Task Order 83

NJDOT Large Truck Monitoring Technical Support

FINAL REPORT

Volume I: Weigh-in-Motion Data Analysis, 2009 - 2011

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RESEARCH PROJECT TITLE

Task Order 83: NJDOT Large Truck Monitoring Technical Support

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Final Report, Volume I: Weigh-In-Motion Data Analysis, 2009 - 2011

AUTHORS

Lazar Spasovic, Ph.D. (Principal Investigator)
Professor

Dejan Besenski, Ph.D.
Senior Transportation Planner

PERFORMING ORGANIZATION

New Jersey Institute of Technology
Department of Civil & Environmental Engineering
University Heights
Newark, NJ 07102

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Chapter 1

Background

In 2007, The New Jersey Department of Transportation (NJDOT) initiated a truck monitoring program. The purpose of the program was to evaluate the impacts of a new 102-inch Large Truck[1] network regulation. The regulation N.J.A.C. 16:32 was proposed by the state in November 2006 and made effective on January 22, 2008. The program encompasses the statewide collection of truck volume, origin-destination (O-D) patterns, crash statistics, subsequent analysis of data, and the production of quarterly and yearly reports.

The Large Truck Regulation stipulates that double-trailer truck combinations and 102" width trucks must use the National Network when traveling within New Jersey, unless making a pickup or delivery or seeking food, fuel, service or lodging within two miles of the National Network. The regulation also requires that any travel off the National Network and onto a New Jersey Access Network roadway be by the shortest distance or most direct route.

The National Network consists of the interstates, the New Jersey Turnpike, the Atlantic City Expressway, and sections of NJ 42 (between I-295 and the Atlantic City Expressway), NJ 81 (between US 1&9 and the New Jersey Turnpike), US 130/NJ 322 (between I-295 and the Commodore Barry Bridge), and NJ 440 (between the New Jersey Turnpike and the Outerbridge Crossing). The New Jersey Access Network consists of most other state and 500-series county routes with some exceptions. Additions and deletions to the New Jersey Access Network travel routes are governed by the regulation N.J.A.C 16:32-1.7.

The previous rules regarding large truck routing in New Jersey were governed by an emergency regulation put in place in February 2006 as a result of a federal court order striking down the legality of earlier legislation. The N.J.A.C. 16:32 stated that double-trailer truck combinations were restricted to the Double Trailer Truck Network which was identical to the current National Network. 102" trucks, on the other hand, were permitted to "travel freely for all purposes" on the 102-Inch Truck Network which consisted of the extents of both the National Network and the current New Jersey Access Network.

[1] Large Trucks are defined as FHWA Vehicle Class 8 to 13 in New Jersey (defined in Appendix A)

1.1. Purpose of the Report

This report summarizes Weigh-in-Motion (WIM) data for 23 key automated recording stations throughout New Jersey. These locations were selected due to either their high truck volume or anticipated changes in truck activity as a result of the implementation of the new regulation. Figure 1 shows the location of the key WIM Stations. The 24 stations are shown as yellow squares.

The focus of the report is on documenting and identifying changes and trends in the large truck activity in New Jersey from January 1st 2009 until December 31, 2011. The report is continuation of the study “Large Truck Monitoring Program - WIM Station Annual Report for 2008” previously done by NJIT.

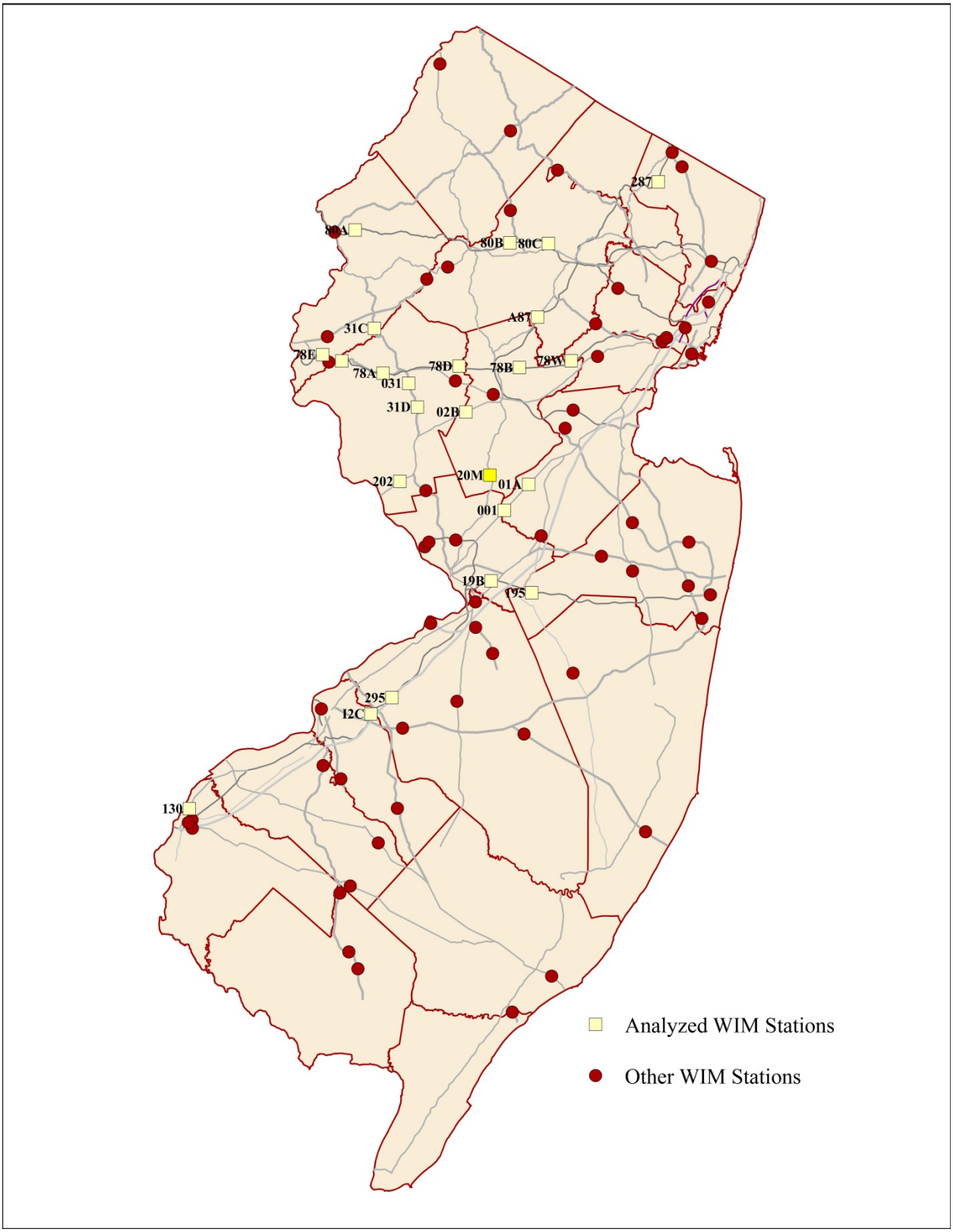

Figure 1. Key WIM Stations

1.3. Research Objective

The overall objective of this research study is to provide support to NJDOT Bureau of Freight Services in analyzing trends and factors impacting movement of large trucks in the State. More specifically, the study has the following goals:

- Produce annual report featuring a combination of charts, tables and maps to summarize NJDOT's Weigh-in-Motion (WIM) data.
- Participate in evaluation and deployment of the data analysis tool "Assist-Me"[2] created by Rutgers/CAIP for producing truck volume summaries based on WIM counts.

There are three types of analyses resulting in three distinctive products:

1. The analysis of large truck activity along five major truck corridors.
2. The analysis of volume trends and vehicle travel patterns at each WIM station
3. The annual large truck volume profiles at each WIM station.

The analysis of large truck activity along five major truck corridors

The average daily monthly volumes from WIM stations are utilized to depict truck flows along a major truck corridor and between major truck corridors. These volumes are depicted on the generated maps that show the shift in large truck volume.

The analysis of volume trends and vehicle travel patterns at each WIM stations

The analysis tries to establish the trends in volume change and identify largest/smallest fluctuations in large truck volume. The daily patterns of different vehicles classes are analyzed and possible changes in their travel patterns are identified.

The annual large truck volume profiles at each WIM station

The Annual profile, variability of large truck volume and a daily profile of volume by vehicle category is presented. This is used to generate findings of first two products. The annual large truck volume profiles at each WIM station are a product of "Assist-Me" tool.

Limitations

The analysis depends on the availability of WIM data at each station, since often data is not available for one or multiple years. The analysis differentiates the direction of travel and tries to determine the change of truck volume and change in travel patterns by direction as well.

[2] http://www.rits.rutgers.edu/ASSISTMEWIM

1.4. Organization of Report

This report is organized into two volumes:

- **Volume I** presents first two products: The analysis of large truck activity along five major truck corridors and the analysis of volume trends and vehicle travel patterns at each WIM station.
- **Volume II** presents the third product: The annual large truck volume profiles, variability of large truck volume and a daily profile of volume by vehicle category at each WIM station..

This section provides a brief description of Volume I chapters.

Chapter 2 presents a discussion on data sources, the availability of the data during the analyzed periods, and the methods used to fill in the missing data.

Chapter 3 focuses on application of available WIM data in determining the trends in truck volume on New Jersey Truck Corridors. The analysis identifies the change in large truck volume between analyzed years. The analysis utilizes individual WIM station data to visually and spatially present trends in large truck volume on five major truck corridors.

Chapter 4 presents the analysis of volume trends and vehicle travel patterns at each WIM stations during the 3-year period. The analysis identifies the trends in volume change and largest/smallest fluctuations in large truck volume. The travel patterns for vehicle classes are analyzed and possible fluctuations in daily travel patterns are identified.

Chapter 2

Data Sources and Methods

2.1. Weigh-in-Motion (WIM) Stations

Weigh-in-Motion (WIM) stations sense axle loadings passing over the roadway sensors. Using a combination of weight per axle and axle spacing, vehicles can be identified into one of the 13-classes in the FHWA vehicle classification system. The misreads and those vehicles not corresponding to a standard configuration become the "unknown" class 14.

During the creation of the working (e.g., CLA[3]) files from the raw WIM data by NJDOT staff, some data are removed due to obvious observed anomalies in the volumes, hardware malfunction, badly formatted records, or other problems. The CLA files were then delivered to NJIT.

The CLA files were then imported into the GIS-based post-processing tool (Assist-Me) to analyze, summarize and visualize WIM station data. The data is summarized on a monthly and annual basis. The following statistics at each WIM station is generated:

- Volume totals per hour and per day.
- Daily average volume.
- The standard deviation of daily volume, and
- The minimum and maximum daily volume.

The statistics are generated per direction of travel. The distribution of vehicle class groups by hour of day was also determined.

2.2. WIM Data Availability

On average in 2009, 74 % of data was available at each WIM station. This means that of the possible 12 months of data only 8.8 months was available. In 2010, the availability of data was reduced to 59% (or 7.1 months of data recorded at each WIM station). In 2011, the data collection process improved yielding 83% of recorded data at each WIM station. This translates to nearly 10 months of data available. The data availability by year is shown in Figure 2.

[3] FHWA standard classification layout as per the Traffic Monitoring Guide

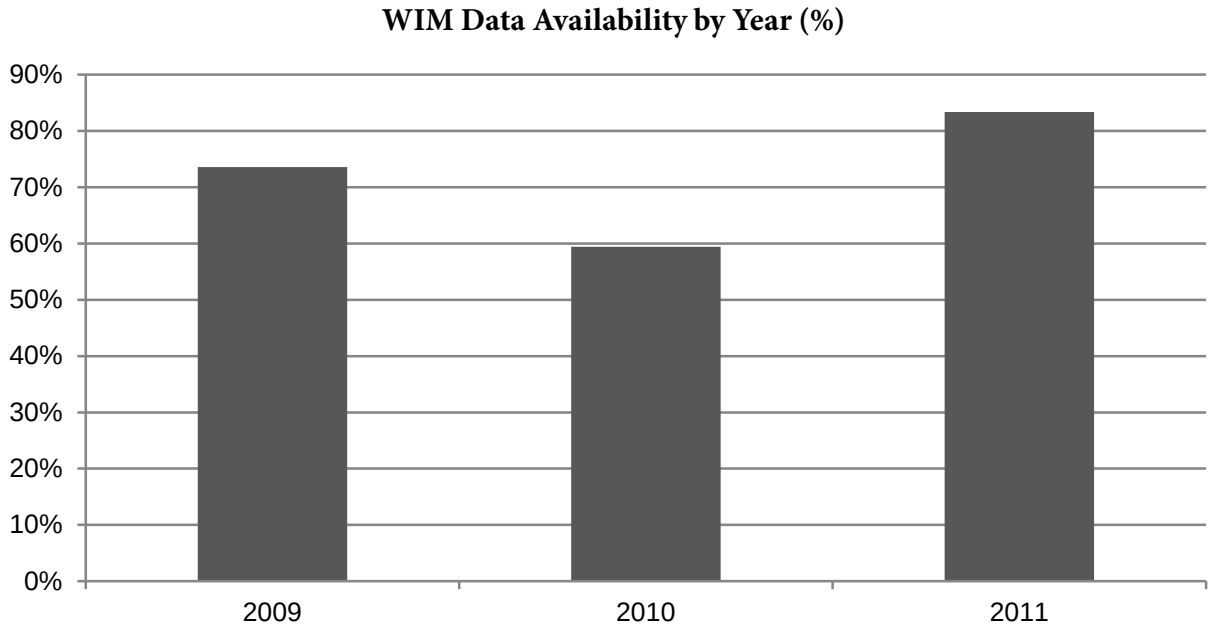

Figure 2. WIM Data Availability by Year

The WIM station data is further analyzed to determine the how many stations were properly functioning in recording data certain percentage of time Table 1 shows that in 2009, 27 WIM stations had worked properly 90 to 100% of time while 12 WIM stations had managed to collect only less than 50 % of the data.

Table 1. Percentage of Time WIM Stations Recorded Data Properly

% of time in operation	2009	2010	2011
0 - 10	4	3	3
10 - 20	4	0	0
20 - 30	1	2	0
30 - 40	1	2	0
40 - 50	2	6	3
50 - 60	2	11	1
60 - 70	3	8	3
70 - 80	6	21	4
80 - 90	3	0	7
90 - 100	27	0	32

Figure 3 shows the location of WIM stations and % of time they were available to collect data in year 2009.

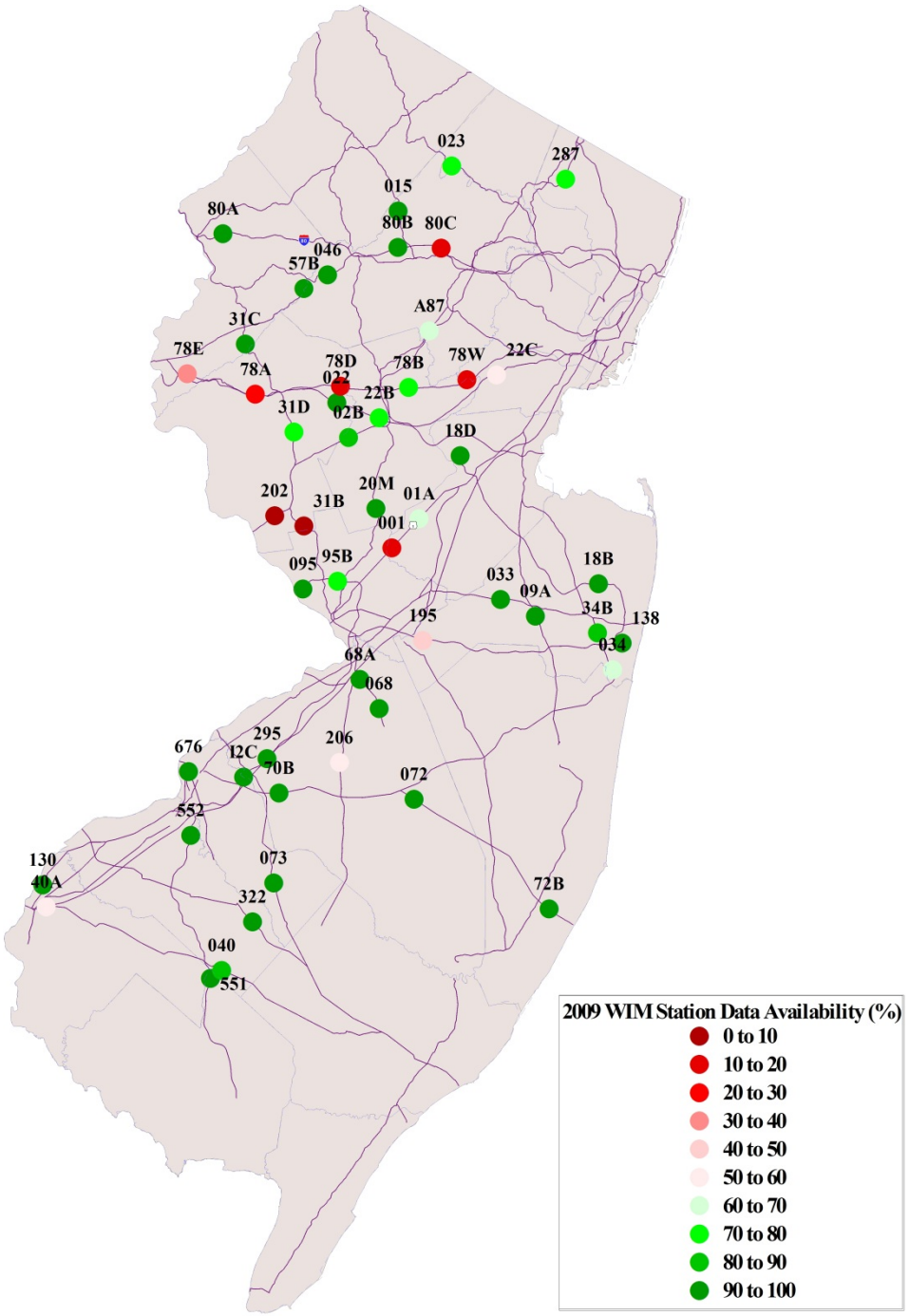

Figure 3. Data Availability (% of time recording) at Each WIM Station in 2009

In 2010, not a single station had a full year of recorded data. 19 WIM Stations had 9 month of data (or 75%). Figure 4 shows the location of WIM stations and their data availability in year 2010.

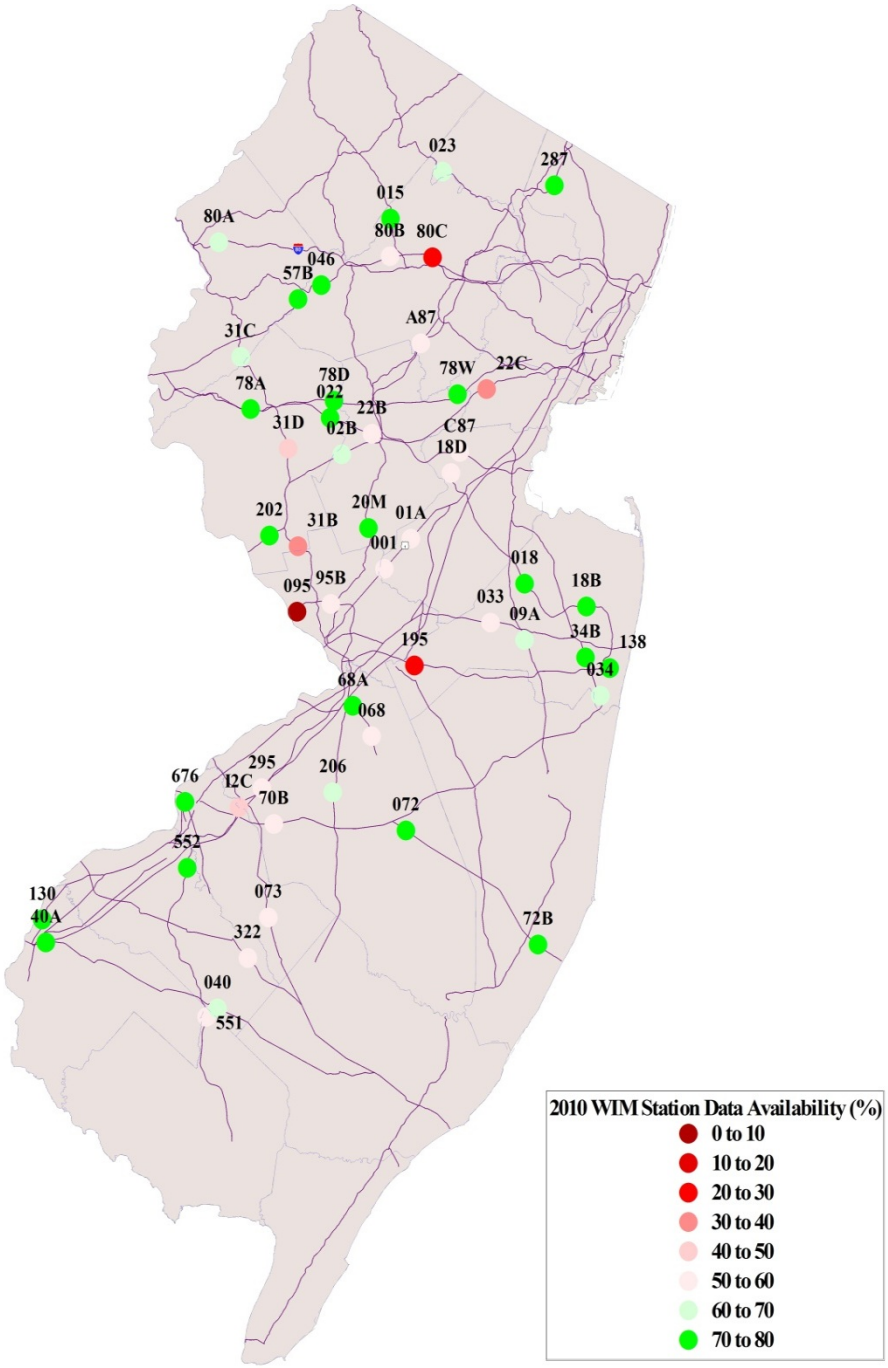

Figure 4. Data Availability (% of time recording) at Each WIM Station in 2010

In 2011, the quality of the data improved significantly, with 32 WIM station having between 90 to 100% of data recorded. From these 32 WIM stations, 17 have a complete set of data (100%). Figure 5 shows the location of WIM stations and their data availability in year 2011.

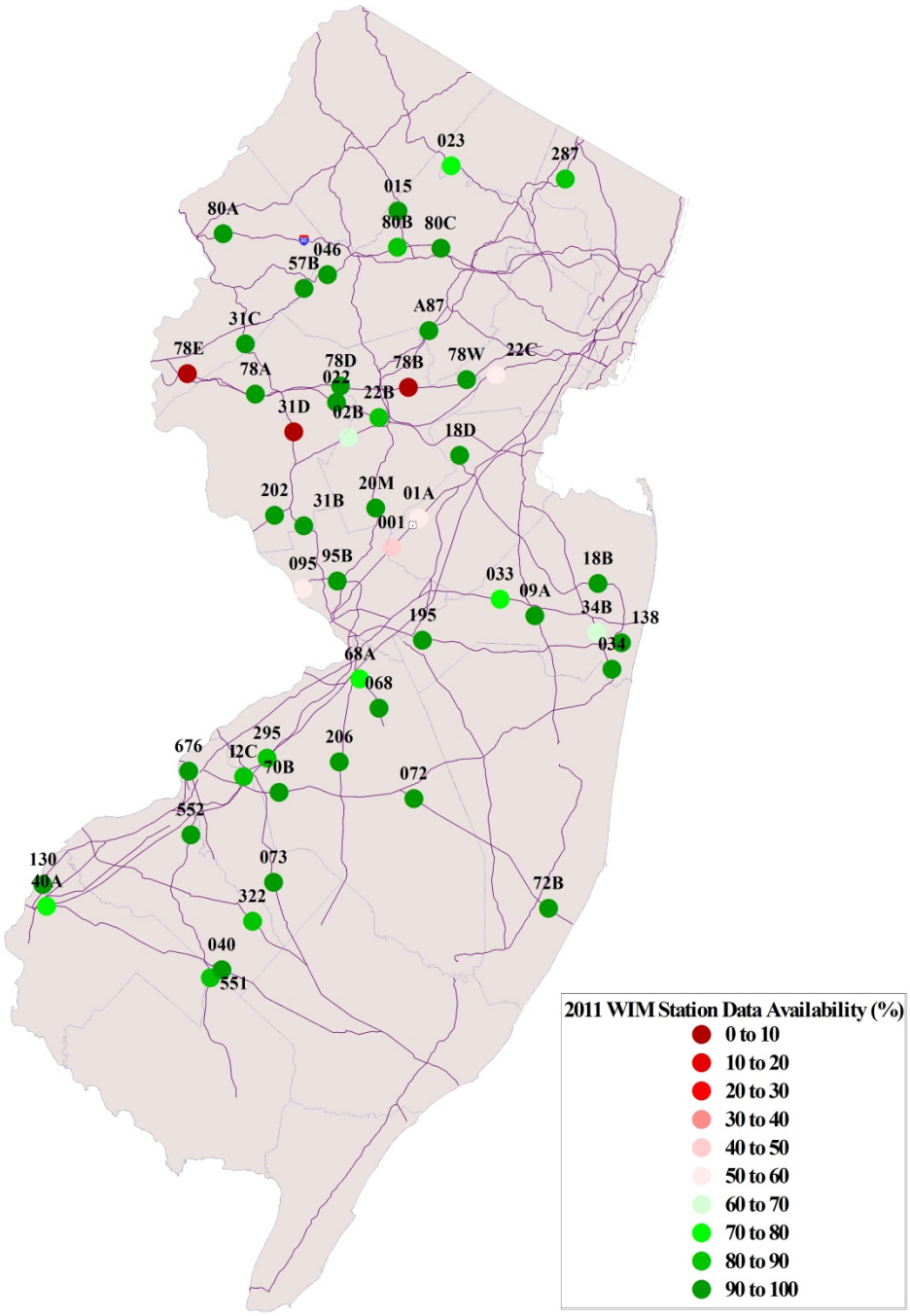

Figure 5. Data Availability (% of time recording) at Each WIM Station in Year 2011

2.3. Estimating Unavailable Data

The research team used forecasting methodologies to estimate the **L**arge **T**ruck **W**eekday **A**verage **D**aily **T**raffic (LTWADT) for months when gaps in data occurred. For truck traffic data exhibits both a trend and a seasonal element, it was important to select a suitable forecasting algorithm. Two algorithms were considered:

1. Holt's Algorithm – Using a user-defined set of historical observations (typically six or 12 months), the algorithm computed the forecast by using exponential smoothing recursions of the trend.

2. The Holt-Winters Seasonal Algorithm – Expanding the Holt's Algorithm two years of historical data were used to establish the seasonality of each month.

For each WIM station, the choice of forecasting methodology was driven by:

- The availability of historical WIM data,
- The average mean squared error.

For some locations, such as newly-deployed WIM Stations, there was insufficient historical data to apply the Holt-Winters Seasonal Algorithm. For those locations, Holt's Algorithm was used. The method that yielded the smallest mean squared error for months when the LTWADT was known was chosen as the preferred forecasting tool for filling in the gaps in the data series.

Chapter 3

Corridor Analysis

3.1. Trends for Year 2009 to 2011

There were several key general findings from the analyzed WIM data:

- The WIM data shows declining LTWADT between 2009 and 2011 on the New Jersey roadway network. In 2010, LTWADT declined by 2 % and in 2011 LTWADT declined by 0.6% compared to 2010.

- The reduction in volume was less significant for the northbound and eastbound direction.

- The LTWADT at interstate highways I-78 (stations D and W), I-95 (stations 95 and 95B) and I-287 (Stations 287 and A87) registered an increase in large truck volume in 2011.

- The LTWADT on the following corridors (I-287, I-78, and I-676) was the only one to show growth during the three year period.

- The analysis of daily volume profiles for three vehicle categories[4] determined that the travel patterns didn't significantly fluctuate between year 2009 and 2011.

Figure 6 presents the change in large truck volume between year 2010 and 2011 in New Jersey. The change in LTWADT is observed between the consecutive WIM stations. The positive change is depicted with shades of blue color while negative change is depicted with shades of red color. The magnitude of the change is described with the thickness of the line.

The corridors analyzed and WIM station used in analysis are:

1. US 202 (WIM stations 202 and 02B)
2. NJ 31 (WIM stations 031, 31D and 31B)
3. I- 78 (WIM stations 78E, 78A, 78D, 78B and 78W)
4. I-80 (WIM stations 80A, 80B, 80C, SHW and SHE)
5. I-287 (WIM stations C87, A87 and 287)

[4] Category 1:large truck, Category 2:medim truck, Category 3: cars + light trucks

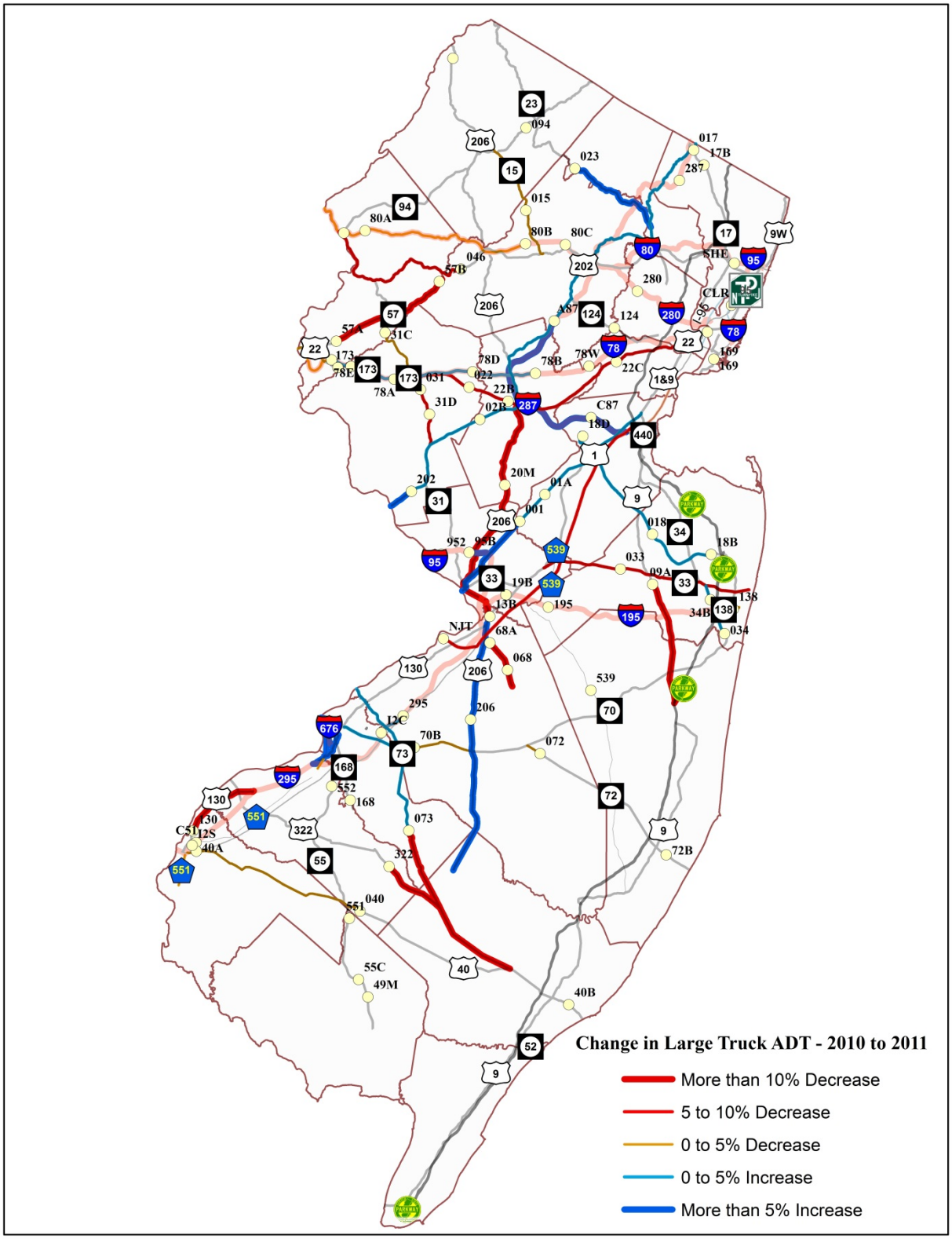

Figure 6. Change in LTWADT on New Jersey Network from Year 2010 to 2011

Following two examples demonstrate the application of WIM station data in:

1. Visually presenting the trends of truck volume by developing summary chart/graph of volume profile, and
2. Visually presenting the magnitude of truck volume for specific truck corridors.

Figure 7 bellow shows the change in the eastbound and westbound truck volume on section of the I-78 between M.P. 5 and MP. 42.2. The LTWADT from WIM stations placed along I-78 corridor are utilized to develop a summary chart/graph of the trends (volume profile) for the corridor. The LTWADT in the eastbound direction has an increasing trend, as expected, since it's a direction utilized mostly by through trips. The LTWADT in the westbound direction has a spike between WIM stations 78B and 78D. Since the interchange of I-78 and I-287 is located between these two WIM stations the change in LTWADT can be attributed to volume shifts between these two major truck corridors.

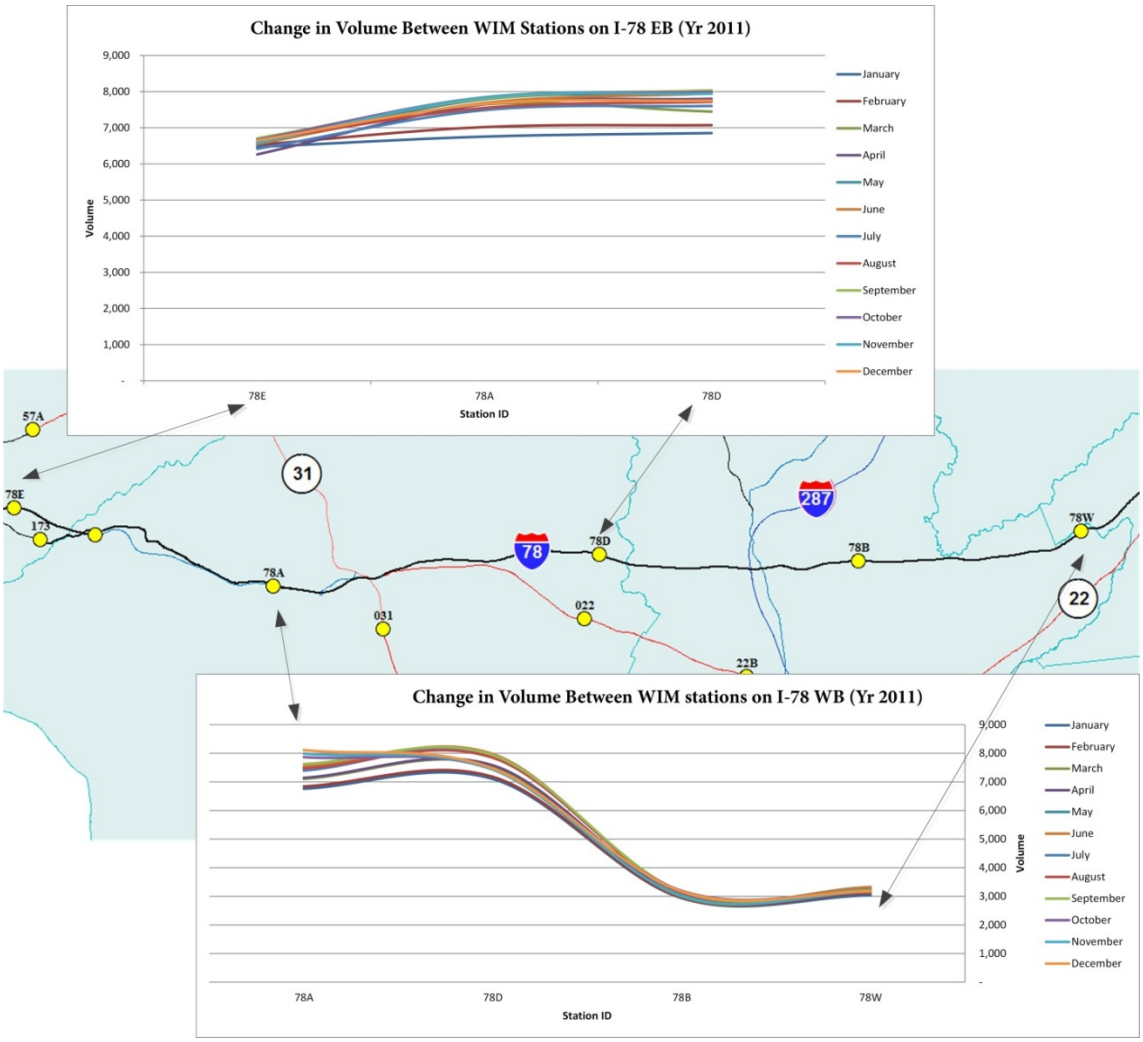

Figure 7. Change in LTWADT Between WIM Stations on I-78 (2011)

The WIM data along US 202 and NJ-31 corridors is used to show the magnitude of truck volume on different sections for these two corridors (Figure 8). Based on the figure it can be concluded that the significant portion of trucks from NJ 31 traveling northbound are continuing on US 202 (northbound) towards their destinations. The data also implies that the truck flow in the southbound direction is shifting from US 202 to NJ 31 as well.

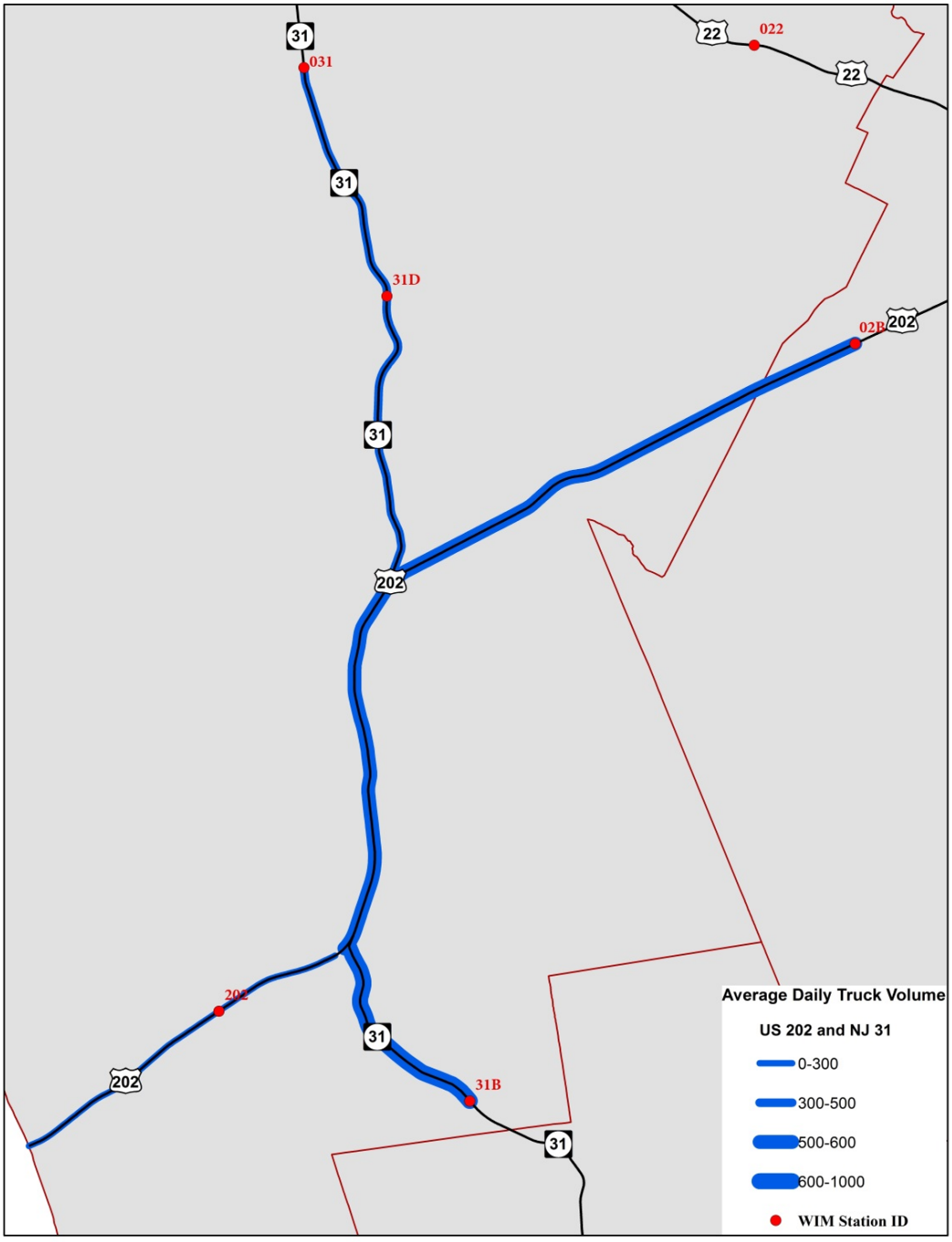

Figure 8. Truck Volume on US 202 and NJ 31 (2011)

These two different ways of displaying WIM data are combined to show the change in LTWADT amongst I-78, I-80 and I-287 truck corridors (Figure 9). Based on the figure it can be concluded:

- The LTWADT on I-78 corridor has an increasing trend in the eastbound direction west of the interchange with I-287.

- The LTWADT on I-287 corridor, between the interchange I-78 and I-280 is 20 % higher compared to the volume south of the interchange with I-78. The LTWADT north of the interchange with I-280 declined by 15 %.

- This inclines that the portion of the truck volume from I-78 shift to I-287.

- Based on the recorded data, the LTWADT on I-280 eastbound past interchange I-287 has an increasing trend.

- It can be concluded that a portion of the traffic from I-78 (via. I-287) and I-287 as well continues eastbound on 1-280 towards their destination.

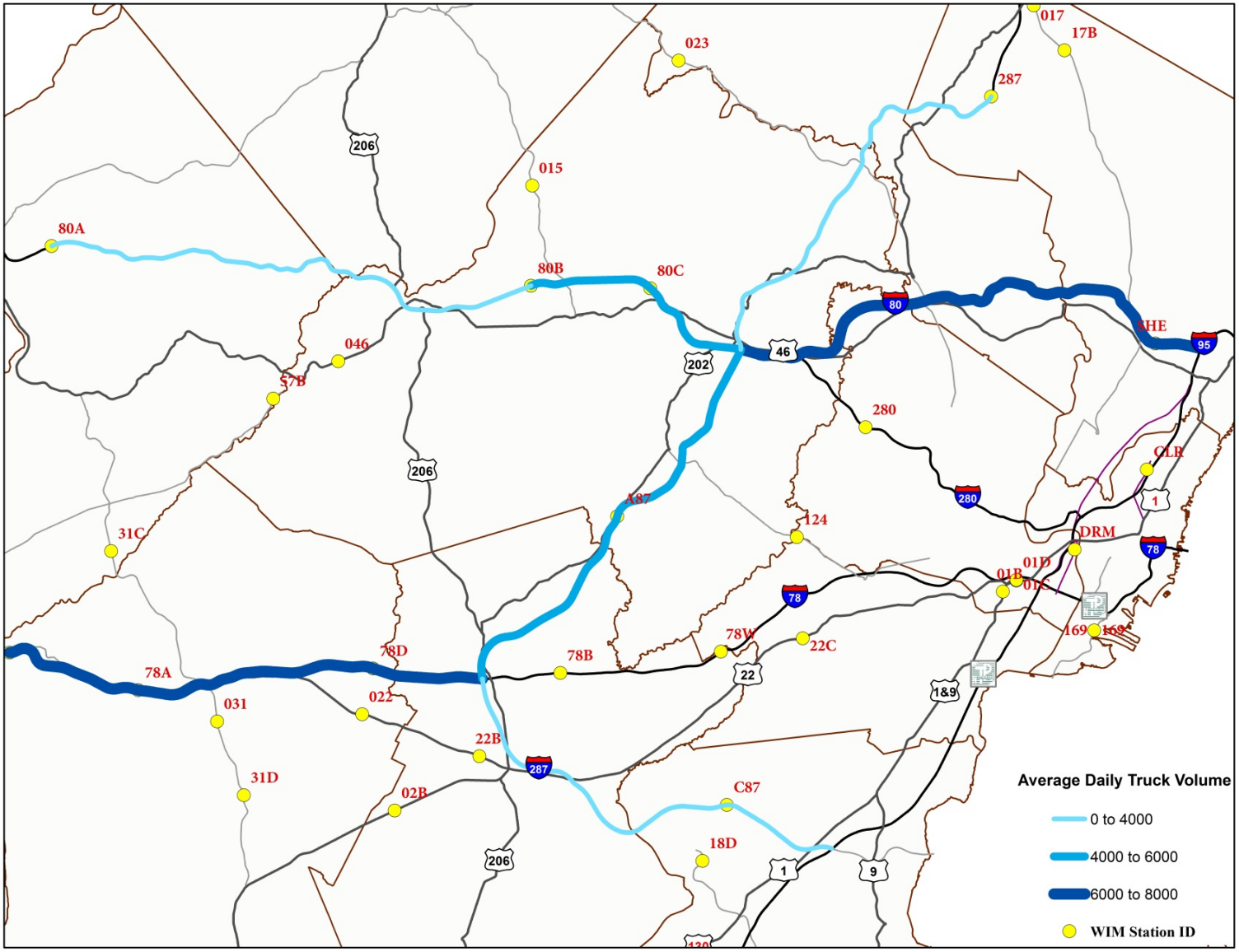

Figure 9. LTWADT and Volume Trends Along I-78, I-287 and I-80 Corridors (2011)

Chapter 4

Truck Volume Analysis for Individual WIM Stations

This chapter presents the analysis of volume trends and vehicle travel patterns at each WIM station. The analysis tries to identify:

- The trends in volume change during the analyzed period,
- The largest/smallest fluctuations in large truck volume and
- The travel patterns for vehicle categories and possible fluctuations in daily travel patterns.

4.1. WIM Station 78W: I-78, MP 42.2

WIM Station 78W is located at milepost 42.2 of westbound Interstate 78 in Watchung Boro, Somerset County. At this location I-78 is a six-lane limited access Rural Interstate and is included in the National Network. Figure 10 shows the location and surrounding features. WIM data collection process had significant interruptions in 2009.

Figure 10. Aerial View of WIM Station at I-78, MP 42.2

Figure 11 shows the change in LTWADT on I-78 between 2010 and 2011. The truck volume declined only during the months of January and April. The noticeable increase in volume was observed in second half of 2011, especially during the months of September and October when truck volume increased by 7.4% and 6.4% respectively. Overall, the large truck volume increased in 2011 by 2.41% compared to 2010.

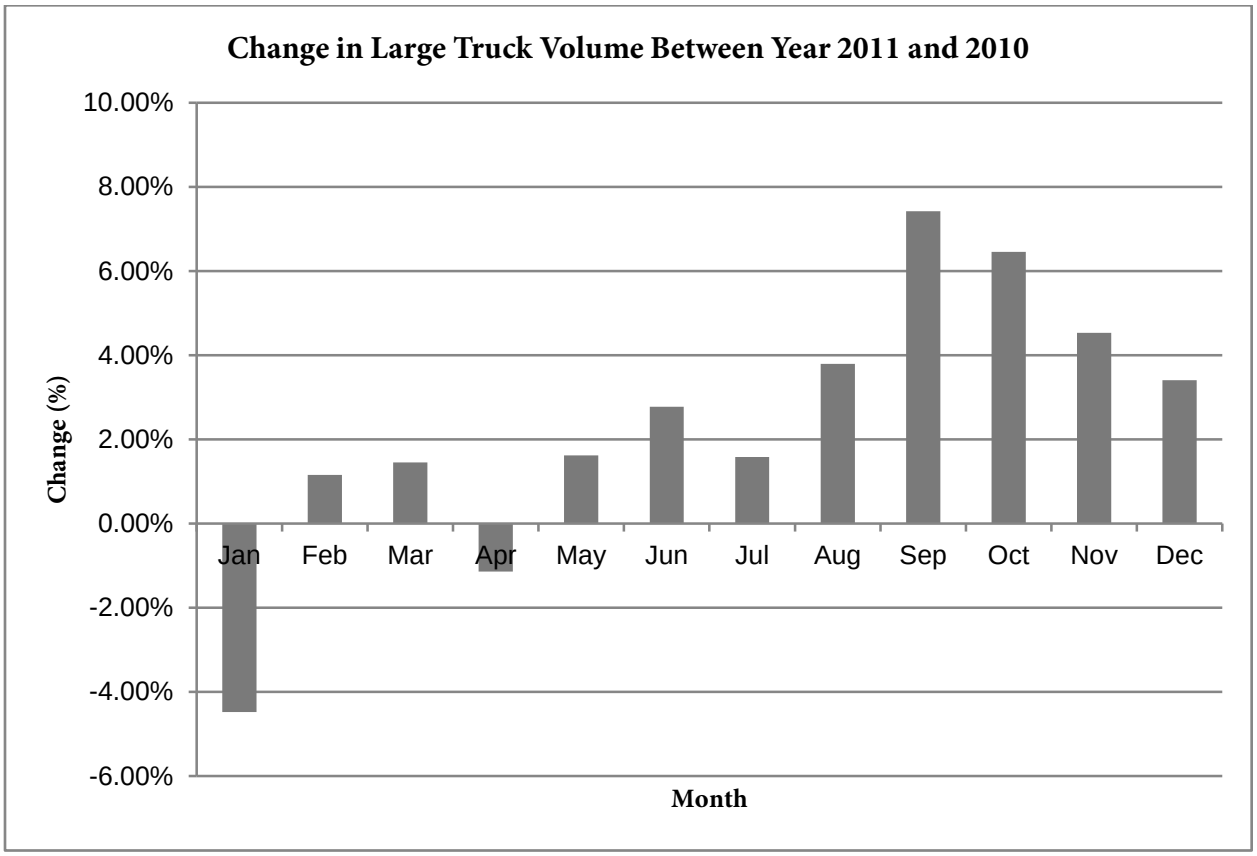

Figure 11. Change in Large Truck Volume at WIM Station 78W (2010-2011)

The large truck and auto volume profile have similar daily distribution. The daily profile by vehicle category is shown in Figure 12. The large truck volume had a peak between 11:00 a.m. and 12:00 p.m. with 13% of total daily traffic. The large truck volume profile is indicative of a Profile 2 pattern. Medium trucks followed a more peaked profile with maximum volume reached between 10:00 a.m. and 12:00 p.m. when over 18% of the daily medium truck traffic occurred. Auto volume followed a commuter pattern with a morning peak between 8:00 and 9:00 a.m. and evening peak during the 5:00 and 6:00 p.m.

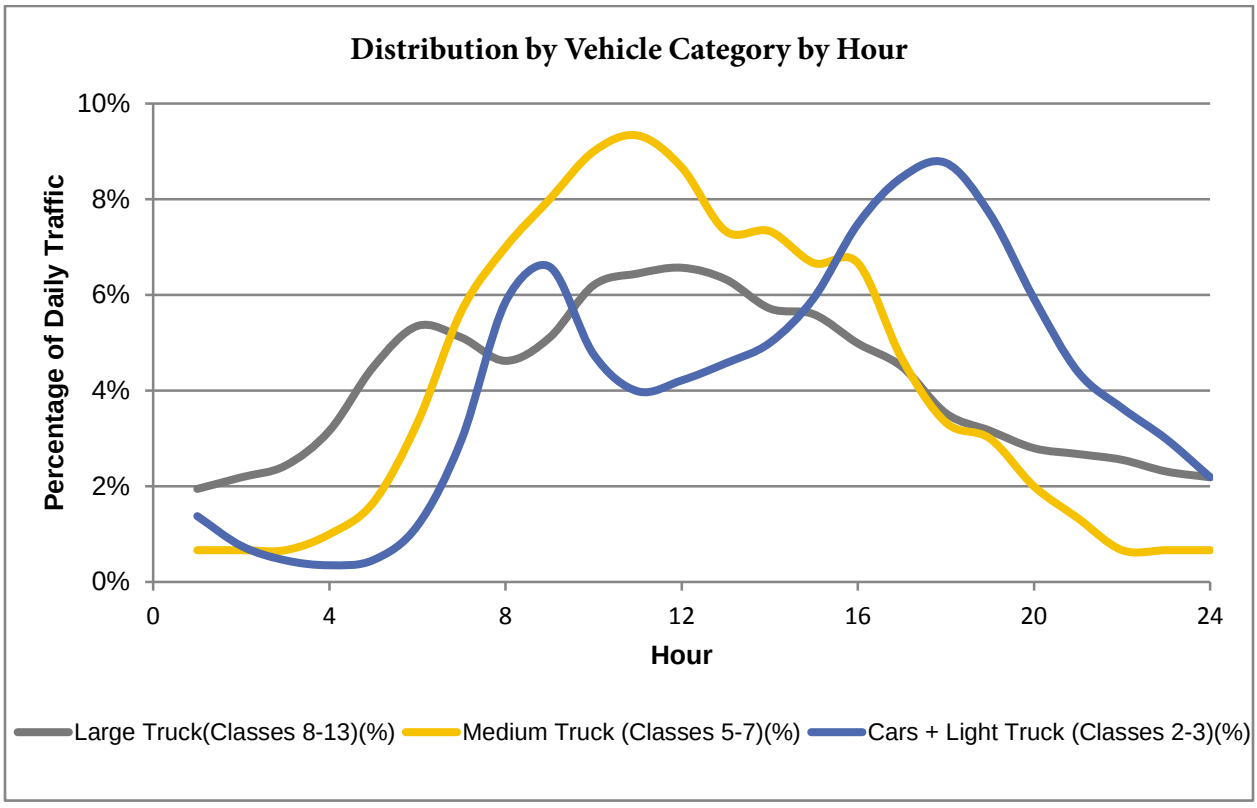

Figure 12. Daily Profile of Volume at Westbound I-78, MP 42.2 (2010)

In 2011 the change in travel patterns for medium trucks is observed. The medium truck volume peaked relatively late in the day between 2:00 and 4:00 p.m. compared to 2010 (Figure 13).

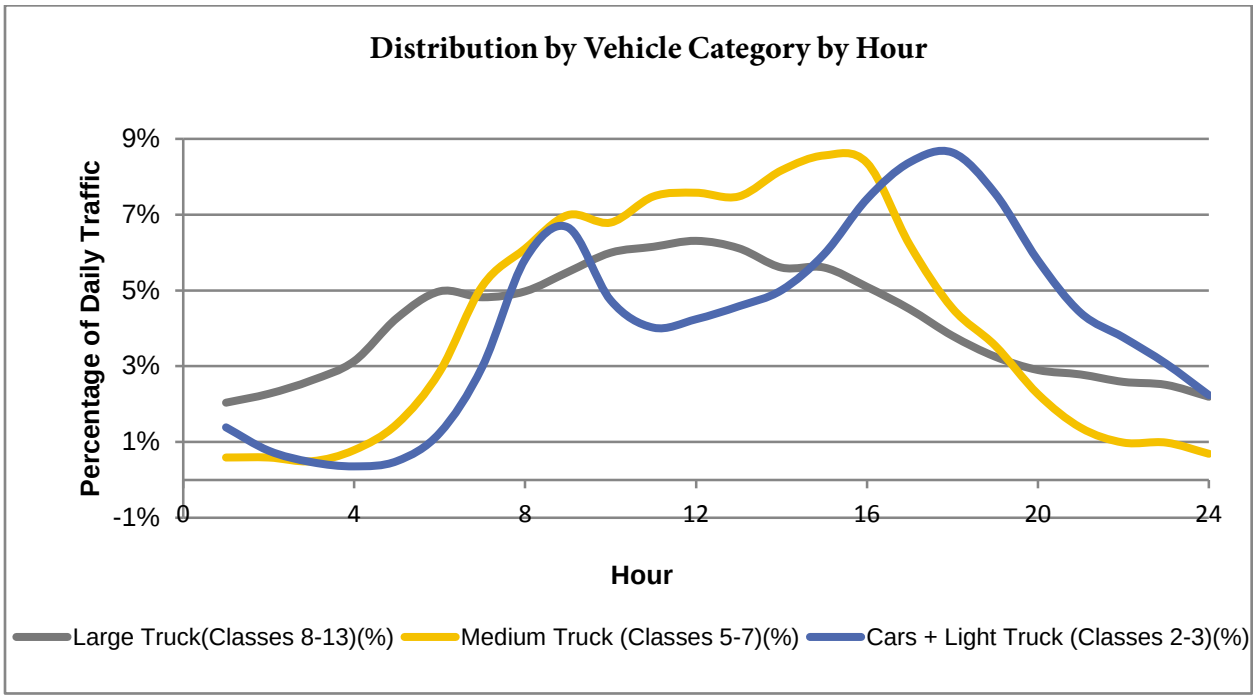

Figure 13. Daily Profile of Volume at Westbound I-78, MP 42.2 (2011)

4.2. WIM Station 78D: I-78, MP 25.7

WIM Station 78D is located at milepost 25.7 of Interstate 78 in Readington, Hunterdon County between Interchanges 24 (CR 523 Oldwick Road) and 26 (CR 665 Rattlesnake/Bridge Road). At this location I-78 is a six-lane limited access Rural Interstate and is included in the National Network. Figure 14 shows the location and surrounding features. WIM data has been continuously recorded at this location in both directions and the availability of data for the period from Jan 1 2009 until December 31 2011 is:

- In 2009 data was only recorded for months of January and February.
- In 2010 data was recorded for all of 2010 except October, November and December.
- In 2011 data was recorded for all of 2011 except for March.

Figure 14. Aerial View of WIM Station at I-78, MP 25.7

As shown in Table 2, LTWADT exhibits increase in 2010 by 13.76% and in 2011 by 1.02%. In 2011, the LTWADT in the westbound direction declined by 0.08 % while the traffic in eastbound direction increased. The directional truck volumes are similar in every year.

Table 2. Change in Large Truck Volume at WIM Station 78D

	2009	2010	2011	% Change from 2010 to 2009	% Change from 2011 to 2010
Eastbound	80,480	90,176	92,105	12.05%	2.14%
Westbound	79,121	91,383	91,308	15.50%	-0.08%
Total	159,601	181,559	183,413	13.76%	1.02%

Figure 15 shows the change in large truck volume between the analyzed years. In 2010, LTWADT increased by 13.76 % compared to 2009. The LTWADT decline for the first three months of 2011. The largest decline was recorded in March of 2010, when 4% less trucks traversed the WIM Station. Last quarter of 2011 recorded an increase in large truck volume.

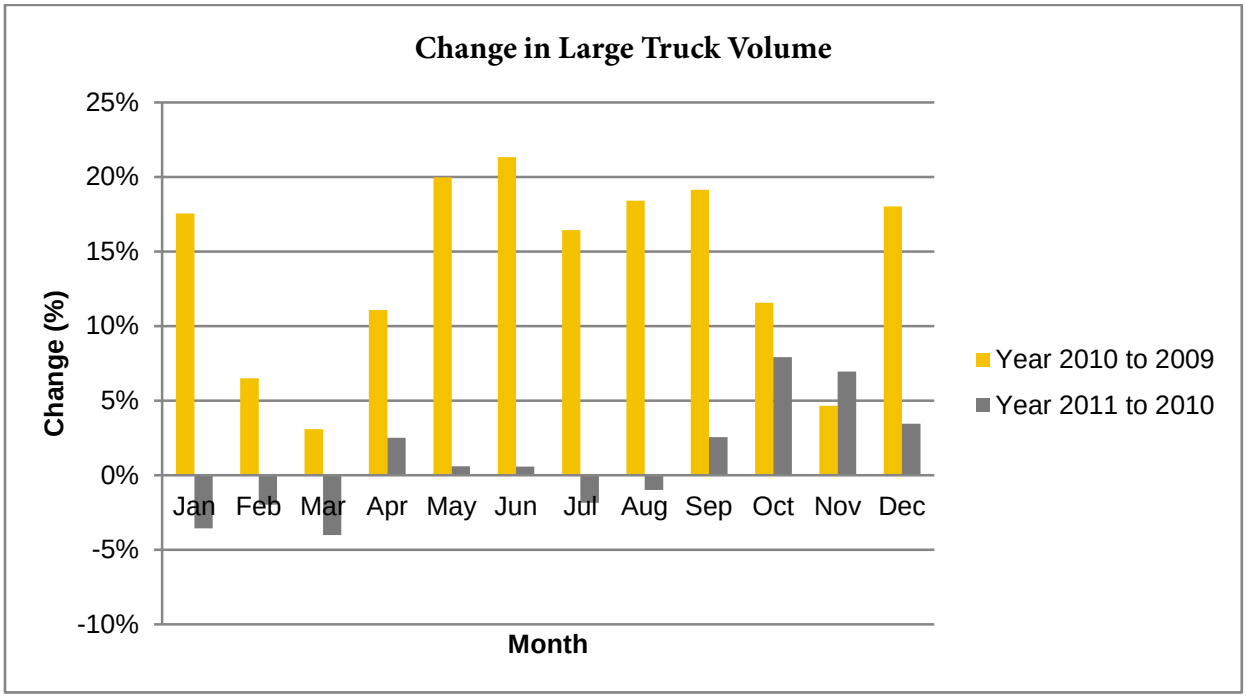

Figure 15. Change in Large Truck Volume at WIM Station 78D (2009-2011)

The relative daily profile of traffic by vehicular category exhibits similar travel patterns among the analyzed years. The large truck volume in the westbound directions shows a mild peak

during midday typical of Profile 2. Auto volume followed a strong commuter pattern during the p.m. peak period with 19.6 % of daily volume between 4:00 and 6:00 p.m. (Figure 16).

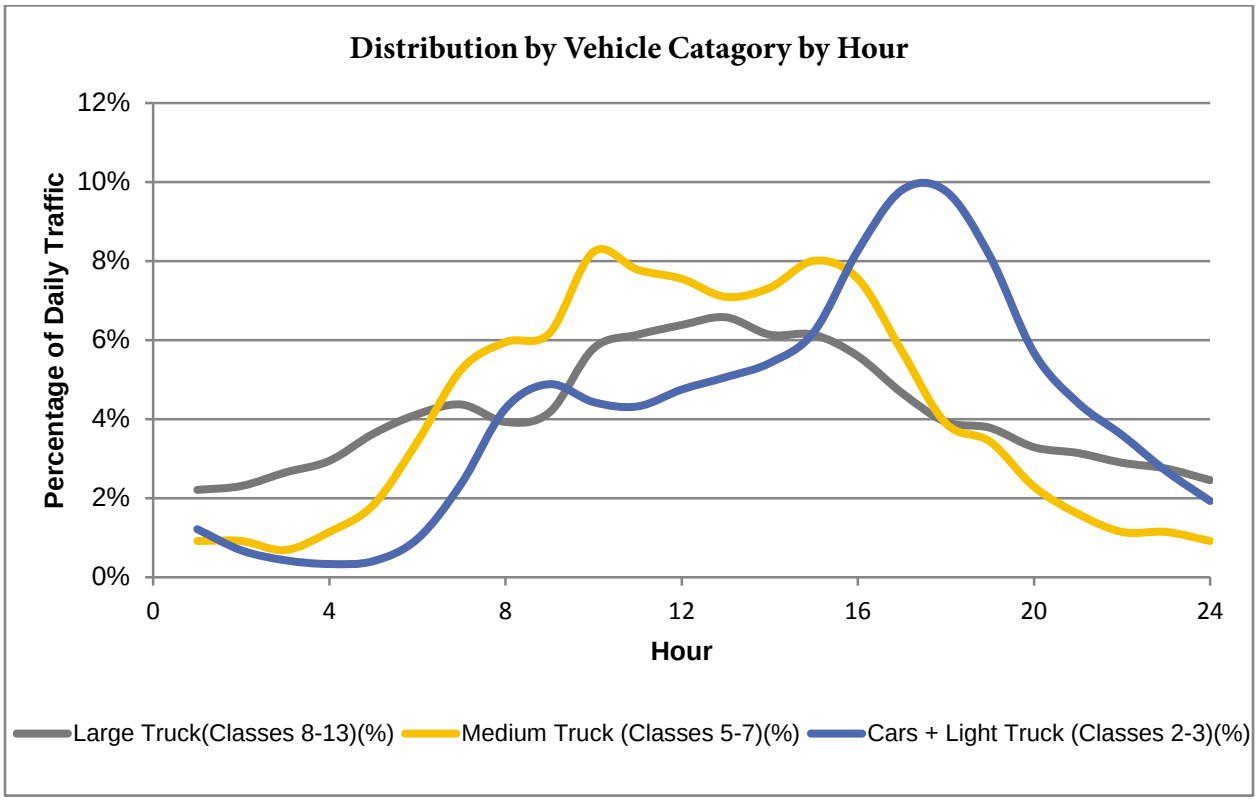

Figure 16. Daily Profile of Volume at Westbound I-78, MP 25.7 (2009)

In the eastbound direction, the large truck Profile 1 is typical of a heavily traveled through-trip route with relatively steady volume throughout the 24-hour weekday. Large truck volume peaked early, between 4:00 and 6:00 a.m., when over 11% of all large truck traffic occurred. Auto volume peaked during 6:00 to 9:00 a.m. period when nearly 25% of auto volume occurred (Figure 17).

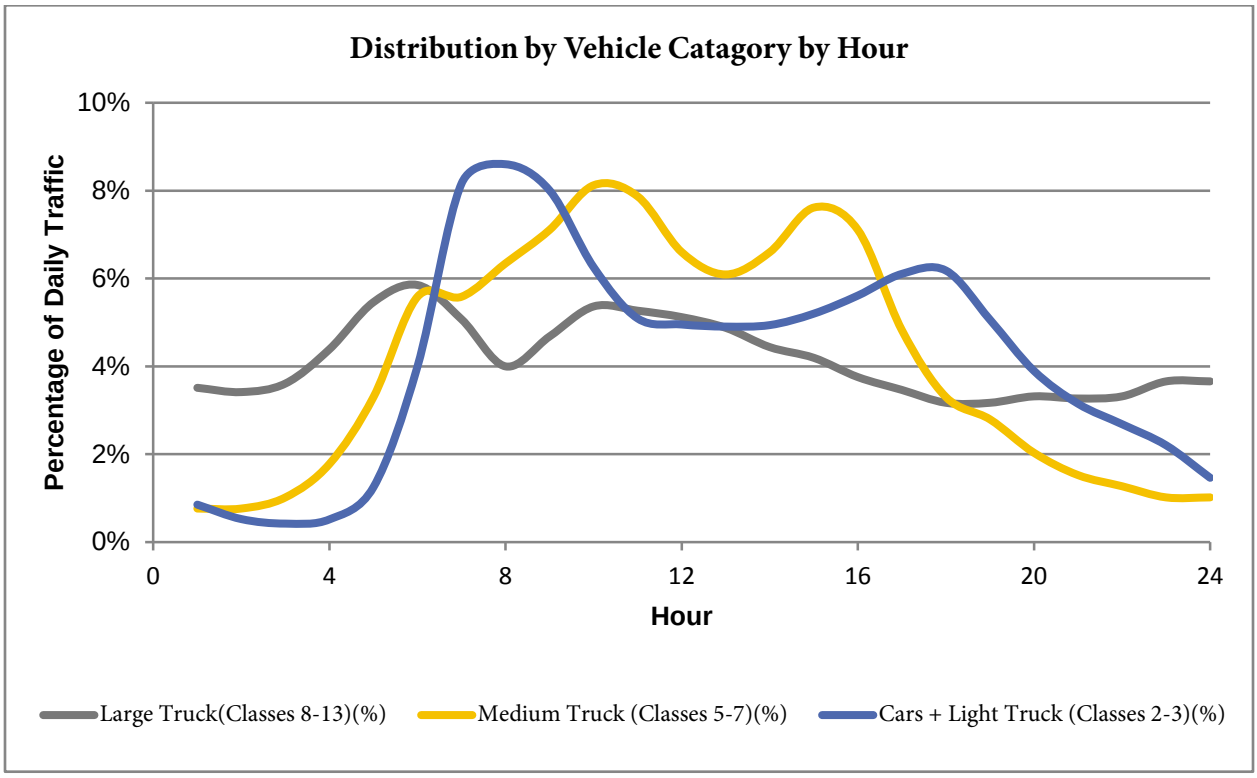

Figure 17. Daily Profile of Volume at Eastbound I-78, MP 25.7 (2009)

4.3. WIM Station 78A: I-78, MP 14.5

WIM Station 78A is located at milepost 14.5 in Union Township, Hunterdon. At this location I-78 is a six-lane limited access Urban Interstate and is included in the National Network. Figure 18 shows the location and surrounding features. WIM data is available at this location since October 2009. WIM data was recorded for all of 2010 and 2011 except for October, November and December of 2010.

Figure 18. Aerial View of WIM Station at I-78, MP 14.5

Overall, in 2011 the decrease of large truck by 0.94% was observed at this WIM station. As shown in Figure 19, LTWADT in 2011 had a largest decline in months of March and April, (4.6%). The largest increase in LTWADT has been recorded in December of 2011 with 4.6 % truck more counted.

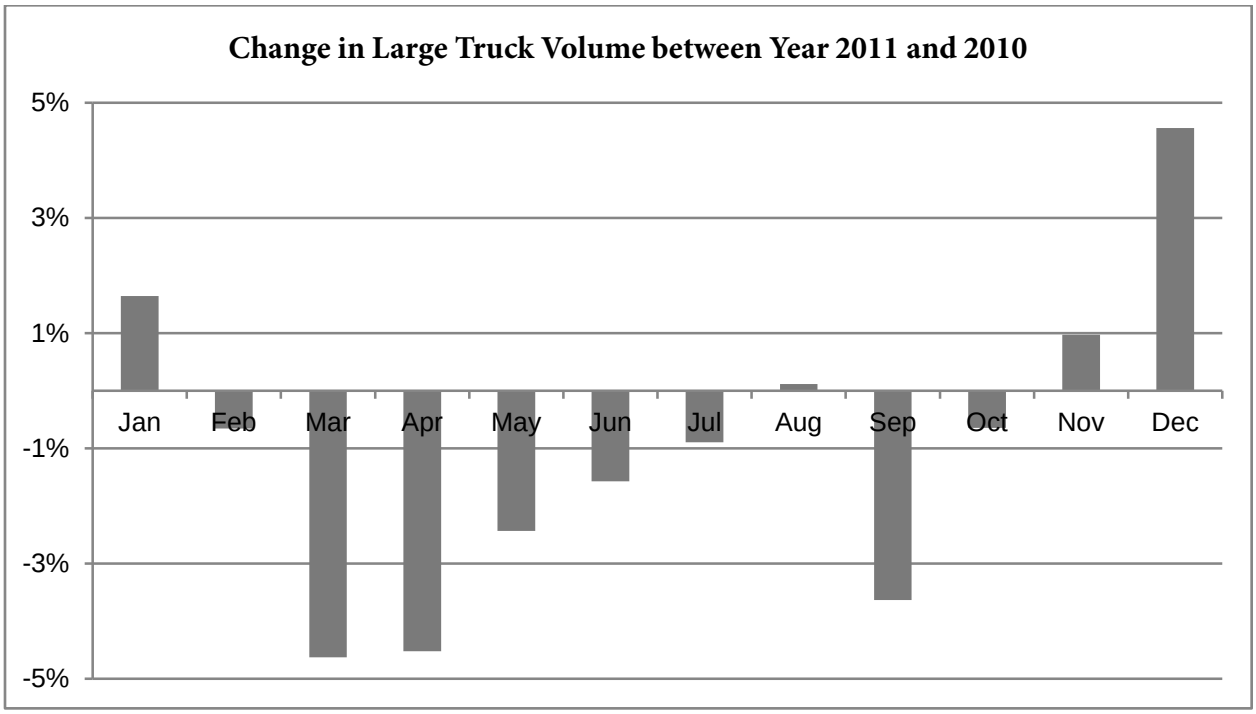

Figure 19. Change in Large Truck Volume at I-78, MP 14.5 (2010-2011)

The relative daily profile of traffic by vehicular category exhibits similar travel patterns among the analyzed years. Figure 20 shows the daily profile of volume in the eastbound direction for 2010. Auto volume peaked early with the highest volume between 6:00 and 8:00 a.m. when more than 18% of daily total occurred. The daily truck travel pattern in 2011 is similar to travel pattern in 2010. The travel pattern is characteristic of Profile 1 with a peak between 4:00 and 6:00 a.m.

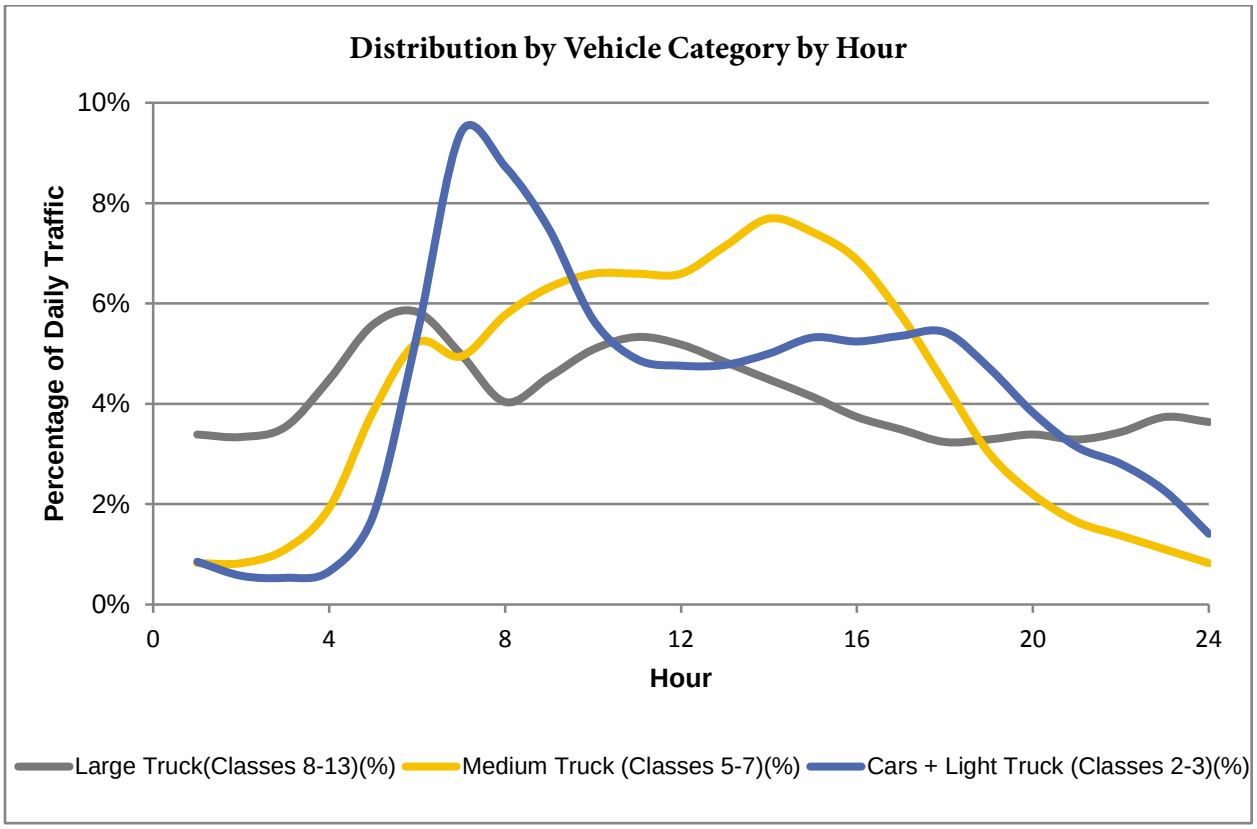

Figure 20. Daily Profile of Volume at Eastbound I-78, MP 14.5 (2009)

In the westbound direction, the large truck hourly volume matches Profile 2 that peaked between 10:00 a.m. and 3:00 p.m. Medium trucks reached maximum volume between 2:00 and 4:00 p.m. Auto volume followed a commuter pattern with a peak during the 4:00 to 6:00 p.m. period with approximately 20 % of daily total occurred (Figure 21).

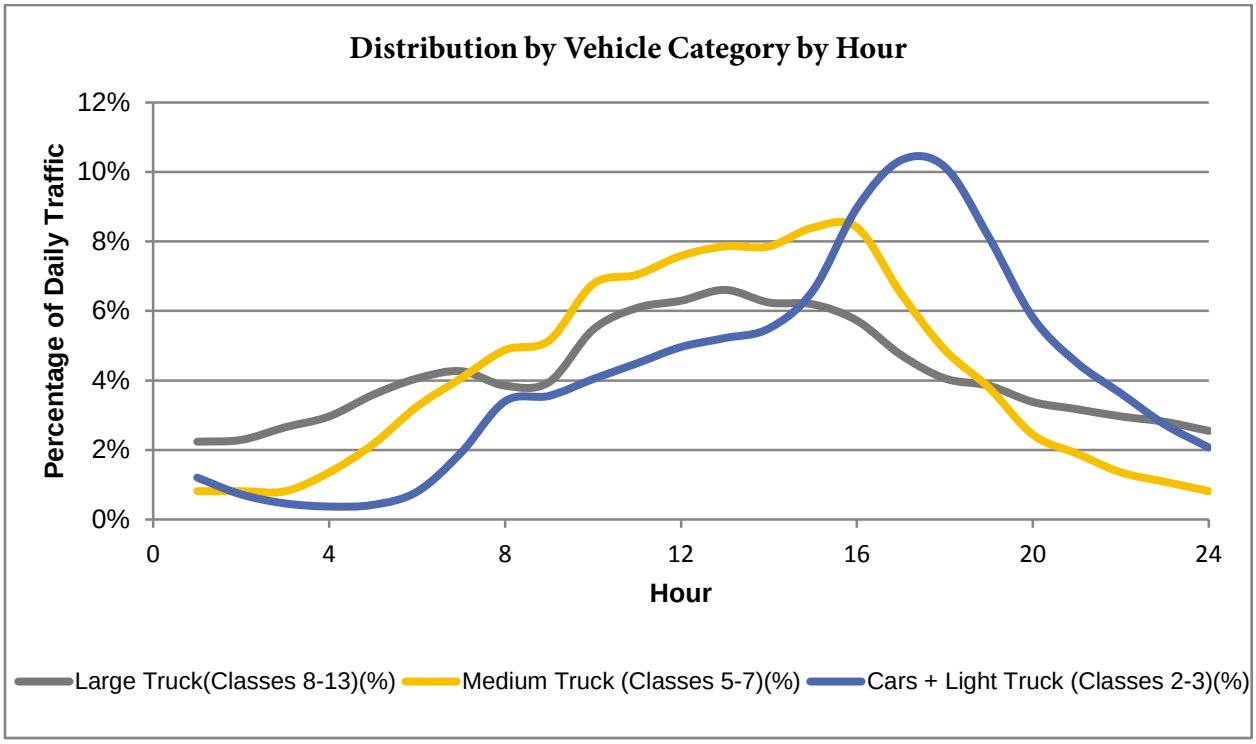

Figure 21. Daily Profile of Volume at Westbound I-78, MP 14.5 (2009)

4.4. WIM Station 80A: I-80, MP 8.3

WIM Station 80A is located at milepost 8.3 of Interstate 80 in Knowlton, Warren County between interchanges 4 (US 46/NJ 94) and 12 (CR 521 Hope-Blairstown Road). At this location I-80 is a seven-lane (four eastbound, three westbound) limited access Rural Interstate and is included in the National Network. Figure 22 shows the location and surrounding features. WIM data has been continuously recorded at this location and a complete set of data is available for the analyzed period.

Figure 22. Aerial View of WIM Station at I-80, MP 8.3

As shown in Table 3, large truck volume declined negligible in 2010 (0.04%). In 2011 truck volume reduced by additional 2.41%. In 2011, the decrease in large truck volume is more dominant in the westbound direction with 3.79% less truck recorded.

Table 3. Change in Large Truck Volume at WIM Station 80A

	2009	2010	2011	% Change from 2010 to 2009	% Change from 2011 to 2010
Eastbound	44,468	44,753	44,284	0.64%	-1.05%
Westbound	44,525	44,208	42,532	-0.71%	-3.79%
Total	88,993	88,961	86,816	-0.04%	-2.41%

Figure 23 shows the change in LTWADT between analyzed years. In 2010, January and December recorded an increase in truck volume of approximately 6% while truck traffic had a largest decrease in June (7.59%). In 2011, only June (6.02%) and October (0.78%) recorded an increase in truck volume.

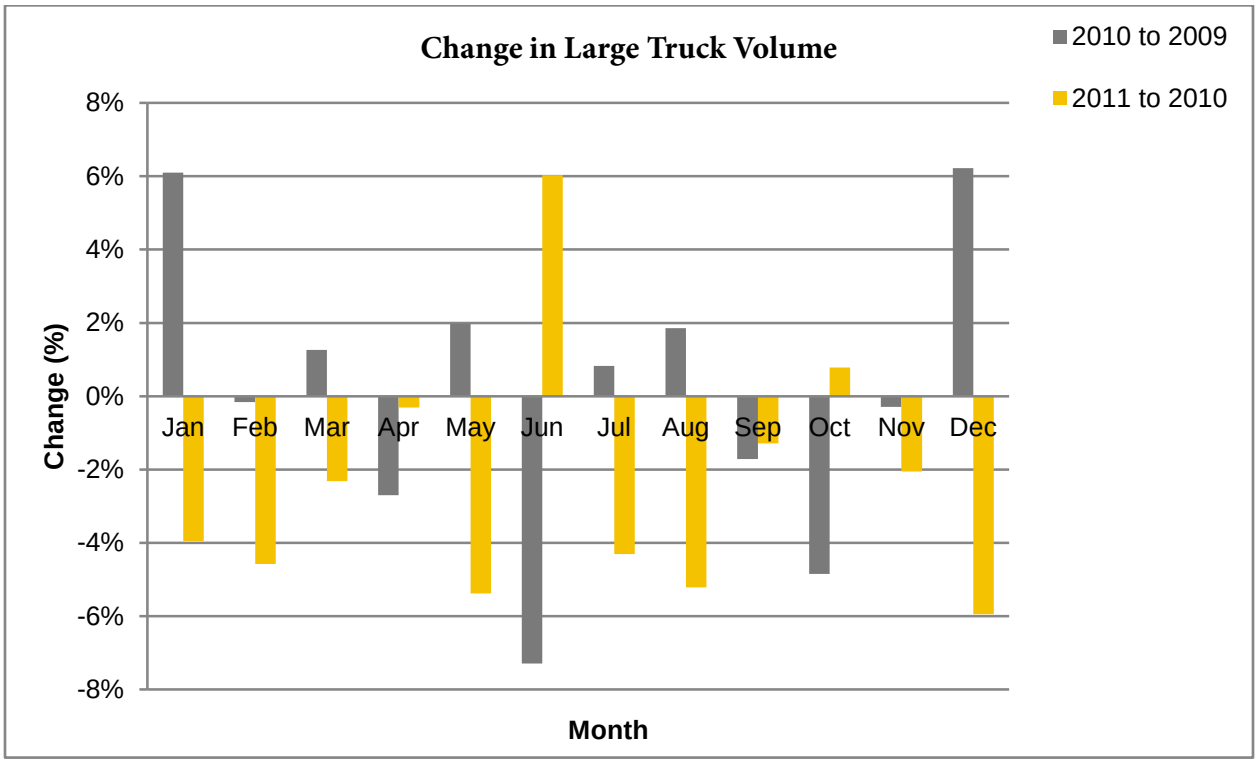

Figure 23. Change in Large Truck Volume at I-80, MP 8.3 (2009-2011)

The analysis of large truck travel patterns shows that there is no significant change in travel patterns for each direction during the analyzed period. Figure 24 shows the relative daily profile of traffic by vehicular category. The large truck pattern in the eastbound direction is characteristic of Profile 1 with the peaks during the morning period. The early peak occurred between 4:00 and 6:00 a.m. The large truck volume declined from 10 a.m. reaching its lowest point between 4:00 and 7:00 p.m. before rising again leading into the overnight hours. Auto volume peaked during the morning peak period from 5:00 and 7:00 a.m. when close to 14% of daily total occurred. During the afternoon peak period between 4:00 and 6:00 p.m. auto volume increased reaching approximately 11.5 % of daily total.

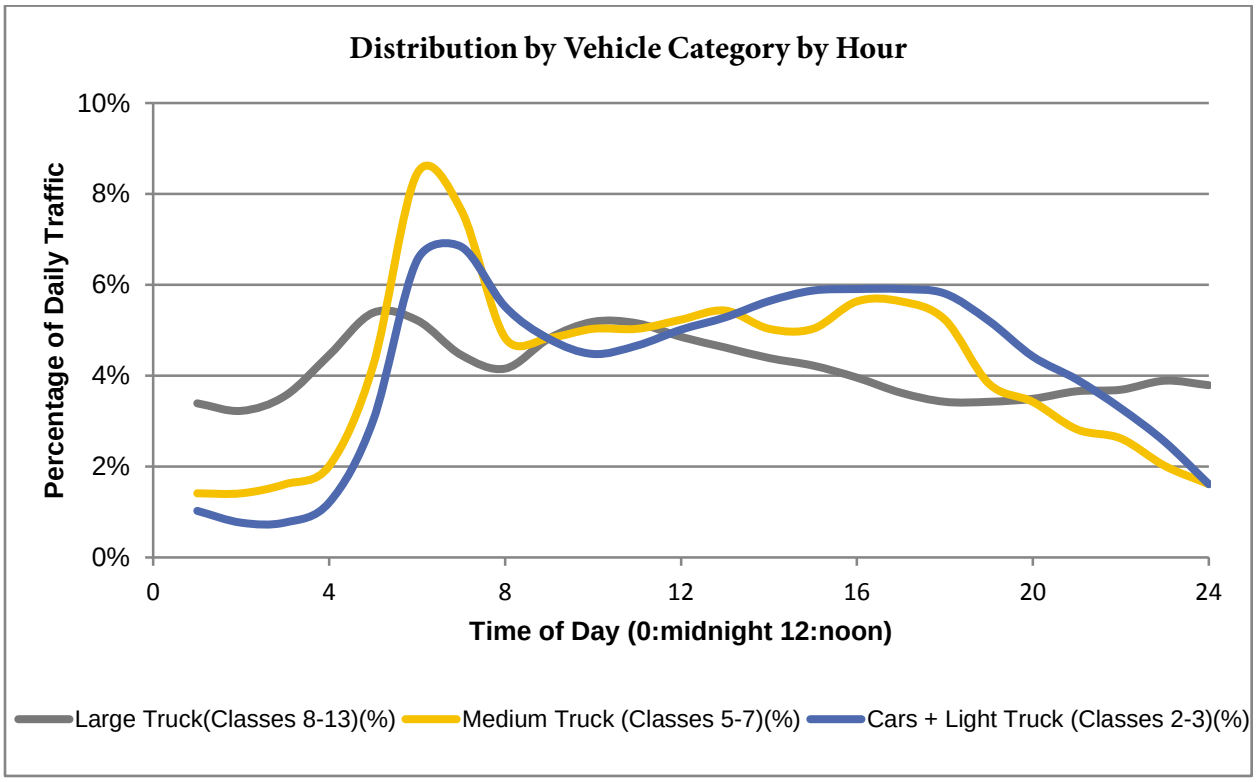

Figure 24. Daily Profile of Volume at Eastbound I-80, MP 8.3 (2009)

Figure 25 shows the relative daily profile of volume by vehicular category in the westbound direction at I-80 milepost 8.3. The large truck hourly volume matches Profile 2 with the peaked between 11:00 a.m. and 4:00 p.m. Medium trucks followed a more peaked profile with maximum volume reached between 2:00 and 3:00 p.m. Auto volume followed a commuter pattern with a peak during the 4:00 to 6:00 p.m. period with approximately 17% of daily total occurred.

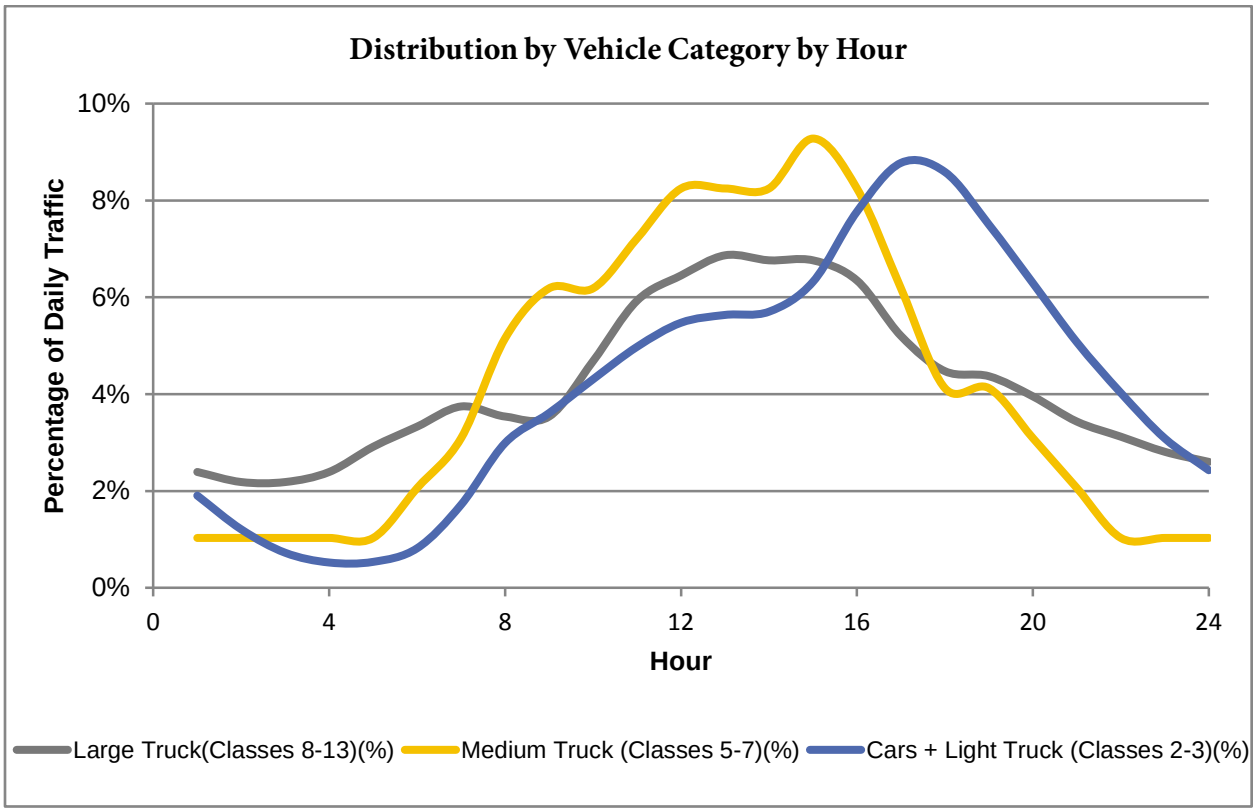

Figure 25. Daily Profile of Volume at Westbound I-80, MP 8.3 (2009)

4.5. WIM Station 80B: I-80, MP 32.4

WIM Station 80B is located at milepost 32.4 of Interstate 80 in Roxbury, Morris County between interchanges 30 (CR 615 Howard Boulevard) and 34 (NJ 15). At this location I-80 is a six-lane limited access Urban Interstate and is included in the National Network. Figure 26 shows the location and surrounding features. WIM data has been continuously recorded at this location for several years. Data is available for all of 2009 however limited data is available for 2010 and 2011.

Figure 26. Aerial View of WIM Station at I-80, MP 32.4

Figure 27 shows the change in LTWADT from 2010 to 2009 in the westbound direction. In 2010 the LTWADT increased by 1.06%. The LTWADT increased during first four months of 2010 reaching its highest value in January with 8.3% more trucks traversing. The largest decrease in LTWADT was recorded in May with 2.3% less trucks compared to 2009.

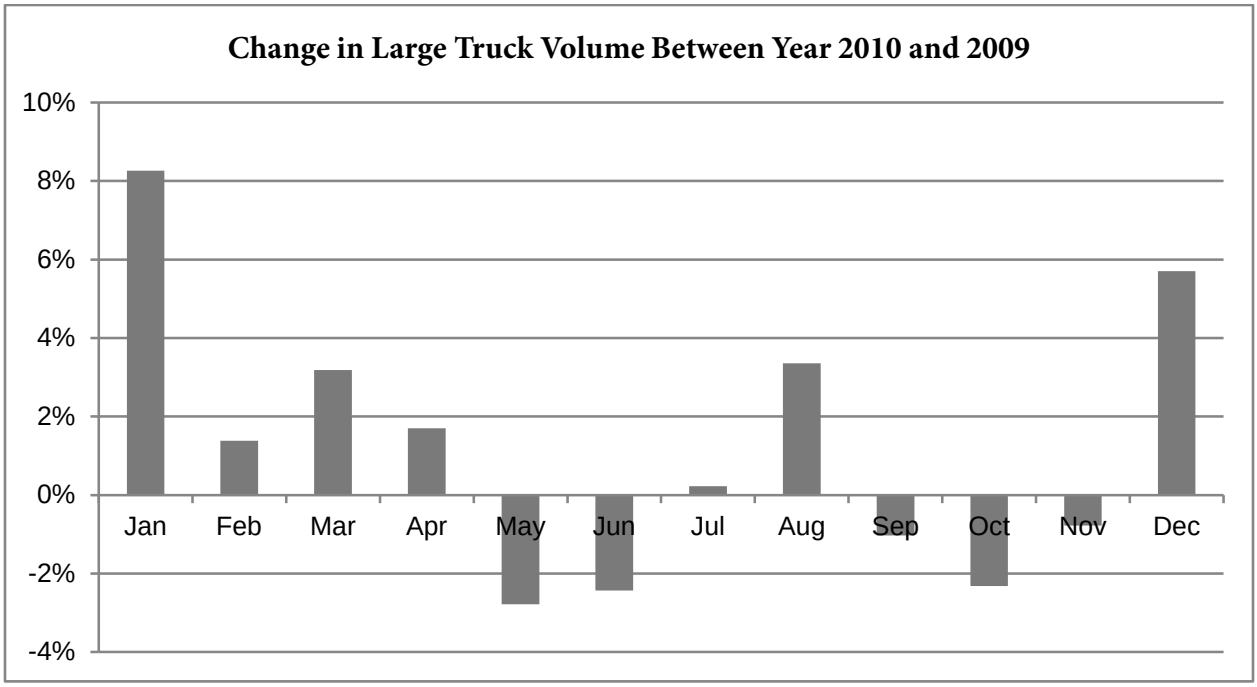

Figure 27. Change in Large Truck Volume at Westbound I-80, MP 32.4 (2009-2010)

Figure 28 shows the change in LTWADT in the eastbound direction. The large truck volume declined in 2010 by 5.13% and by 6.03% in 2011. The month of July had a largest fluctuation is truck volume. In 2010, 17.8% less trucks was recorded while in 2011 22.4% more trucks traversed the WIM station. July of 2011 was the only month with a positive change.

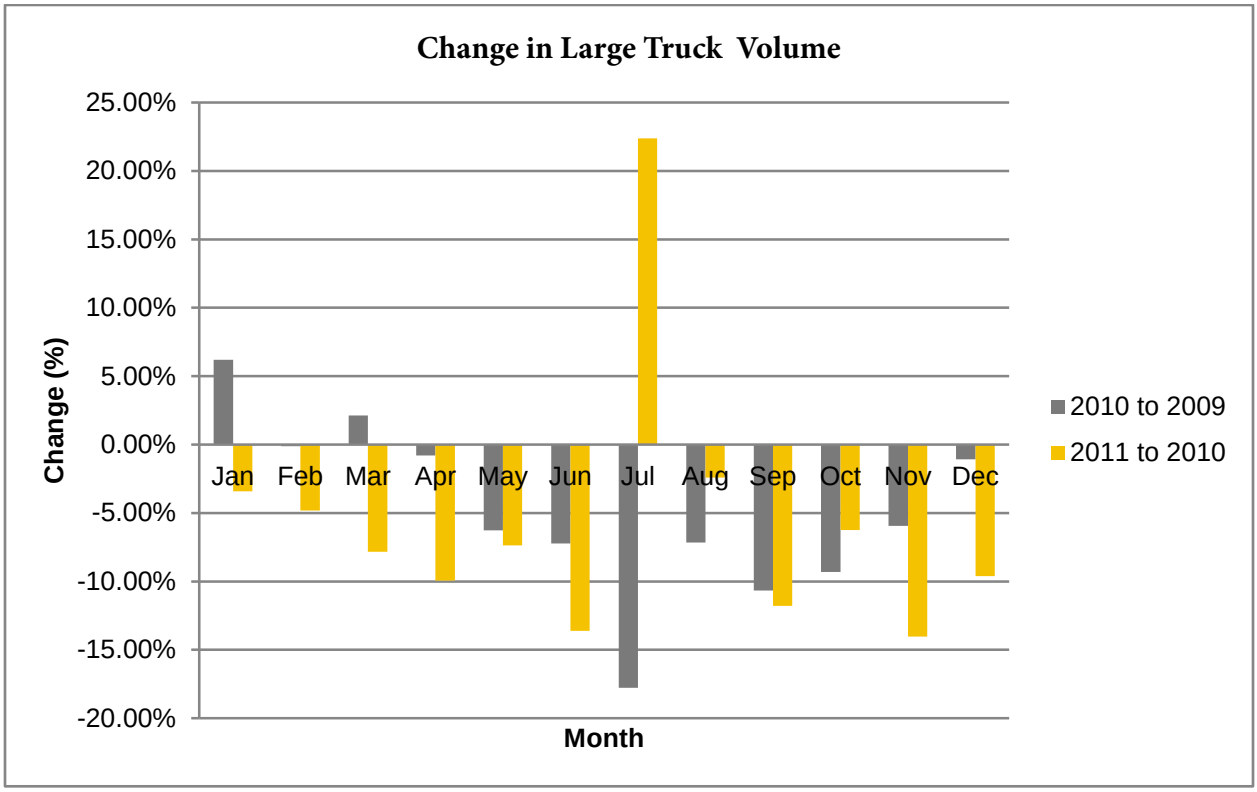

Figure 28. Change in Large Truck Volume at Eastbound I-80, MP 32.4 (2009-2011)

The analysis of large truck travel patterns shows that there is no significant change in travel patterns from 2009 throughout 2011. The large truck travel pattern in the eastbound direction shown in Figure 29, matches Profile 1 with the early volume peak between 4:00 and 6:00 a.m. The large and medium truck volume had a sharp decline between 7:00 and 8:00 a.m. which roughly corresponds to the auto and light truck morning commuter peak. The large truck daily minimum occurred during the evening peak period when auto volume increased.

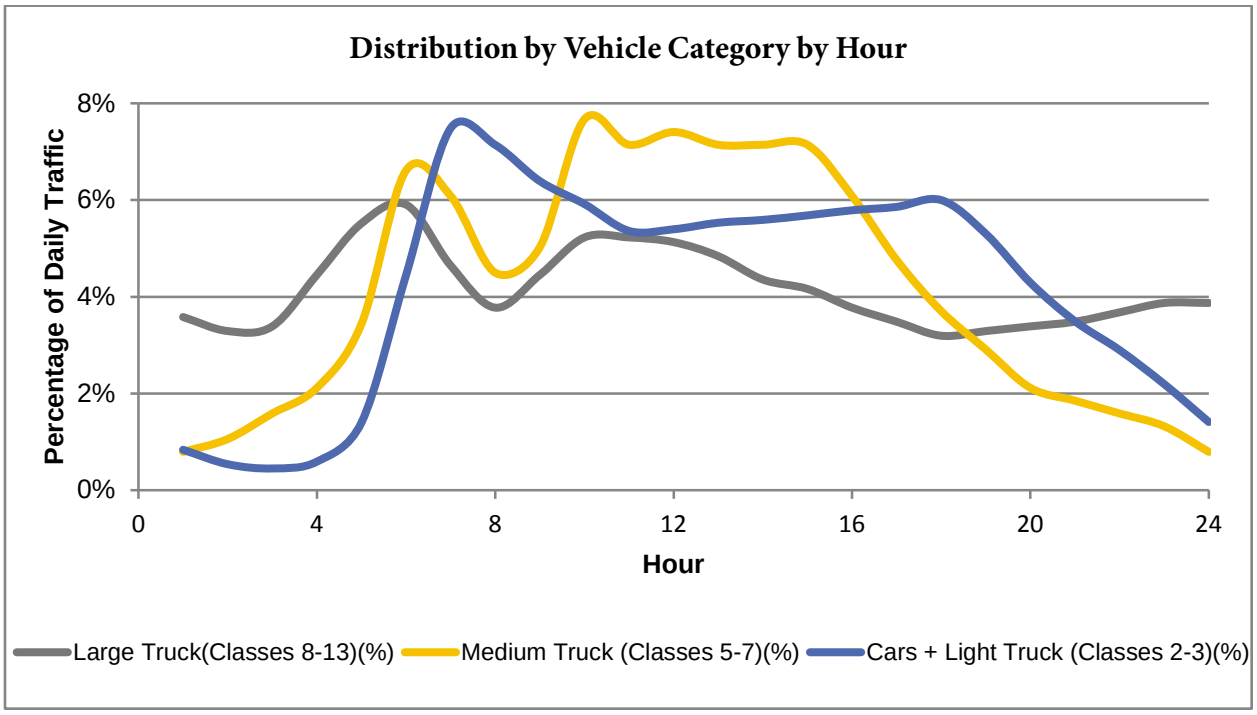

Figure 29. Daily Profile of Volume at Eastbound I-80, MP 32.4 (2009)

Figure 30 shows the relative daily profile of traffic by vehicular category in the westbound direction at I-80 milepost 32.4. The large truck volume followed a moderate bell curve peaking at 1:00 p.m. typical of Profile 2. The westbound auto volume reached a peak from 3:00 pm to 6:00pm with 26% of total volume.

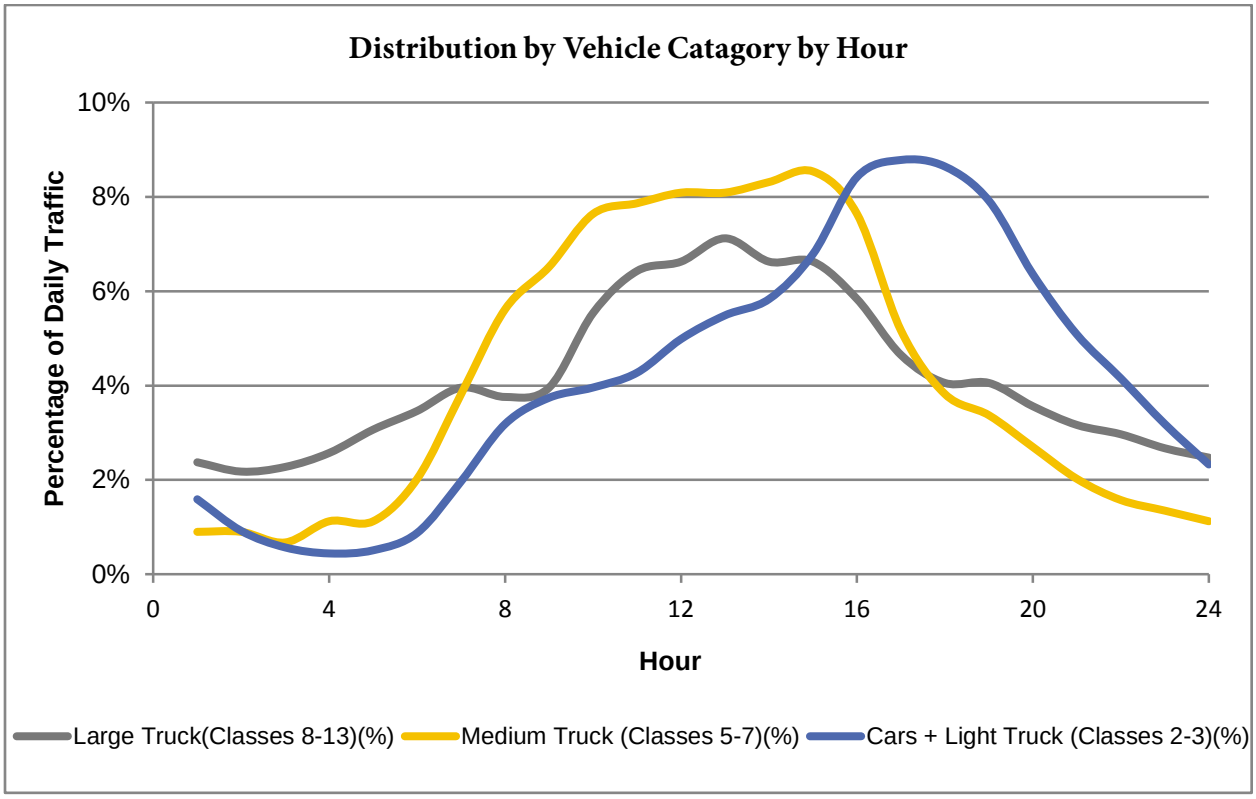

Figure 30. Daily Profile of Volume at Westbound I-80, MP 32.4 (2009)

4.6. WIM Station 195: I-195, MP 10.2

WIM Station 195 is located at milepost 10.2 of Interstate 195 in Upper Freehold, Monmouth County between interchanges 8 (CR 524/539 Old York Road) and 11 (CR 43 Imlaystown-Hightstown Road). At this location I-195 is a four-lane limited access Rural Interstate and is included in the National Network. Figure 31 shows the location and surrounding features. WIM data has been continuously recorded at this location however limited data is available in the eastbound direction for the analyzed period.

Figure 31. Aerial View of WIM Station at I-195, MP 10.2

As shown in Figure 32, LTWADT sharply declined during first three months of 2010 compared to the same period in 2009. A steady increase in LTWADT was recorded from September 2010. This trend continued until April 2011. In second half of the 2011, the LTWADT was higher compared to the same period in 2010. Overall, the large truck volume increased by 0.6% and 3.14% in 2010 and 2011 respectively.

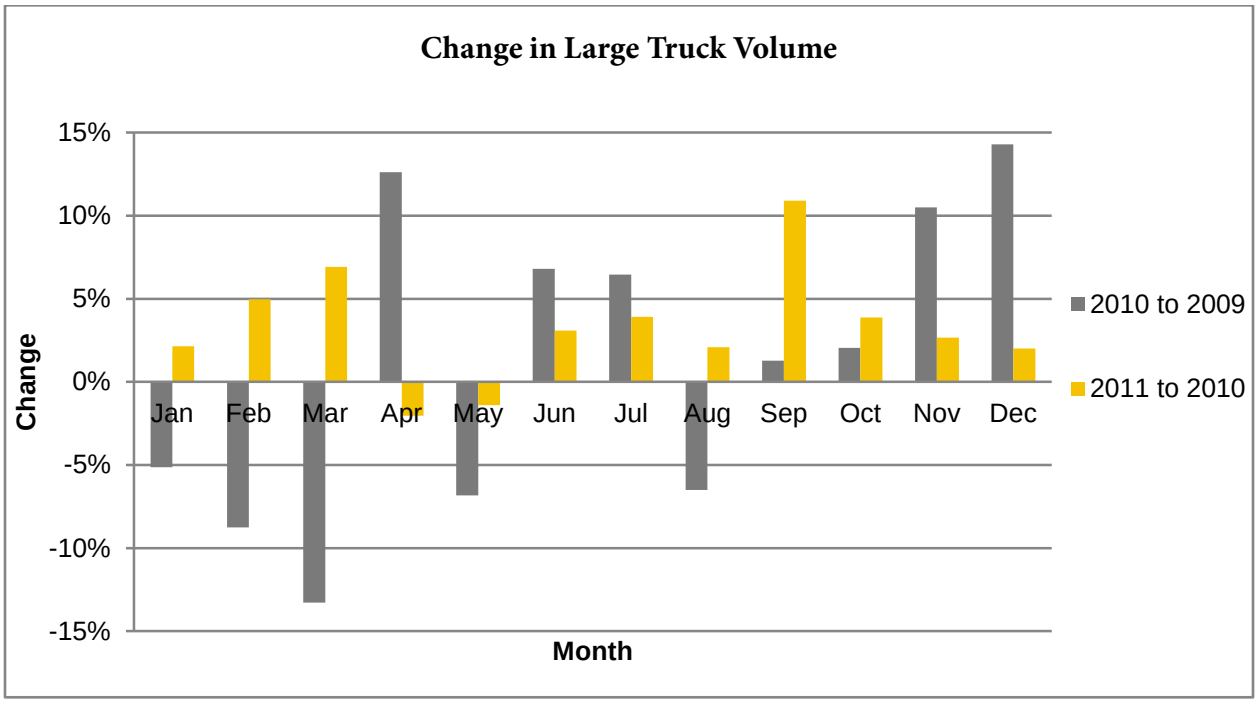

Figure 32. Change in Large Truck Volume at I-195, MP 10.2 (2009-2011)

The analysis of large truck travel patterns shows that there is no significant change in travel patterns from 2009 throughout 2011. The large truck pattern in the westbound direction, shown in Figure 33, matches Profile 2 with the volume peak between 9:00 and 12:00 p.m. Medium trucks followed a strong peak between 1:00 and 6:00 p.m. while auto volume were prevalent during the morning peak period from 7:00 to 9:00 a.m. with 19% of total recorded.

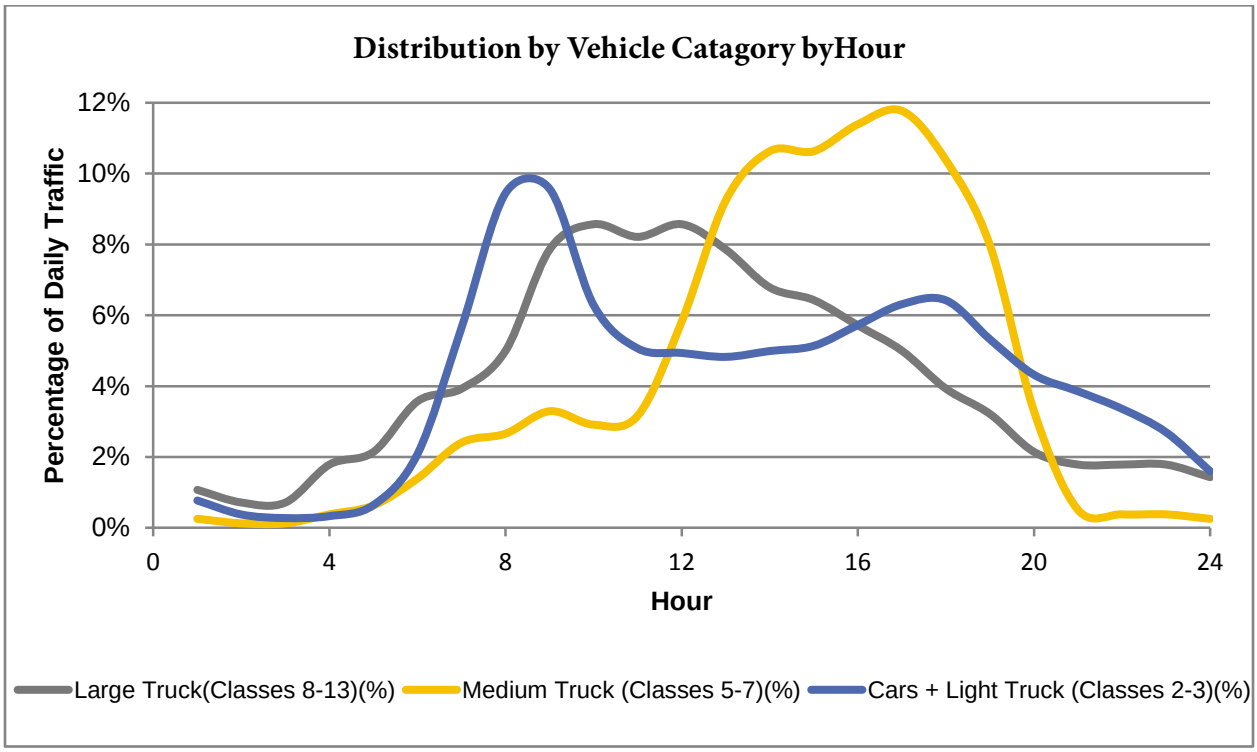

Figure 33. Daily Profile of Volume at Eastbound I-195, MP 10.2 (2009)

4.7. WIM Station 095: I-95, MP 1.2

WIM Station 095 is located at milepost 1.2 of westbound Interstate 95 in Ewing Township, Mercer County in the vicinity of interchange 2 (Bear Tavern Road). At this location I-95 is a six-lane Urban Interstate and is included in the National Network. Figure 34 shows the location and surrounding features. WIM data has been continuously recorded at this location for several years however limited data is available for northbound direction post 2009.

Figure 34. Aerial View of WIM Station at I-95, MP 1.2

Figure 35 shows the change in LTWADT for the westbound direction at I-95 MP 1.2. The LTWADT declined in 2010. September of 2010 had a largest estimated decrease of 22.7%. The increase in LTWADT was recorded in 2011 but the truck volume didn't reach the volume observed in 2009. The LTWADT in 2011 was lower by 5.2% compared to 2009.

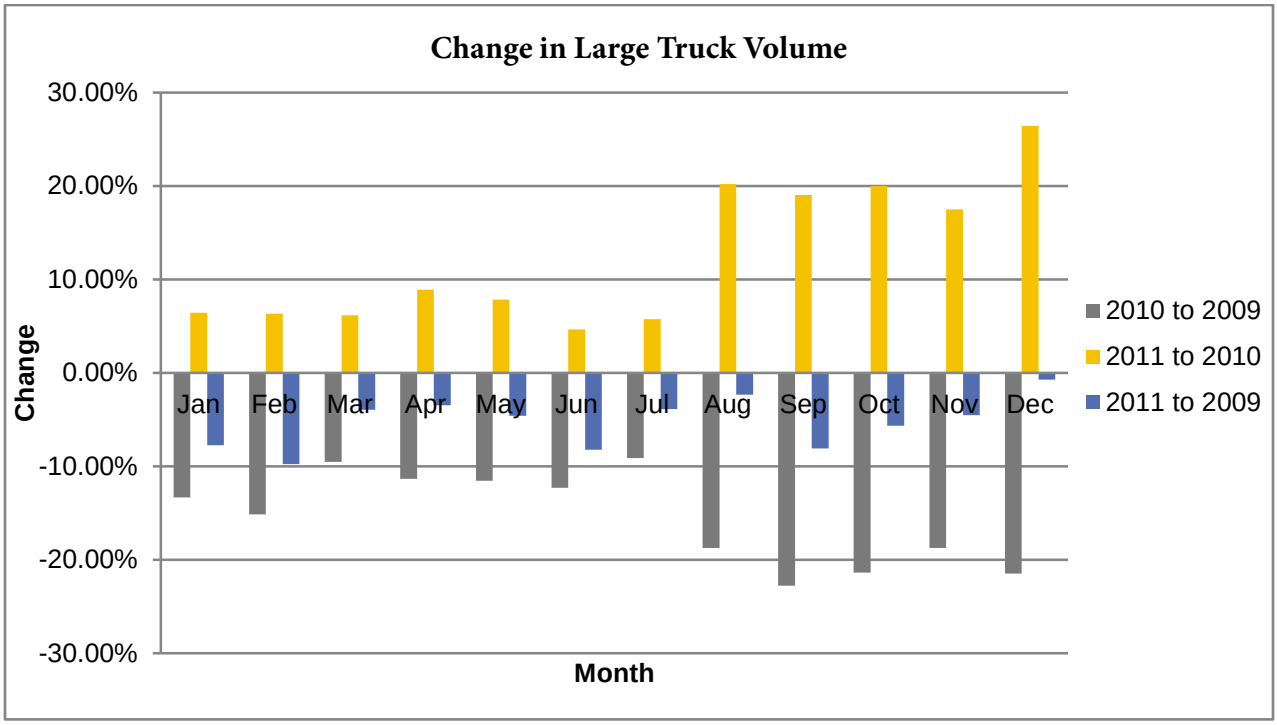

Figure 35. Change in Large Truck Volume at Westbound I-95, MP 1.2 (2009-2011)

The daily traffic pattern had similar characteristics for the duration of analyzed period. Figure 36 shows the daily traffic pattern in the southbound direction during 2009. Large truck volume exhibited Profile 2 pattern. Profile 2 pattern characterizes moderate difference between the midday and rest of the day. The large truck traffic pattern peaked between 10:00 a.m. and 1:00 p.m. Medium trucks followed a same pattern with a strong midday peak while personal vehicles were prevalent during the afternoon peak between 4:00 and 6:00 p.m. where 23.2% of total daily volume was recorded.

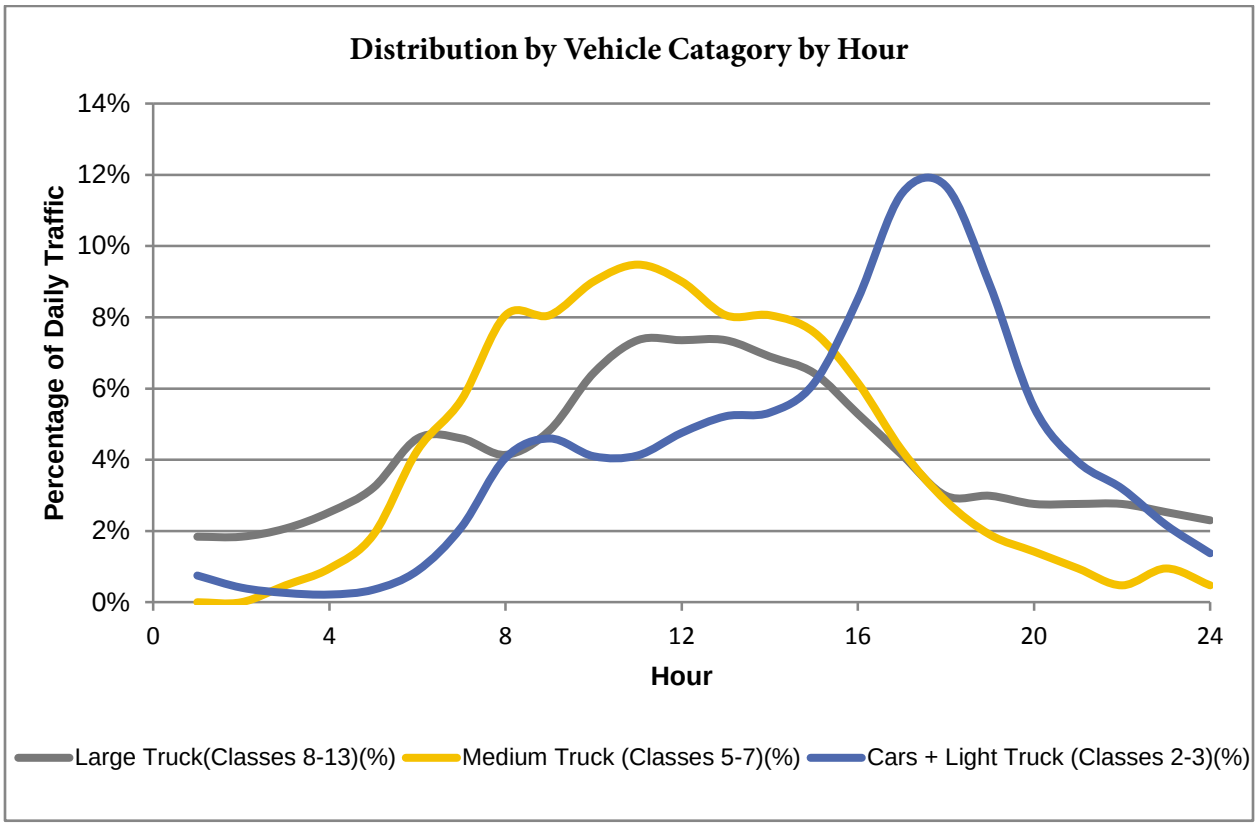

Figure 36. Daily Profile of Volume at Southbound I-95, MP 1.2 (2009)

The daily traffic pattern for large truck in the northbound direction (year 2009) is shown in Figure 37. Large truck volume exhibited a Profile 2 pattern characteristic with a moderate difference between the midday and rest of the day. The volume peaked between 9:00 a.m. and 12:00 p.m. Medium trucks followed a same pattern with a strong midday peak profile while personal vehicles were prevalent during the morning peak between 7:00 and 9:00 a.m. where 22.2% of total daily volume was recorded.

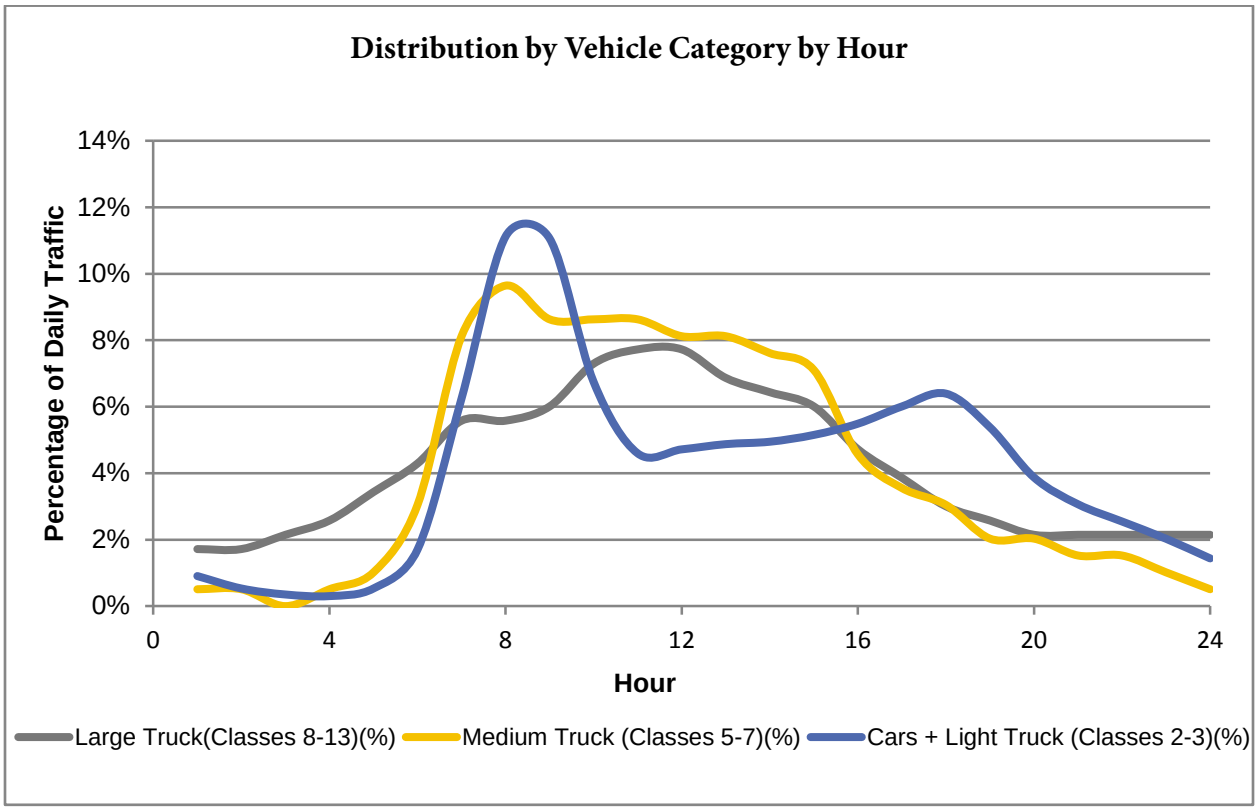

Figure 37. Daily Profile of Volume at Northbound I-95, MP 1.2 (2009)

4.8. WIM Station 95B: I-95, MP 6.3

WIM Station 095 is located at milepost 1.2 of westbound Interstate 95 in Lawrence Township, Mercer County between the interchanges 5A(Federal City Road) and 7A(US 206). At this location I-95 is a six-lane Urban Interstate and is included in the National Network. Figure 38 shows the location and surrounding features. WIM data has been continuously recorded at this location since 2007.

Figure 38. Aerial View of WIM Station at I-95, MP 6.3

Overall, the LTWADT in 2011 increased by 4.5% compared to 2010 but never reach levels from 2009. The observed volume was 6.6% smaller compared to year 2009 (Table 4).In 2010, the northbound direction experienced higher reduction in LTWADT compared to the southbound direction. In 2011, southbound direction experienced higher increase in LTWADT compared to northbound direction.

Table 4. Change in Large Truck Volume at WIM Station 95B

	2009	2010	2011	2010 to 2009	2011 to 2010	2011 to 2009
Northbound	12,446	10,976	11,296	-11.808%	2.92%	-9.24%
Southbound	21,341	19,226	20,259	-9.91%	5.37%	-5.07%
Total	33,787	30,202	31,555	-10.61%	4.48%	-6.60%

Figure 39 shows the change in LTWADT between the analyzed years. In 2010, the LTWADT declined by 10%. The decreasing trend continued in January and February of 2011 as well. An increase in LTWADT was observed for the most of 2011 except in August and September where LTWADT decreased negligibly.

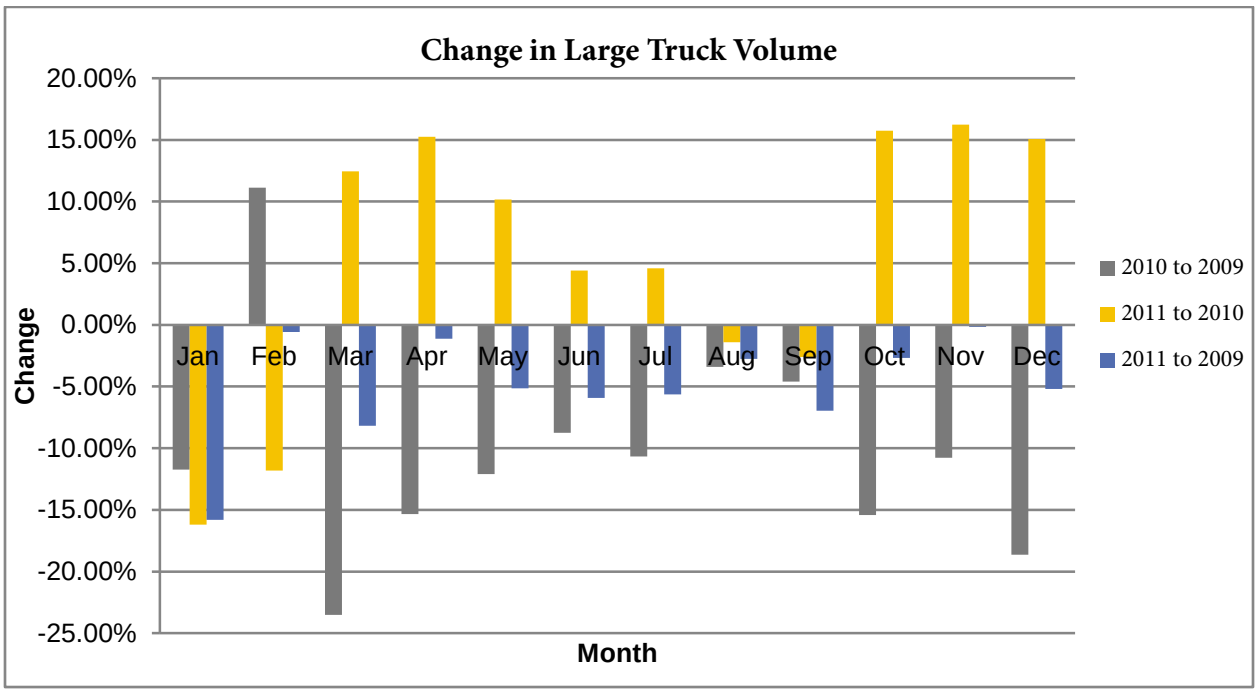

Figure 39. Change in Large Truck Volume at I-95, MP 6.3 (2009-2011)

The analysis of daily traffic pattern for all vehicle categories revealed that the daily vehicle profile for large trucks and personal vehicles is similar in the northbound and southbound direction during the analysis period. Figure 40 shows the relative daily profile of traffic by vehicular category in the northbound direction for 2009. Large truck volume exhibited a Profile 2 pattern with heavy volume and a moderate difference between the midday and overnight extremes. The peak fell between 10:00 a.m. and 12:00 p.m. Medium trucks followed a stronger midday peak profile while personal vehicles were prevalent during the commuter peaks. Morning peak (7:00 to 9:00 a.m.) recorded 16% of total daily volume while evening peak (4:00 to 6:00 p.m.) recorded 17% of total daily volume.

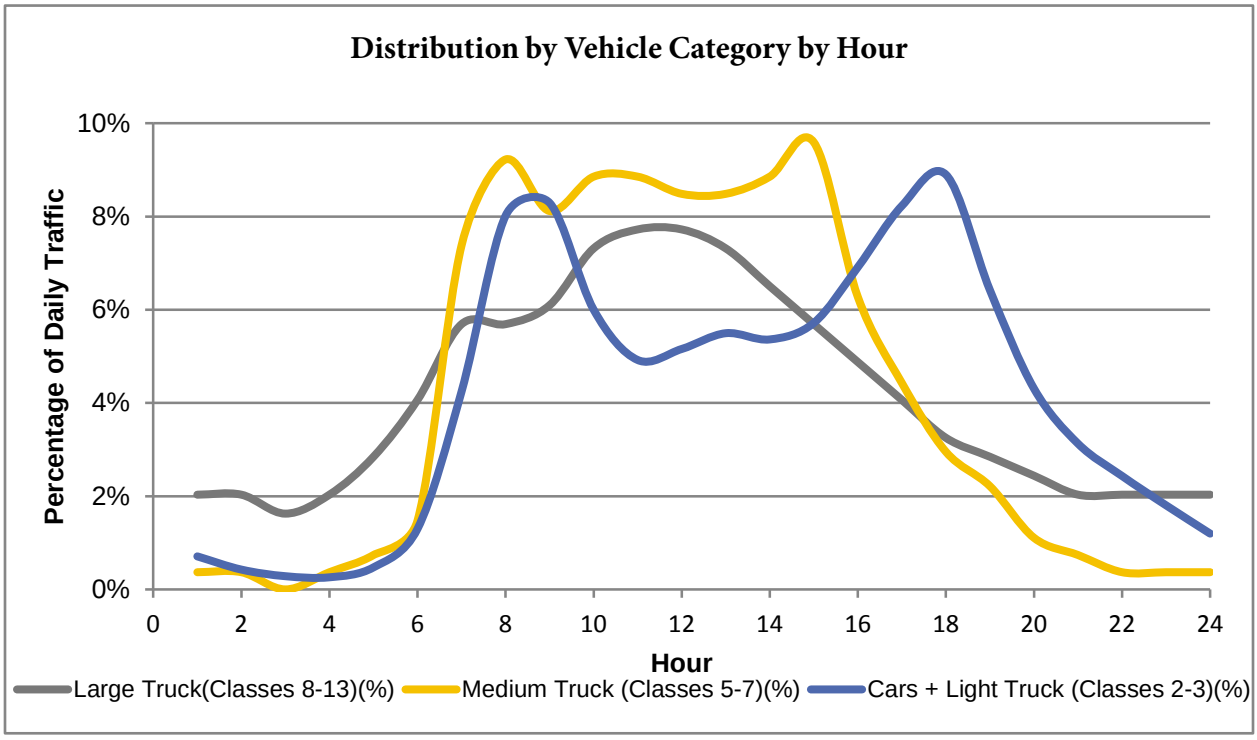

Figure 40. Daily Profile of Volume at Northbound I-95, MP 6.3 (2009)

Figure 41 shows the relative daily profile of traffic by vehicular category in the southbound direction at I-95 milepost 6.3. Auto volume was a mirror image of the northbound with a heavy flow (18.2% of total daily volume) during the 4:00 to 6:00 p.m. period. Medium trucks peak occurred between 9:00 and 10:00 a.m.

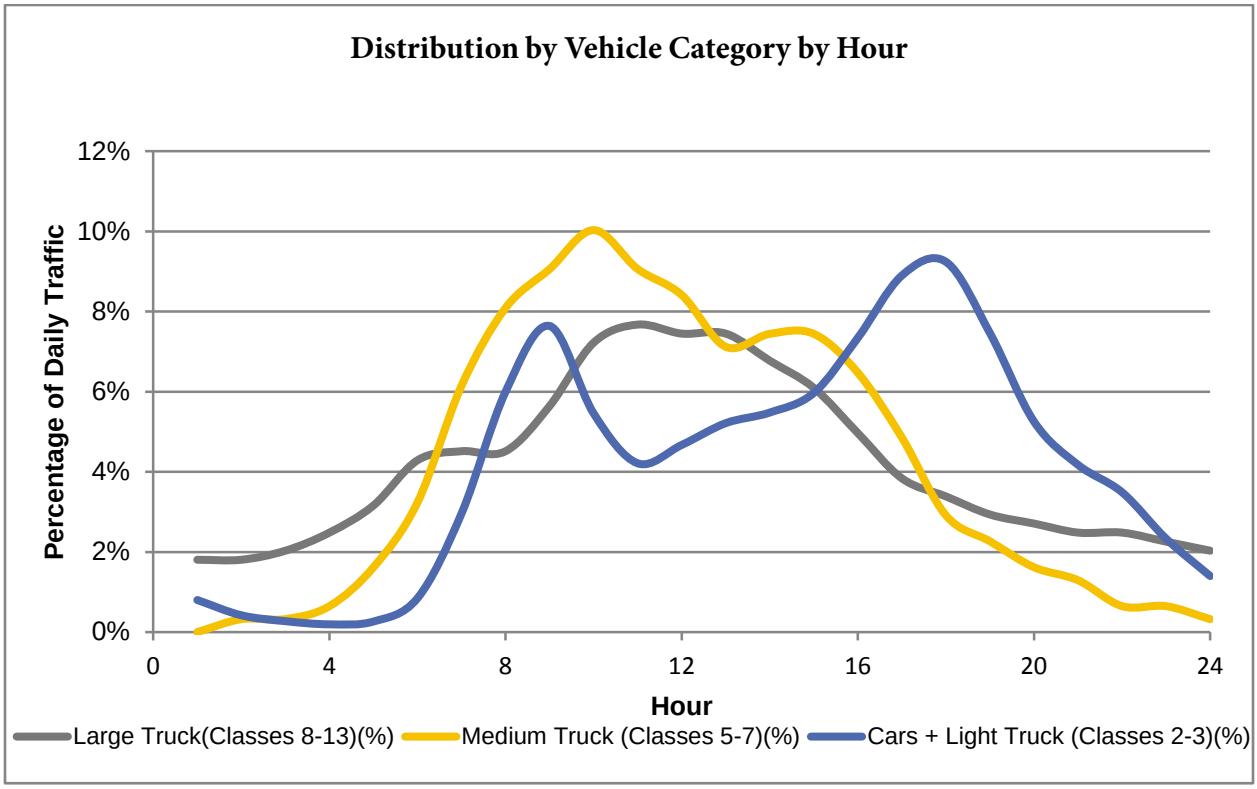

Figure 41. Daily Profile of Volume at Southbound I-95, MP 6.3 (2009)

4.9. WIM Station 287A: I-287, MP 31.7

WIM Station 287A (a.k.a. A87) is located at milepost 31.7 of northbound Interstate 287 in Harding, Morris County between interchanges 30 (North Maple Avenue) and 33 (Harter Road). At this location I-287 is a six-lane limited access Urban Interstate and is included in the National Network. Figure 42 shows the location and surrounding features. WIM data has been continuously recorded at this location for more than four years at the northbound direction only.

Figure 42. Aerial View of WIM Station at I-287, MP 31.7

Figure 43 shows the change in LTWADT between the analyzed years. In 2010, LTWADT increased by 7.2% and 0.35% in 2010 and 2011 respectively. The largest increase was observed in December 2010 when additional 14% of trucks were observed. In second half of 2011 large truck volume decreased.

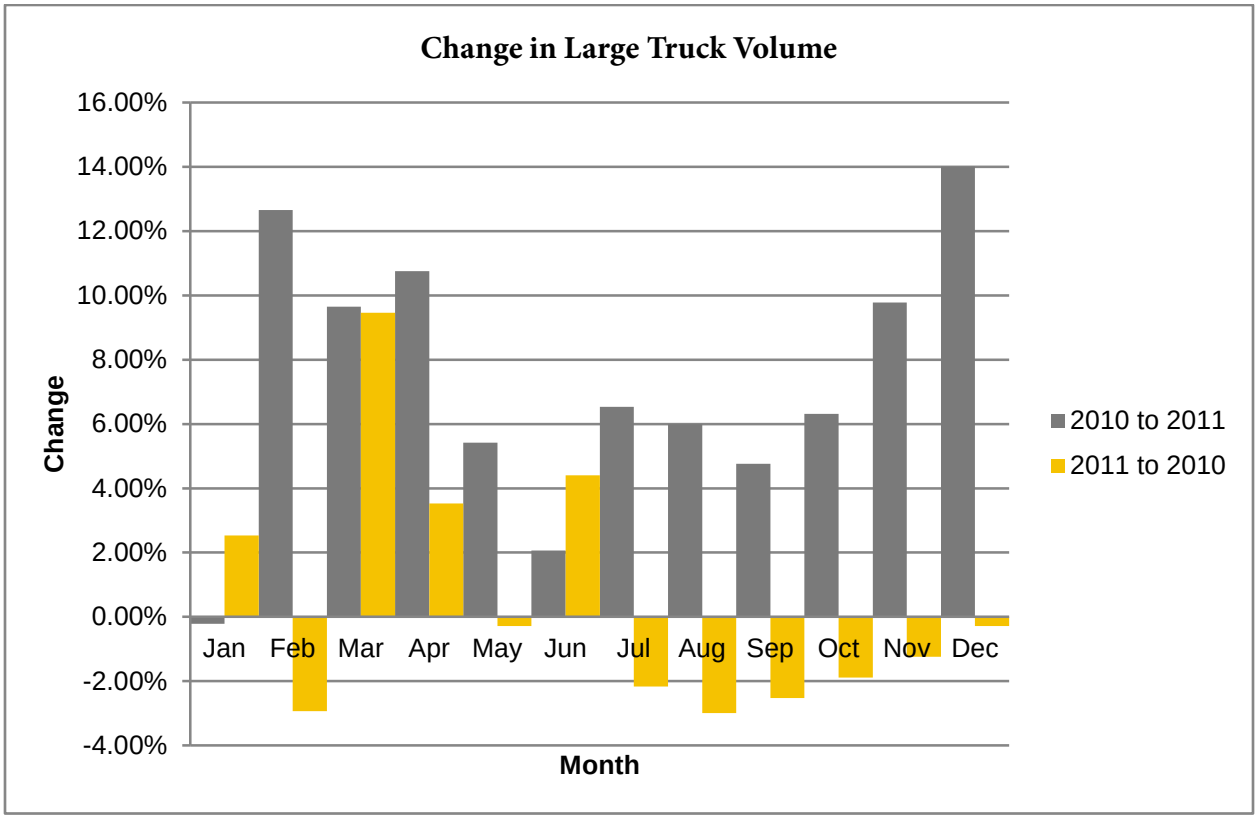

Figure 43. Change in Large Truck Volume at I-287, MP 31.7 (2009-2011)

The analysis of daily traffic pattern for all vehicle categories revealed that there was no change in daily travel patterns for all vehicle categories from 2009 to 2011. Figure 44 shows the relative daily profile of traffic by vehicular category in the northbound direction in 2009. Large truck volume exhibited Profile 1 with minimal variation between the morning peaks and the afternoon low volume. Medium trucks followed a stronger midday peak profile while personal vehicles were prevalent during the commuter peaks. Morning peak (7:00 to 9:00 a.m.) recorded 18% of total daily auto volume while evening peak (4:00 to 6:00 p.m.) recorded 15% of total daily auto volume.

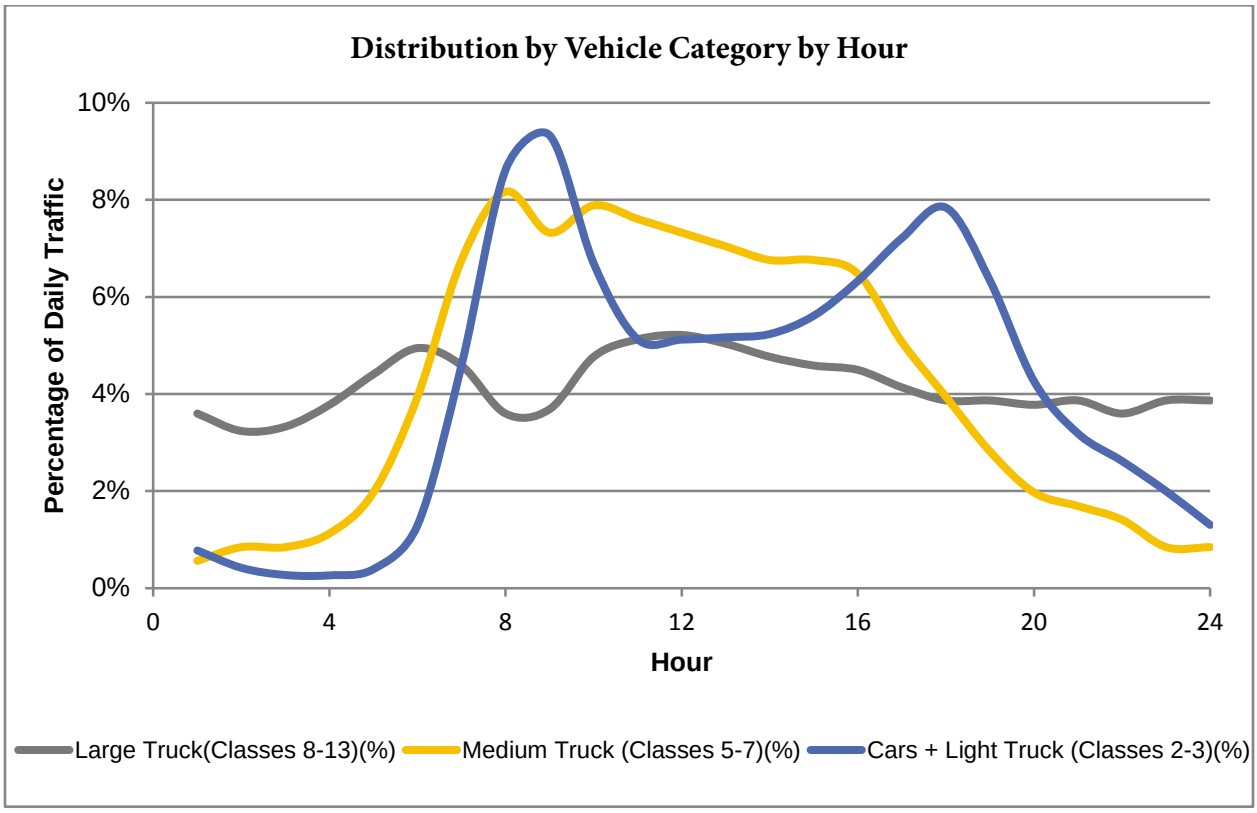

Figure 44. Daily Profile of Volume at Northbound I-287, MP 31.7 (2009)

4.10. WIM Station 287: I-287, MP 61.7

WIM Station 287 is located at milepost 61.7 of Interstate 287 in Franklin Lakes, Bergen County between interchanges 59 (NJ 208) and 66 (NJ 17). At this location I-287 is a four-lane limited access Urban Interstate and is included in the National Network. I-287 through this section is the only National Network facility connecting New Jersey with upstate New York. Figure 45 shows the location and surrounding features. WIM data has been continuously recorded at this location for several years.

Figure 45. Aerial View of WIM Station at I-287, MP 61.7

Figure 46 shows the change in large truck volume between the analyzed years. In 2010, LTWADT increased by approximately 7% and in 2011 by additional 3%. The highest increase in truck volume of 11.3% was recorded in March 2010. The change in large truck volume was similar for both directions; the northbound and southbound direction incurred 7.4% with 6.5% increase respectively.

January and May were the only two months that recorded decrease in large truck volume (1.8% and 0.05% respectively). The largest change in volume occurring in December when 9.2% more truck traversed the WIM station. The increase of 5.2% and 1% was observed for the northbound and southbound direction respectively.

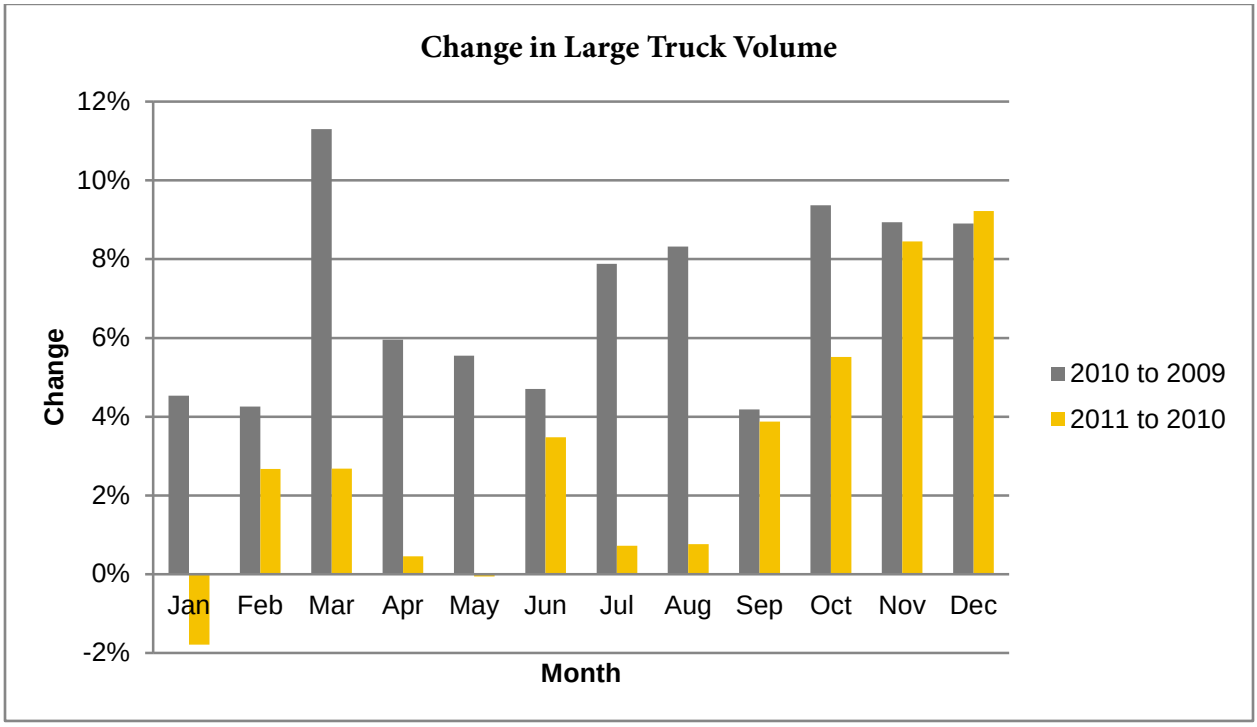

Figure 46. Change in Large Truck Volume at I-287, MP 61.7 (2009-2011)

The analysis of daily traffic pattern for all vehicle categories revealed that there was no change in daily travel from 2009 to 2011. Figure 47 shows the relative daily profile of traffic by vehicular category for the southbound direction in 2009. Large truck volume exhibited a bell curve pattern typical of Profile 2. Medium trucks followed a stronger afternoon peak profile reaching peak from 2:00 p.m. to 4:00 p.m. Auto trips exhibited two strong commuter peaks, where morning peak contained 12.7% and afternoon peak 18.9% of total auto volume.

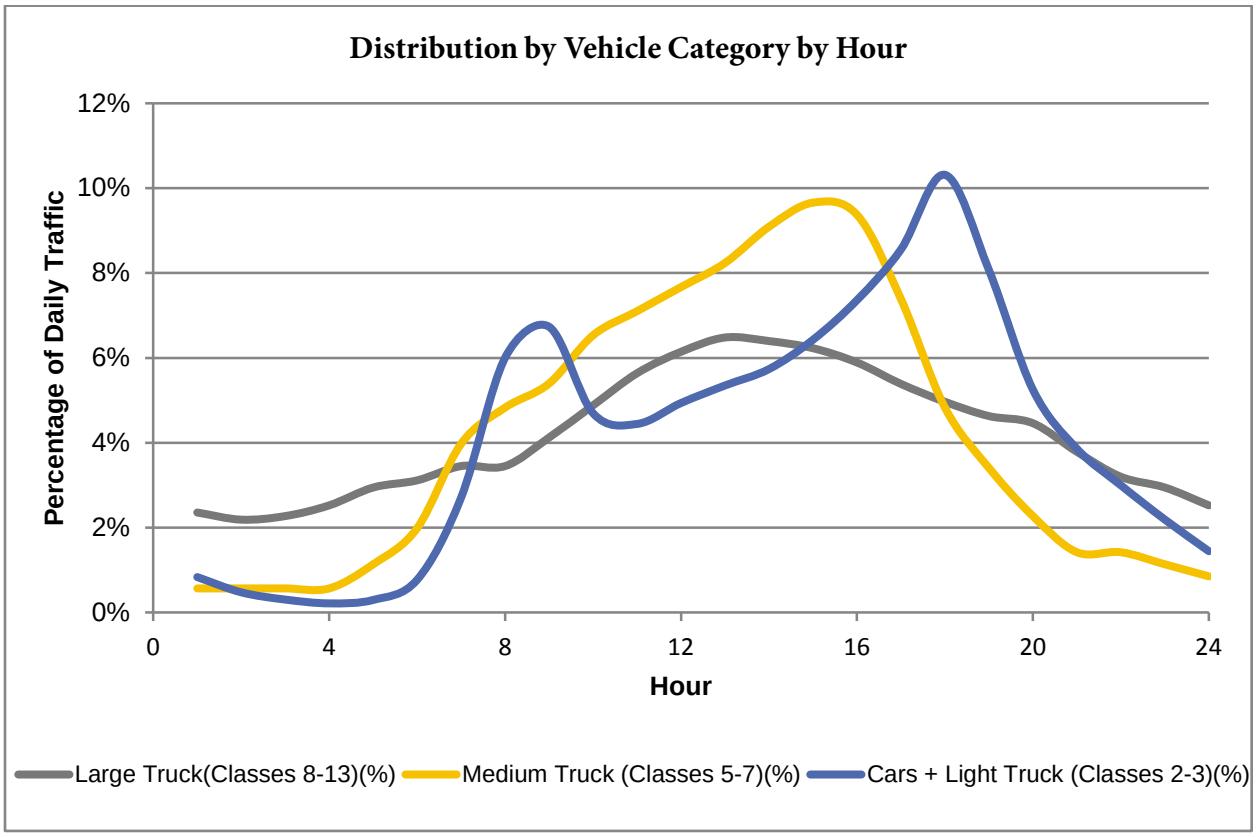

Figure 47. Daily Profile of Volume at Southbound 1-287, MP 61.7 (2009)

Figure 48 shows the relative daily profile of traffic by vehicular category in the northbound direction at I-287 milepost 61.7. This location exhibited the flat profile of large truck traffic typical of Profile 1. On an hour by hour basis, the relative percentage ranged from 3.2% for the hour beginning at 2:00 a.m. to 5.0% for the hour starting at 12:00 p.m. Auto trips exhibited two similar commuter peaks where morning peak (7:00 to 9:00 a.m.) contained 16.3% and afternoon peak (4:00 to 6:00 p.m.) 15.3% of total auto volume.

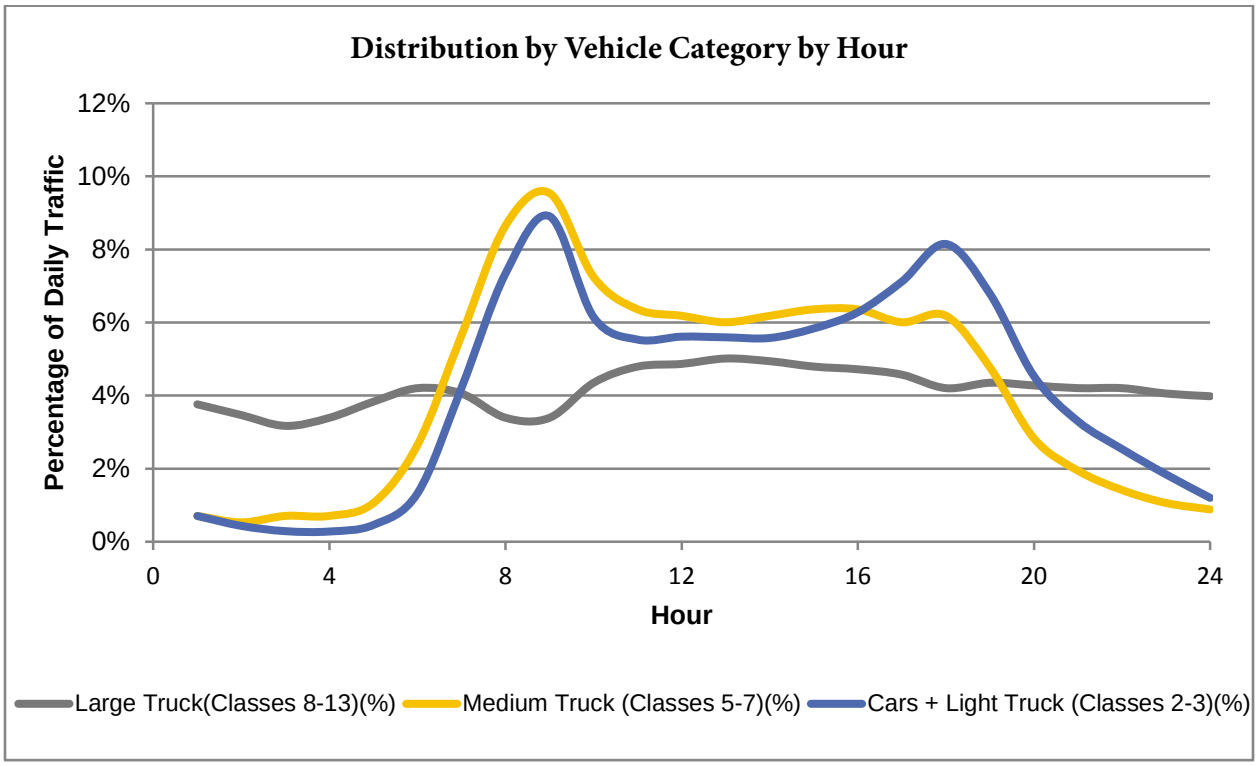

Figure 48. Daily Profile of Volume at Northbound 1-287, MP 61.7 (2009)

4.11. WIM Station I2C: I-295, MP 35.7

WIM Station I2C is located at milepost 35.7 of Interstate 295 in Cherry Hill Township, Camden County between interchanges 34 (NJ 70Marlton Pike E) and 36 (NJ 73). At this location I-295 is a six-lane limited access Urban Interstate and is included in the National Network. Figure 49 shows the location and surrounding features. WIM data has been recorded at this location at both directions for several years however the significant disruption in data collection process occurred in 2010.

Figure 49. Aerial View of WIM Station at I-295, MP 35.7

Figure 50 shows the change in LTWADT between the analyzed years in the northbound direction. In 2010, LTWADT declined by approximately 4.6% compared to 2009. The month of September had a largest reduction in volume of 11.8%. The first half of 2011 had a negative change in LTWADT. Compared to 2010, the large truck volume declined by 1.2%

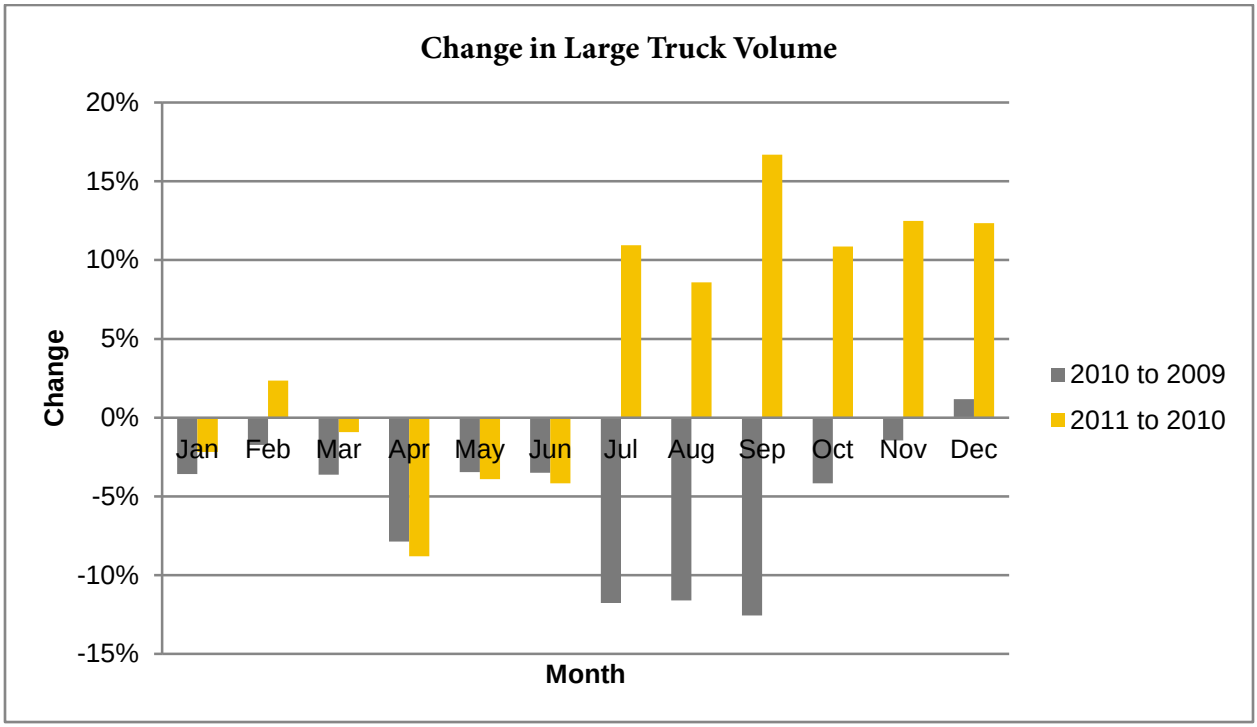

Figure 50. Change in Large Truck Volume at Northbound I-287, MP 61.7 (2009-2011)

Figure 51 shows the change LTWADT between the analyzed years in the southbound direction. In 2010, the large truck volume declined by 6.7% compared to 2009. In 2011, the LTWADT increased by 10.2% over 2010 and 2.9% compared to 2009.

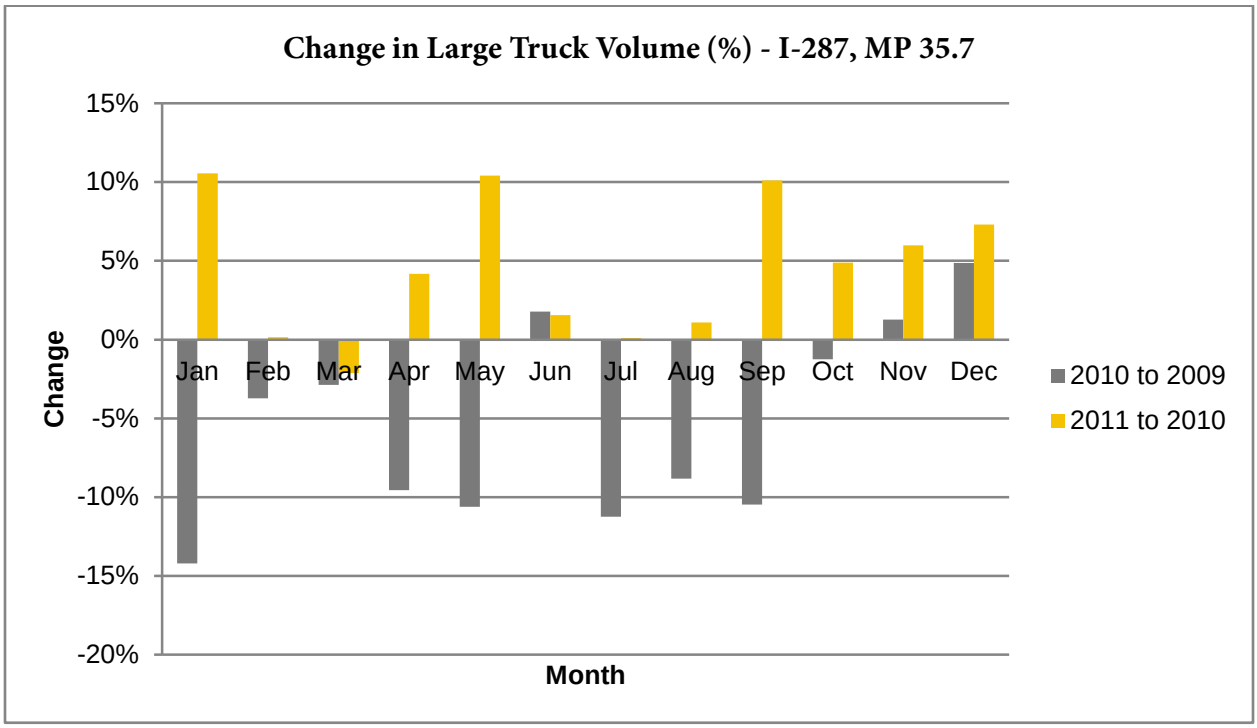

Figure 51. Change in Large Truck Volume at Southbound I-287, MP 61.7 (2009-2011)

The analysis of daily traffic pattern for all vehicle categories revealed that there is no change in daily travel patterns from 2009 to 2011. Figure 52 shows the relative daily profile of traffic by vehicular category in the northbound direction in 2009. As typical of most Profile 2 locations, large truck volume peaked during the late morning. Medium trucks followed a more peaked profile during the same time period. Auto volume followed a commuter route pattern with a peak during the 4:00 to 6:00 p.m. period with 17% of daily auto volume.

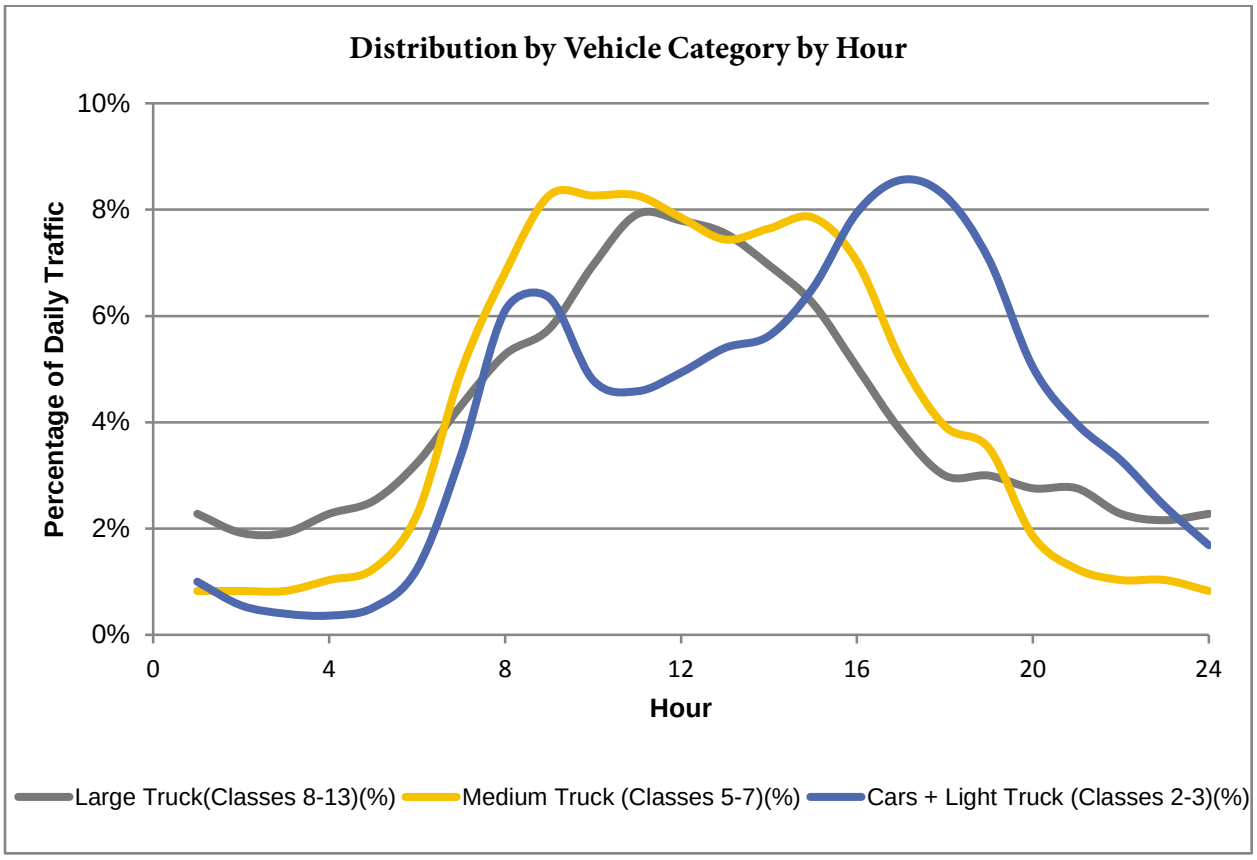

Figure 52. Daily Profile of Volume at Northbound I-295, MP 35.7 (2009)

Figure 53 shows the relative daily profile of traffic by vehicular category in the southbound direction in 2009. The Profile 2 pattern of large truck volume peaked during midday as it did in the northbound direction. Medium truck volume peaked in the mid-morning between 8:00 and 9:00 a.m. Autos and light trucks were prevalent during peak hours. The morning peak hour (7:00 to 9:00 a.m.) comprised out of 16% of daily auto volume while the evening peak hour (4:00 to 6:00 p.m.) contained 14.7% of daily auto volume.

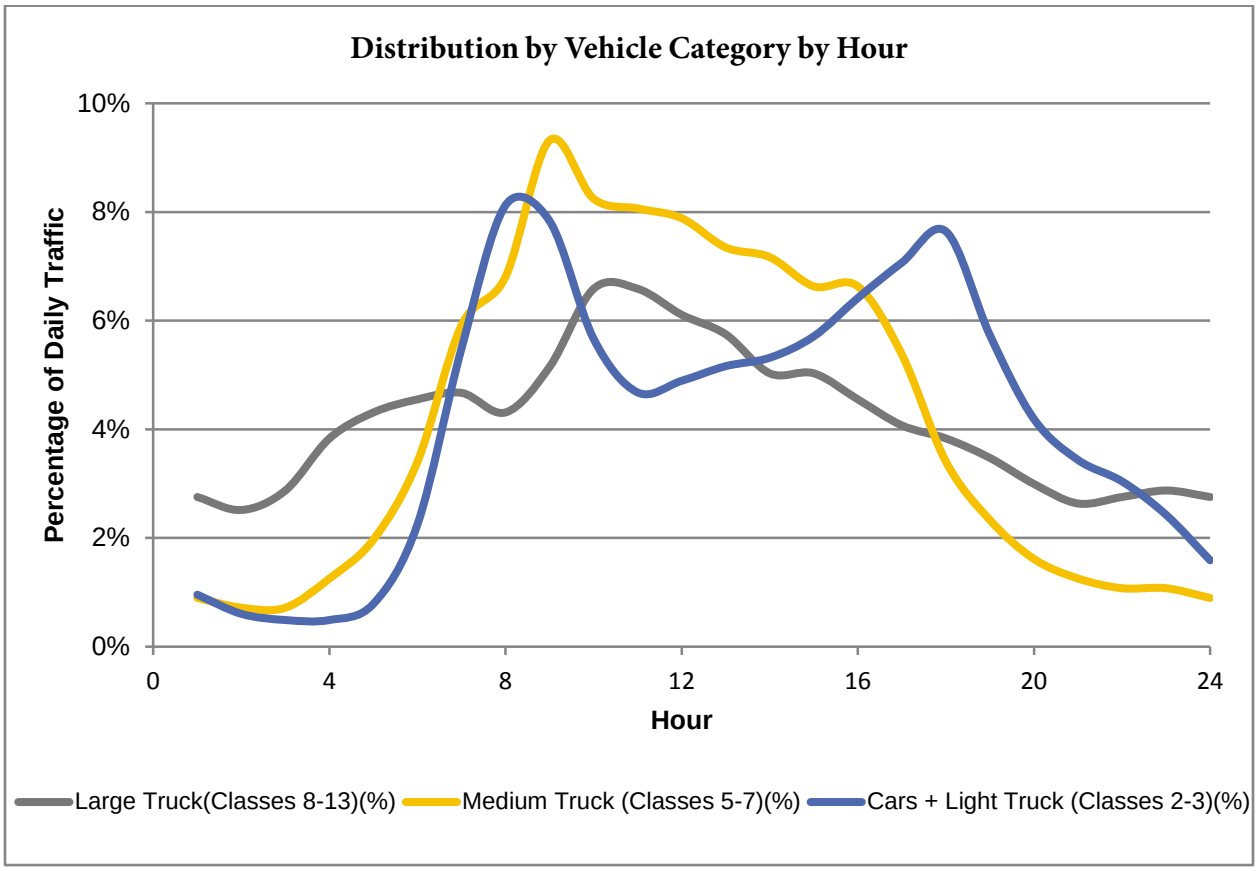

Figure 53. Daily Profile of Volume at Southbound I-295, MP 35.7 (2009)

4.12. WIM Station 295: I-295, MP 39.6

WIM Station 295 is located at milepost 39.6 of Interstate 295 in Mt. Laurel, Burlington County between interchanges 36 (NJ 73) and 40 (NJ 38). At this location I-295 is a six-lane limited access Urban Interstate and is included in the National Network. Figure 54 shows the location and surrounding features. WIM data has been continuously recorded at this location since 2005.

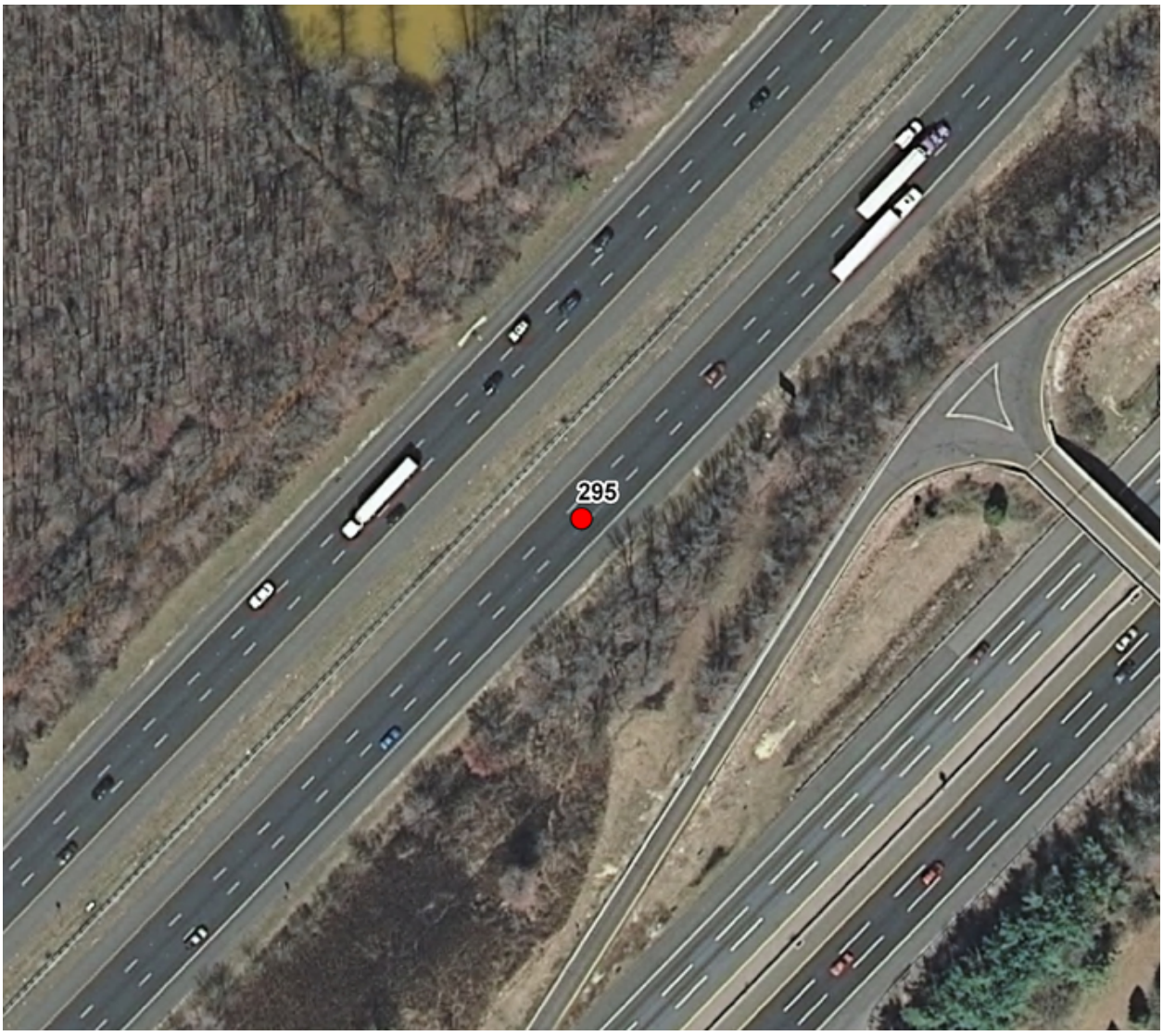

Figure 54. Aerial View of WIM Station at I-295, MP 39.6

Figure 55 shows the change in LTWADT between the analyzed years. In 2010, LTWADT declined by approximately 5.5% compared to 2009. The LTWADT declined through the year reaching its peak in September when 12.6% less trucks were recorded. The month of December was the only month that registered increase in LTWADT of 1.17%. The seconds half of 2011 recorded a significant increase in LTWADT. The month of September registering the highest increase of 16.7%.

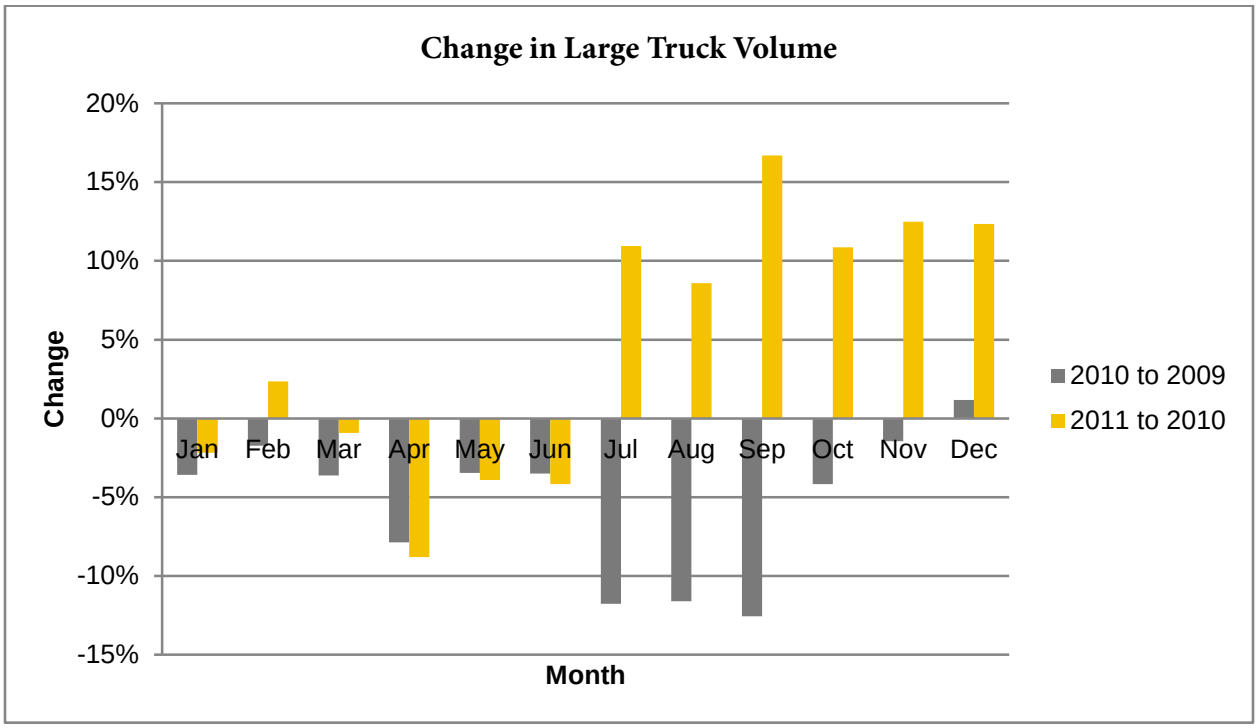

Figure 55. Change in Large Truck Volume at I-287, MP 39.6 (2009-2011)

The analysis of daily traffic pattern for all vehicle categories revealed that there was no change in daily travel from 2009 to 2011. Figure 56 shows the relative daily profile of traffic by vehicular category in the southbound direction. The large truck volume is typical of Profile 2 and reached its peak between 10:00 a.m. and 1:00 p.m. Medium trucks peaked at the hour beginning at 8:00 a.m. Auto volume followed a commuter route pattern with a morning peak from 7:00 to 9:00 am with 14% of total daily volume and afternoon peak from 4:00 to 6:00 p.m. with 17% of daily auto volume.

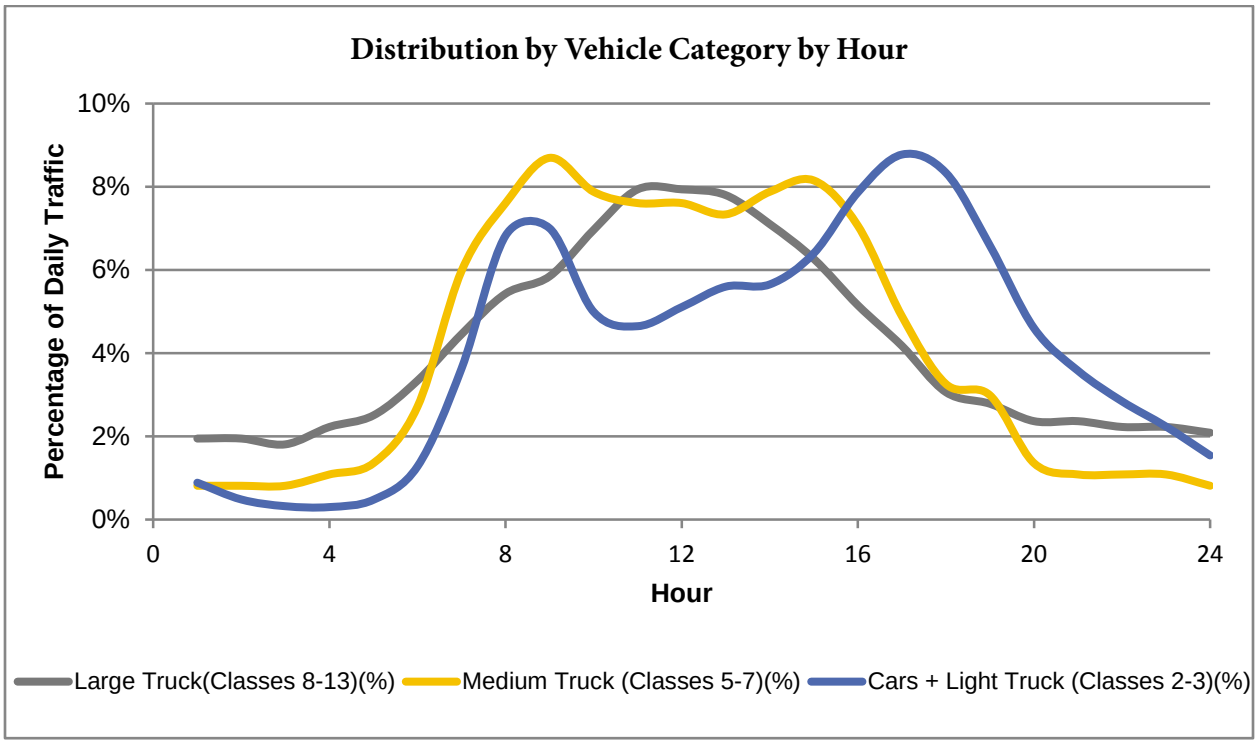

Figure 56. Daily Profile of Volume at Southbound I-295, MP 39.6 (2009)

Figure 57 shows the relative daily profile of traffic by vehicular category in the northbound direction in 2009. The large truck volume is typical of Profile 2 and peaked between 9:00 a.m. and 12:00 p.m. Medium trucks peaked sharply for the hour beginning at 8:00 a.m. Autos peaked during the typical commuter time periods.

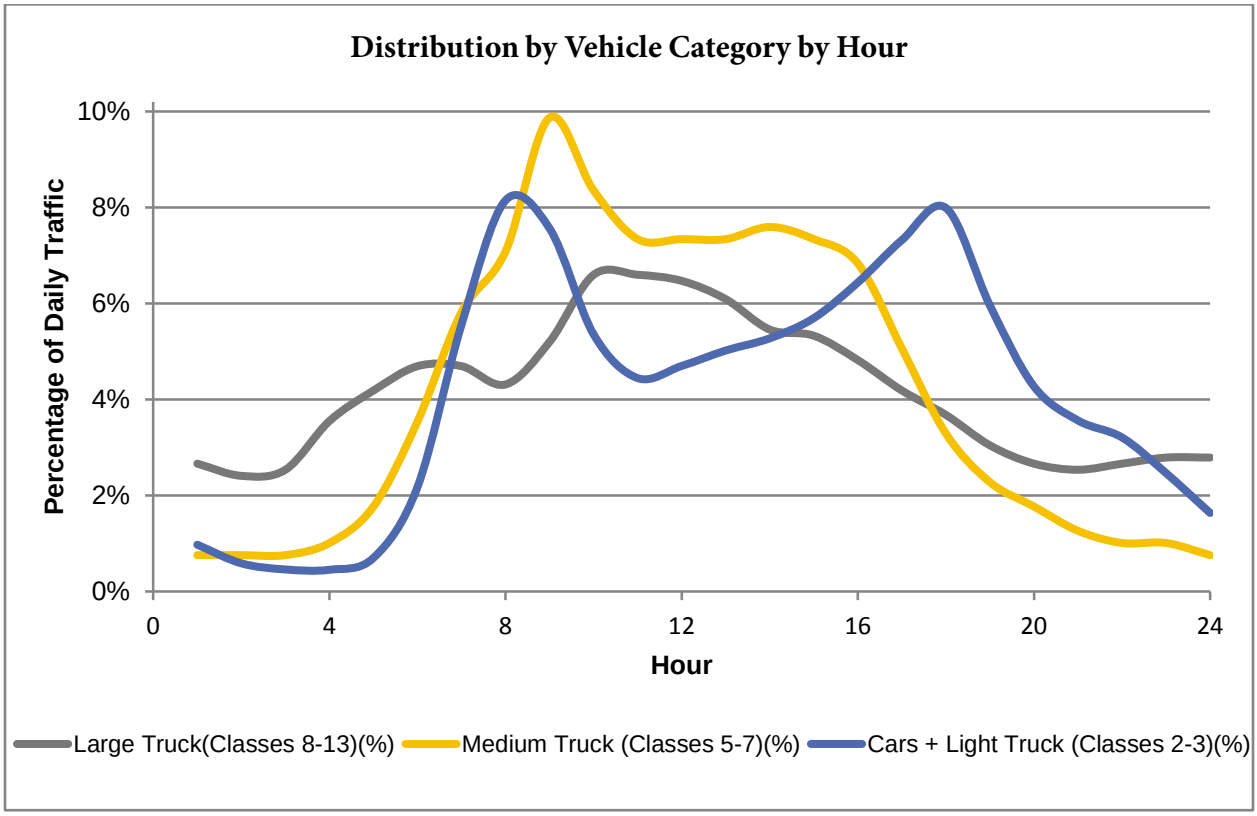

Figure 57. Daily Profile of Volume at Northbound I-295, MP 39.6 (2009)

4.13. WIM Station 001: US 1, MP 12.9

WIM Station 001 is located at milepost 12.9 of US Route 1 in Plainsboro, Middlesex County at the interchange with Forrestal Road. At this location US 1 is a six-lane limited access divided Urban Principal Arterial and is included in the New Jersey Access Network. Figure 58 shows the location and surrounding features. WIM data has been continuously recorded at this location for several years however limited data was available for the analyzed period. The data set for the southbound direction contains only few months of large truck data in 2009 and 2010 while in 2011 was not collected. The data collected in northbound direction was only collected in 2010 and 2011.

Figure 58. Aerial View of WIM Station at US 1, MP 12.9

Figure 59 shows the change in LTWADT in 2011 compared to 2010 for the northbound direction. In 2011 the large truck volume increased by 3.8%. The highest increase in LTWADT of 11.4% occurred in September and the highest decline of 6.4% was if January.

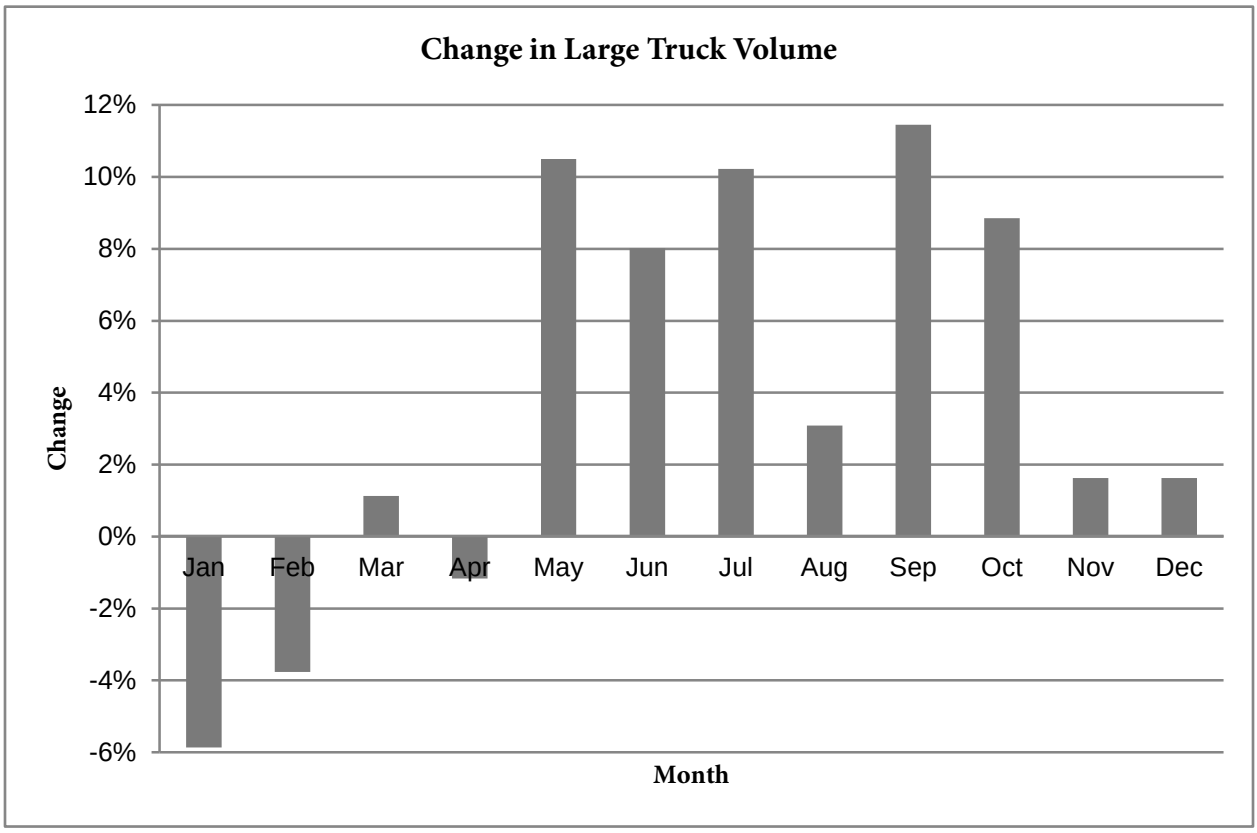

Figure 59. Change in Large Truck Volume at Northbound US 1, MP 12.9 (2011 to 2010)

The analysis of daily traffic pattern for all vehicle categories revealed that there was no change in daily travel from 2010 to 2011. Figure 60 shows the relative daily profile of traffic by vehicular category in the northbound direction in 2010. The large truck volume follows Profile 2 with the peak between 9:00 and 11:00 a.m. when nearly 17% of all large truck traffic occurred. Medium trucks followed a more peaked profile with maximum volume between 2:00 and 3:00 p.m. Auto volume followed a bi-directional commuter route pattern with peaks during both the 7:00 to 9:00 a.m. period with 12.6% of daily auto volume and the 4:00 to 6:00 p.m. period with over 16% of daily auto volume. The daily profile in 2011 is similar to 2010.

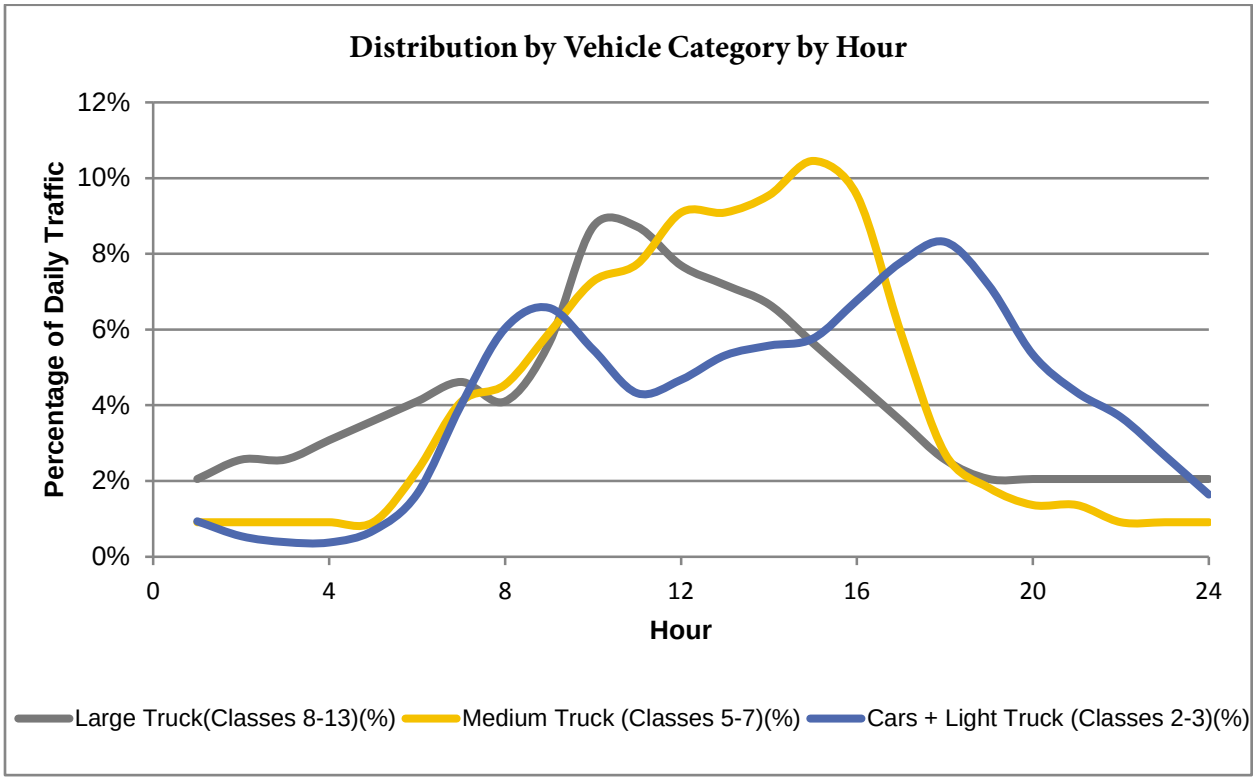

Figure 60. Daily Profile of Volume at Northbound US 1, MP 12.9 (2010)

4.14. WIM Station 01A: US 1, MP 18.0

WIM Station 01A is located at milepost 18.0 of northbound US Route 1 in South Brunswick, Middlesex County between the interchanges with New Road and Major Road. At this location US 1 is a four-lane partial access divided Urban Principal Arterial and is included in the New Jersey Access Network. Figure 61 shows the location and surrounding features. WIM data has been continuously recorded at this location for the northbound direction however limited data is available for each analyzed year.

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Figure 61. Aerial View of WIM Station at US 1, MP 18.0

Figure 62 shows the change in large truck volume between the analyzed years. In 2010 the LTWADT increased negligibly by 0.69% and in 2011by additional 2.17%.

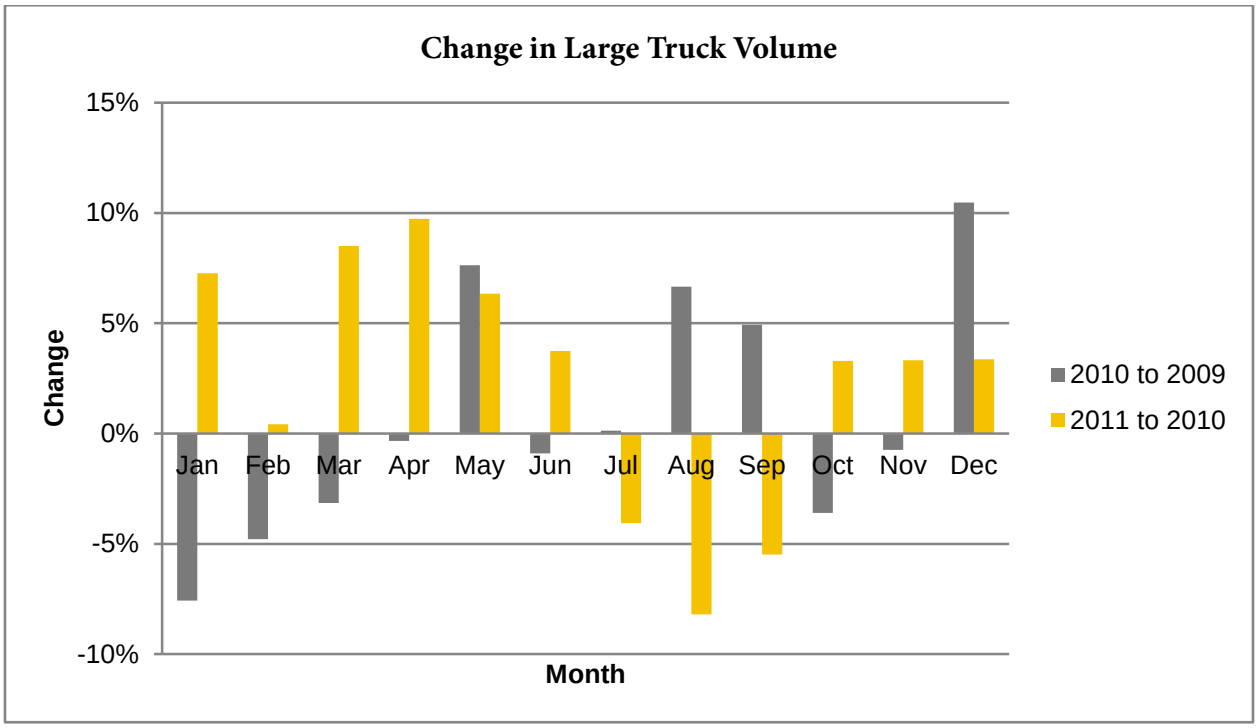

Figure 62. Change in Large Truck Volume at US 1 MP 18 (2009-2011)

The analysis of daily traffic pattern for all vehicle categories revealed that there was no change in daily travel from 2009 to 2011. Figure 63 shows the relative daily profile of traffic by vehicular category in the northbound direction at US 1 milepost 12.9 in 2009. The large truck volume follows Profile 2 with the peak between 10:00 and 11:00 a.m. when nearly 9% of all large truck traffic occurred. Medium trucks volume peaked between 2:00 and 3 p.m. Auto volume followed a directional commuter route pattern with peak between the 4:00 to 7:00 p.m. with 22% of daily auto volume.

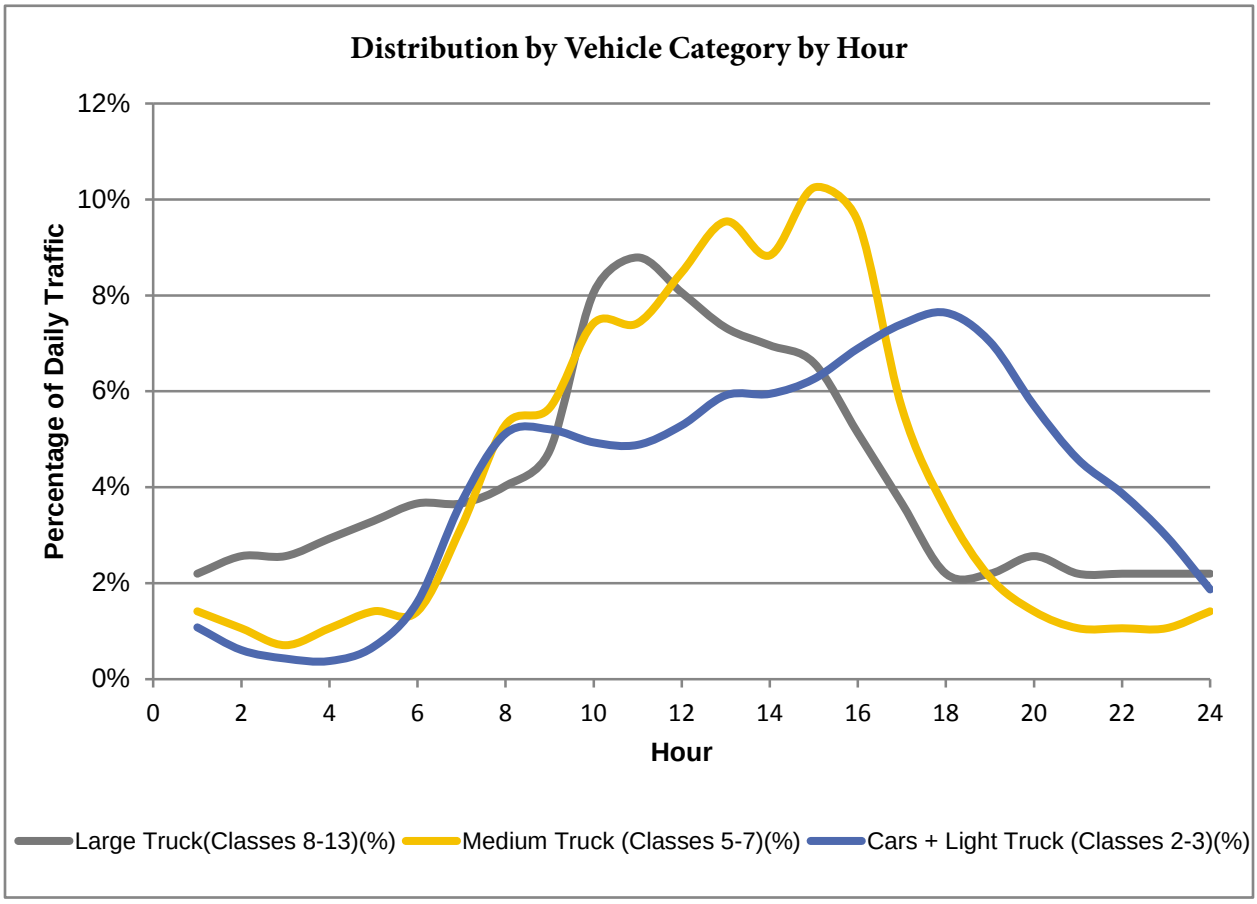

Figure 63. Daily Profile of Volume at Northbound US 1, MP 18 (2009)

4.15. WIM Station 130: US 130, MP 3.4

WIM Station 130 is located at milepost 3.4 of US Route 130 in Penns Grove, Salem County. At this location US 130 is a two-lane Urban Minor Arterial and is included in the New Jersey Access Network. Figure 64 shows the location and surrounding features. WIM data has been continuously recorded at this location since mid-2007 and complete data set was available for 2009 and 2011.

Figure 64. Aerial View of WIM Station at US 130, MP 3.4

Figure 65 shows the change in LTWADT between the analyzed years. In 2010, the LTWADT declined by approximately 3.4% compared to 2009 while in 2011 it declined by additional 7.13%.

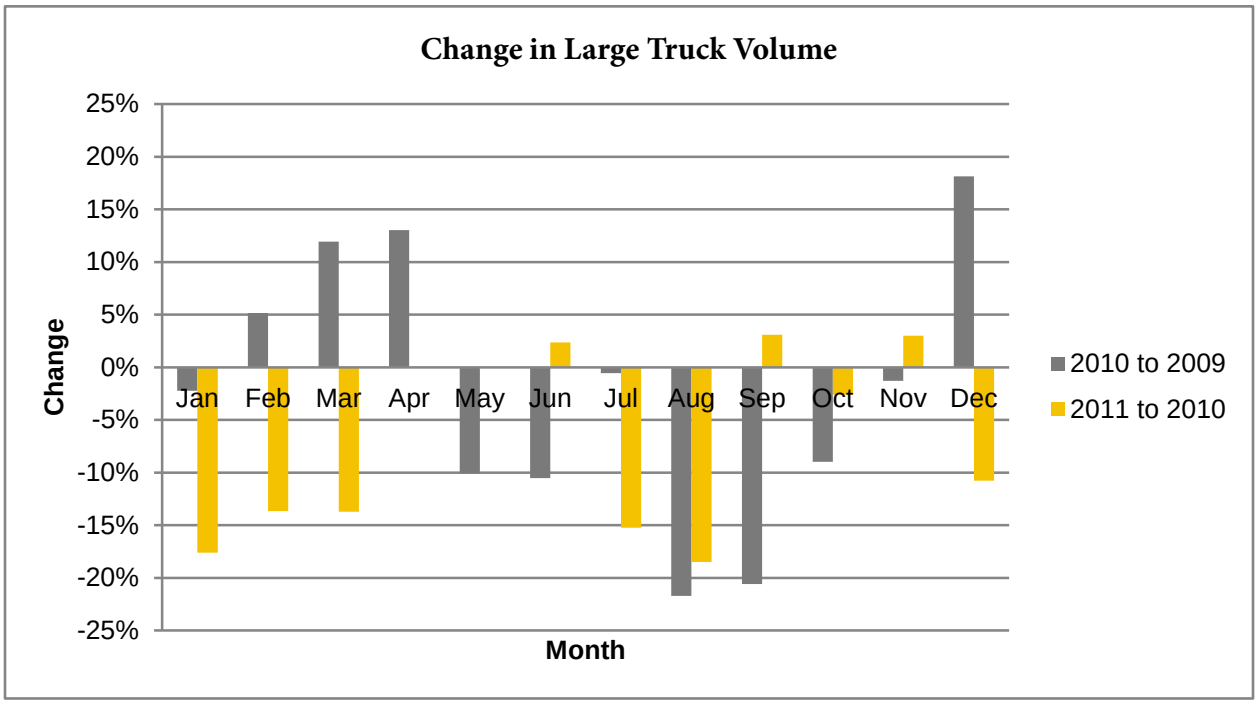

Figure 65. Change in Large Truck Volume at US 130, MP 3.4 (2009-2011)

The negative change in LTWADT is primarily caused by the reduction in LTWADT in the northbound direction (Figure 66). In 2010, the LTWADT declined approximately 12%. The largest negative change in truck volume was in September with 27.8% less trucks. December was the only month with positive change. In the southbound direction the LTWADT declined by only 0.5%. In 2011, the negative trend continued with both directions registering decrease in large truck volume, 9.2% and 6.5% for the northbound and southbound direction respectively.

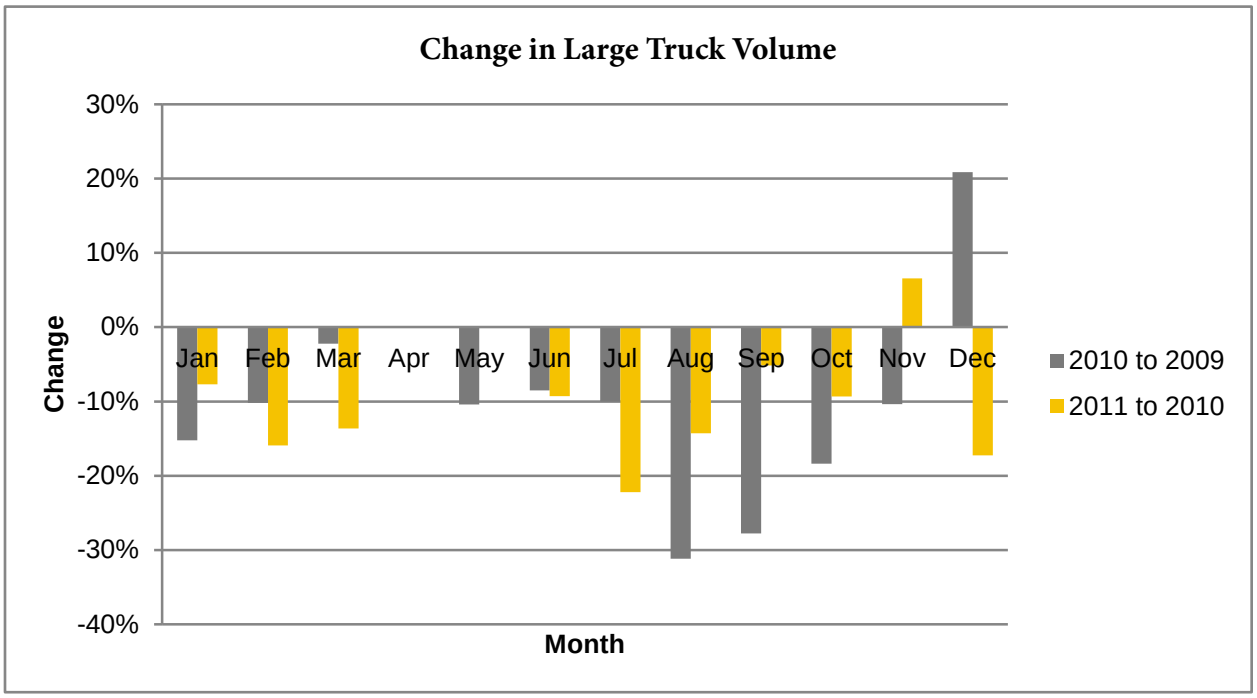

Figure 66. Change in Large Truck Volume at Northbound US 130, MP 3.4 (2009-2011)

All vehicle categories had a similar daily travel patterns during each analyzed year. Figure 67 shows the relative daily profile of traffic by vehicular category in the southbound direction (year 2009). Large truck volume depicts Profile 4 with the peak between 9:00 a.m. and 1:00 p.m. when over 35% of all large truck traffic occurred. Medium trucks followed a pronounced profile with a sharp rise during 8:00 to 9:00 a.m. and from 2:00 to 4:00 p.m. Auto volume grew throughout the day to a peak at 3:00 to 5:00 p.m. period with 16% of daily auto volume.

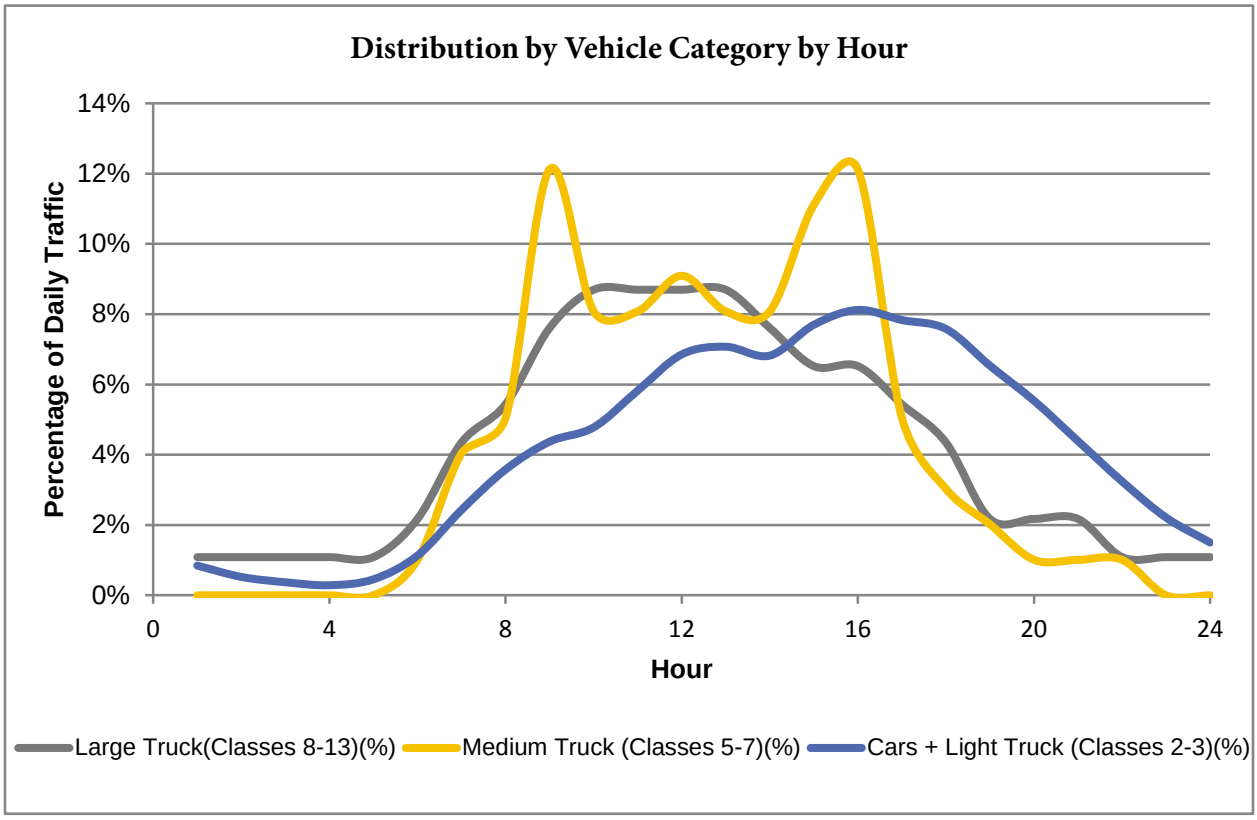

Figure 67. Daily Profile of Volume at Northbound US 130, MP 3.4 (2009)

Figure 68 shows the relative daily profile of traffic by vehicular category in the southbound direction. The large truck volume exhibits a Profile 4 pattern with the peak between 10:00 and 11:00 a.m. when 13% of total daily. Medium trucks peaked between 2:00 to 3:00 p.m. with over 15% of medium truck daily volume. At this location, in a pattern similar to the northbound direction auto volume increased throughout the day to with a peak from 3:00 to 5:00 p.m.

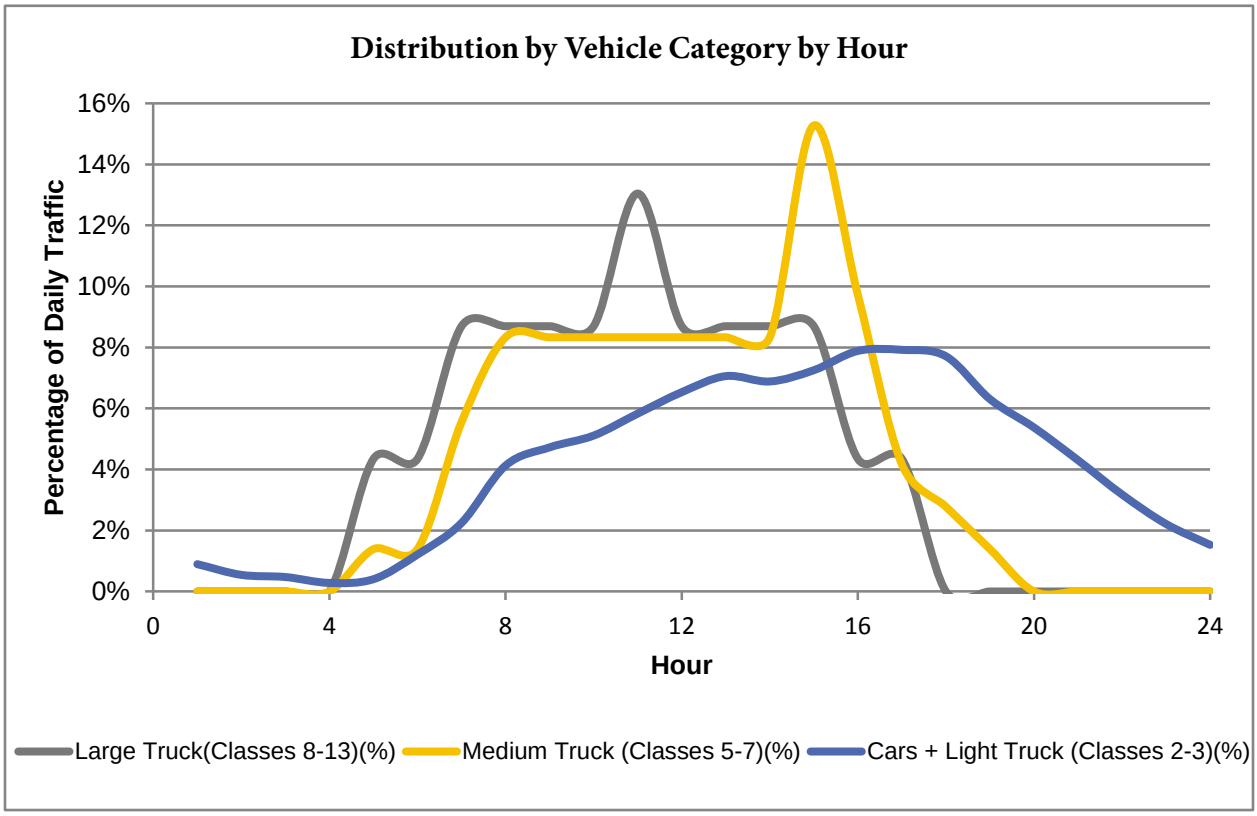

Figure 68. Daily Profile of Volume at Southbound US 130, MP 3.4 (2009)

4.16. WIM Station 31D: NJ 31, MP 26.4

WIM Station 31D is located at milepost 26.4 of NJ Route 31 in Readington, Hunterdon County. At this location NJ 31 is a four-lane Urban Principal Arterial and is included in the New Jersey Access Network. Figure 69 shows the location and surrounding features. The data was not available for last three month of 2009 and also from August 2010 until the end of 2011.

Figure 69. Aerial View of WIM Station at NJ 31, MP 26.4

In 2010, the LTWADT decline by approximately 6.2% compared to 2009. The LTWADT in the northbound direction declined throughout the year while the truck volume in the southbound direction registered increase (Table 5).

Table 5. Change in Large Truck Volume at WIM Station 31D

	2009	2010	2010 to 2009
Southbound	4,065	4,169	2.55%
Northbound	4,146	3,531	-14.83%
Total	8,211	7,700	-6.22%

Figure 70 shows the change in LTWADT between the analyzed years. The highest reduction in volume was in January of 2010 when 13% less trucks traversed the WIM station.

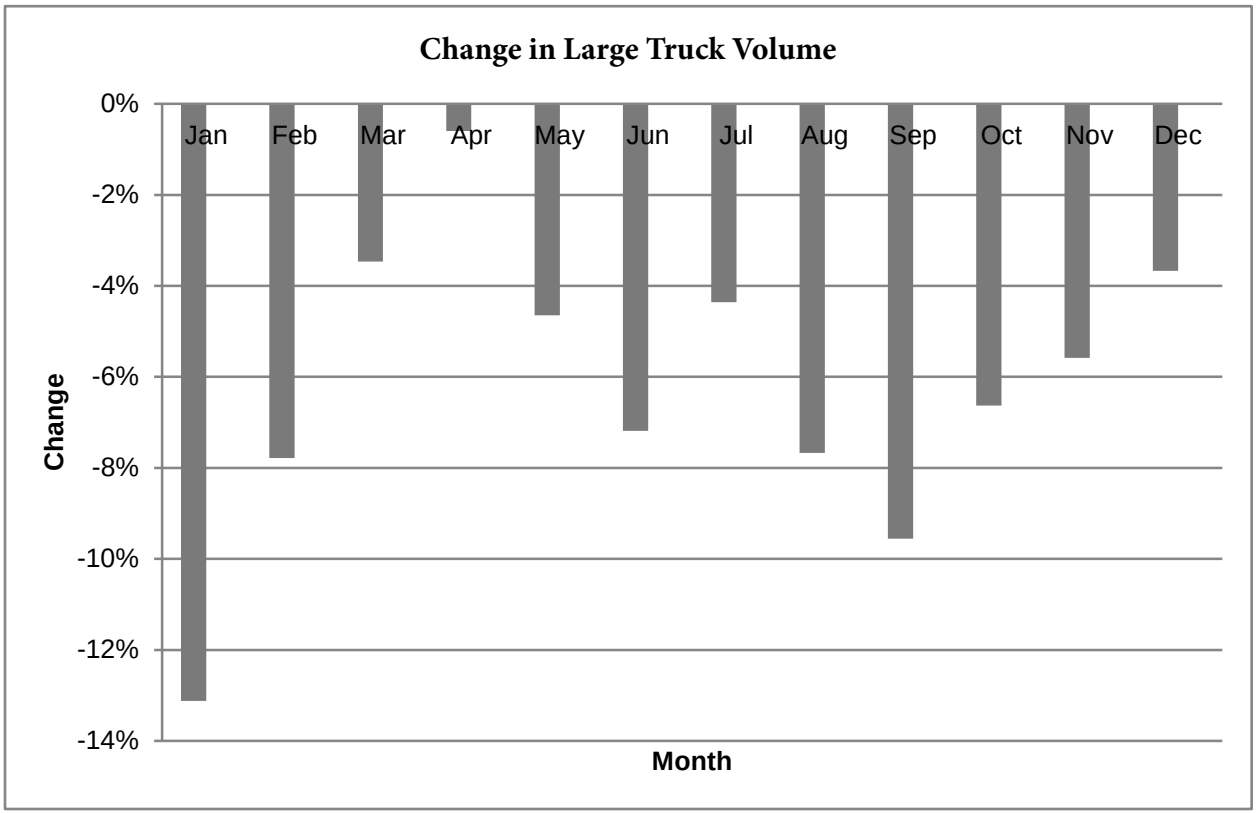

Figure 70. Annual Profile of Large Truck Volume at NJ 31, MP 13.0 (2009-2010)

The large truck and auto volume have similar daily profiles in 2009 and 2010. The range of weekday large truck volume at southbound NJ 31 milepost 13.0 is shown in Figure 71. The large truck volume reached first peak between 5:00 a.m. and 7:00 a.m. with 14.4% of total daily traffic. The second peak occurred between 9:00 a.m. and 11:00 a.m. with 13.6% of total daily traffic. This sustained high volume during the 5:00 a.m. to 1:00 p.m. interval (54% of total daily volume) is indicative of a Profile 2 pattern. Medium trucks followed a more peaked profile with maximum volume between 8:00 and 9:00 a.m. when over 10% of the daily traffic. Auto volume followed a commuter route pattern with a highest peak during the 8:00 to 9:00 a.m. period.

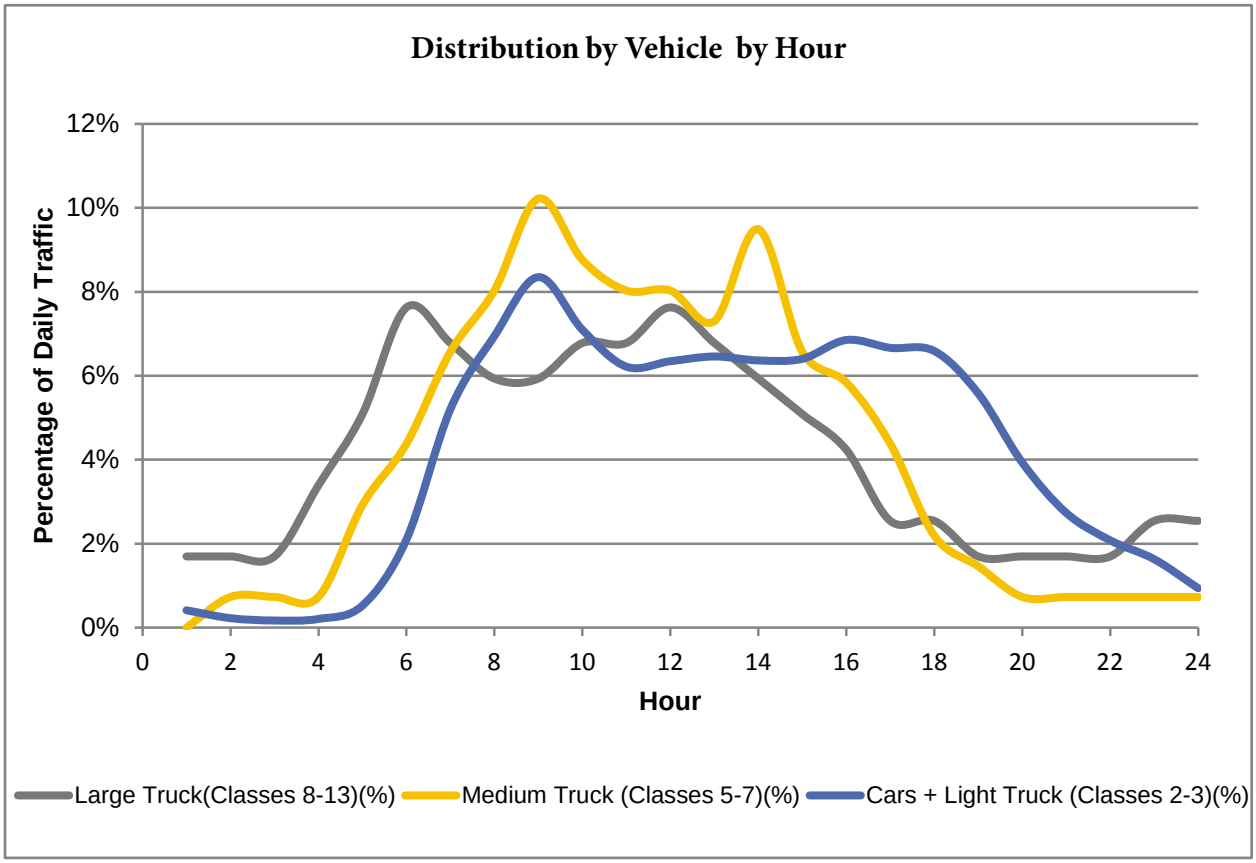

Figure 71. Daily Profile of Volume at Southbound NJ 31, MP 13.0 (2009)

Figure 72 shows the relative daily profile of traffic by vehicular category in the northbound direction at NJ 31 milepost 26.4 during the 4th quarter of 2009. The large truck volume peaked between 9:00 a.m. and 12:00 p.m. when 24% of all large truck traffic occurred. Medium trucks followed a sharply peaked profile with maximum volume between 9:00 and 10:00 a.m. when nearly 25% of the daily volume occurred. Auto volume followed a directional commuter pattern with a pronounced peak during the 4:00 to 6:00 p.m. period.

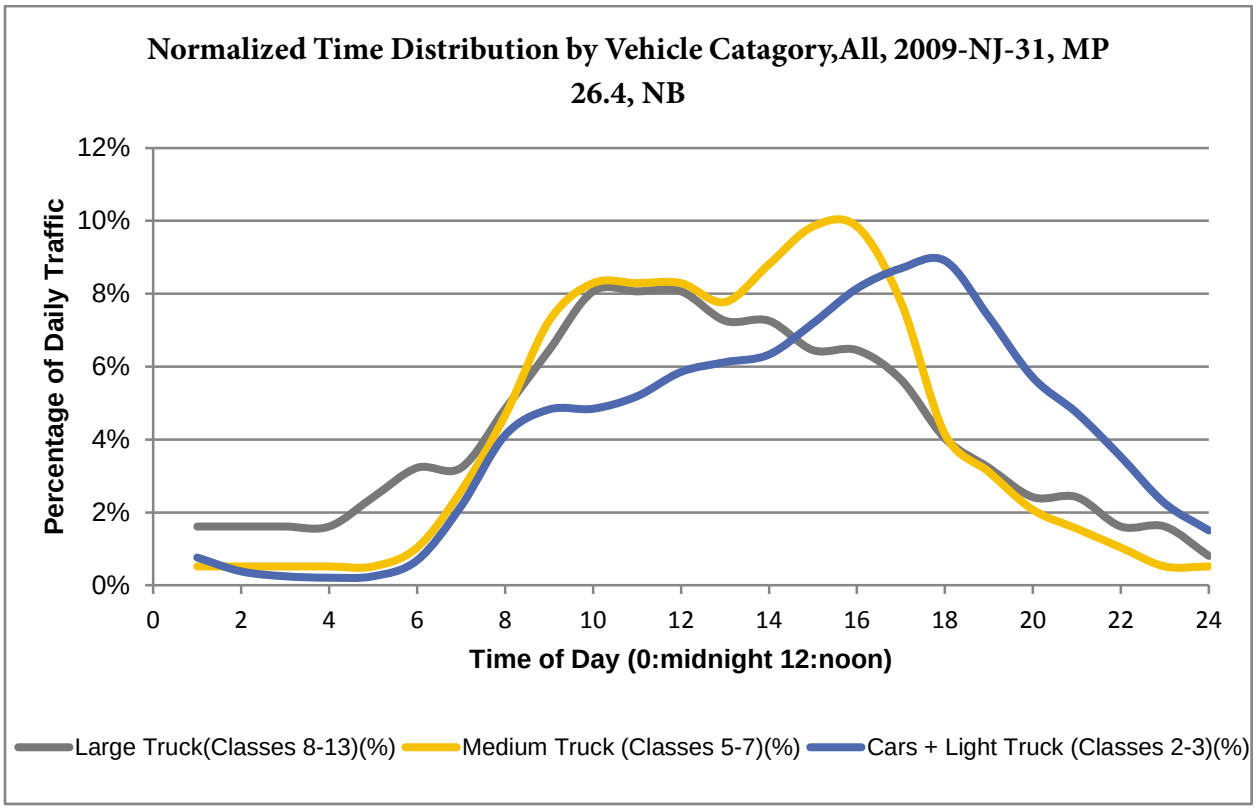

Figure 72. Daily Profile of Volume at Northbound NJ 31, MP 26.4 (2009)

4.17. WIM Station 31C: NJ 31, MP 40.4

WIM Station 31C is located at milepost 40.4 of NJ Route 31 in Washington Township, Warren County. At this location NJ 31 is a two-lane Urban Principal Arterial and is included in the New Jersey Access Network. Figure 73 shows the location and surrounding features. WIM data has been continuously collected during the analysis period.

Figure 73. Aerial View of WIM Station at NJ 31, MP 40.4

As shown in Table 6, the LTWADT increased in 2010 by 7.19% while in 2011 declined by nearly 5%. The reduction in LTWADT volume is more pronounced in the southbound direction with 8.2% less truck recorded in 2011.

Table 6. Change in Large Truck Volume at WIM Station 31C

	2009	2010	2011	2009 to 2010	2010 to 2011
Southbound	3,389	3,611	3,314	6.54%	-8.23%
Northbound	4,046	4,359	4,258	7.73%	-2.31%
Total	7,435	7,970	7,572	7.19%	-4.99%

Figure 74 shows a change in large truck volume between analyzed years on monthly bases. April 2010 recorded highest increase in LTWADT by approximately 18%. The highest decrease in LTWADT was observed in April 2011 with nearly 10% fewer trucks traversing the WIM station.

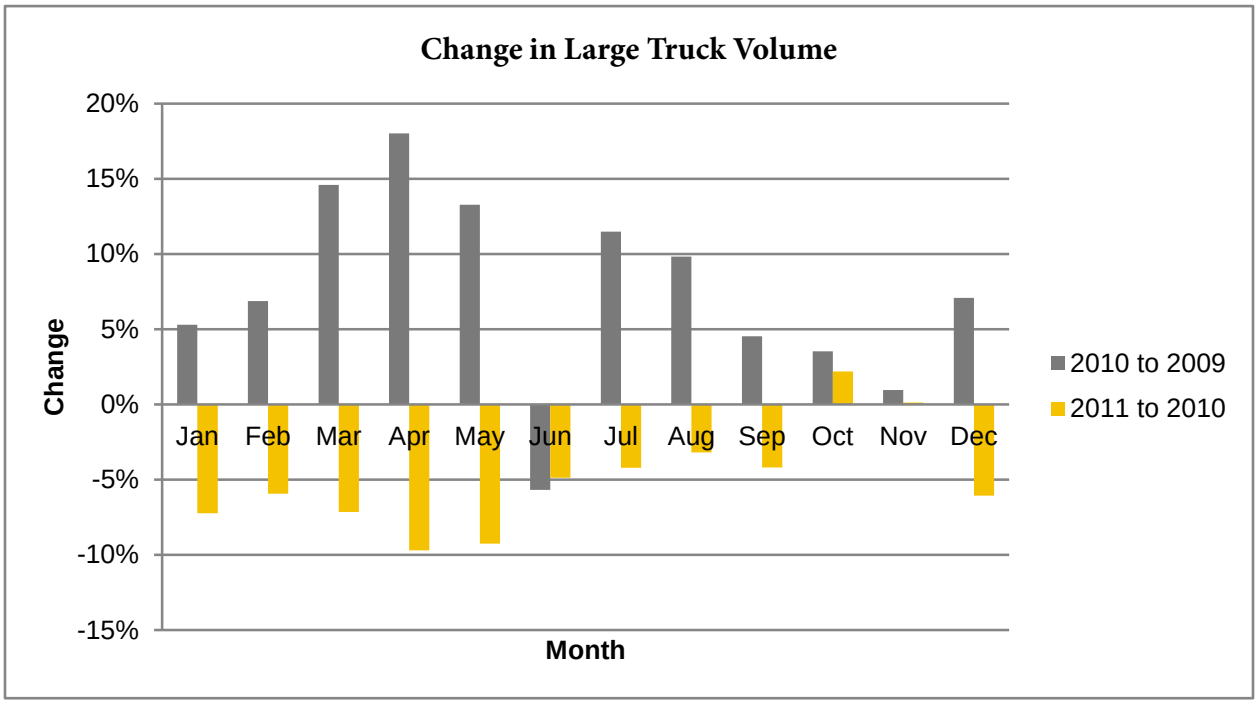

Figure 74. Change in Large Truck Volume at NJ 31 MP 40.4 (2009-2011)

The analysis of large truck travel patterns shows that there is no significant change in travel patterns during the analyzed period. Figure 75 shows the relative daily profile of traffic by vehicular category in the northbound direction in 2009. Medium trucks volume grew steadily peaking between 9:00 and 10:00 a.m. when 10% of the daily medium truck traffic occurred. Auto volume followed a strong commuter route pattern with highest peak during the 4:00 to 6:00 p.m. period with nearly 20% of daily auto volume.

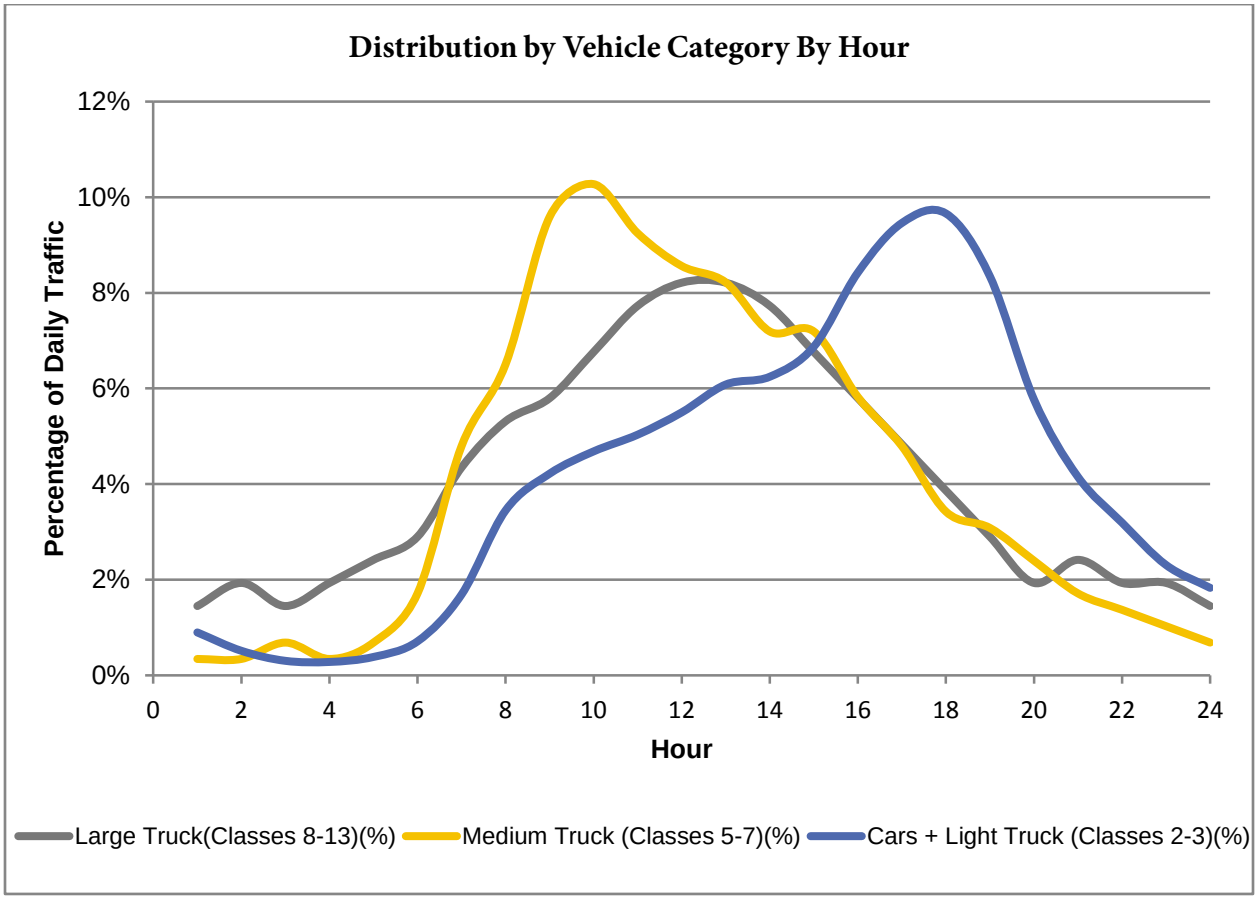

Figure 75. Daily Profile of Volume at Northbound NJ 31, MP 40.4 (2009)

Figure 76 shows the relative daily profile of traffic by vehicular category in the southbound direction. The large truck volume peaked between 7:00 and 8:00 a.m. when 8.3% of all large truck traffic occurred. Medium trucks volume peaked between 7:00 a.m. and 2:00 p.m. when nearly 63% of the daily medium truck traffic occurred. Auto volume followed a commuter route pattern with highest peak during the 6:00 to 8:00 a.m. period with 16.2% of daily auto volume.

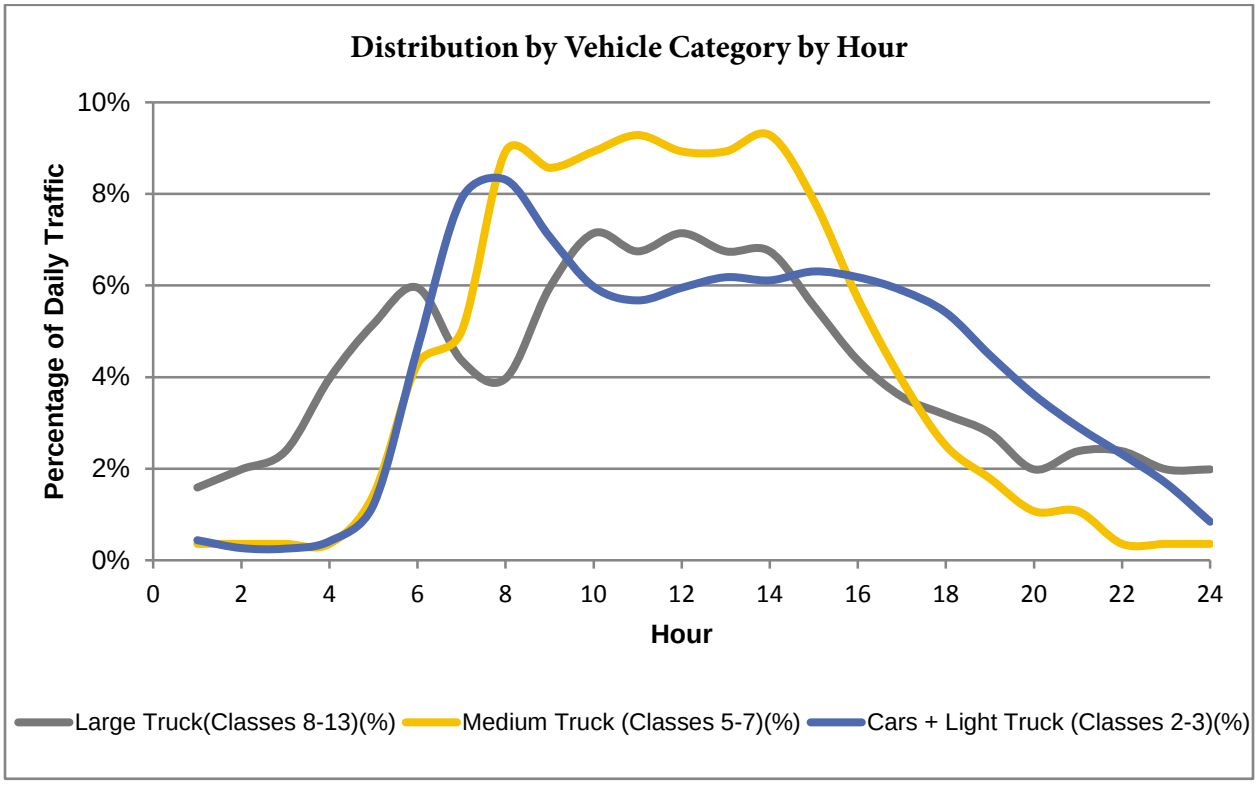

Figure 76. Daily Profile of Volume at Southbound NJ 31, MP 40.4 (2009)

4.18. WIM Station 202: US 202, MP 3.5

WIM Station 202 is located at milepost 3.5 of US 202 in West Amwell Township, Hunterdon County. At this location US 202 is a two-lane Rural Principal Arterial and is included in the New Jersey Access Network. Figure 77 shows the location and surrounding features. WIM data has been continuously recorded at this location for several years but a complete data set was available for year 2010 and 2011 only.

Figure 77. Aerial View of WIM Station at US 202, MP 3.5

Figure 78 shows a monthly change in LTWADT between analyzed years. The highest increase in LTWADT was in July 2010 with 17.5% more truck traversing the WIM Station. It can be observed also that every month recorded a positive change in LTWADT.

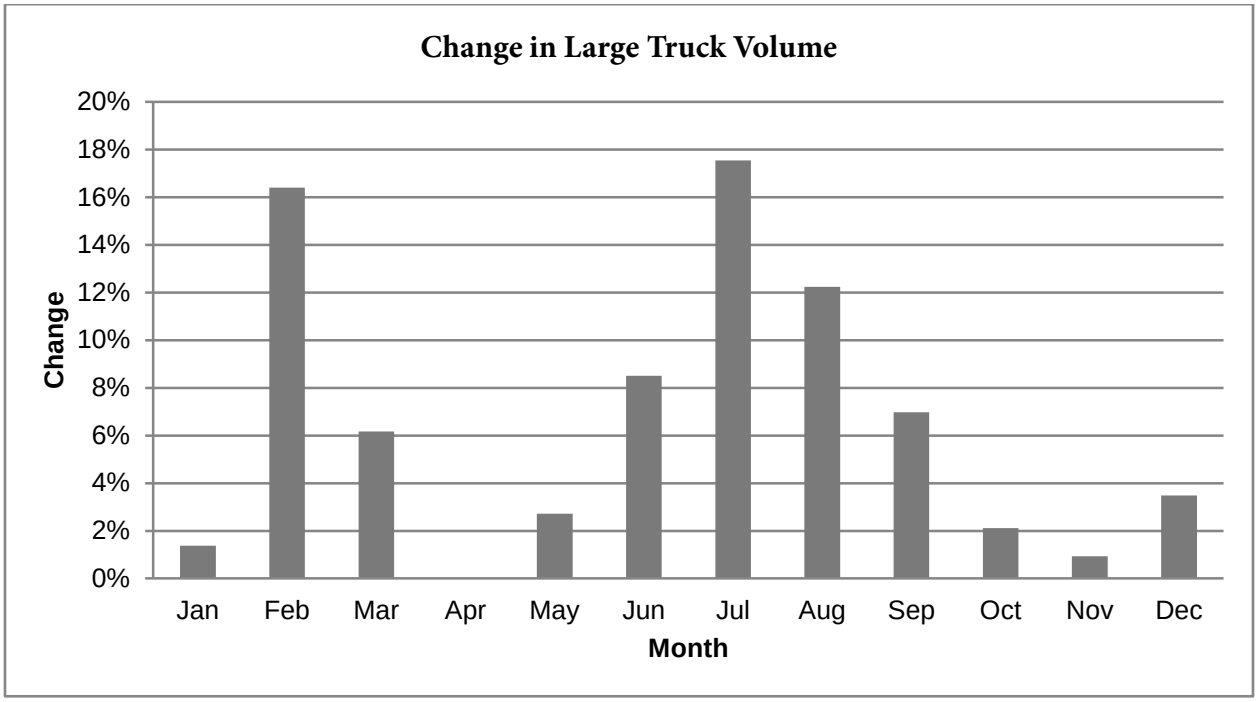

Figure 78. Change in Large Truck Volume at US 202, MP 3.5 (2010-2011)

Figure 79 shows the relative daily profile of traffic by vehicular category in the southbound direction at US 202 MP 3.5 in 2010. The large truck volume was highest between 10:00 a.m. and 2:00 p.m. when nearly 37.5% of all large truck traffic occurred. Medium trucks followed a similar profile with maximum volume between 8:00 a.m. and 3:00 p.m. when nearly 54% of the daily volume occurred. Auto volume followed an intense directional commuter pattern with a pronounced peak during the 5:00 to 6:00 p.m. two hour period when 11% of all personal vehicles traveled.

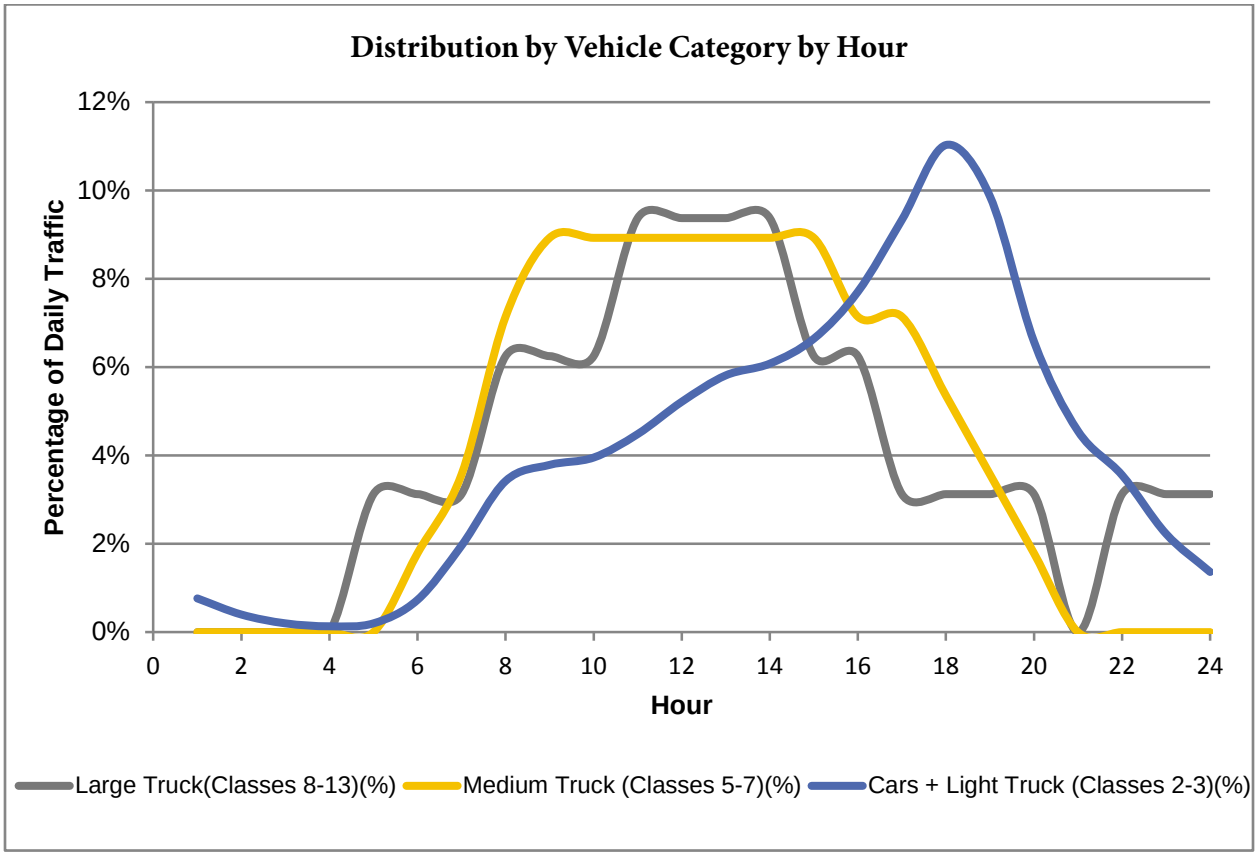

Figure 79. Daily Profile of Volume at Southbound US 202, MP 3.5 (2010)

In 2011, large truck volume had a more pronounced peak, with volume increasing during the day and reaching its peak from11:00 a.m. until 1:00 p.m. Figure 80 shows the relative daily profile of traffic by vehicular category in the southbound direction. Medium trucks and auto volume had a similar profile to those in 2010.

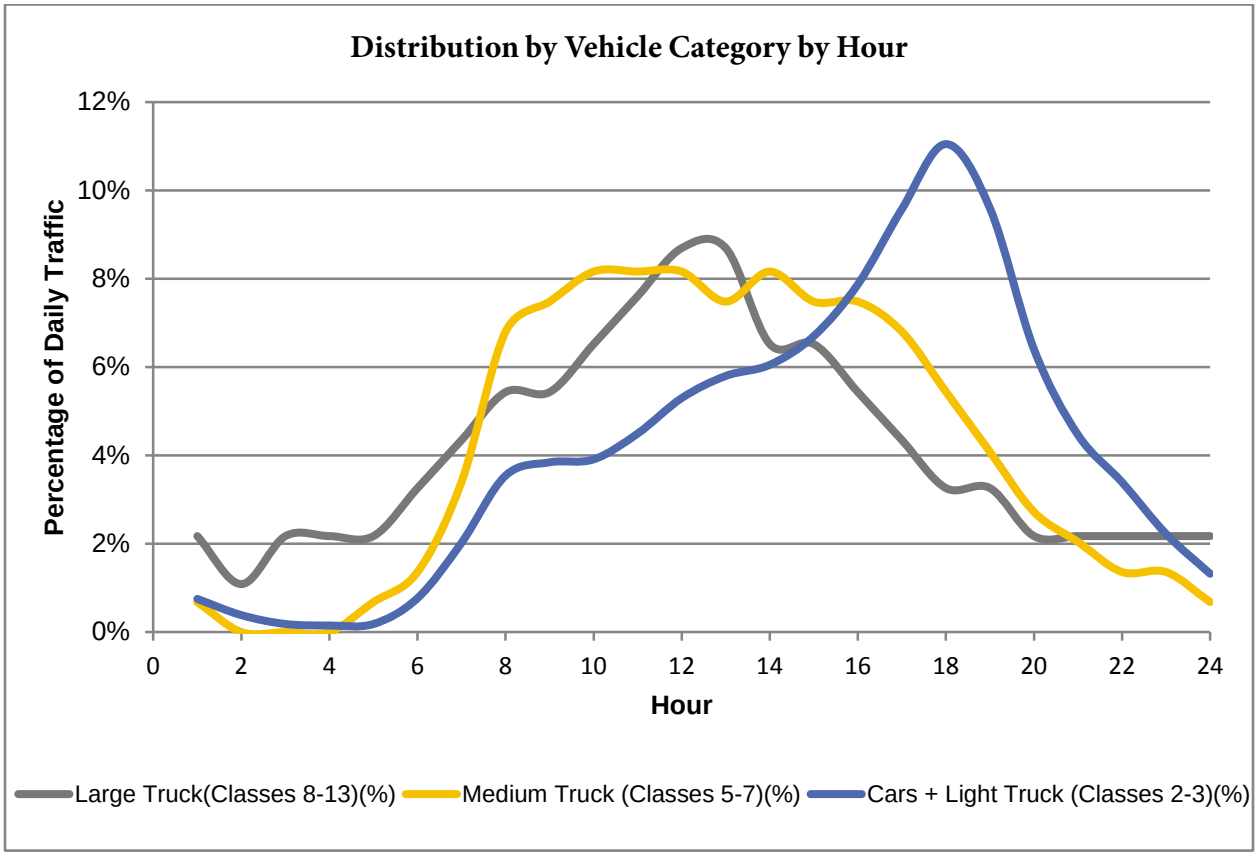

Figure 80. Daily Profile of Volume at Southbound US 202, MP 3.5 (2011)

Figure 81 shows the relative daily profile of traffic by vehicular category in the northbound direction in 2010. The large truck volume had two distinct peaks, with one occurring from 3:00 to 4:00 a.m. and second from 9:00 a.m. until 12:00 p.m. Medium trucks profile peak was from 6:00 a.m. and 6:00 a.m. when 12.6% of the daily volume occurred. Auto volume followed a directional commuter pattern with a pronounced peak during the 7:00 to 9:00 a.m. when nearly 20% of all personal vehicles traveled. In 2011, large trucks and personal vehicle profiles resembled profiles from 2010.

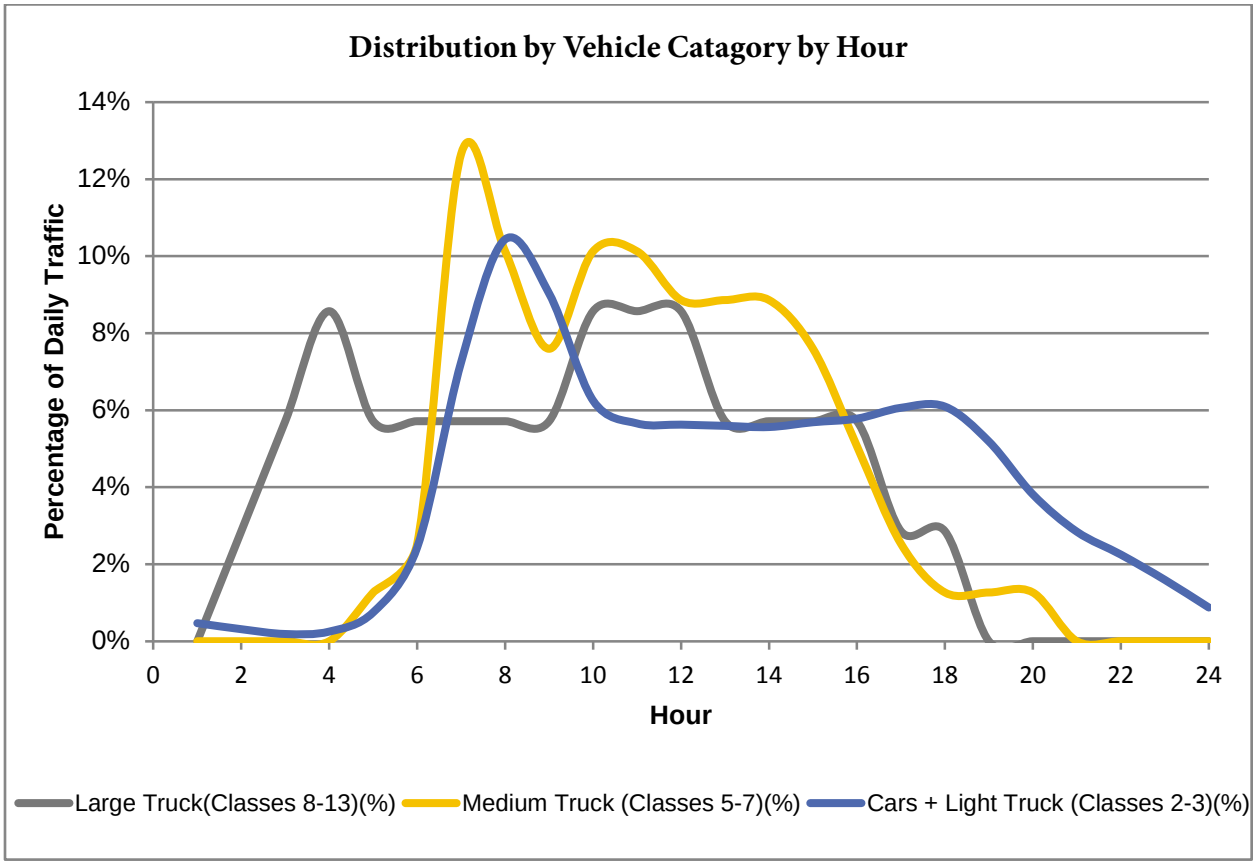

Figure 81. Daily Profile of Volume at Northbound US 202, MP 3.5 (2010)

4.19. WIM Station 02B: US 202, MP 19.2

WIM Station 02B is located at milepost 19.2 of US 202 in Branchburg Township, Somerset County. At this location US 202 is a two-lane Rural Principal Arterial and is included in the New Jersey Access Network. Figure 82 shows the location and surrounding features. WIM data has been continuously recorded at this location for several years with some brief interruptions in data recording process.

Figure 82. Aerial View of WIM Station at US 202, MP 19.2

As shown in Table 7, the LTWADT in 2010 increased by 3.64% while in 2011 it declined by only 1%. In 2011, the reduction in the LTWADT volume is more dominant in the southbound direction with close to 2% less truck recorded.

Table 7. Change in Large Truck Volume at WIM Station 02B

	2009	2010	2011	2010 to 2009	2011 to 2010
Southbound	5,915	6,158	6,035	4.11%	-1.99%
Northbound	6,650	6,865	6,851	3.23%	-0.20%
Total	12,565	13,023	12,886	3.64%	-1.05%

Figure 83 shows the monthly change in the LTWADT between the analyzed years. The large truck volume recorded an increase for first ten months of 2010. The largest increase was in April 2010, when 8.5% more trucks traversed the WIM Station. The LTWADT declined from November 2010 until June 2011. The highest negative change was in January when 11.8% less truck traversed compared to 2010. In second half of 2011, the LTWADT recorded an increase except in October where negligible change of 0.3% was observed.

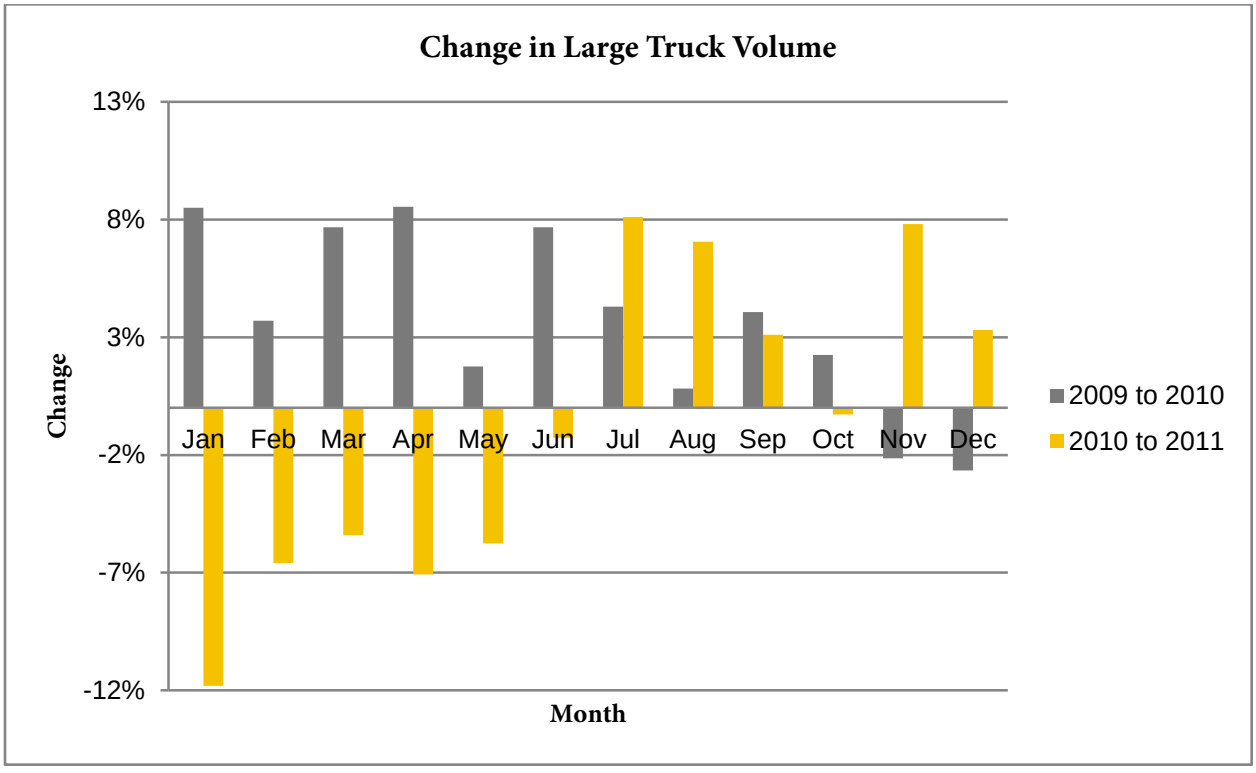

Figure 83. Change in Large Truck Volume at US 202, MP 19.2 (2009-2011)

The analysis of daily traffic pattern for all vehicle categories revealed that there was no change in daily travel patterns from 2009 to 2011. Figure 84 shows the relative daily profile by vehicular category in the northbound direction. The large truck volume is typical of Profile 4 that peaked between 9:00 a.m. and 12:00 p.m. Medium trucks grew throughout the day peaking between 3:00 and 4:00 p.m. Auto volume followed a commuter route pattern with a morning peak from 7:00 to 9:00 a.m. with nearly 18% of total daily volume.

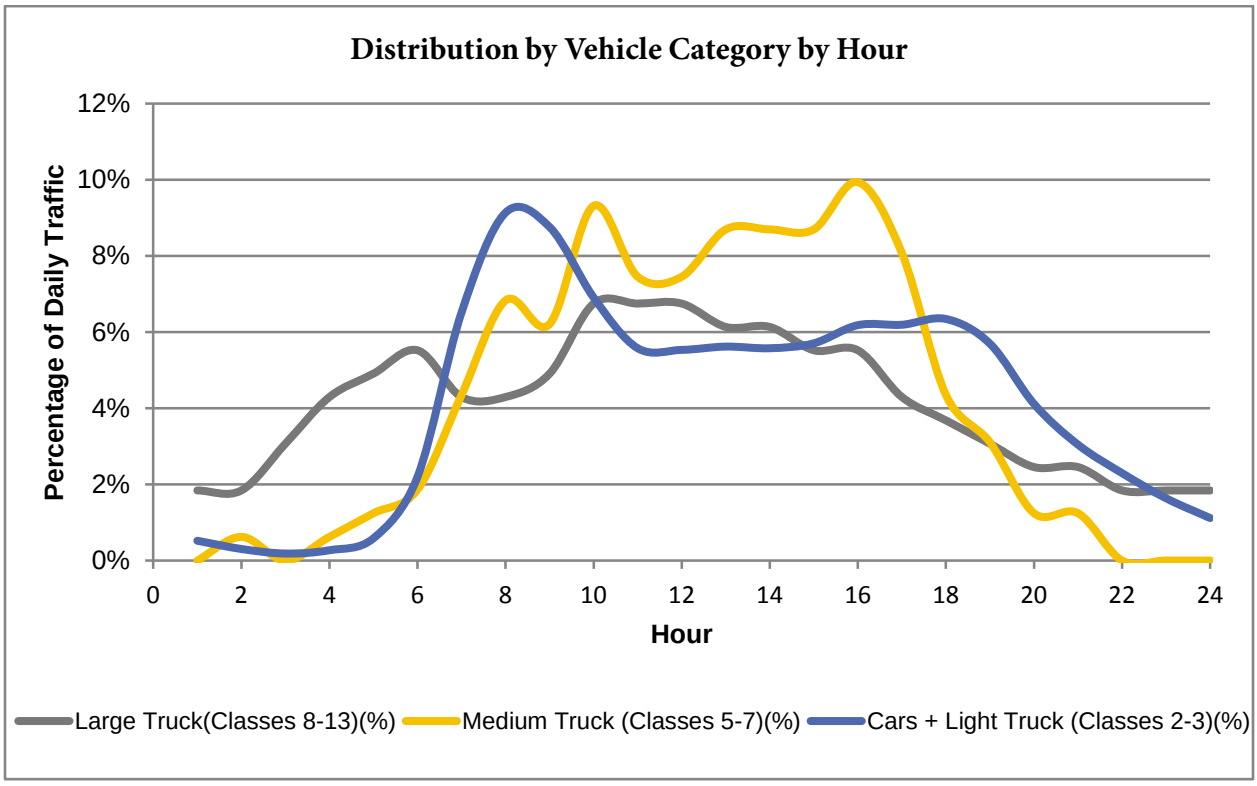

Figure 84. Daily Profile of Volume at Northbound US 202, MP 19.2 (2009)

Figure 85 shows the relative daily profile of traffic by vehicular category in the southbound direction. The large truck volume peaked between 10:00 and 11:00 a.m. when nearly 8.5% of all large truck traffic occurred. Medium trucks peaked between 2:00 and 4:00 p.m. when nearly 19% of the daily medium truck traffic occurred. Auto volume followed a strong commuter route pattern with highest peak during the 5:00 to 6:00 p.m. period with 10% of daily auto volume.

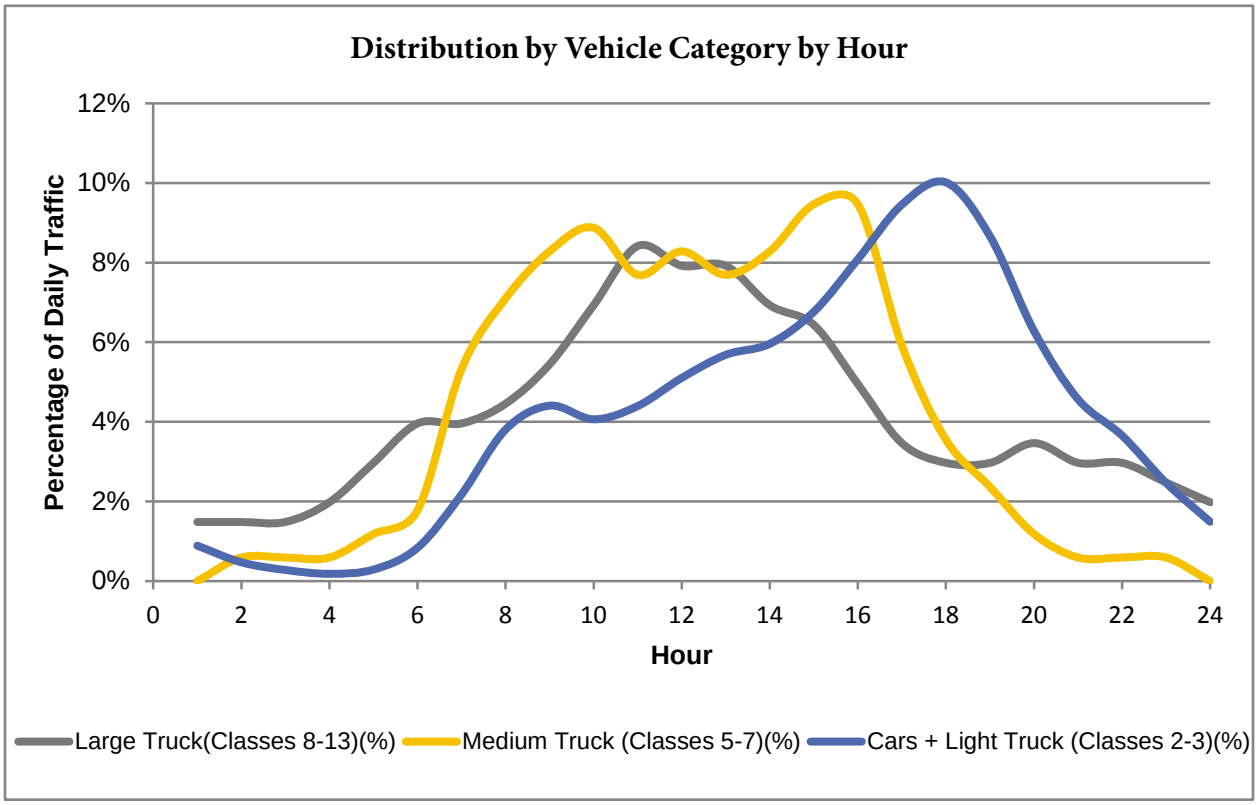

Figure 85. Daily Profile of Volume at Southbound US 202, MP 19.2 (2009)

4.20. WIM Station 20M: US 206, MP 59.5

WIM Station 20M is located at milepost 59.5 of US 206 in Montgomery Township, Somerset County. At this location US 206 is a two-lane Urban Principal Arterial and is included in the New Jersey Access Network. Figure 86 shows the location and surrounding features. WIM data has been continuously recorded at this location for several years with some brief interruptions in data recording process.

Figure 86. Aerial View of WIM Station at US 206, MP 59.5

As shown in Table 8, the LTWADT declined in 2010 by 1.05%. That trend continued in 2011 with an additional decline of 5.6%. In 2011, the significant reduction in the LTWADT occurred in the northbound direction with close to 18% less truck recorded. The southbound direction registered an increase in of 5.8%.

Table 8. Change in Large Truck Volume at WIM Station 20M

	2009	2010	2011	2010 to 2009	2011 to 2010
Southbound	1,881	1,923	2,036	2.25%	5.86%
Northbound	1,844	1,763	1,443	-4.41%	-18.13%
Total	3,725	3,686	3,479	-1.05%	-5.61%

Figure 87 shows the monthly change in large truck volume between the analyzed years. Observed truck volume in first half of 2010 was higher compared to the same period in 2009. The second half of 2010 registered a decline in truck volume. The decline in truck volume continued through the 2011 as well with few months registering a higher truck volume compared to the same period in 2010.

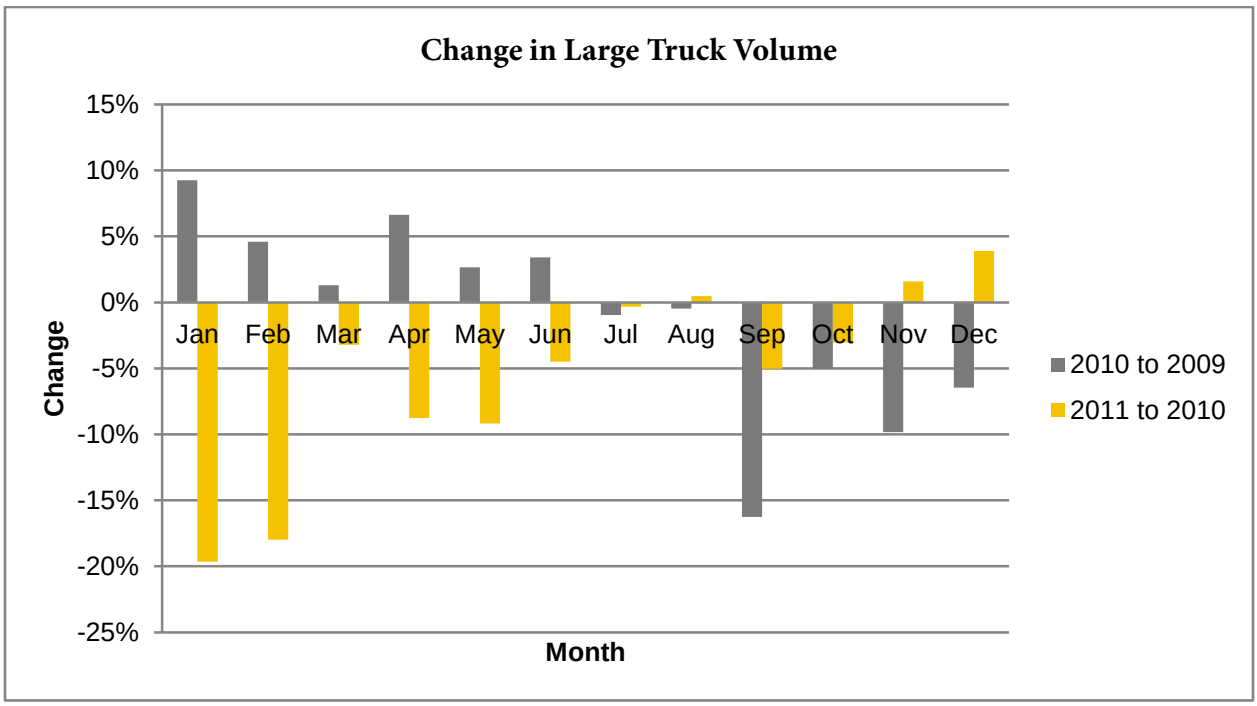

Figure 87. Change in Large Truck Volume at US 206, MP 59.5 (2009-2011)

The analysis of daily traffic pattern for all vehicle categories revealed that there was no change in daily travel patterns from 2009 to 2011. Figure 88 shows the relative daily profile of traffic by vehicular category in the northbound direction in 2009. The large truck volume peaked between 10:00 a.m. and 11:00 a.m. Medium trucks had a steady volume between 8:00 a.m. and 2:00 p.m. followed with the peak at 2:00 to 3:00 p.m. hour. Auto volume followed a commuter route pattern with a afternoon peak from 5:00 to 6:00 p.m. During the 4:00 to 6:00 p.m. period nearly 18% of total car daily volume was observed.

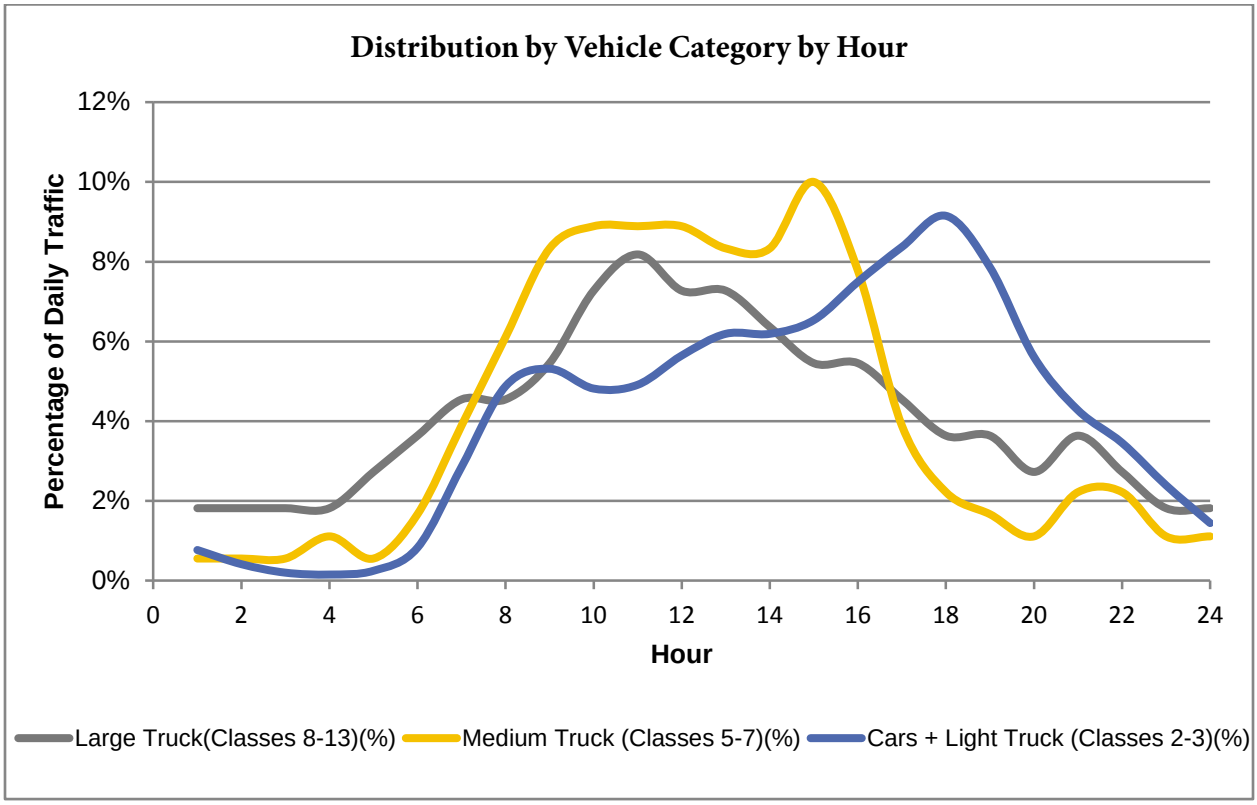

Figure 88. Daily Profile of Volume at Northbound US 206, MP 59.5 (2009)

Figure 89 shows the relative daily profile of traffic by vehicular category in the southbound direction. The large truck volume peaked between 9:00 a.m. and 2:00 p.m. with nearly 40% of total daily traffic occurred. Medium trucks peaked between 10:00 a.m. and 1:00 p.m. Auto volume followed a commuter route pattern with a morning peak from 8:00 to 9:00 a.m.

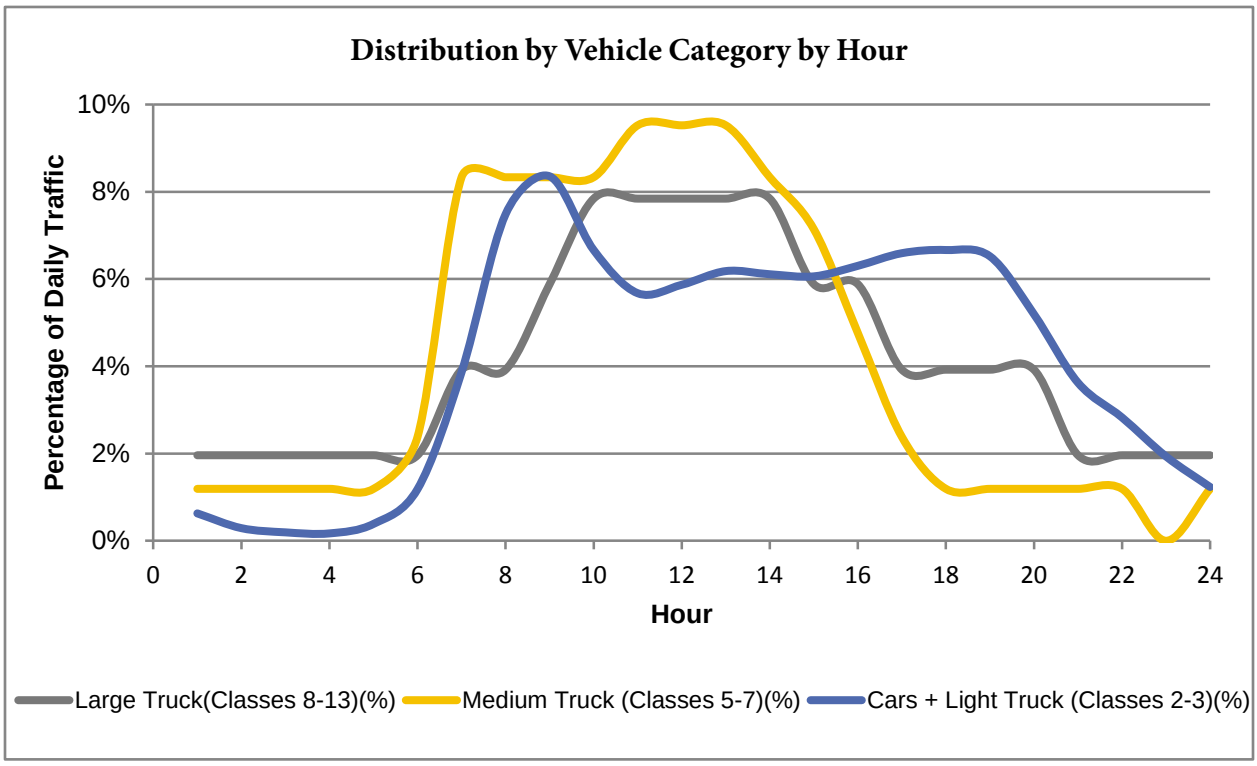

Figure 89. Daily Profile of Volume at Southbound US 206, MP 59.5 (2009)

The analysis of following WIM stations is based on the data that is collected during the one year. The WIM stations data was utilized in corridor analysis and volume trend analysis presented in Chapter 2.

4.21. WIM Station 78E: I-78, MP 5.02

WIM Station 78E is located at milepost 5.02 of eastbound Interstate 78 in Greenwich, Warren County east of Interchange 3 (Route 22/122/173). At this location I-78 is a six-lane limited access Urban Interstate and is included in the National Network. Figure 90 shows the location and surrounding features. WIM data collection process commenced in July 2007. During the analysis period (year 2009 to 2011) there were interruption in data collection process resulting in data not being collected in 2010 and 2011.

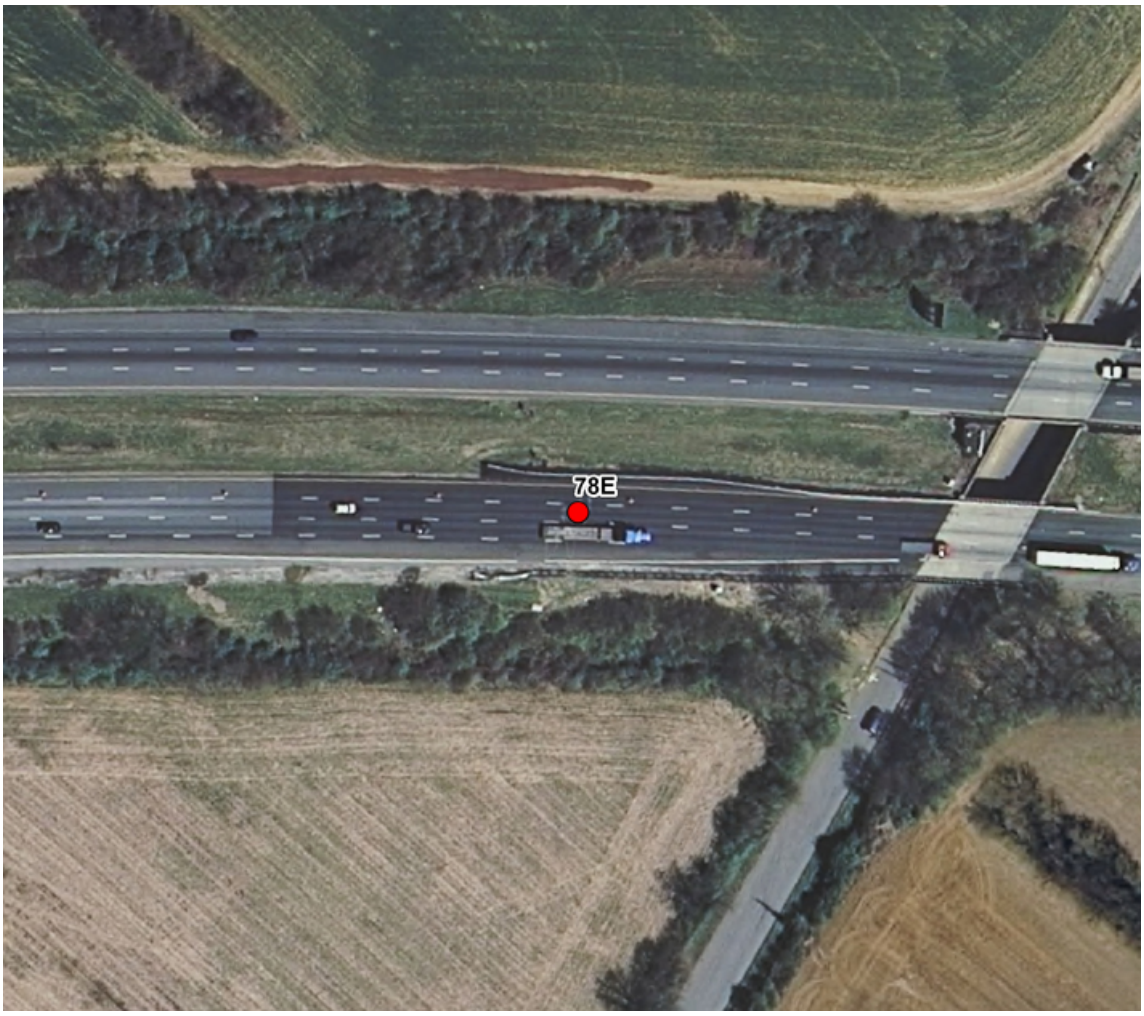

Figure 90. Aerial View of WIM Station at I-78, MP 5.02

As shown in Figure 91, the LTWADT did not show much range during most of 2009. The peak recorded daily average of approximately 7,000 occurred from May through July. An annual low of approximately 6,700 occurred during the month of April 2009.

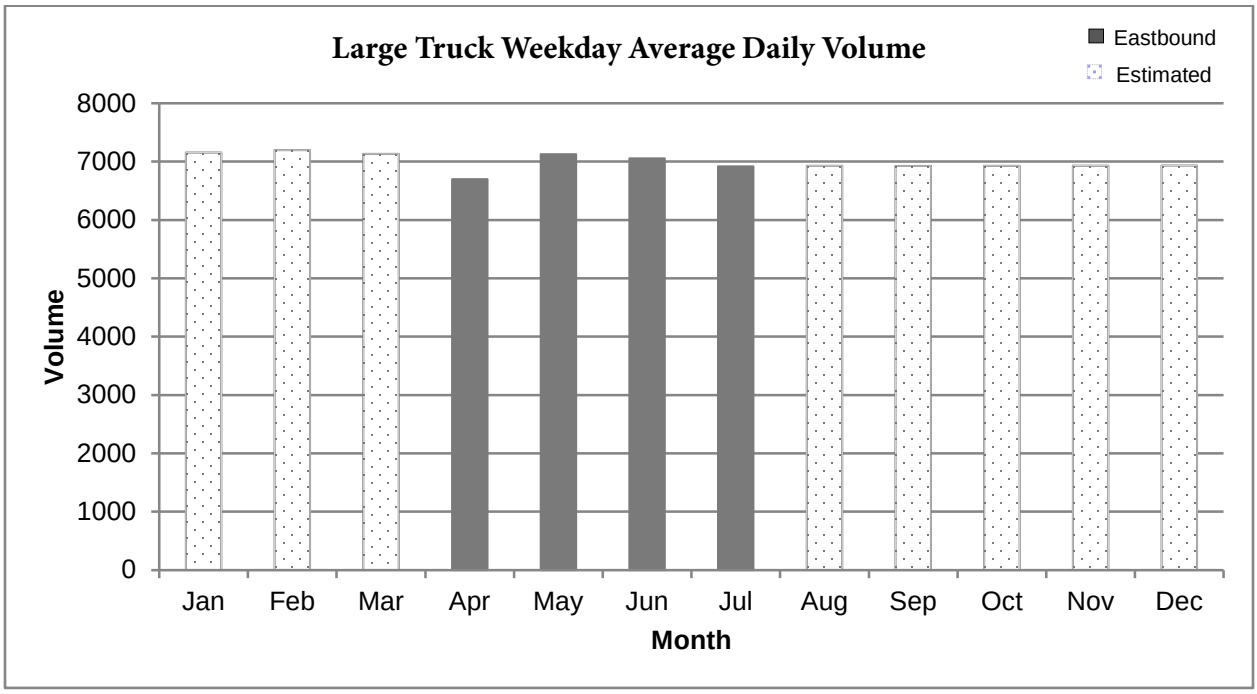

Figure 91. Annual Profile of Large Truck Volume at Eastbound I-78, MP 5.02 (2009)

The range of LTWADT at eastbound I-78 milepost 5.02 is shown in Figure 92. A relatively large amount of variability occurred in April 2009. Data shows similar variability among data collected for other months during 2009.

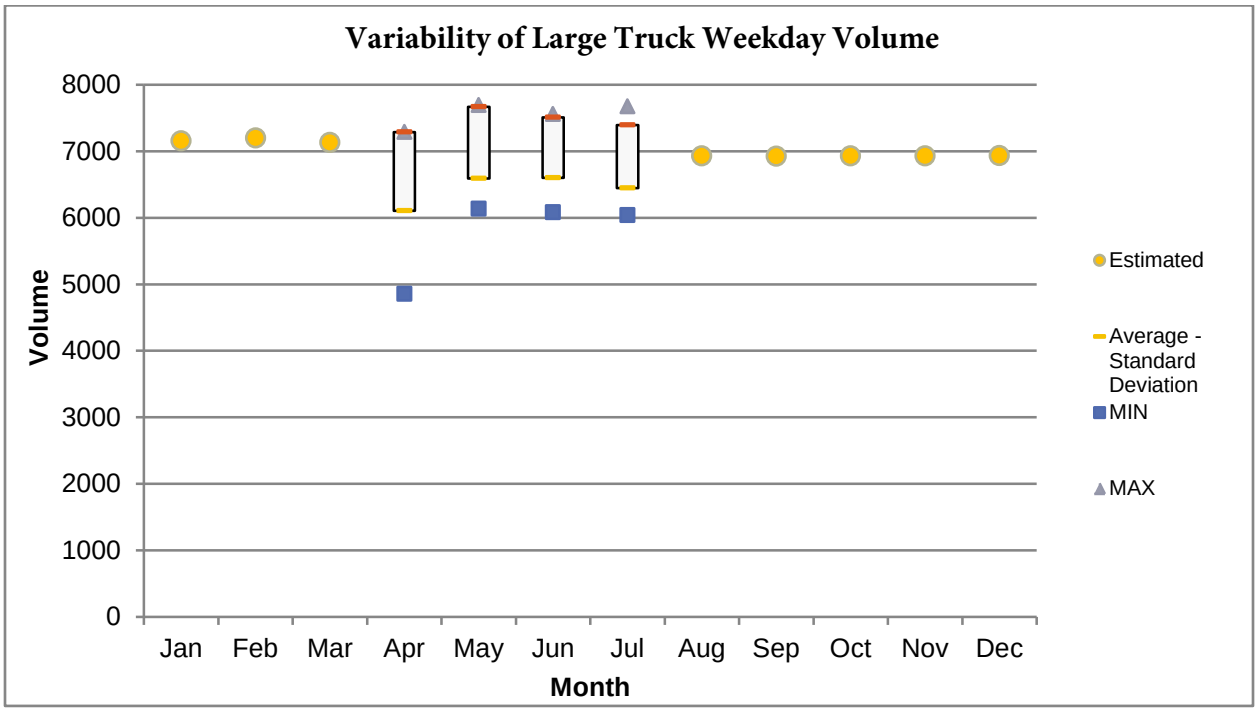

Figure 92. Variability of Large Truck Volume at Eastbound I-78, MP 5.02 (2009)

Figure 93 shows the relative daily profile of traffic by vehicular category in the eastbound direction in 2009. The large truck volume was relatively constant throughout the day but did peak slightly during the early morning. The peaking profile is typical of Profile 1. Auto volume abruptly peaked in the morning between 6:00 and 8:00 a.m. with over 8% of daily auto volume in that hour. This suggests a strong commuter pattern from employment locations to the east.

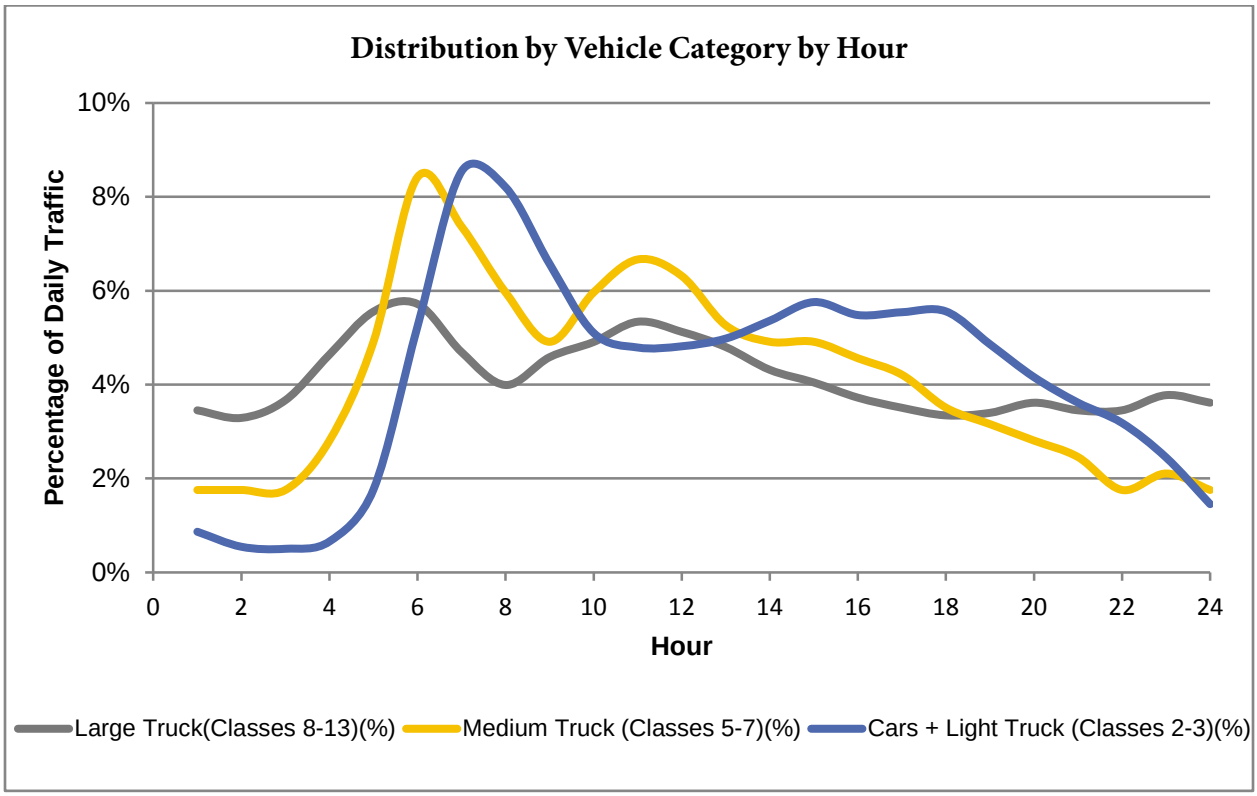

Figure 93. Daily Profile of Volume at Eastbound I-78, MP 5.02 (2009)

4.22. WIM Station 78B: I-78, MP 34.5

WIM Station 78B is located at milepost 34.5 of westbound Interstate 78 in Bernards Township, Somerset County near the ramps of Interchange 33 (CR 525 Martinsville/Liberty Corner Road). At this location I-78 is a six-lane limited access Urban Interstate and is included in the National Network. Figure 94 shows the location and surrounding features. WIM data has been recorded for all of 2009 except for October, November and December. The WIM data was not recorded in 2010 and 2011.

Figure 94. Aerial View of WIM Station at I-78, MP 34.5

As shown in Figure 95, the LTWADT exhibited an upward trend during the second half of 2009. An annual low of 2,849 occurred during the month of March 2009.

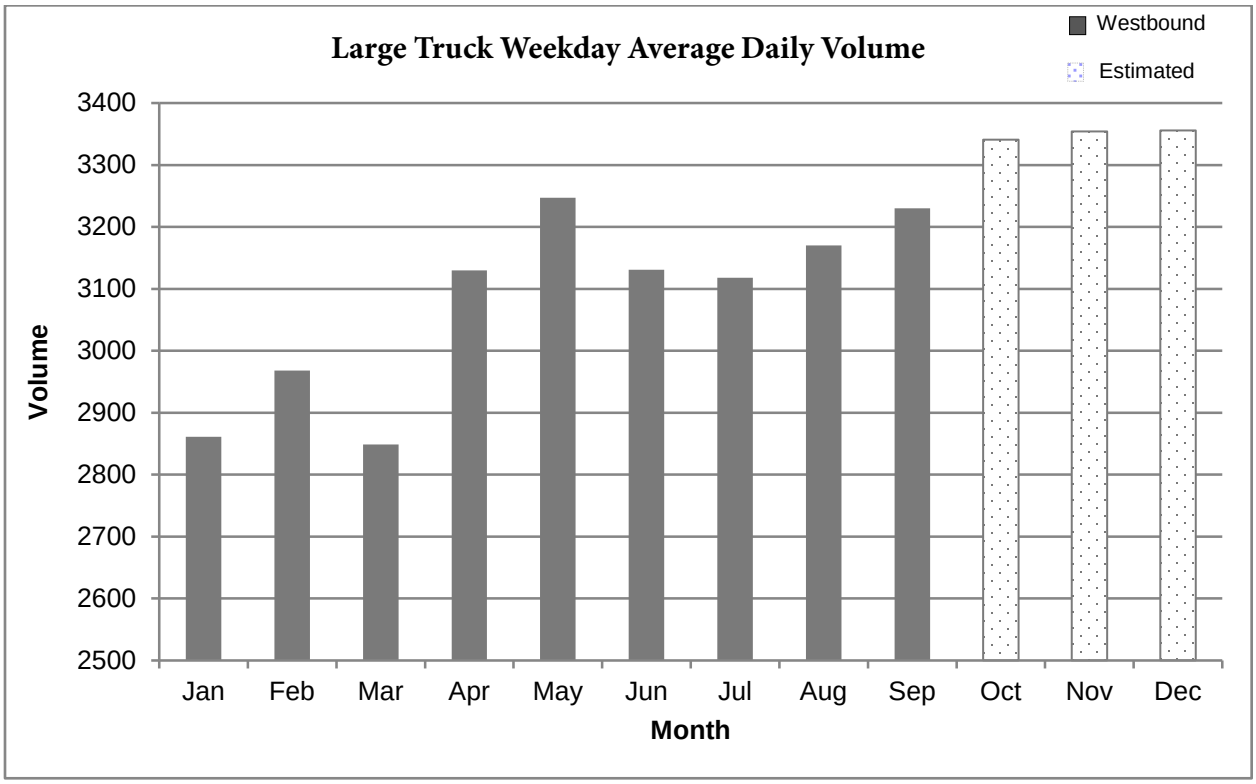

Figure 95. Annual Profile of Large Truck Volume at Westbound I-78, MP 34.5 (2009)

The range of the LTWADT at westbound I-78 milepost 34.5 is shown in Figure 96. The highest variability occurred in April 2009.

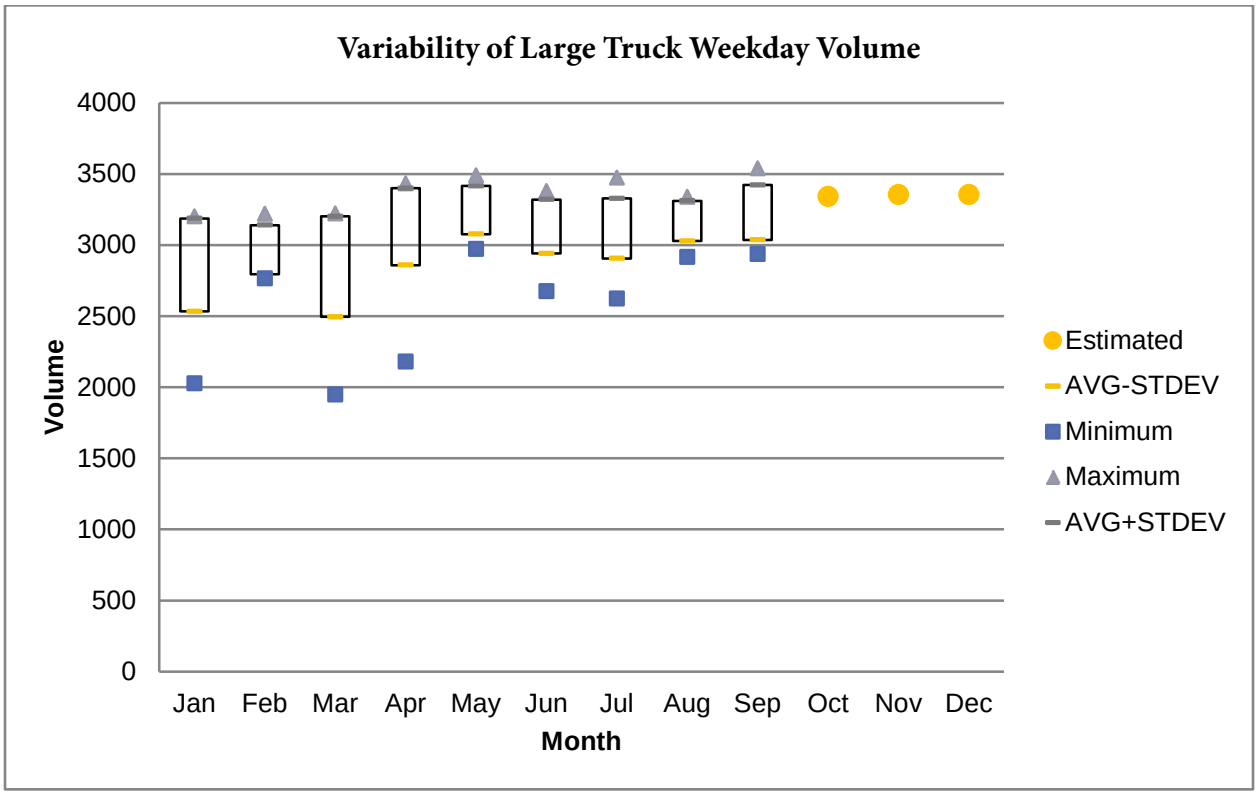

Figure 96. Variability of Large Truck Volume at Westbound I-78, MP 34.5 (2009)

Figure 97 shows the relative daily profile of traffic by vehicular category in the westbound direction in 2009. The large truck volume displayed daily Profile 2 with a peak between 9:00 a.m. and 1:00 p.m. An early peak for medium trucks occurred between 8:00 and 10:00 a.m. and it was followed by relatively high volume until 3:00 p.m. Personal vehicles peaked during the 4:00 to 6:00 p.m. period with nearly 19% of daily auto volume.

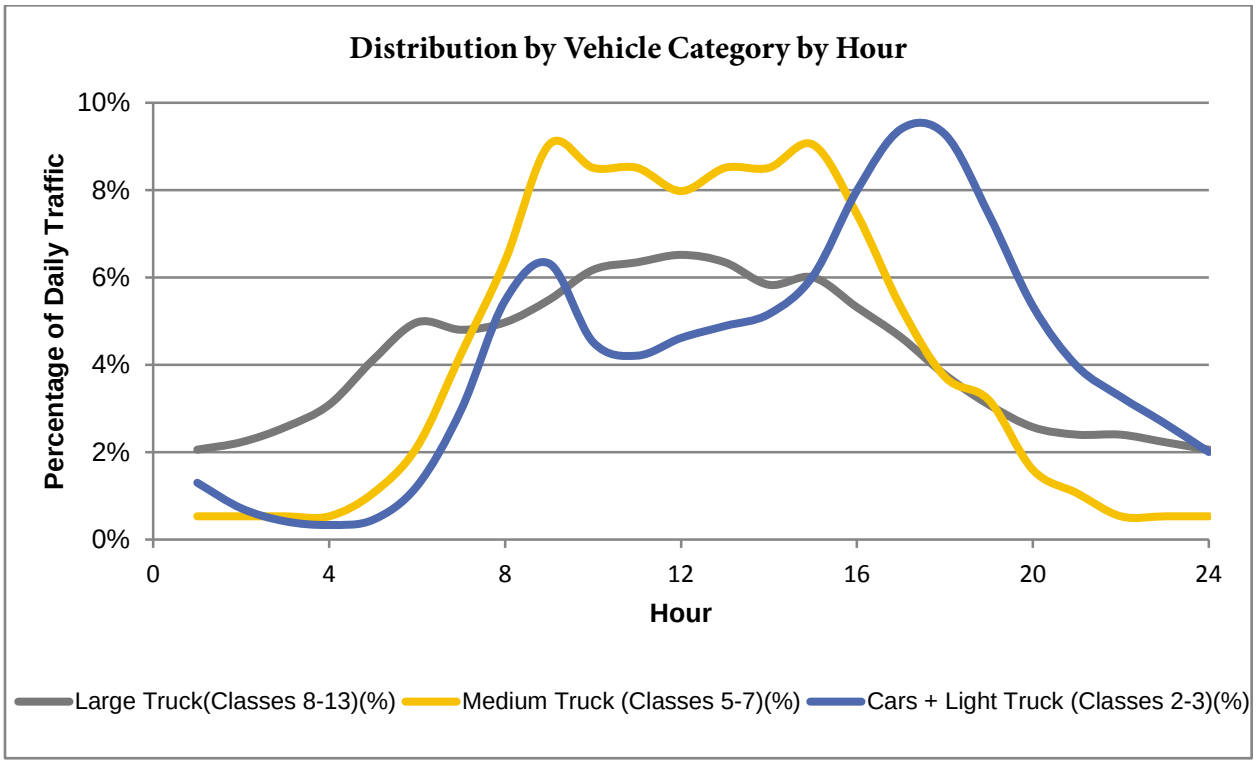

Figure 97. Daily Profile of Volume at Westbound I-78, MP 34.5 (2009)

4.23. WIM Station 31B: NJ 31, MP 13.0

WIM Station 31B is located at milepost 13.0 of NJ Route 31 in East Amwell, Hunterdon County. At this location NJ 31 is a two-lane Rural Principal Arterial and is included in the New Jersey Access Network. Figure 98 shows the location and surrounding features. WIM data has been continuously recorded at this location for more than four years however limited data was available for 2009 and 2010 particularly in the northbound direction.

Figure 98. Aerial View of WIM Station at NJ 31, MP 13.0

As shown in Figure 99, the LTWADT ranged from approximately 515 to 580 per direction per weekday during 2011 at NJ 31 milepost 13.0. Highest volume in the northbound direction was recorded in May of 2011. The lowest southbound LTWADT occurred in July 2012.

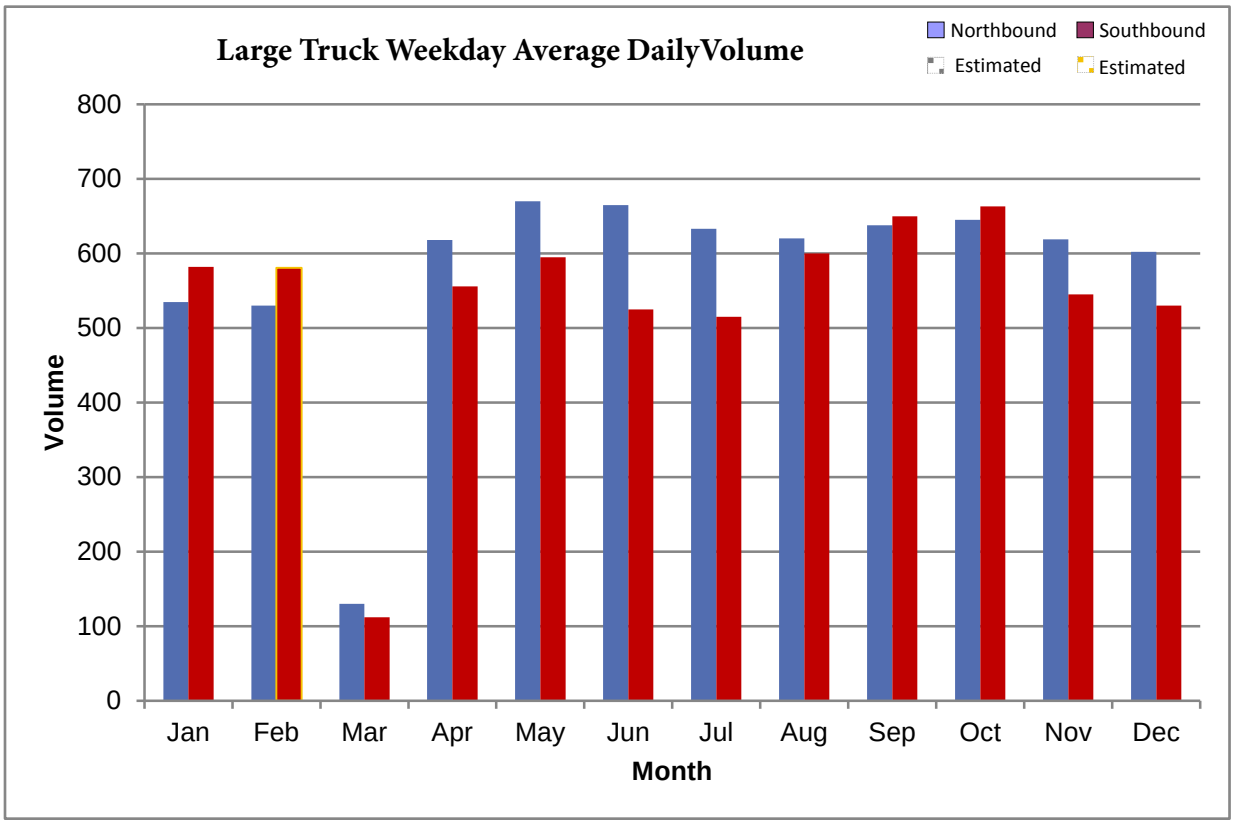

Figure 99. Annual Profile of Large Truck Volume at NJ 31, MP 13.0 (2011)

The range of the LTWADT volume at northbound NJ 31 milepost 13.0 is shown in Figure 100. The month of March had uncharacteristically low volume for 21 day data collection period. November was a high variability month with highest overall weekday when 720 trucks crossed the WIM Station on 30th and the minimum observation on March 11th when there were just 111 trucks recorded.

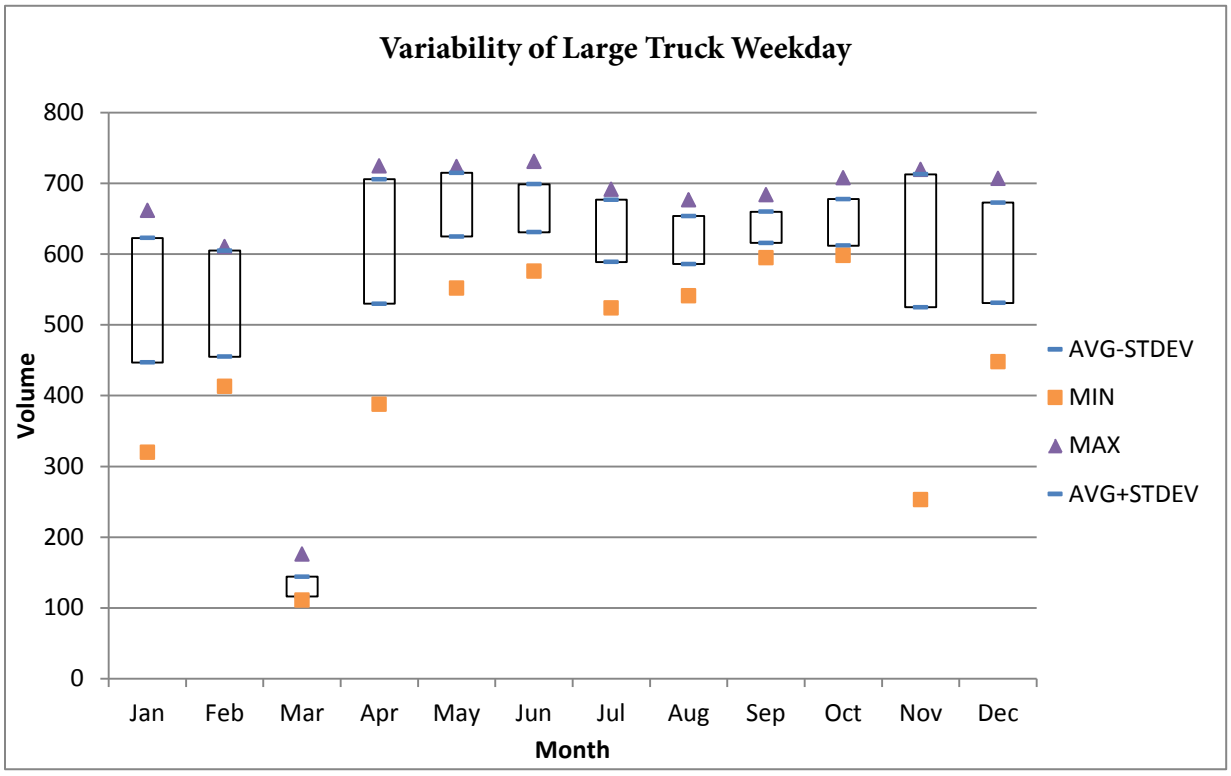

Figure 100. Variability of Large Truck Volume at Northbound NJ 31, MP 13.0 (2011)

The range of the LTWADT volume at southbound NJ 31 milepost 13.0 is shown in Figure 101. From the available data, the highest weekday volume occurred on October 12, 2011when 730 large trucks crossed southbound over the WIM Station. The annual minimum occurred on March 11, 2011 when the WIM counter registered 85 large trucks.

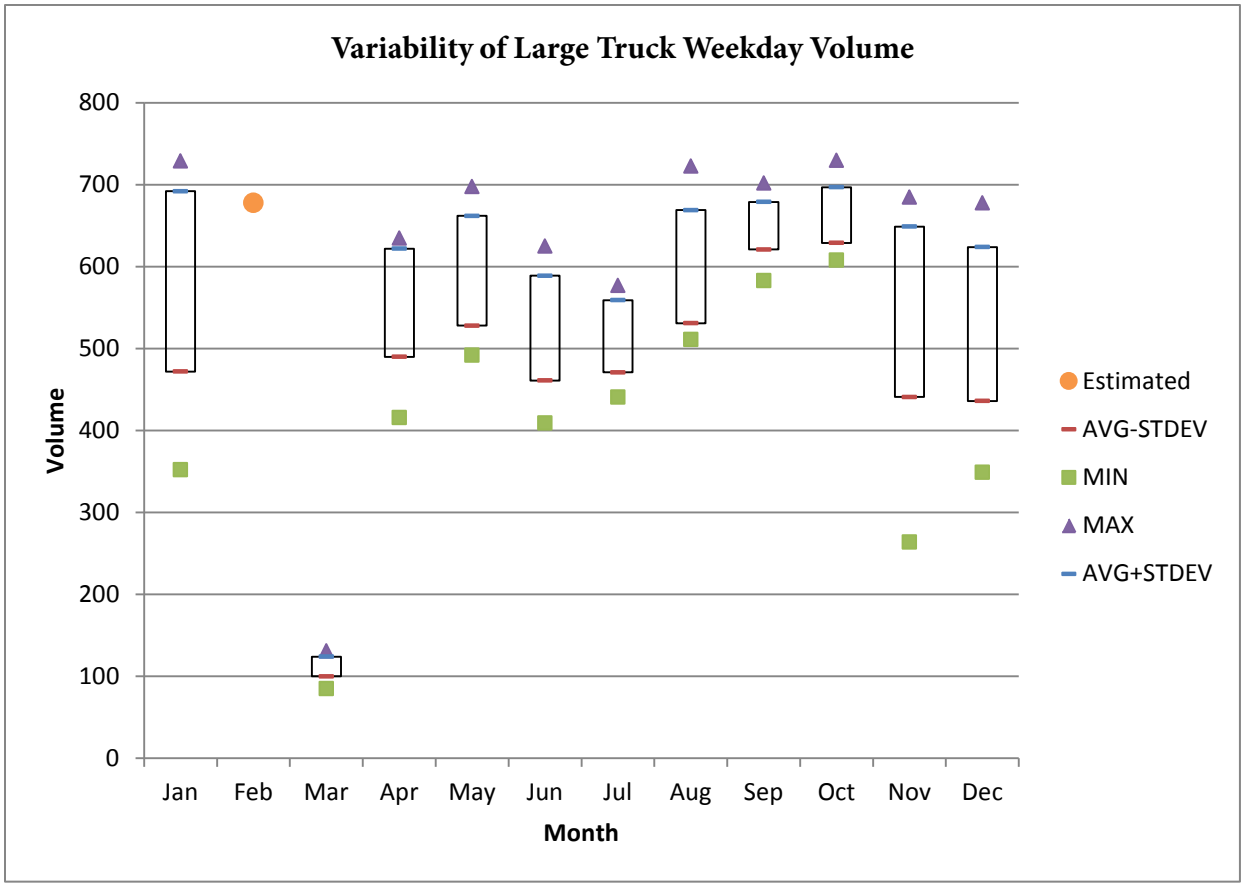

Figure 101. Variability of Large Truck Volume at Southbound NJ 31, MP 13.0 (2011)

Figure 102 shows the relative daily profile of traffic by vehicular category in the northbound direction in 2011. The large truck volume peaked between 9:00 a.m. and 12:00 p.m. when over 21% of all large truck traffic occurred. However, the large overall volume and relatively high overnight large truck count suggests a Profile 2 pattern on this arterial. Medium trucks followed a more pronounced profile with a sustained peak from 9:00 to 11:00 a.m., and a sharp drop after 5:00 p.m. Auto volume followed a typical commuter route pattern with highest peak during the 4:00 to 6:00 p.m. period and a lesser peak during the morning.

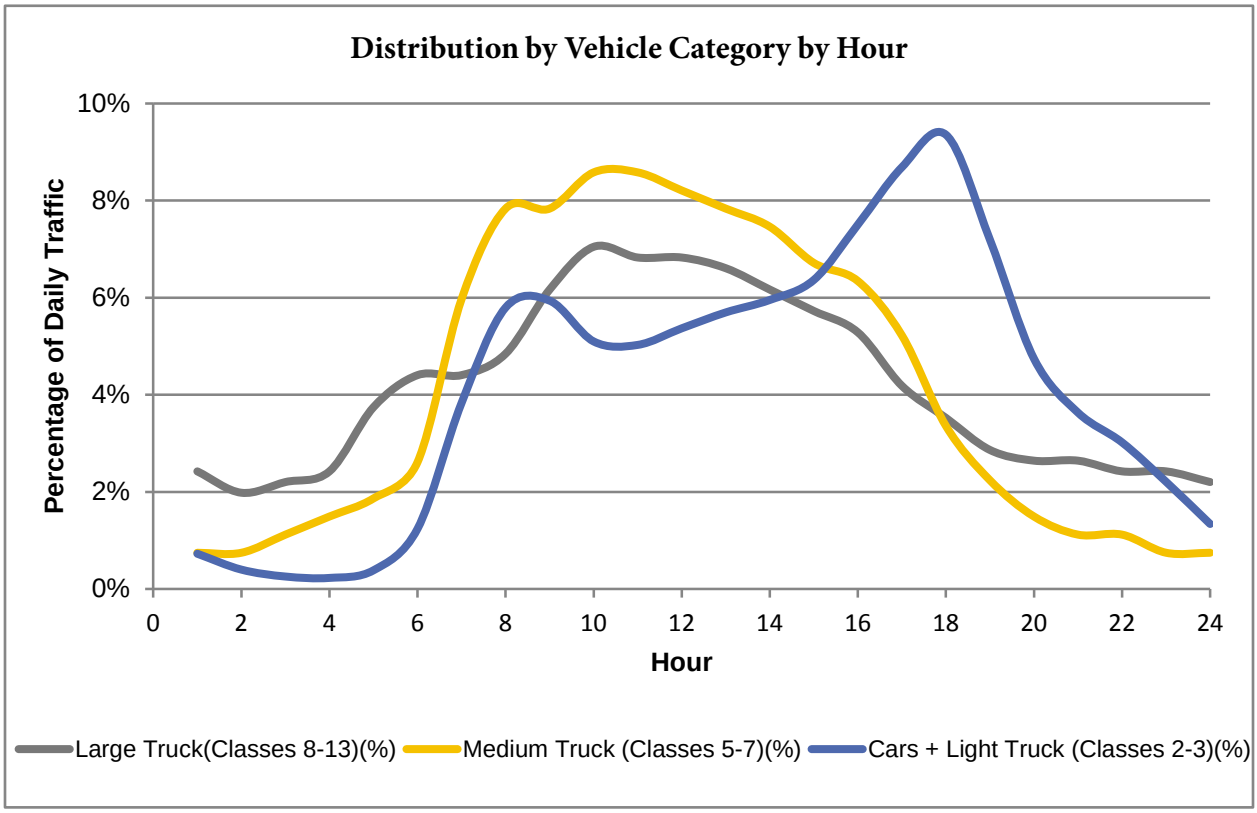

Figure 102. Daily Profile of Volume at Northbound NJ 31, MP 13.0 (2011)

Figure 103 shows the relative daily profile of traffic by vehicular category in the southbound direction in 2011. The large truck volume peaked between 10:00 a.m. and 12:00 p.m. with 13% of all large truck traffic occurred. The large overall volume and relatively high overnight large truck count suggests a Profile 2 pattern on this arterial. Medium trucks followed a more pronounced profile with a sharp peak from 8:00 to 9:00 a.m., and a sharp drop after 5:00 p.m. Auto volume followed a typical commuter route pattern with highest peak during the 8:00 to 9:00 a.m. and a similar peak during the late afternoon.

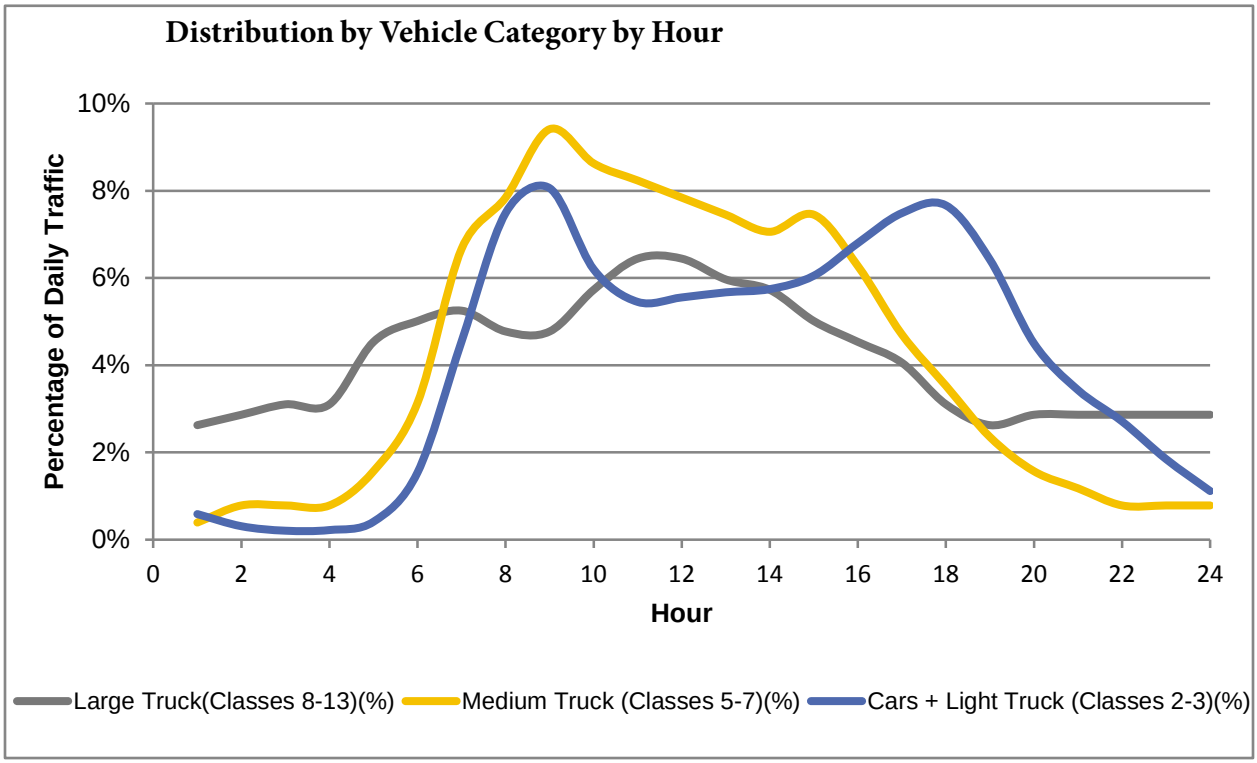

Figure 103. Daily Profile of Volume at Southbound NJ 31, MP 13.0 (2011)

Appendix A - Vehicle Classification Schemas

Large Trucks as defined in this report are highlighted in yellow.

Table 9. FHWA Vehicle Classification

Class	Vehicle	Detail
1	Motorcycles	
2	Passenger Cars	2 Axles/4 Tires
3	Light Trucks/Other	2 Axles/4 Tires
4	Buses	
5	Single-Unit Trucks	2 Axles/6 Tires
6		3 Axles
7		4 or More Axles
8	Single-Trailer Trucks	4 or Less Axles
9		5 Axles
10		6 or More Axles
11	Multi-Trailer Trucks	5 or Less Axles
12		6 Axles
13		7 Axles

Table 10. DRJTBC Vehicle Classification

Class	Vehicle	Detail
1	Passenger Cars	
2	Trucks	2 Axles
3		3 Axles
4		4 Axles
5		5 Axles
6		6 Axles
7		7 Axles

Table 11. NJTA Vehicle Classification

Class	Vehicle	Detail
1	Passenger Cars	
2	Trucks	2 Axles
3		3 Axles
4		4 Axles
5		5 Axles
6		6 Axles
B2	Buses	2 Axles
B3		3 Axles