	8431	7574	
Fridays	Mean Hourly Volume (vph)	92	94	91	92	
	Mean Daily Volume (vpd)	57	59	57	57	
Saturdays	Mean Hourly Volume (vph)	481	205	303	374	
	Mean Daily Volume (vpd)	11532	4928	7263	8985	
Monthly	Mean Hourly Volume (vph)	93	95	90	91	
	Mean Daily Volume (vpd)	58	59	56	57	
Sundays	Mean Hourly Volume (vph)	481	206	381	301	
	Mean Daily Volume (vpd)	11545	4941	9153	7232	
Mondays	Mean Hourly Volume (vph)	93	95	91	92	
	Mean Daily Volume (vpd)	58	59	57	57	
Tuesdays	Mean Hourly Volume (vph)	506	220	398	320	
	Mean Daily Volume (vpd)	12137	5272	9542	7686	
Wednesdays	Mean Hourly Volume (vph)	93	96	92	92	
	Mean Daily Volume (vpd)	58	60	57	57	
Thursdays	Mean Hourly Volume (vph)	458	173	447	182	
	Mean Daily Volume (vpd)	10981	4160	10736	4372	
Fridays	Mean Hourly Volume (vph)	93	94	93	93	
	Mean Daily Volume (vpd)	58	59	58	58	
Saturdays	Mean Hourly Volume (vph)	460	191	369	280	
	Mean Daily Volume (vpd)	11040	4580	8861	6720	
Monthly	Mean Hourly Volume (vph)	93	94	92	92	
	Mean Daily Volume (vpd)	58	59	57	57	

Site 613 on I-164, September 1998		Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	393	160	408	162
	Mean Daily Volume (vpd)	9438	3849	9794	3878
	Mean Speed (km/h) (mph)	91 57	89 56	92 57	89 55
Mondays	Mean Hourly Volume (vph)	442	199	437	208
	Mean Daily Volume (vpd)	10607	4770	10491	4998
	Mean Speed (km/h) (mph)	91 57	91 56	92 57	90 56
Tuesdays	Mean Hourly Volume (vph)	400	196	411	237
	Mean Daily Volume (vpd)	9610	4707	9860	5682
	Mean Speed (km/h) (mph)	89 56	90 56	91 56	89 56
Wednesdays	Mean Hourly Volume (vph)	408	200	420	227
	Mean Daily Volume (vpd)	9792	4809	10070	5439
	Mean Speed (km/h) (mph)	90 56	90 56	91 57	89 56
Thursdays	Mean Hourly Volume (vph)	437	212	375	241
	Mean Daily Volume (vpd)	10477	5085	8990	5790
	Mean Speed (km/h) (mph)	90 56	91 56	90 56	89 55
Fridays	Mean Hourly Volume (vph)	525	238	464	276
	Mean Daily Volume (vpd)	12596	5719	11132	6623
	Mean Speed (km/h) (mph)	92 57	93 58	92 57	91 57
Saturdays	Mean Hourly Volume (vph)	457	184	459	171
	Mean Daily Volume (vpd)	10977	4424	11009	4092
	Mean Speed (km/h) (mph)	91 57	91 57	92 57	90 56
Monthly	Mean Hourly Volume (vph)	432	199	421	220
	Mean Daily Volume (vpd)	10376	4777	10111	5290
	Mean Speed (km/h) (mph)	90 56	91 56	91 57	90 56

Site 614 on I-64, January 1998						
	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound	
Sundays	Mean Daily Volume (vpd)	155	18	149	21	
	Mean Speed (km/h) (mph)	3729	441	3568	515	
Mondays	Mean Hourly Volume (vph)	111	108	110	112	
	Mean Daily Volume (vpd)	69	67	68	70	
Tuesdays	Mean Hourly Volume (vph)	199	26	186	35	
	Mean Daily Volume (vpd)	4773	615	4457	832	
Wednesdays	Mean Hourly Volume (vph)	110	115	107	112	
	Mean Daily Volume (vpd)	68	71	67	70	
Thursdays	Mean Hourly Volume (vph)	205	25	199	33	
	Mean Daily Volume (vpd)	4929	611	4770	781	
Fridays	Mean Hourly Volume (vph)	109	114	108	113	
	Mean Daily Volume (vpd)	68	71	67	70	
Saturdays	Mean Hourly Volume (vph)	198	25	188	31	
	Mean Daily Volume (vpd)	4748	605	4523	755	
Monthly	Mean Hourly Volume (vph)	109	113	107	112	
	Mean Daily Volume (vpd)	68	70	67	70	
Sundays	Mean Hourly Volume (vph)	196	25	185	31	
	Mean Daily Volume (vpd)	4700	606	4440	739	
Mondays	Mean Hourly Volume (vph)	110	115	107	111	
	Mean Daily Volume (vpd)	68	71	67	69	
Tuesdays	Mean Hourly Volume (vph)	224	32	212	39	
	Mean Daily Volume (vpd)	5385	767	5089	930	
Wednesdays	Mean Hourly Volume (vph)	111	115	108	111	
	Mean Daily Volume (vpd)	69	72	67	69	
Thursdays	Mean Hourly Volume (vph)	184	22	177	25	
	Mean Daily Volume (vpd)	4406	521	4238	611	
Fridays	Mean Hourly Volume (vph)	111	114	109	112	
	Mean Daily Volume (vpd)	69	71	67	70	
Saturdays	Mean Hourly Volume (vph)	195	25	186	31	
	Mean Daily Volume (vpd)	4681	598	4454	739	
Monthly	Mean Hourly Volume (vph)	110	113	108	112	
	Mean Daily Volume (vpd)	68	71	67	70	

Site 614 on I-64, February 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	168	20	162	25
	Mean Daily Volume (vpd)	4028	489	3890	594
	Mean Speed (km/h) (mph)	111 69	108 67	110 68	106 66
Mondays	Mean Hourly Volume (vph)	205	25	197	31
	Mean Daily Volume (vpd)	4932	607	4731	742
	Mean Speed (km/h) (mph)	109 68	115 71	108 67	111 69
Tuesdays	Mean Hourly Volume (vph)	210	26	202	32
	Mean Daily Volume (vpd)	5052	631	4859	758
	Mean Speed (km/h) (mph)	109 68	114 71	107 67	111 69
Wednesdays	Mean Hourly Volume (vph)	207	26	195	31
	Mean Daily Volume (vpd)	4979	632	4673	751
	Mean Speed (km/h) (mph)	106 66	109 68	103 64	107 67
Thursdays	Mean Hourly Volume (vph)	210	26	191	36
	Mean Daily Volume (vpd)	5033	628	4591	871
	Mean Speed (km/h) (mph)	104 64	106 66	101 63	104 65
Fridays	Mean Hourly Volume (vph)	225	38	217	45
	Mean Daily Volume (vpd)	5407	918	5210	1072
	Mean Speed (km/h) (mph)	105 65	112 69	103 64	109 68
Saturdays	Mean Hourly Volume (vph)	196	23	190	29
	Mean Daily Volume (vpd)	4693	543	4566	693
	Mean Speed (km/h) (mph)	110 69	116 72	108 67	113 70
Monthly	Mean Hourly Volume (vph)	203	26	194	33
	Mean Daily Volume (vpd)	4875	636	4646	783
	Mean Speed (km/h) (mph)	108 67	111 69	106 66	109 68

Site 614 on I-64, April 1998						
	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound	
Sundays	Mean Hourly Volume (vph)	203	31	206	40	
	Mean Daily Volume (vpd)	4861	753	4943	948	
	Mean Speed (km/h) (mph)	111 69	112 69	110 68	118 73	
Mondays	Mean Hourly Volume (vph)	221	34	224	41	
	Mean Daily Volume (vpd)	5305	823	5372	985	
	Mean Speed (km/h) (mph)	110 68	113 70	108 67	114 71	
Tuesdays	Mean Hourly Volume (vph)	221	32	221	38	
	Mean Daily Volume (vpd)	5296	765	5315	920	
	Mean Speed (km/h) (mph)	109 68	112 70	107 66	116 72	
Wednesdays	Mean Hourly Volume (vph)	228	33	221	40	
	Mean Daily Volume (vpd)	5466	803	5311	968	
	Mean Speed (km/h) (mph)	109 68	108 67	106 66	115 72	
Thursdays	Mean Hourly Volume (vph)	244	42	231	46	
	Mean Daily Volume (vpd)	5857	1001	5552	1102	
	Mean Speed (km/h) (mph)	109 68	111 69	106 66	116 72	
Fridays	Mean Hourly Volume (vph)	268	46	254	53	
	Mean Daily Volume (vpd)	6441	1110	6086	1282	
	Mean Speed (km/h) (mph)	110 68	113 70	108 67	117 73	
Saturdays	Mean Hourly Volume (vph)	210	28	211	34	
	Mean Daily Volume (vpd)	5037	681	5055	817	
	Mean Speed (km/h) (mph)	110 68	113 70	108 67	115 72	
Monthly	Mean Hourly Volume (vph)	228	35	224	42	
	Mean Daily Volume (vpd)	5482	852	5382	1006	
	Mean Speed (km/h) (mph)	110 68	112 69	108 67	116 72	

Site 614 on I-64, May 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	273	132	309	144
	Mean Daily Volume (vpd)	6540	3162	7407	3447
	Mean Speed (km/h) (mph)	99 62	90 56	99 61	92 57
Mondays	Mean Hourly Volume (vph)	310	135	329	144
	Mean Daily Volume (vpd)	7448	3248	7903	3460
	Mean Speed (km/h) (mph)	101 63	91 56	100 62	92 57
Tuesdays	Mean Hourly Volume (vph)	300	135	332	142
	Mean Daily Volume (vpd)	7193	3230	7967	3414
	Mean Speed (km/h) (mph)	100 62	91 56	100 62	92 57
Wednesdays	Mean Hourly Volume (vph)	301	137	336	144
	Mean Daily Volume (vpd)	7232	3283	8070	3452
	Mean Speed (km/h) (mph)	100 62	91 57	100 62	92 57
Thursdays	Mean Hourly Volume (vph)	319	141	343	148
	Mean Daily Volume (vpd)	7665	3373	8237	3562
	Mean Speed (km/h) (mph)	101 63	91 57	100 62	93 58
Fridays	Mean Hourly Volume (vph)	342	153	368	162
	Mean Daily Volume (vpd)	8209	3663	8834	3889
	Mean Speed (km/h) (mph)	102 63	93 58	100 62	94 59
Saturdays	Mean Hourly Volume (vph)	289	135	326	139
	Mean Daily Volume (vpd)	6945	3247	7833	3331
	Mean Speed (km/h) (mph)	100 62	91 56	100 62	92 57
Monthly	Mean Hourly Volume (vph)	305	138	335	146
	Mean Daily Volume (vpd)	7310	3319	8035	3512
	Mean Speed (km/h) (mph)	100 62	91 57	100 62	93 58

Site 614 on I-64, August 1998						
	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound	
Sundays	Mean Daily Volume (vpd)	7660	3301	8047	3614	
	Mean Speed (km/h)	100	94	99	96	
	(mph)	62	58	62	59	
Mondays	Mean Hourly Volume (vph)	315	129	299	132	
	Mean Daily Volume (vpd)	7562	3088	7188	3176	
	Mean Speed (km/h)	100	93	97	94	
Tuesdays	Mean Speed (mph)	62	58	61	59	
	Mean Hourly Volume (vph)	284	122	227	117	
	Mean Daily Volume (vpd)	6825	2925	5455	2818	
Wednesdays	Mean Speed (km/h)	98	92	93	91	
	Mean Speed (mph)	61	57	58	57	
	Mean Hourly Volume (vph)	302	128	247	121	
Thursdays	Mean Daily Volume (vpd)	7251	3065	5920	2901	
	Mean Speed (km/h)	98	93	94	92	
	(mph)	61	58	58	57	
Thursdays	Mean Hourly Volume (vph)	310	133	281	131	
	Mean Daily Volume (vpd)	7434	3188	6750	3153	
	Mean Speed (km/h)	98	93	95	93	
Fridays	Mean Speed (mph)	61	58	59	58	
	Mean Hourly Volume (vph)	370	149	367	159	
	Mean Daily Volume (vpd)	8882	3575	8816	3821	
Fridays	Mean Speed (km/h)	101	95	100	97	
	(mph)	63	59	62	60	
	Mean Hourly Volume (vph)	336	141	349	145	
Saturdays	Mean Daily Volume (vpd)	8075	3382	8377	3479	
	Mean Speed (km/h)	101	94	100	96	
	(mph)	63	59	62	60	
Monthly	Mean Hourly Volume (vph)	318	134	298	136	
	Mean Daily Volume (vpd)	7625	3204	7163	3260	
	Mean Speed (km/h)	99	93	97	94	
	(mph)	62	58	60	58	

Site 615 on I-64, January 1998		Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	299	163
	Mean Daily Volume (vpd)	7172	3903
	Mean Speed (km/h) (mph)	110 68	111 69
Mondays	Mean Hourly Volume (vph)	306	159
	Mean Daily Volume (vpd)	7333	3825
	Mean Speed (km/h) (mph)	109 68	111 69
Tuesdays	Mean Hourly Volume (vph)	312	163
	Mean Daily Volume (vpd)	7487	3918
	Mean Speed (km/h) (mph)	109 68	111 69
Wednesdays	Mean Hourly Volume (vph)	309	165
	Mean Daily Volume (vpd)	7414	3953
	Mean Speed (km/h) (mph)	108 67	111 69
Thursdays	Mean Hourly Volume (vph)	304	160
	Mean Daily Volume (vpd)	7299	3830
	Mean Speed (km/h) (mph)	109 68	111 69
Fridays	Mean Hourly Volume (vph)	331	169
	Mean Daily Volume (vpd)	7943	4059
	Mean Speed (km/h) (mph)	110 68	111 69
Saturdays	Mean Hourly Volume (vph)	314	164
	Mean Daily Volume (vpd)	7547	3925
	Mean Speed (km/h) (mph)	110 68	111 69
Monthly	Mean Hourly Volume (vph)	311	163
	Mean Daily Volume (vpd)	7459	3913
	Mean Speed (km/h) (mph)	109 68	111 69

Site 615 on I-64, February 1998		Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	298	146
	Mean Daily Volume (vpd)	7153	3503
	Mean Speed (km/h)	112	110
	(mph)	69	68
Mondays	Mean Hourly Volume (vph)	301	145
	Mean Daily Volume (vpd)	7229	3476
	Mean Speed (km/h)	111	110
	(mph)	69	68
Tuesdays	Mean Hourly Volume (vph)	274	145
	Mean Daily Volume (vpd)	6566	3482
	Mean Speed (km/h)	111	110
	(mph)	69	68
Wednesdays	Mean Hourly Volume (vph)	310	147
	Mean Daily Volume (vpd)	7434	3517
	Mean Speed (km/h)	111	110
	(mph)	69	68
Thursdays	Mean Hourly Volume (vph)	319	149
	Mean Daily Volume (vpd)	7648	3572
	Mean Speed (km/h)	111	110
	(mph)	69	68
Fridays	Mean Hourly Volume (vph)	348	159
	Mean Daily Volume (vpd)	8350	3827
	Mean Speed (km/h)	111	110
	(mph)	69	69
Saturdays	Mean Hourly Volume (vph)	310	145
	Mean Daily Volume (vpd)	7434	3474
	Mean Speed (km/h)	112	110
	(mph)	69	68
Monthly	Mean Hourly Volume (vph)	309	148
	Mean Daily Volume (vpd)	7424	3556
	Mean Speed (km/h)	111	110
	(mph)	69	68

Site 615 on I-64, April 1998		Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	352	184
	Mean Daily Volume (vpd)	8437	4406
	Mean Speed (km/h) (mph)	110 68	110 68
Mondays	Mean Hourly Volume (vph)	348	177
	Mean Daily Volume (vpd)	8362	4238
	Mean Speed (km/h) (mph)	109 68	109 68
Tuesdays	Mean Hourly Volume (vph)	342	176
	Mean Daily Volume (vpd)	8219	4225
	Mean Speed (km/h) (mph)	109 67	109 68
Wednesdays	Mean Hourly Volume (vph)	294	169
	Mean Daily Volume (vpd)	7047	4063
	Mean Speed (km/h) (mph)	108 67	109 68
Thursdays	Mean Hourly Volume (vph)	363	184
	Mean Daily Volume (vpd)	8718	4428
	Mean Speed (km/h) (mph)	109 68	110 68
Fridays	Mean Hourly Volume (vph)	384	189
	Mean Daily Volume (vpd)	9226	4541
	Mean Speed (km/h) (mph)	110 68	110 68
Saturdays	Mean Hourly Volume (vph)	333	173
	Mean Daily Volume (vpd)	7994	4140
	Mean Speed (km/h) (mph)	109 68	109 68
Monthly	Mean Hourly Volume (vph)	342	178
	Mean Daily Volume (vpd)	8200	4278
	Mean Speed (km/h) (mph)	109 68	109 68

Site 615 on I-64, May 1998			Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)		400	229
	Mean Daily Volume (vpd)		9600	5485
	Mean Speed (km/h) (mph)		102 63	98 61
Mondays	Mean Hourly Volume (vph)		401	226
	Mean Daily Volume (vpd)		9614	5424
	Mean Speed (km/h) (mph)		102 63	97 61
Tuesdays	Mean Hourly Volume (vph)		396	223
	Mean Daily Volume (vpd)		9493	5352
	Mean Speed (km/h) (mph)		102 63	97 60
Wednesdays	Mean Hourly Volume (vph)		397	223
	Mean Daily Volume (vpd)		9516	5348
	Mean Speed (km/h) (mph)		102 63	97 60
Thursdays	Mean Hourly Volume (vph)		417	230
	Mean Daily Volume (vpd)		10008	5528
	Mean Speed (km/h) (mph)		102 63	98 61
Fridays	Mean Hourly Volume (vph)		447	246
	Mean Daily Volume (vpd)		10728	5892
	Mean Speed (km/h) (mph)		103 64	99 61
Saturdays	Mean Hourly Volume (vph)		409	228
	Mean Daily Volume (vpd)		9815	5465
	Mean Speed (km/h) (mph)		102 64	98 61
Monthly	Mean Hourly Volume (vph)		411	230
	Mean Daily Volume (vpd)		9857	5516
	Mean Speed (km/h) (mph)		102 63	98 61

Site 615 on I-64, June 1998		Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	364	183
	Mean Daily Volume (vpd)	8728	4398
	Mean Speed (km/h) (mph)	99 61	90 56
Mondays	Mean Hourly Volume (vph)	347	170
	Mean Daily Volume (vpd)	8336	4089
	Mean Speed (km/h) (mph)	98 61	89 55
Tuesdays	Mean Hourly Volume (vph)	316	163
	Mean Daily Volume (vpd)	7580	3916
	Mean Speed (km/h) (mph)	96 60	88 55
Wednesdays	Mean Hourly Volume (vph)	355	173
	Mean Daily Volume (vpd)	8517	4149
	Mean Speed (km/h) (mph)	98 61	89 56
Thursdays	Mean Hourly Volume (vph)	361	181
	Mean Daily Volume (vpd)	8659	4339
	Mean Speed (km/h) (mph)	99 61	90 56
Fridays	Mean Hourly Volume (vph)	395	195
	Mean Daily Volume (vpd)	9474	4686
	Mean Speed (km/h) (mph)	100 62	92 57
Saturdays	Mean Hourly Volume (vph)	364	183
	Mean Daily Volume (vpd)	8726	4402
	Mean Speed (km/h) (mph)	99 61	90 56
Monthly	Mean Hourly Volume (vph)	352	176
	Mean Daily Volume (vpd)	8447	4224
	Mean Speed (km/h) (mph)	98 61	90 56

Site 615 on I-64, July 1998		Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	625	434
	Mean Daily Volume (vpd)	14997	10421
	Mean Speed (km/h) (mph)	99 61	95 59
Mondays	Mean Hourly Volume (vph)	600	417
	Mean Daily Volume (vpd)	14400	10012
	Mean Speed (km/h) (mph)	98 61	94 58
Tuesdays	Mean Hourly Volume (vph)	590	418
	Mean Daily Volume (vpd)	14157	10026
	Mean Speed (km/h) (mph)	98 61	94 58
Wednesdays	Mean Hourly Volume (vph)	602	420
	Mean Daily Volume (vpd)	14452	10088
	Mean Speed (km/h) (mph)	98 61	94 58
Thursdays	Mean Hourly Volume (vph)	625	433
	Mean Daily Volume (vpd)	14995	10398
	Mean Speed (km/h) (mph)	99 61	95 59
Fridays	Mean Hourly Volume (vph)	652	444
	Mean Daily Volume (vpd)	15643	10658
	Mean Speed (km/h) (mph)	99 62	95 59
Saturdays	Mean Hourly Volume (vph)	611	426
	Mean Daily Volume (vpd)	14659	10217
	Mean Speed (km/h) (mph)	99 61	94 59
Monthly	Mean Hourly Volume (vph)	616	428
	Mean Daily Volume (vpd)	14784	10272
	Mean Speed (km/h) (mph)	98 61	94 59

Site 615 on I-64, August 1998		Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	333	148
	Mean Daily Volume (vpd)	8002	3563
	Mean Speed (km/h) (mph)	102 63	95 59
Mondays	Mean Hourly Volume (vph)	307	128
	Mean Daily Volume (vpd)	7368	3080
	Mean Speed (km/h) (mph)	102 63	93 58
Tuesdays	Mean Hourly Volume (vph)	308	127
	Mean Daily Volume (vpd)	7402	3050
	Mean Speed (km/h) (mph)	102 63	93 58
Wednesdays	Mean Hourly Volume (vph)	314	133
	Mean Daily Volume (vpd)	7540	3193
	Mean Speed (km/h) (mph)	102 63	94 58
Thursdays	Mean Hourly Volume (vph)	329	138
	Mean Daily Volume (vpd)	7898	3312
	Mean Speed (km/h) (mph)	102 64	94 59
Fridays	Mean Hourly Volume (vph)	348	148
	Mean Daily Volume (vpd)	8347	3555
	Mean Speed (km/h) (mph)	103 64	96 59
Saturdays	Mean Hourly Volume (vph)	336	142
	Mean Daily Volume (vpd)	8054	3417
	Mean Speed (km/h) (mph)	102 64	95 59
Monthly	Mean Hourly Volume (vph)	325	138
	Mean Daily Volume (vpd)	7802	3314
	Mean Speed (km/h) (mph)	102 63	94 59

Site 615 on I-64, September 1998		Driving Lane East Bound	Passing Lane East Bound
Sundays	Mean Hourly Volume (vph)	390	219
	Mean Daily Volume (vpd)	9357	5257
	Mean Speed (km/h)	100	94
	Mean Speed (mph)	62	59
Mondays	Mean Hourly Volume (vph)	390	217
	Mean Daily Volume (vpd)	9366	5203
	Mean Speed (km/h)	100	94
	Mean Speed (mph)	62	59
Tuesdays	Mean Hourly Volume (vph)	379	211
	Mean Daily Volume (vpd)	9106	5070
	Mean Speed (km/h)	100	94
	Mean Speed (mph)	62	58
Wednesdays	Mean Hourly Volume (vph)	385	213
	Mean Daily Volume (vpd)	9230	5101
	Mean Speed (km/h)	100	94
	Mean Speed (mph)	62	58
Thursdays	Mean Hourly Volume (vph)	399	220
	Mean Daily Volume (vpd)	9584	5281
	Mean Speed (km/h)	100	95
	Mean Speed (mph)	62	59
Fridays	Mean Hourly Volume (vph)	435	239
	Mean Daily Volume (vpd)	10436	5740
	Mean Speed (km/h)	101	96
	Mean Speed (mph)	63	60
Saturdays	Mean Hourly Volume (vph)	396	218
	Mean Daily Volume (vpd)	9506	5241
	Mean Speed (km/h)	101	94
	Mean Speed (mph)	62	59
Monthly	Mean Hourly Volume (vph)	395	219
	Mean Daily Volume (vpd)	9489	5258
	Mean Speed (km/h)	100	94
	Mean Speed (mph)	62	59

Site 616 on I-64, January 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	282	71	275	76
	Mean Daily Volume (vpd)	6767	1701	6610	1819
	Mean Speed (km/h) (mph)	105 65	114 71	105 65	116 72
Mondays	Mean Hourly Volume (vph)	360	121	358	123
	Mean Daily Volume (vpd)	8632	2912	8601	2943
	Mean Speed (km/h) (mph)	103 64	113 70	104 64	115 71
Tuesdays	Mean Hourly Volume (vph)	367	130	378	131
	Mean Daily Volume (vpd)	8807	3111	9062	3151
	Mean Speed (km/h) (mph)	104 64	113 70	104 64	114 71
Wednesdays	Mean Hourly Volume (vph)	368	133	374	132
	Mean Daily Volume (vpd)	8836	3187	8972	3176
	Mean Speed (km/h) (mph)	103 64	112 70	104 65	115 71
Thursdays	Mean Hourly Volume (vph)	350	121	343	115
	Mean Daily Volume (vpd)	8404	2897	8229	2752
	Mean Speed (km/h) (mph)	103 64	112 69	103 64	114 71
Fridays	Mean Hourly Volume (vph)	394	141	399	150
	Mean Daily Volume (vpd)	9460	3380	9566	3589
	Mean Speed (km/h) (mph)	104 65	114 71	103 64	114 71
Saturdays	Mean Hourly Volume (vph)	327	87	333	98
	Mean Daily Volume (vpd)	7837	2099	8000	2343
	Mean Speed (km/h) (mph)	104 65	114 71	103 64	115 72
Monthly	Mean Hourly Volume (vph)	350	115	352	118
	Mean Daily Volume (vpd)	8409	2755	8456	2833
	Mean Speed (km/h) (mph)	104 64	113 70	104 64	115 71

Site 616 on I-64, February 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	288	80	294	86
	Mean Daily Volume (vpd)	6923	1929	7050	2057
	Mean Speed (km/h) (mph)	107 66	113 70	104 65	115 72
Mondays	Mean Hourly Volume (vph)	324	112	347	120
	Mean Daily Volume (vpd)	7782	2681	8324	2879
Tuesdays	Mean Speed (km/h) (mph)	95 59	101 63	93 58	102 63
	Mean Hourly Volume (vph)	360	131	386	133
	Mean Daily Volume (vpd)	8633	3152	9253	3186
Wednesdays	Mean Speed (km/h) (mph)	105 65	113 70	104 64	115 71
	Mean Hourly Volume (vph)	331	128	364	124
	Mean Daily Volume (vpd)	7938	3067	8740	2966
Thursdays	Mean Speed (km/h) (mph)	100 62	107 67	99 61	109 68
	Mean Hourly Volume (vph)	327	120	343	119
	Mean Daily Volume (vpd)	7855	2877	8238	2851
Fridays	Mean Speed (km/h) (mph)	99 61	104 65	95 59	106 66
	Mean Hourly Volume (vph)	350	132	379	144
	Mean Daily Volume (vpd)	8405	3161	9105	3465
Saturdays	Mean Speed (km/h) (mph)	101 63	107 67	98 61	109 68
	Mean Hourly Volume (vph)	320	94	347	108
	Mean Daily Volume (vpd)	7692	2264	8329	2592
Monthly	Mean Speed (km/h) (mph)	106 66	113 70	103 64	115 71
	Mean Hourly Volume (vph)	329	114	351	119
	Mean Daily Volume (vpd)	7889	2733	8434	2856
	Mean Speed (km/h) (mph)	102 63	108 67	99 62	110 68

Site 616 on I-64, April 1998					
		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	96	110	346	115
	Mean Daily Volume (vpd)	2315	2643	8305	2762
	Mean Speed (km/h) (mph)	109 68	113 70	105 65	116 72
Mondays	Mean Hourly Volume (vph)	107	141	424	152
	Mean Daily Volume (vpd)	2564	3381	10172	3652
	Mean Speed (km/h) (mph)	108 67	113 70	105 65	114 71
Tuesdays	Mean Hourly Volume (vph)	98	151	430	159
	Mean Daily Volume (vpd)	2361	3621	10311	3806
	Mean Speed (km/h) (mph)	108 67	113 70	104 65	115 71
Wednesdays	Mean Hourly Volume (vph)	205	153	419	151
	Mean Daily Volume (vpd)	4911	3661	10053	3620
	Mean Speed (km/h) (mph)	108 67	113 70	104 65	114 71
Thursdays	Mean Hourly Volume (vph)	240	172	441	171
	Mean Daily Volume (vpd)	5748	4123	10583	4093
	Mean Speed (km/h) (mph)	108 67	114 71	104 64	115 71
Fridays	Mean Hourly Volume (vph)	134	178	461	188
	Mean Daily Volume (vpd)	3217	4279	11057	4520
	Mean Speed (km/h) (mph)	110 68	115 71	104 65	115 72
Saturdays	Mean Hourly Volume (vph)	100	104	368	113
	Mean Daily Volume (vpd)	2395	2491	8841	2710
	Mean Speed (km/h) (mph)	108 67	114 71	104 65	115 71
Monthly	Mean Hourly Volume (vph)	145	145	413	150
	Mean Daily Volume (vpd)	3491	3478	9915	3603
	Mean Speed (km/h) (mph)	108 67	114 71	104 65	115 71

Site 616 on I-64, May 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	281	212	438	215
	Mean Daily Volume (vpd)	6733	5084	10521	5157
	Mean Speed (km/h) (mph)	97 60	97 60	98 61	97 60
Mondays	Mean Hourly Volume (vph)	240	241	494	240
	Mean Daily Volume (vpd)	5760	5788	11854	5755
	Mean Speed (km/h) (mph)	96 59	98 61	100 62	98 61
Tuesdays	Mean Hourly Volume (vph)	265	250	518	259
	Mean Daily Volume (vpd)	6365	6006	12421	6211
	Mean Speed (km/h) (mph)	97 60	99 61	100 62	99 62
Wednesdays	Mean Hourly Volume (vph)	247	254	518	256
	Mean Daily Volume (vpd)	5928	6093	12441	6155
	Mean Speed (km/h) (mph)	96 60	99 61	100 62	99 62
Thursdays	Mean Hourly Volume (vph)	289	266	528	266
	Mean Daily Volume (vpd)	6924	6387	12665	6387
	Mean Speed (km/h) (mph)	98 61	100 62	100 62	100 62
Fridays	Mean Hourly Volume (vph)	301	285	563	302
	Mean Daily Volume (vpd)	7232	6829	13514	7239
	Mean Speed (km/h) (mph)	98 61	101 63	100 62	101 63
Saturdays	Mean Hourly Volume (vph)	276	209	481	225
	Mean Daily Volume (vpd)	6632	5005	11553	5389
	Mean Speed (km/h) (mph)	98 61	98 61	99 62	98 61
Monthly	Mean Hourly Volume (vph)	273	244	505	251
	Mean Daily Volume (vpd)	6545	5861	12112	6031
	Mean Speed (km/h) (mph)	97 60	99 61	100 62	99 61

Site 616 on I-64, July 1998					
		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	594	347	575	337
	Mean Daily Volume (vpd)	14264	8327	13793	8083
	Mean Speed (km/h) (mph)	96 60	92 57	96 59	92 57
Mondays	Mean Hourly Volume (vph)	615	359	627	370
	Mean Daily Volume (vpd)	14752	8626	15056	8882
	Mean Speed (km/h) (mph)	97 60	94 58	96 60	93 58
Tuesdays	Mean Hourly Volume (vph)	613	358	624	369
	Mean Daily Volume (vpd)	14700	8597	14982	8857
	Mean Speed (km/h) (mph)	96 60	93 58	96 60	93 58
Wednesdays	Mean Hourly Volume (vph)	628	366	633	372
	Mean Daily Volume (vpd)	15061	8795	15202	8921
	Mean Speed (km/h) (mph)	97 60	94 58	97 60	93 58
Thursdays	Mean Hourly Volume (vph)	641	377	652	387
	Mean Daily Volume (vpd)	15381	9052	15640	9296
	Mean Speed (km/h) (mph)	97 60	94 59	97 60	94 58
Fridays	Mean Hourly Volume (vph)	668	394	680	417
	Mean Daily Volume (vpd)	16035	9451	16312	10002
	Mean Speed (km/h) (mph)	97 61	95 59	97 61	95 59
Saturdays	Mean Hourly Volume (vph)	595	324	601	341
	Mean Daily Volume (vpd)	14280	7776	14422	8195
	Mean Speed (km/h) (mph)	96 60	92 57	96 60	92 57
Monthly	Mean Hourly Volume (vph)	624	363	630	373
	Mean Daily Volume (vpd)	14980	8703	15122	8941
	Mean Speed (km/h) (mph)	97 60	94 58	96 60	93 58

Site 616 on I-64, August 1998						
	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound	
Sundays	Mean Daily Volume (vpd)	477	235	461	227	
	Mean Speed (km/h) (mph)	11453	5633	11068	5459	
Mondays	Mean Hourly Volume (vph)	101	100	101	100	
	Mean Daily Volume (vpd)	63	62	63	62	
Tuesdays	Mean Hourly Volume (vph)	513	251	512	255	
	Mean Daily Volume (vpd)	12300	6028	12280	6121	
Wednesdays	Mean Hourly Volume (vph)	101	101	102	101	
	Mean Daily Volume (vpd)	63	63	63	63	
Thursdays	Mean Hourly Volume (vph)	512	248	525	257	
	Mean Daily Volume (vpd)	12279	5955	12592	6167	
Fridays	Mean Hourly Volume (vph)	101	101	101	101	
	Mean Daily Volume (vpd)	63	63	63	63	
Saturdays	Mean Hourly Volume (vph)	523	259	526	261	
	Mean Daily Volume (vpd)	12559	6221	12612	6276	
Monthly	Mean Hourly Volume (vph)	101	102	102	102	
	Mean Daily Volume (vpd)	63	63	63	63	
Sundays	Mean Hourly Volume (vph)	529	271	533	271	
	Mean Daily Volume (vpd)	12691	6503	12797	6497	
Monday	Mean Hourly Volume (vph)	101	102	102	102	
	Mean Daily Volume (vpd)	63	63	63	63	
Tuesday	Mean Hourly Volume (vph)	518	272	550	306	
	Mean Daily Volume (vpd)	12426	6524	13206	7342	
Wednesday	Mean Hourly Volume (vph)	100	102	101	102	
	Mean Daily Volume (vpd)	62	63	63	64	
Thursday	Mean Hourly Volume (vph)	483	222	504	243	
	Mean Daily Volume (vpd)	11586	5332	12090	5839	
Friday	Mean Hourly Volume (vph)	101	101	101	101	
	Mean Daily Volume (vpd)	63	63	63	63	
Saturday	Mean Hourly Volume (vph)	506	250	513	258	
	Mean Daily Volume (vpd)	12146	5993	12323	6201	
Monthly	Mean Hourly Volume (vph)	101	101	101	101	
	Mean Daily Volume (vpd)	63	63	63	63	

Site 616 on I-64, September 1998					
		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	467	225	459	224
	Mean Daily Volume (vpd)	11204	5399	11020	5371
	Mean Speed (km/h) (mph)	99 61	96 60	99 61	96 60
Mondays	Mean Hourly Volume (vph)	512	259	505	255
	Mean Daily Volume (vpd)	12290	6209	12112	6117
	Mean Speed (km/h) (mph)	99 61	97 61	99 62	98 61
Tuesdays	Mean Hourly Volume (vph)	519	261	527	265
	Mean Daily Volume (vpd)	12461	6272	12640	6371
	Mean Speed (km/h) (mph)	99 61	98 61	100 62	98 61
Wednesdays	Mean Hourly Volume (vph)	527	267	532	269
	Mean Daily Volume (vpd)	12641	6406	12764	6444
	Mean Speed (km/h) (mph)	99 62	98 61	100 62	99 61
Thursdays	Mean Hourly Volume (vph)	535	281	522	285
	Mean Daily Volume (vpd)	12839	6743	12521	6850
	Mean Speed (km/h) (mph)	99 62	99 61	99 62	98 61
Fridays	Mean Hourly Volume (vph)	576	305	586	325
	Mean Daily Volume (vpd)	13836	7311	14072	7810
	Mean Speed (km/h) (mph)	99 62	100 62	100 62	100 62
Saturdays	Mean Hourly Volume (vph)	501	229	518	249
	Mean Daily Volume (vpd)	12021	5497	12441	5982
	Mean Speed (km/h) (mph)	99 62	97 61	100 62	98 61
Monthly	Mean Hourly Volume (vph)	520	261	522	267
	Mean Daily Volume (vpd)	12476	6267	12523	6420
	Mean Speed (km/h) (mph)	99 62	98 61	100 62	98 61

Site 617 on I-74, May 1998		Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	393	280	521	119
	Mean Daily Volume (vpd)	9430	6710	12503	2847
	Mean Speed (km/h)	98	99	106	88
	(mph)	61	61	66	55
Mondays	Mean Hourly Volume (vph)	374	246	469	124
	Mean Daily Volume (vpd)	8982	5899	11260	2988
	Mean Speed (km/h)	98	98	105	89
	(mph)	61	61	65	56
Tuesdays	Mean Hourly Volume (vph)	386	232	461	118
	Mean Daily Volume (vpd)	9259	5580	11072	2822
	Mean Speed (km/h)	98	98	105	88
	(mph)	61	61	65	55
Wednesdays	Mean Hourly Volume (vph)	387	249	475	121
	Mean Daily Volume (vpd)	9291	5975	11396	2905
	Mean Speed (km/h)	97	98	104	89
	(mph)	61	61	65	55
Thursdays	Mean Hourly Volume (vph)	410	253	472	114
	Mean Daily Volume (vpd)	9843	6076	11322	2726
	Mean Speed (km/h)	98	99	104	87
	(mph)	61	61	64	54
Fridays	Mean Hourly Volume (vph)	444	305	532	127
	Mean Daily Volume (vpd)	10654	7324	12770	3056
	Mean Speed (km/h)	99	101	105	90
	(mph)	62	63	65	56
Saturdays	Mean Hourly Volume (vph)	418	270	531	115
	Mean Daily Volume (vpd)	10027	6469	12741	2759
	Mean Speed (km/h)	99	99	106	88
	(mph)	62	62	66	55
Monthly	Mean Hourly Volume (vph)	402	263	497	120
	Mean Daily Volume (vpd)	9658	6321	11926	2869
	Mean Speed (km/h)	98	99	105	88
	(mph)	61	61	65	55

Site 617 on I-74, June 1998					
Sundays	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
		Mean Daily Volume (vpd)	474	337	570
	Mean Speed (km/h)	11376	8087	13684	3720
	(mph)	97	97	105	87
	61	60	60	65	54
Mondays	Mean Hourly Volume (vph)	441	283	505	150
	Mean Daily Volume (vpd)	10580	6781	12123	3606
	Mean Speed (km/h)	97	96	103	87
	(mph)	60	60	64	54
Tuesdays	Mean Hourly Volume (vph)	437	277	505	152
	Mean Daily Volume (vpd)	10491	6648	12130	3653
	Mean Speed (km/h)	97	96	102	87
	(mph)	60	60	64	54
Wednesdays	Mean Hourly Volume (vph)	456	293	511	153
	Mean Daily Volume (vpd)	10952	7044	12257	3681
	Mean Speed (km/h)	97	97	103	87
	(mph)	60	60	64	54
Thursdays	Mean Hourly Volume (vph)	461	297	528	151
	Mean Daily Volume (vpd)	11060	7139	12679	3633
	Mean Speed (km/h)	97	97	104	87
	(mph)	60	60	65	54
Fridays	Mean Hourly Volume (vph)	507	352	594	163
	Mean Daily Volume (vpd)	12178	8442	14261	3913
	Mean Speed (km/h)	98	100	104	88
	(mph)	61	62	65	55
Saturdays	Mean Hourly Volume (vph)	489	322	600	154
	Mean Daily Volume (vpd)	11728	7724	14390	3693
	Mean Speed (km/h)	98	98	106	87
	(mph)	61	61	66	54
Monthly	Mean Hourly Volume (vph)	465	307	542	154
	Mean Daily Volume (vpd)	11151	7363	13012	3695
	Mean Speed (km/h)	97	97	104	87
	(mph)	60	60	65	54

Site 617 on I-74, July 1998						
	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound	
Sundays	Mean Daily Volume (vpd)	588	446	673	234	
	Mean Speed (km/h)	14108	10716	16150	5612	
	Mean Speed (mph)	95	95	102	85	
Mondays	Mean Hourly Volume (vph)	59	59	63	53	
	Mean Daily Volume (vpd)	532	365	586	220	
	Mean Speed (km/h)	12765	8770	14072	5274	
Tuesdays	Mean Speed (mph)	95	93	101	83	
	Mean Hourly Volume (vph)	509	358	571	220	
	Mean Daily Volume (vpd)	12215	8594	13700	5291	
Wednesdays	Mean Speed (km/h)	94	93	100	84	
	Mean Speed (mph)	58	58	62	52	
	Mean Hourly Volume (vph)	533	375	605	233	
Thursdays	Mean Daily Volume (vpd)	12798	9000	14521	5597	
	Mean Speed (km/h)	94	94	101	85	
	Mean Speed (mph)	59	58	62	53	
Fridays	Mean Hourly Volume (vph)	542	392	622	241	
	Mean Daily Volume (vpd)	13010	9399	14922	5777	
	Mean Speed (km/h)	95	95	101	86	
Saturdays	Mean Speed (mph)	59	59	63	53	
	Mean Hourly Volume (vph)	608	447	709	248	
	Mean Daily Volume (vpd)	14585	10729	17015	5947	
Monthly	Mean Speed (km/h)	96	96	103	87	
	Mean Speed (mph)	60	60	64	54	
	Mean Hourly Volume (vph)	586	407	688	228	
Monthly	Mean Daily Volume (vpd)	14062	9767	16506	5461	
	Mean Speed (km/h)	96	95	103	85	
	Mean Speed (mph)	59	59	64	53	
Monthly	Mean Hourly Volume (vph)	557	399	637	233	
	Mean Daily Volume (vpd)	13373	9582	15290	5586	
	Mean Speed (km/h)	95	94	101	85	
	Mean Speed (mph)	59	59	63	53	

Site 617 on I-74, August 1998					
Sundays	Mean Hourly Volume (vph)	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound
		Mean Daily Volume (vpd)	468	315	518
	Mean Speed (km/h)	11240	7566	12421	3111
	(mph)	100	101	106	94
	Mean Hourly Volume (vph)	62	63	66	58
Mondays	Mean Hourly Volume (vph)	422	241	463	106
	Mean Daily Volume (vpd)	10125	5788	11103	2551
	Mean Speed (km/h)	100	100	106	90
	(mph)	62	62	66	56
Tuesdays	Mean Hourly Volume (vph)	437	258	480	118
	Mean Daily Volume (vpd)	10499	6184	11517	2839
	Mean Speed (km/h)	100	101	106	92
	(mph)	62	63	66	57
Wednesdays	Mean Hourly Volume (vph)	427	272	471	115
	Mean Daily Volume (vpd)	10259	6524	11310	2766
	Mean Speed (km/h)	99	101	105	91
	(mph)	62	63	65	56
Thursdays	Mean Hourly Volume (vph)	463	278	500	106
	Mean Daily Volume (vpd)	11113	6669	11998	2539
	Mean Speed (km/h)	100	102	106	90
	(mph)	62	63	66	56
Fridays	Mean Hourly Volume (vph)	452	298	522	115
	Mean Daily Volume (vpd)	10858	7143	12530	2767
	Mean Speed (km/h)	99	102	105	91
	(mph)	62	63	65	57
Saturdays	Mean Hourly Volume (vph)	474	322	578	141
	Mean Daily Volume (vpd)	11371	7731	13881	3376
	Mean Speed (km/h)	101	102	108	95
	(mph)	62	63	67	59
Monthly	Mean Hourly Volume (vph)	450	286	508	120
	Mean Daily Volume (vpd)	10811	6862	12201	2882
	Mean Speed (km/h)	100	101	106	92
	(mph)	62	63	66	57

Site 617 on I-74, September 1998						
	Driving Lane East Bound	Passing Lane East Bound	Driving Lane West Bound	Passing Lane West Bound	Driving Lane East Bound	Passing Lane West Bound
Sundays	Mean Hourly Volume (vph)	476	249	322	189	
	Mean Daily Volume (vpd)	11432	5980	7718	4528	
	Mean Speed (km/h) (mph)	97 60	96 60	96 60	93 58	
Mondays	Mean Hourly Volume (vph)	451	223	309	175	
	Mean Daily Volume (vpd)	10822	5347	7417	4195	
	Mean Speed (km/h) (mph)	97 60	94 59	95 59	93 58	
Tuesdays	Mean Hourly Volume (vph)	436	215	343	169	
	Mean Daily Volume (vpd)	10453	5159	8236	4064	
	Mean Speed (km/h) (mph)	97 60	94 59	98 61	92 57	
Wednesdays	Mean Hourly Volume (vph)	455	220	321	166	
	Mean Daily Volume (vpd)	10924	5275	7693	3993	
	Mean Speed (km/h) (mph)	96 60	94 58	96 60	92 57	
Thursdays	Mean Hourly Volume (vph)	475	227	377	188	
	Mean Daily Volume (vpd)	11406	5460	9044	4511	
	Mean Speed (km/h) (mph)	97 60	95 59	100 62	93 58	
Fridays	Mean Hourly Volume (vph)	527	275	401	220	
	Mean Daily Volume (vpd)	12654	6594	9636	5270	
	Mean Speed (km/h) (mph)	98 61	98 61	99 61	96 60	
Saturdays	Mean Hourly Volume (vph)	505	252	417	180	
	Mean Daily Volume (vpd)	12113	6049	10002	4329	
	Mean Speed (km/h) (mph)	98 61	98 61	101 63	94 58	
Monthly	Mean Hourly Volume (vph)	473	236	354	183	
	Mean Daily Volume (vpd)	11353	5663	8497	4387	
	Mean Speed (km/h) (mph)	97 60	96 59	98 61	93 58	

Site 642 on I-65, January 1999					Driving Lane North Bound	Passing Lane North Bound	Driving Lane South Bound	Passing Lane South Bound
Sundays	Mean Hourly Volume (vph)		1110	756	1086	769		
	Mean Daily Volume (vpd)		26641	18145	26070	18445		
	Mean Speed (km/h) (mph)		90 56	100 62	93 58	101 63		
Mondays	Mean Hourly Volume (vph)		1337	1024	1309	919		
	Mean Daily Volume (vpd)		32094	24566	31407	22052		
	Mean Speed (km/h) (mph)		88 55	100 62	92 57	101 63		
Tuesdays	Mean Hourly Volume (vph)		1342	1095	1343	948		
	Mean Daily Volume (vpd)		32211	26286	32239	22763		
	Mean Speed (km/h) (mph)		88 55	100 62	92 57	101 63		
Wednesdays	Mean Hourly Volume (vph)		1278	1029	1278	933		
	Mean Daily Volume (vpd)		30675	24686	30663	22402		
	Mean Speed (km/h) (mph)		88 55	100 62	92 57	101 63		
Thursdays	Mean Hourly Volume (vph)		1249	1036	1242	904		
	Mean Daily Volume (vpd)		29986	24854	29818	21693		
	Mean Speed (km/h) (mph)		87 54	99 62	91 57	100 62		
Fridays	Mean Hourly Volume (vph)		1329	1050	1267	932		
	Mean Daily Volume (vpd)		31891	25191	30417	22362		
	Mean Speed (km/h) (mph)		86 53	99 61	90 56	100 62		
Saturdays	Mean Hourly Volume (vph)		1157	786	1091	739		
	Mean Daily Volume (vpd)		27767	18856	26178	17736		
	Mean Speed (km/h) (mph)		88 54	99 62	91 57	100 62		
Monthly	Mean Hourly Volume (vph)		1259	968	1231	878		
	Mean Daily Volume (vpd)		30211	23244	29533	21071		
	Mean Speed (km/h) (mph)		88 55	100 62	92 57	100 62		