

JUNE 2019



**WIM #34
MN 23, MP 122.1
CLARA CITY, MN**

**MONTHLY
REPORT**



Your Destination...Our Priority



WIM Site Location

WIM #34 is located on MN 23 near Clara City in Chippewa county.

System Operation

WIM #34 was operational for the entire month of June 2019. Volume was computed using all monthly data.

System Calibration

WIM #34 was most recently calibrated on 2015-06-17. Table 1 summarizes the front axle weights of class 9s by lane ¹. Figure 1 shows the distribution of gross vehicle weights (GVW) in Class 9 vehicles at this site for the last 12 months of operation ². Figure 2 depicts the average front axle weight as a percent difference from the first full month following calibration.

Summary of Volume Statistics

Total Monthly Volume: 112977 | Passenger Vehicles: 96463 | Heavy Commercial Vehicles: 16514

Monthly Average Daily Traffic (MADT): 3766 | Monthly Heavy Commercial Average Daily Traffic (MHCADT): 550

See Table 2 for vehicle class breakdown

Passenger Vehicles (PVs) and Heavy Commercial Vehicles (HCVs)

Volume trends. NB vehicles typically reached highest volume levels on Fridays, with lowest volumes reported on Tuesdays. SB vehicles typically reached highest volume levels on Sundays, with lowest volumes reported on Tuesdays (see Figure 3 and 4).

Passenger Vehicles (PVs)

Volume trends. On an average 24-hour day (see Figure 5), NB PVs generally reached peak volume levels between 02 PM and 04 PM. Similarly, SB PVs peaked in volume between 03 PM and 05 PM

Heavy Commercial Vehicles (HCVs)

Volume trends. On an average 24-hour day, HCVs traveling NB typically reached peak volume levels between 02 PM and 04 PM, while volume going SB peaked between 03 PM and 05 PM. See Figure 6. Out of all HCVs, the two highest traffic volumes were generated by Class 9's and Class 5's.

Overweight HCVs

Volume trends. Of a total of 16514 HCVs, 2859 of them were overweight ³. These overweight HCVs contributed to 2.6% of total monthly volume, and 17.6% of total monthly

HCV volume. NB overweight vehicles typically reached highest numbers on Tuesdays, with lowest volumes reported on Saturdays. SB overweight vehicles tended to reach highest volumes on Mondays, with lowest volumes reported on Saturdays. See Figure 3 . The top two overweight violators by class were the class 9 and class 10 vehicles . Overall, overweight vehicles tended to reach peak volume concentrations during typical business hours, with 54.8% of all overweight vehicles traveling NB this month (see Figure 7 & 8). Figure 9 shows the number of vehicles exceeding 88,000 pounds that crossed the WIM over the last 12 months. The highest number of 88,000+ vehicles within the last 12 months occurred in June.

WIMs are currently used as a screening tool for weight enforcement, and it is estimated that the WIM scales can measure gross vehicle weights (GVW) within 90-95% of static weight scale measurements. Due to the possibility of measurement error, vehicles exceeding 10% of their legal weight limits (or 1.1 times their legal weight limits) are considered overweight in this report ⁴.

Using normal load limits ,215 NB vehicles exceeded 88,000 pounds (108 vehicles were Class 13's; 61 vehicles were Class 10's). Of vehicles traveling SB,

293 NB vehicles exceeded 88,000 pounds (106 vehicles were Class 10's; 103 vehicles were Class 13's). Refer to Table 3 for the Top 10 highest recorded GVWs from Classes 9 and 10 from June 2019.

Loaded vs. Unloaded HCVs. Figure 10 shows the GVW distributions of Class 9s and 10s in June 2019. Data suggests that there were greater numbers of fully_loaded Class 9's than empty Class 9's traveling NB, while there were more fully_loaded Class 9's than empty traveling SB. Data also suggests that there were more fully_loaded Class 10's than empty traveling in the NB direction. In the SB direction, there were more empty class 10 vehicles.

Freight Totals. A total of 147709 tons of freight was recorded to have crossed the WIM. More freight was shipped NB (50.5%) than SB (49.5%). See Table 4 and Figure 11 for more freight information.

Infrastructure Considerations

Bridge. Bridge No. 12012 is approximately 3.8 miles north of WIM #34, and Bridge No. 12004 is 3.1 miles south of WIM #34. WIM #34 recorded a total of 112977 vehicles with a combined GVW of 1228913 kips (1 kip = 1,000 pounds = 0.5 tons) in June 2019. See Table 5 and Figures 12-13 for GVW information by vehicle class and lane.

Pavement Design. A total of 14801 equivalent single axle loads (ESALs) passed over the pavement at this site. Approximately 51.3% of all ESALs were recorded NB while 48.7% was observed SB. In particular, 62% of all ESALs were generated by the Class 9's (Class 9's were also responsible for generating 37% of total GVW observed this month). See Table 6 and Figures 14-15 for more information on ESALs (Table 6 also provides flexible ESAL factors for each vehicle class using a terminal serviceability of 2.5 and a structural number of 5).

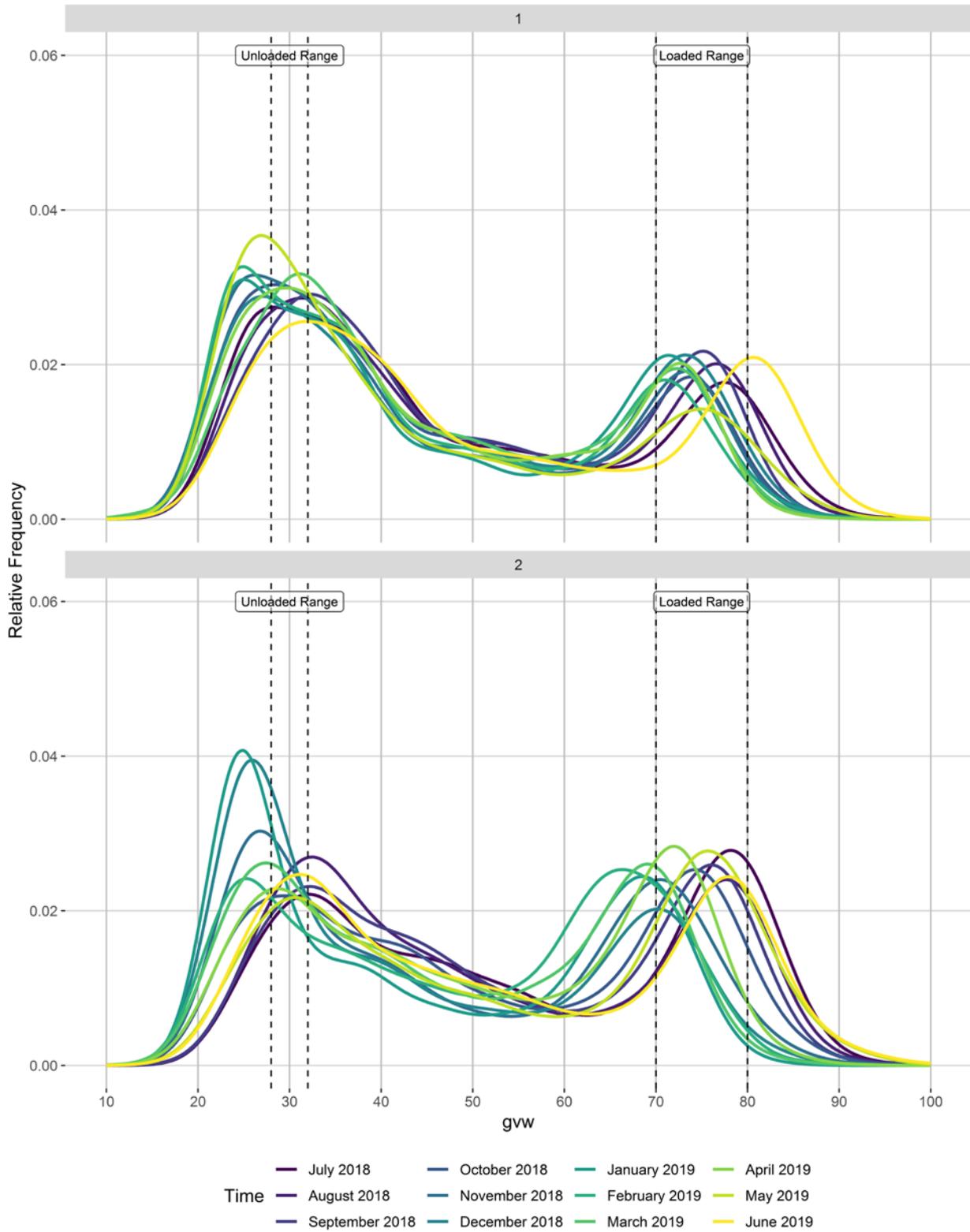
WIM monthly reports can be found at: <http://www.dot.state.mn.us/traffic/data/reports-monthly-wim.html>

MnDOT's vehicle classification scheme and vehicle class groupings for traffic forecasting can be found at: <http://www.dot.state.mn.us/traffic/data/data-products.html#weight>

- ¹ Front axle weights of Class 9s are monitored on a monthly basis to assure performance between calibrations. The current goal of the WIM scale calibration is to have each individual axle weight stay within a range of ±9% of baseline calibration values
- ² Previous WIM research indicates that unloaded Class 9s typically weigh 28-32 kips, while loaded Class 9s generally fall in the 70-80 kip range. More recent data from several WIM sites suggests that the unloaded Class 9 range may have moved a little higher over time (due to increased presence of sleeper cabs, etc.), although these ranges are also thought to be site-specific.
- ³ An HCV is considered overweight during normal load limits in this report if they satisfy any of the following 1) exceed a gross vehicle weight (GVW) of 80,000 pounds, 2) exceed any of the legal weight maximums on any axle configurations (legal maximums are: single axle = 20,000 pounds; tandem axles spaced 8' or less = 34,000 pounds; tridem axles spaced 9' or less = 43,000 pounds; quad axles spaced 13' or less = 51,000 pounds). Monthly reports use this standard regardless of the time of year however, the Winter Load Increase (WLI) allows a 10% across the board increase in axle and gross vehicle weights without a permit on US, state routes, and county roads. An HCV is considered overweight during Winter Load Increase(WLI) if they satisfy any of the following 1) exceed a gross vehicle weight (GVW) of 88,000 pounds, 2) exceed any of the legal weight maximums on any axle configurations (legal maximums are: single axle = 22,000 pounds; tandem axles spaced 8' or less = 37,400 pounds; tridem axles spaced 9' or less = 47,300 pounds; quad axles spaced 13' or less = 56,100 pounds). An overweight HCV is only included once in the overweight volume calculations regardless of how many of the aforementioned conditions are violated. For information on MN weight limit dates and statutes: http://www.mrr.dot.state.mn.us/research/seasonal_load_limits/sllindex.asp
- ⁴ For example, Class 9s and 10s can legally have gross vehicle weights up to 80,000 lbs (with the exception of permitted loads) during normal load limits. To account for measurement error on the WIM scales, those exceeding 10% of the legal GVW maximum (or 1.1 times the legal GVW) should be screened (e.g., 80,000 lbs + 8,000 lbs = 88,000 lbs). Similarly during WLI vehicles weighing 96,800 lbs should be screened.

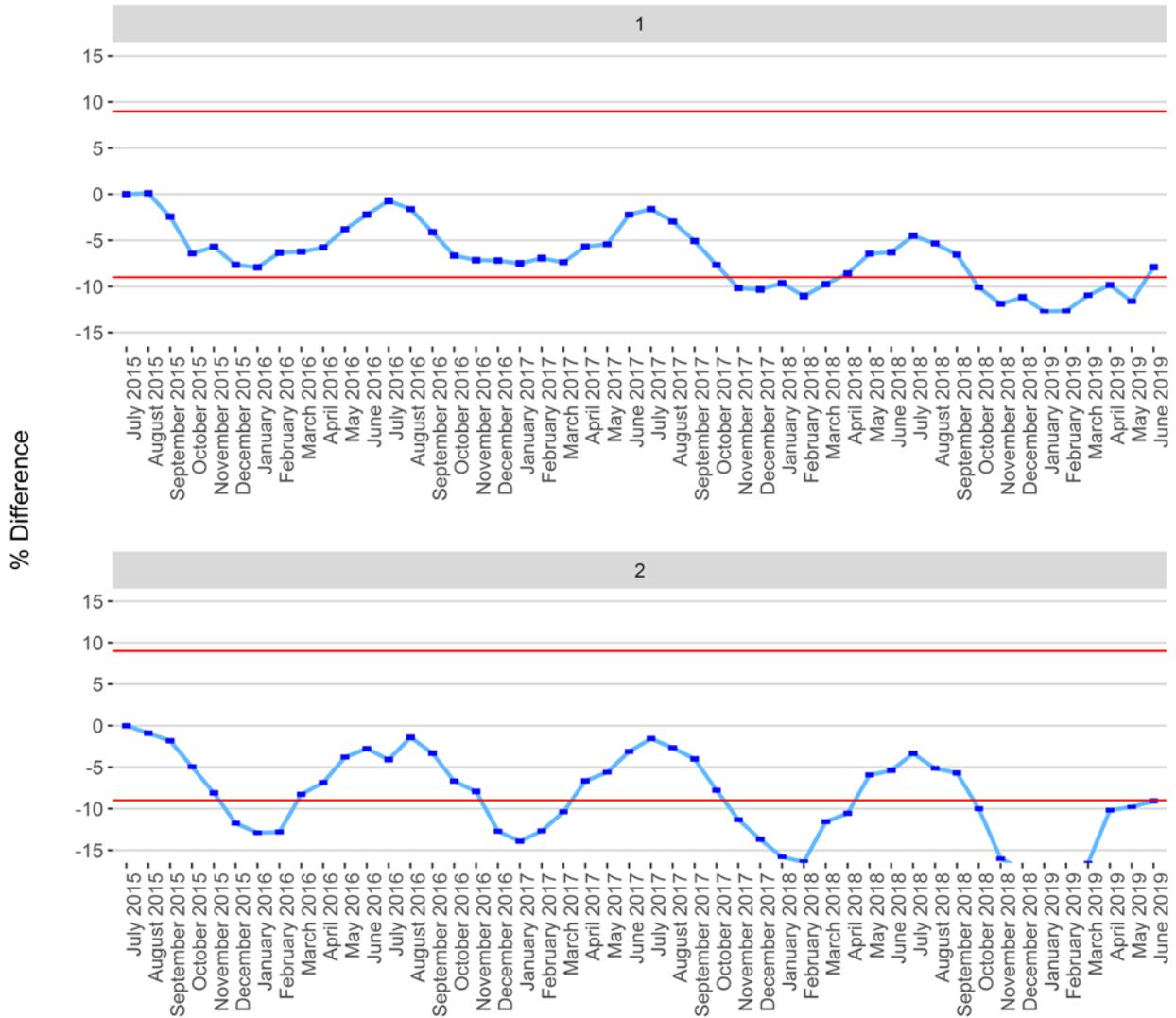
To request this document in an alternative format, please call 651-366-4718 or 1-800-657-3774, or email your request to ADArequest.dot@state.mn.us. Please request at least one week in advance.

Figure 1 - Monthly Class 9 GVW Histogram



Months that have not passed QC parameters are not displayed

Figure 2 - Percent Difference of Front Axle Weight from Last Calibration (+/- 95% CI)



Months that have not passed QC parameters are not displayed

Figure 2 - Average Vehicle Volume vs. Day of the Week

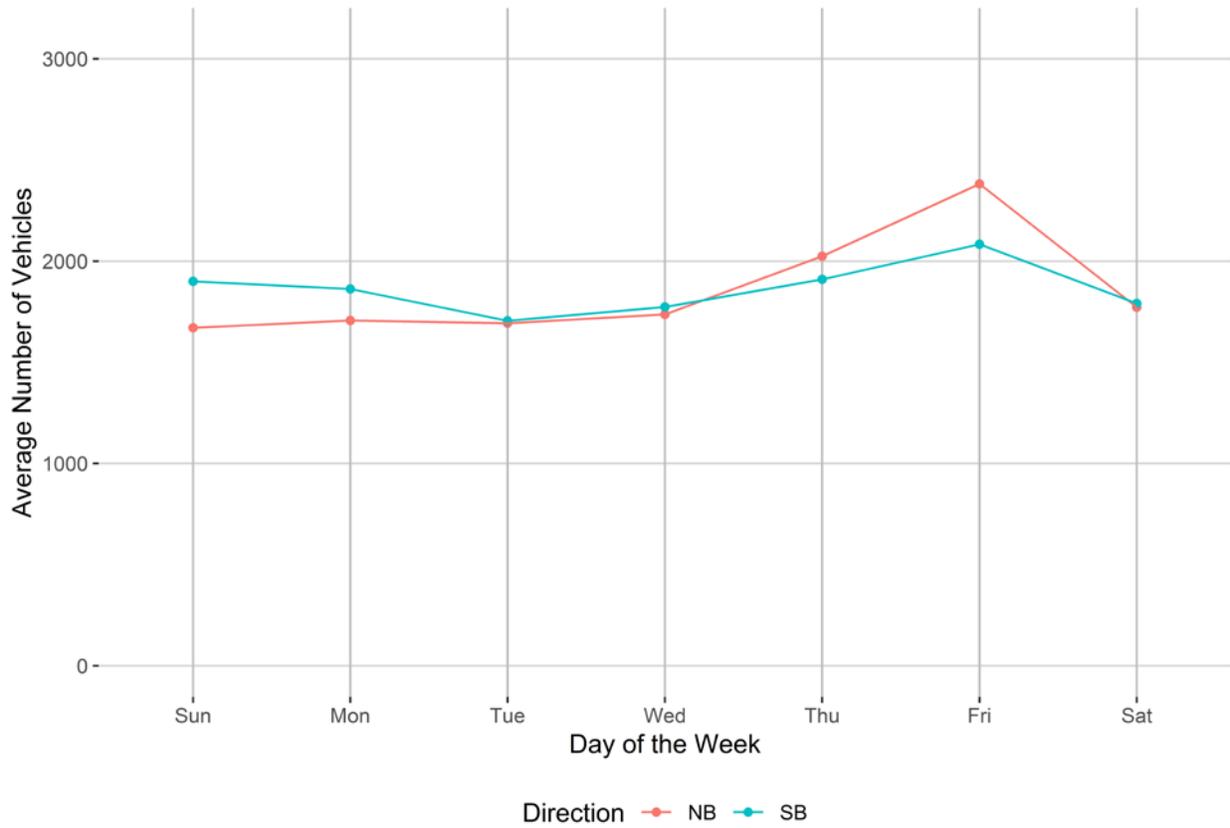


Figure 3 - Average Overweight Vehicle Volume vs. Day of the Week

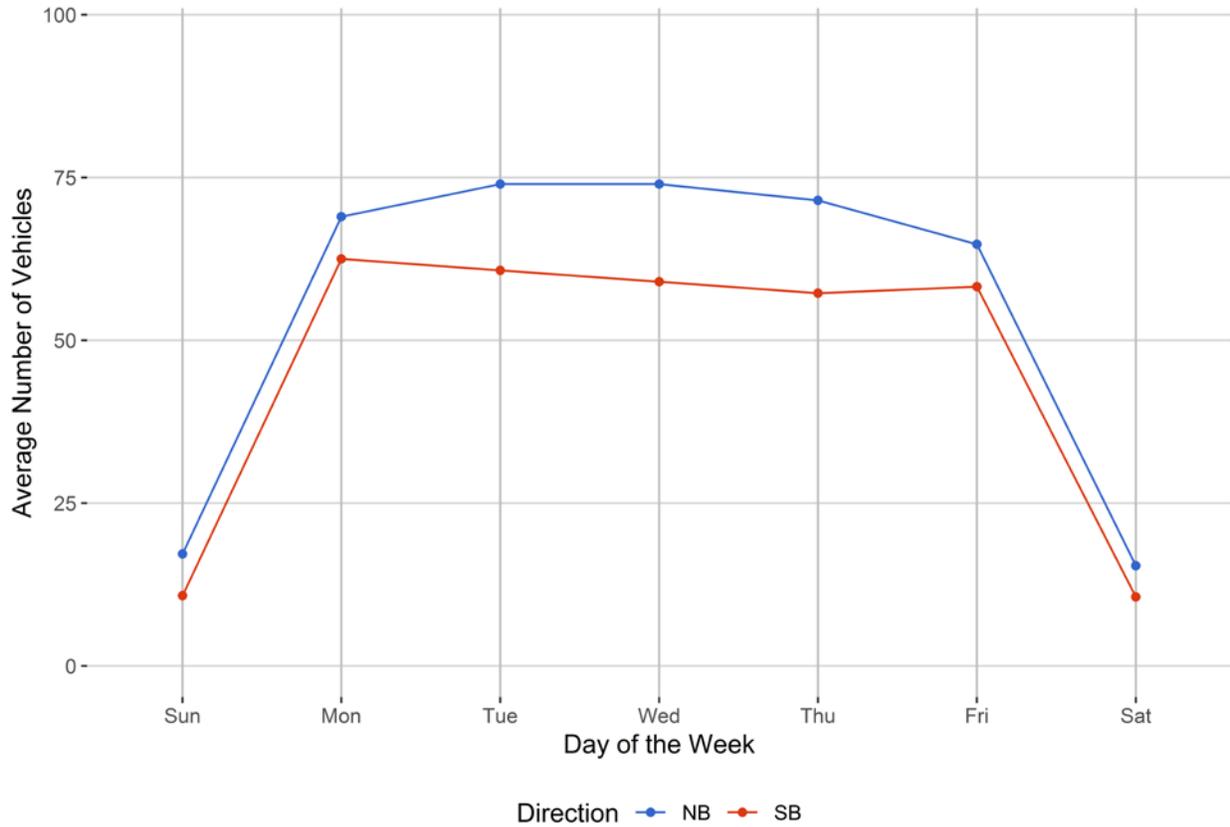


Figure 4 - Passenger Vehicles vs. Hour of the Day

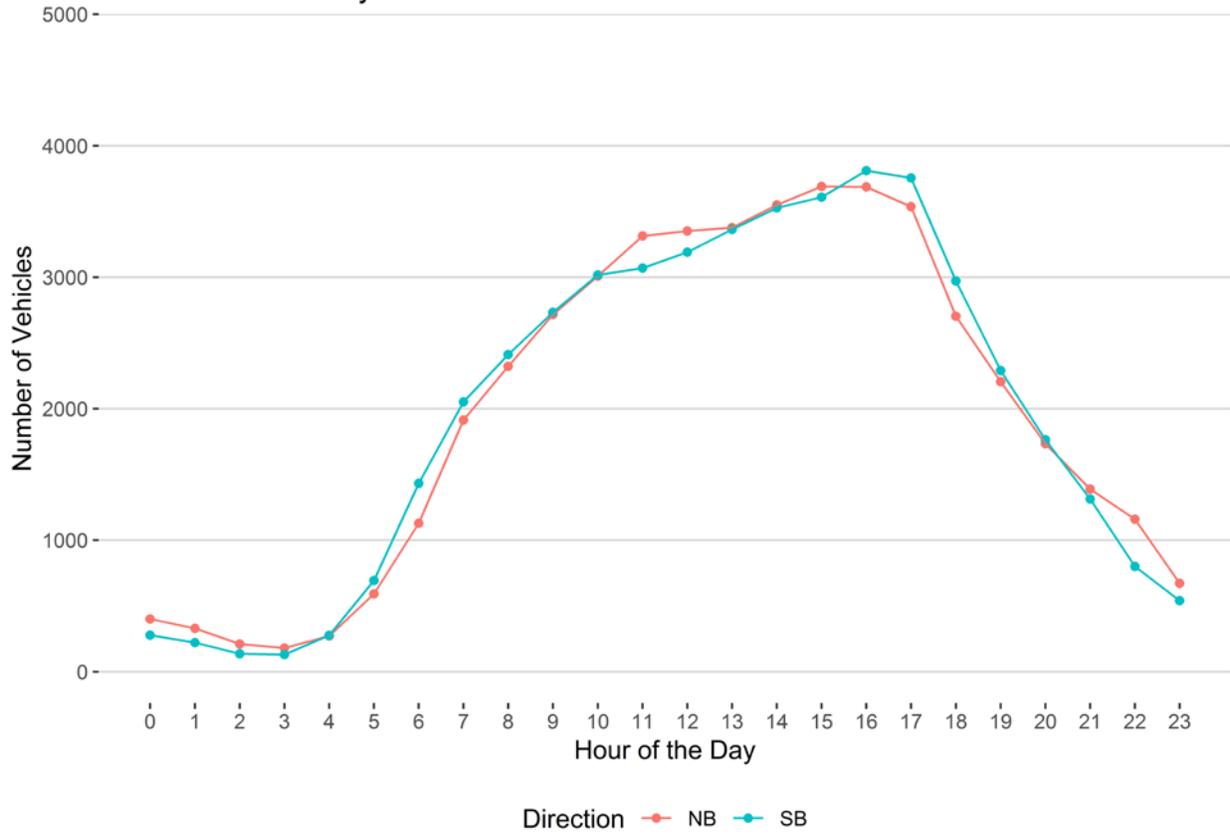


Figure 5 - Heavy Commercial Vehicles vs. Hour of the Day

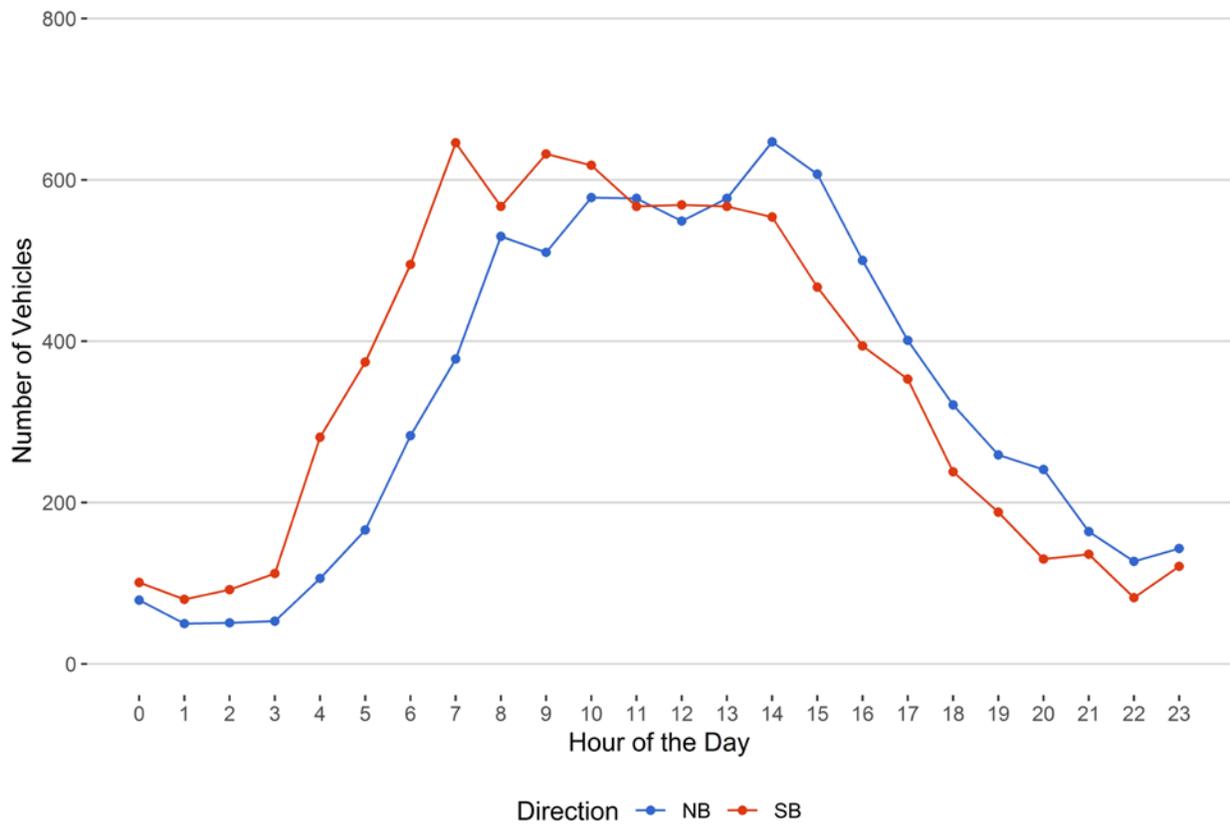


Figure 6 - Overweight Vehicles by Class vs. Hour of the Day

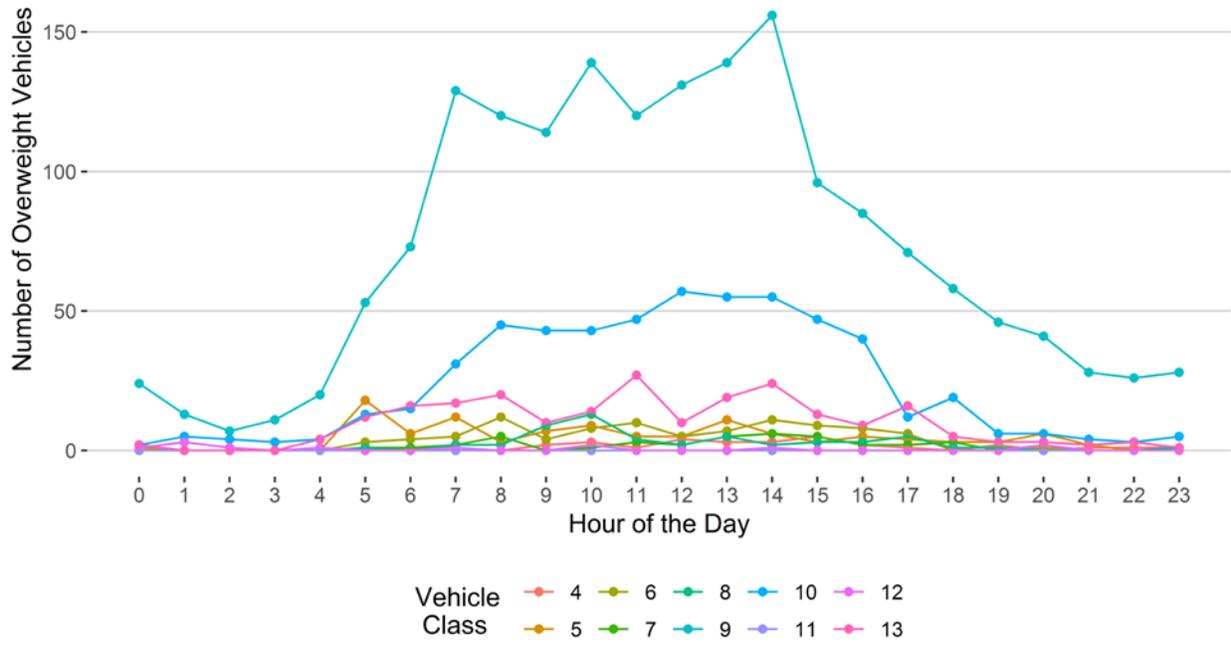


Figure 7 - Overweight Vehicles by Direction
Hour of the Day

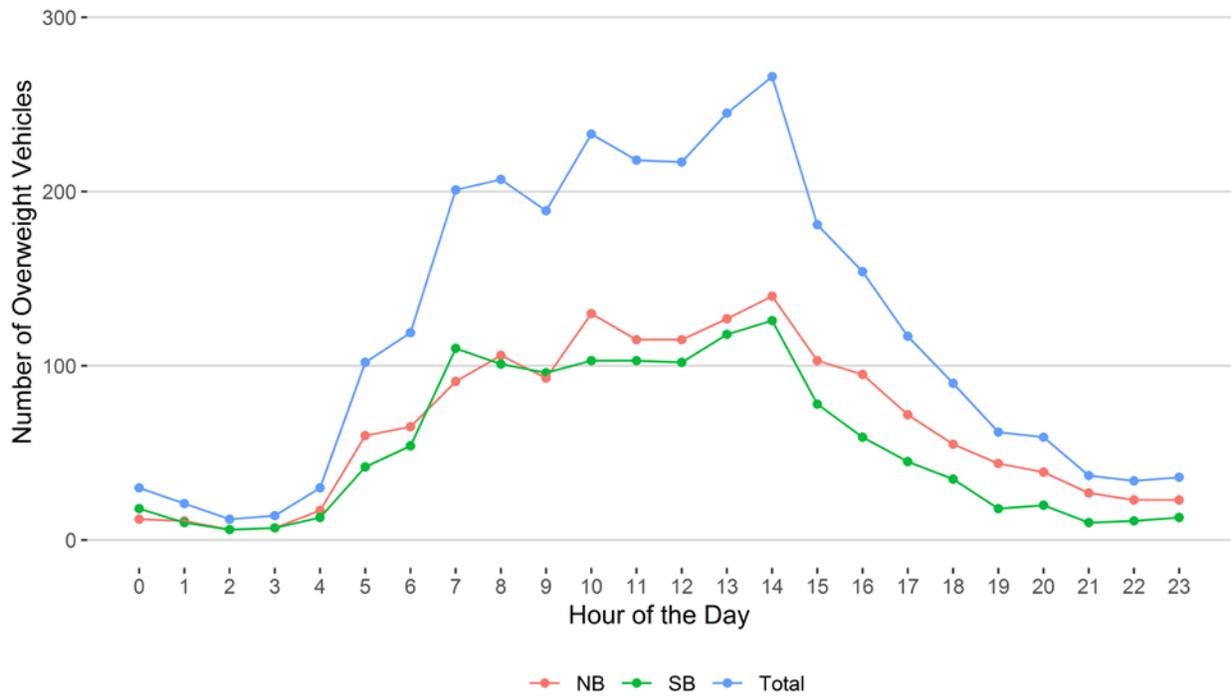
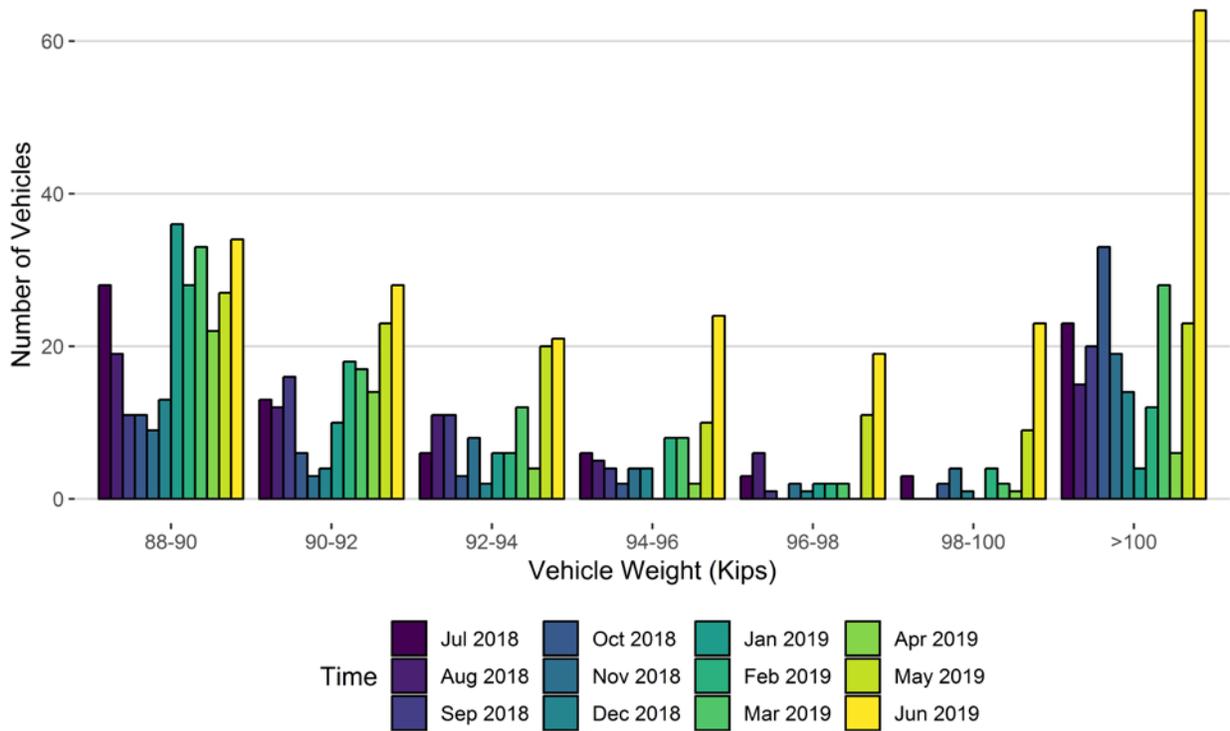
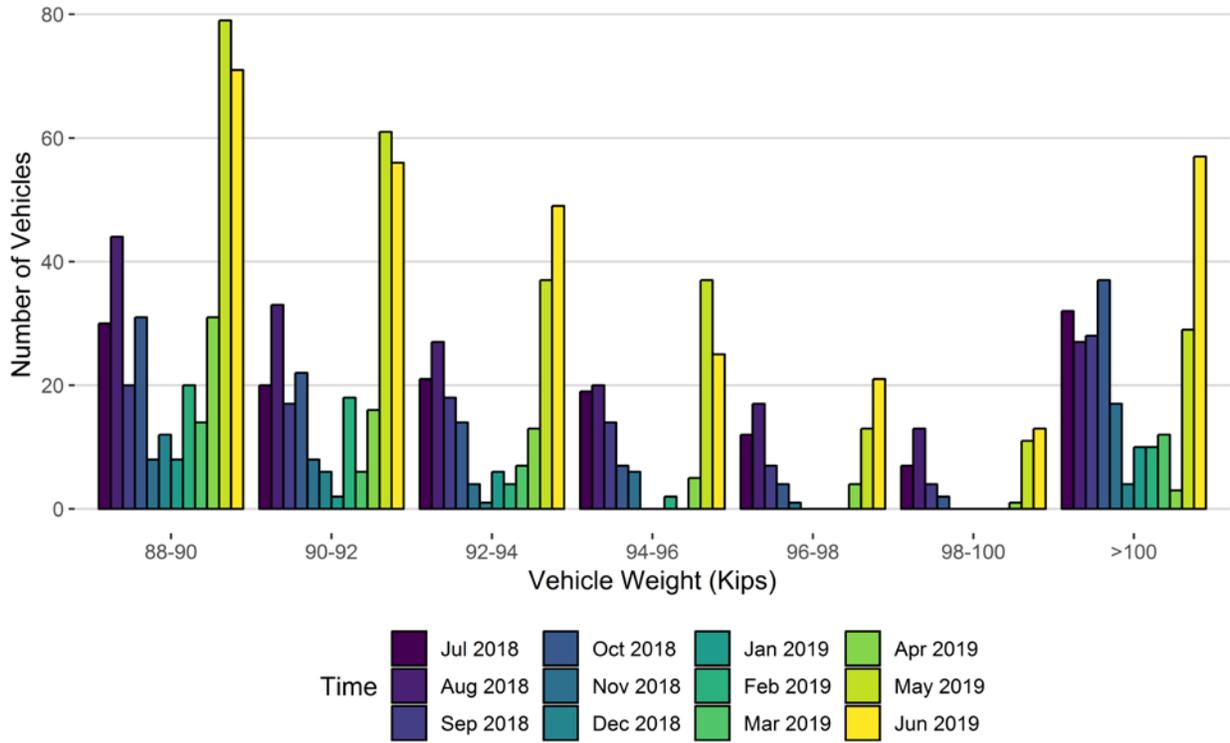


Figure 8 - Histogram of NB Vehicles Over 88,000 Pounds for Current Month



Vehicle Weights (Kips)	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019
88-90	28	19	11	11	9	13	36	28	33	22	27	34
90-92	13	12	16	6	3	4	10	18	17	14	23	28
92-94	6	11	11	3	8	2	6	6	12	4	20	21
94-96	6	5	4	2	4	4	0	8	8	2	10	24
96-98	3	6	1	0	2	1	2	2	2	0	11	19
98-100	3	0	0	2	4	1	0	4	2	1	9	23
>100	23	15	20	33	19	14	4	12	28	6	23	64
Total	82	68	63	57	49	39	58	78	102	49	123	213

Figure 8 - Histogram of SB Vehicles Over 88,000 Pounds for Current Month



Vehicle Weights (Kips)	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	Jun 2019
88-90	30	44	20	31	8	12	8	20	14	31	79	71
90-92	20	33	17	22	8	6	2	18	6	16	61	56
92-94	21	27	18	14	4	1	6	4	7	13	37	49
94-96	19	20	14	7	6	0	0	2	0	5	37	25
96-98	12	17	7	4	1	0	0	0	0	4	13	21
98-100	7	13	4	2	0	0	0	0	0	1	11	13
>100	32	27	28	37	17	4	10	10	12	3	29	57
Total	141	181	108	117	44	23	26	54	39	73	267	292

Figure 8 - Class 9's and 10's by Direction vs Gross Vehicle Weight

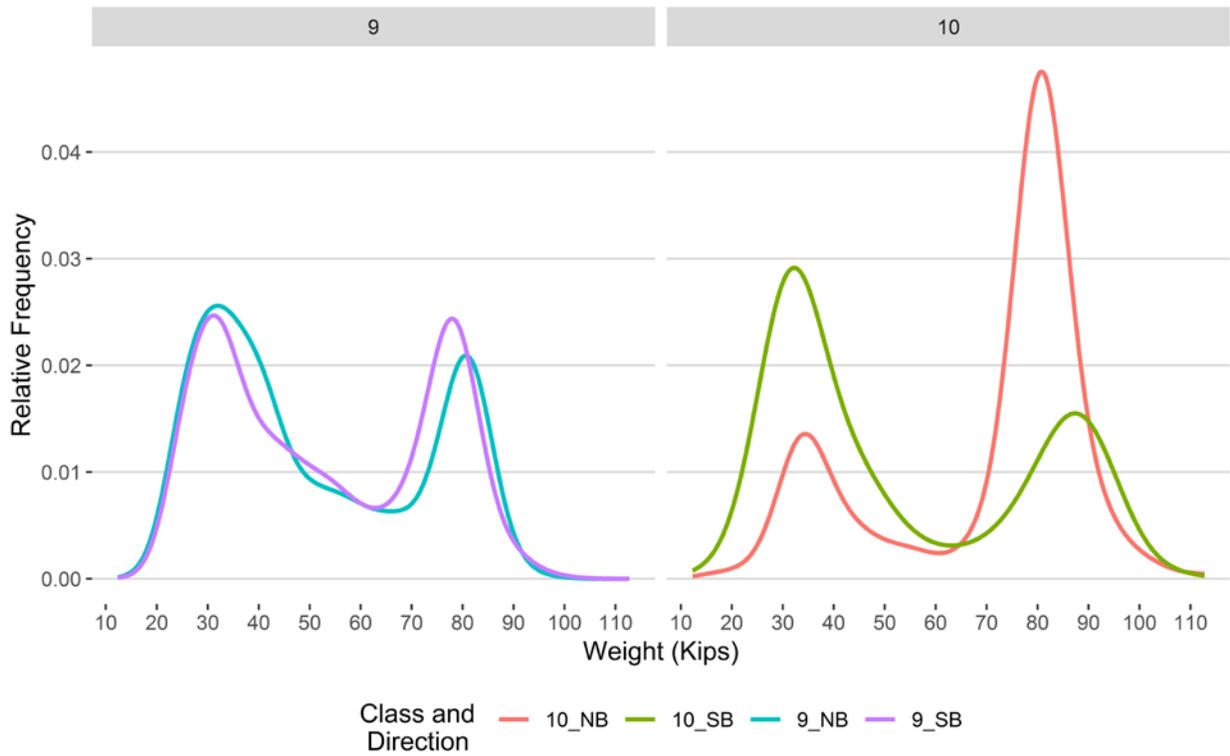


Figure 9 - Freight Percentage by Direction and Class

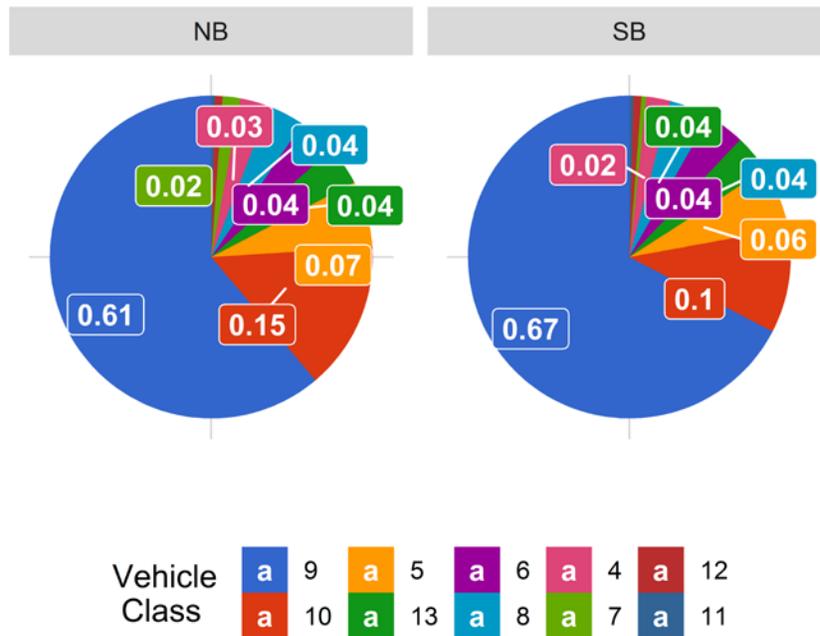


Figure 10 - Total Gross Vehicle Weight Percentage by Class and Lane

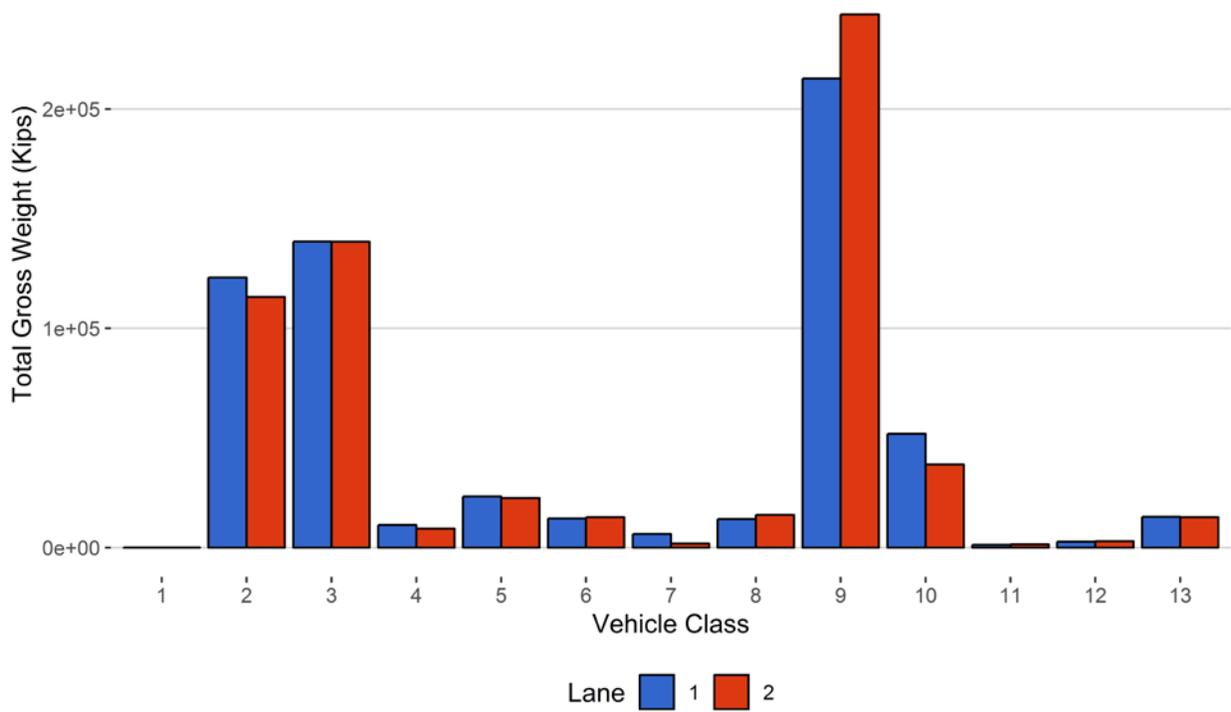


Figure 11 - Total Gross Vehicle Weight t

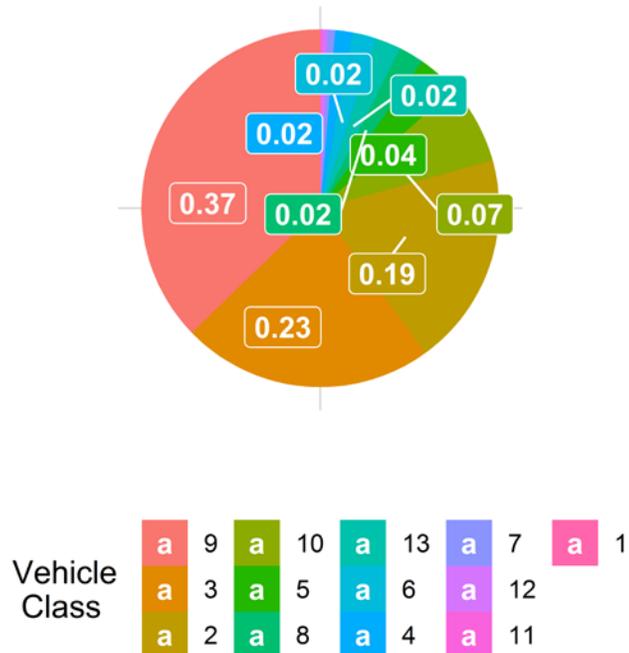


Figure 12 - Total ESALs by Class and Lane

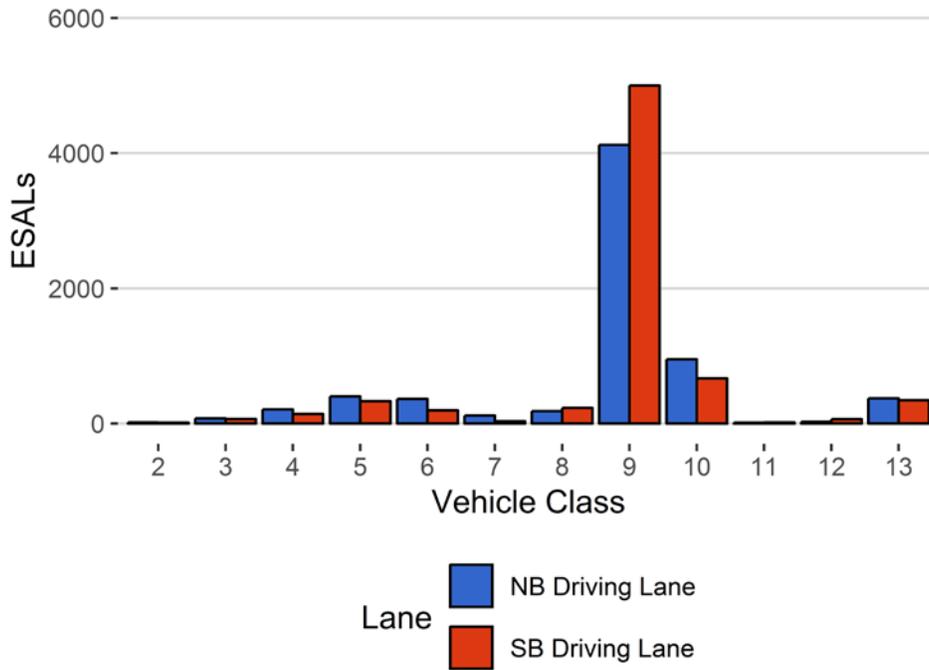


Figure 13 - ESALs by Class

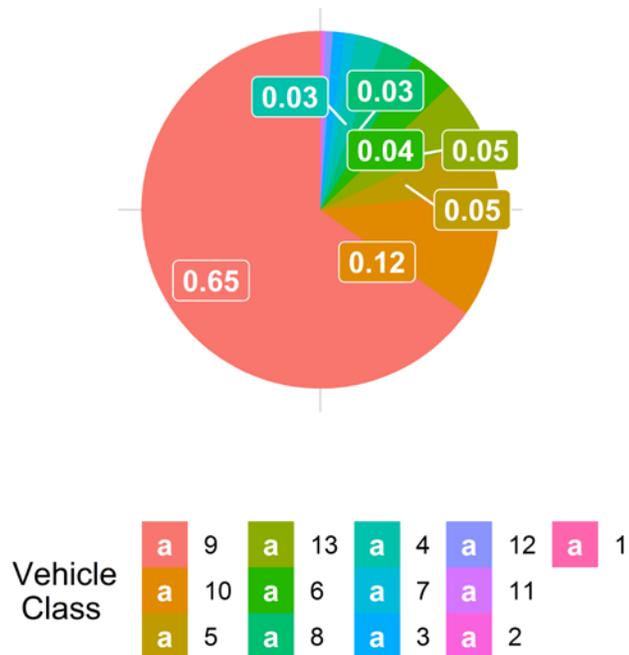


Table 1 Class 9 Front Axle Weight by Lane

<i>Month</i>	<i>Lane 1 (Kips)</i>	<i>Front Axle +/- 9%</i>	<i>Lane 2 (Kips)</i>	<i>Front Axle +/- 9%</i>
July 2015	11.97	0.00	12.29	0.00
August 2015	11.98	0.10	12.18	-0.91
September 2015	11.67	-2.43	12.07	-1.82
October 2015	11.20	-6.43	11.68	-4.95
November 2015	11.28	-5.69	11.29	-8.10
December 2015	11.05	-7.65	10.84	-11.75
January 2016	11.02	-7.92	10.70	-12.91
February 2016	11.21	-6.33	10.71	-12.81
March 2016	11.22	-6.23	11.27	-8.26
April 2016	11.28	-5.77	11.45	-6.85
May 2016	11.51	-3.81	11.82	-3.79
June 2016	11.70	-2.21	11.95	-2.75
July 2016	11.88	-0.72	11.79	-4.08
August 2016	11.77	-1.61	12.12	-1.39
September 2016	11.47	-4.10	11.88	-3.32
October 2016	11.17	-6.65	11.47	-6.67
November 2016	11.11	-7.15	11.31	-7.94
December 2016	11.10	-7.19	10.73	-12.70
January 2017	11.07	-7.51	10.58	-13.92
February 2017	11.14	-6.94	10.73	-12.67
March 2017	11.08	-7.37	11.01	-10.37
April 2017	11.29	-5.67	11.47	-6.64
May 2017	11.32	-5.43	11.60	-5.59
June 2017	11.70	-2.21	11.91	-3.10
July 2017	11.77	-1.60	12.10	-1.55
August 2017	11.61	-2.96	11.96	-2.66
September 2017	11.36	-5.08	11.80	-4.01
October 2017	11.05	-7.67	11.33	-7.77
November 2017	10.75	-10.18	10.90	-11.32
December 2017	10.73	-10.32	10.61	-13.69
January 2018	10.81	-9.63	10.35	-15.81
February 2018	10.64	-11.04	10.27	-16.40
March 2018	10.80	-9.75	10.87	-11.58
April 2018	10.94	-8.59	10.99	-10.55
May 2018	11.19	-6.45	11.56	-5.93
June 2018	11.21	-6.30	11.63	-5.38
July 2018	11.43	-4.50	11.88	-3.33
August 2018	11.33	-5.34	11.66	-5.13
September 2018	11.18	-6.55	11.59	-5.68

October 2018	10.76	-10.10	11.06	-10.01
November 2018	10.54	-11.89	10.32	-16.01
December 2018	10.63	-11.16	10.16	-17.30
January 2019	10.45	-12.69	9.92	-19.28
February 2019	10.45	-12.65	9.84	-19.93
March 2019	10.65	-10.95	10.26	-16.54
April 2019	10.79	-9.84	11.04	-10.18
May 2019	10.58	-11.61	11.09	-9.79
June 2019	11.02	-7.90	11.18	-9.06

Table 2 Vehicle Classification Data

<i>Vehicle Class</i>	<i>Monthly Average Daily Volume</i>	<i>Monthly Total Volume</i>	<i>Monthly Total Volume Percentage</i>	<i>Monthly Total Overweight Vehicles</i>	<i>Monthly Total Overweight Percentage</i>
1	2	64	0.1	0	0
2	1895	56841	50.3	0	0
3	1319	39558	35	0	0
4	21	632	0.6	31	1.1
5	104	3123	2.8	109	3.8
6	31	922	0.8	93	3.3
7	5	149	0.1	38	1.3
8	30	908	0.8	54	1.9
9	296	8875	7.9	1728	60.4
10	49	1466	1.3	564	19.7
11	2	69	0.1	0	0
12	3	89	0.1	12	0.4
13	9	280	0.2	230	8
TOTAL	3766	112977	100	2859	100

Table 3 Top 10 Gross Vehicle Weight, Class 9 and 10

<i>Date</i>	<i>Day of Week</i>	<i>Time</i>	<i>Vehicle Class</i>	<i>Direction</i>	<i>Lane</i>	<i>GVW (lbs)</i>
2019-06-02	Sunday	04:30:41	10	NB	1	126.81
2019-06-30	Sunday	09:45:35	10	NB	1	112.75
2019-06-20	Thursday	16:47:19	10	NB	1	112.36
2019-06-30	Sunday	05:44:19	10	NB	1	112.03
2019-06-11	Tuesday	13:40:28	10	SB	2	108.95
2019-06-17	Monday	16:01:17	10	SB	2	107.22
2019-06-17	Monday	12:42:19	10	SB	2	105.83
2019-06-01	Saturday	04:52:29	10	NB	1	104.41
2019-06-04	Tuesday	05:47:49	10	NB	1	103.87
2019-06-05	Wednesday	06:34:20	10	NB	1	103.53

Table 4 Freight Summary

<i>Vehicle Class</i>	<i>Direction</i>	<i>Weight of Empty Vehicle (Kips)</i>	<i>Total Number of Vehicles</i>	<i>Number of Empty Vehicles</i>	<i>Percentage of Empty Vehicles</i>	<i>Total Weight of Vehicles with Freight (Kips)</i>	<i>Total Weight of Empty Vehicles (Kips)</i>	<i>Total Weight of Freight (Tons)</i>
4	NB	15	313	26	8.3	9930	348	2812
5	NB	8	1530	50	3.3	22863	375	5511
6	NB	19	393	42	10.7	12538	723	2935
7	NB	11.5	111	0	0	6197	0	2460
8	NB	31	421	202	48	8466	4515	839
9	NB	33	4179	1091	26.1	183486	30445	40791
10	NB	33.5	736	66	9	49858	2018	13706
11	NB	36.5	34	15	44.1	923	354	115
12	NB	36.5	47	2	4.3	2614	59	486
13	NB	31.5	133	0	0	14000	0	4905
TOTAL	****	****	7897	1494	****	310875	****	74561
<i>Vehicle Class</i>	<i>Direction</i>	<i>Weight of Empty Vehicle (Kips)</i>	<i>Total Number of Vehicles</i>	<i>Number of Empty Vehicles</i>	<i>Percentage of Empty Vehicles</i>	<i>Total Weight of Vehicles with Freight (Kips)</i>	<i>Total Weight of Empty Vehicles (Kips)</i>	<i>Total Weight of Freight (Tons)</i>
4	SB	15	309	33	10.7	8213	431	2037
5	SB	8	1545	94	6.1	21857	704	5124
6	SB	19	515	86	16.7	12333	1494	2091
7	SB	11.5	36	0	0	1792	0	689
8	SB	31	473	205	43.3	10455	4455	1073
9	SB	33	4560	1148	25.2	210748	32454	49076
10	SB	33.5	708	257	36.3	30109	7782	7500
11	SB	36.5	34	12	35.3	1185	257	191
12	SB	36.5	41	1	2.4	2874	25	707
13	SB	31.5	143	0	0	13822	0	4659
TOTAL	****	****	8364	1836	****	313389	****	73148
GRAND TOTAL	****	****	16261	3330	330	624264	86441	147709

Table 5 Gross Vehicle Weight by Class and Lane

<i>Vehicle Class</i>	<i>NB</i>	<i>SB</i>	<i>Total</i>	<i>Percentage</i>
1	49	40	89	0
2	123114	114289	237403	19.3
3	139597	139506	279103	22.7
4	10278	8644	18923	1.5
5	23238	22561	45799	3.7
6	13261	13827	27089	2.2
7	6197	1792	7989	0.7
8	12982	14909	27891	2.3
9	213931	243202	457133	37.2
10	51876	37891	89767	7.3
11	1276	1442	2718	0.2
12	2673	2900	5573	0.5
13	14000	13822	27823	2.3
TOTAL	612473	614826	1227300	100
GVW/LANE	49.9	50.1	100	0.01

Table 6 ESALs by Class and Lane and Flexible ESAL Factors

<i>Vehicle Class</i>	<i>NB</i>	<i>SB</i>	<i>Total</i>	<i>Percentage</i>	<i>Flexible ESAL Factor</i>
1	0	0	0	0	0.0156
2	17	15	32	0.2	0.0012
3	76	70	146	1.1	0.0076
4	210	142	352	2.5	1.13
5	404	332	736	5.3	0.48
6	366	196	562	4	1.24
7	120	35	155	1.1	2.06
8	186	234	420	3	0.94
9	4123	5000	9123	65.2	2.09
10	953	669	1622	11.6	2.25
11	14	20	34	0.2	1
12	27	65	93	0.7	1.98
13	375	347	722	5.2	5.06
TOTAL	6873	7125	13998	100	18
ESALS/LANE	49.1	50.9	100	-	-

Table 7 Site Summary: Volume and Vehicle Class

<i>Month</i>	<i>Total Volume</i>	<i>Monthly ADT</i>	<i>Monthly HCADT</i>	<i>Passenger Vehicles</i>	<i>Passenger Vehicles %</i>	<i>Heavy Commercial Vehicles</i>	<i>Heavy Commercial Vehicles %</i>
Jul 2018	113876	3673	505	98216	86.2	15660.3	13.8
Aug 2018	116576	3760	558	99287	85.2	17289.3	14.8
Sep 2018	104355	3478	463	90479	86.7	13875.8	13.3
Oct 2018	108346	3495	550	91301	84.3	17045.5	15.7
Nov 2018	100582	3353	542	84315	83.8	16266.5	16.2
Dec 2018	89419	2884	461	75130	84	14289	16
Jan 2019	82665	2667	496	67282	81.4	15383.3	18.6
Feb 2019	69157	2470	423	57312	82.9	11844.7	17.1
Mar 2019	88959	2870	407	76331	85.8	12627.9	14.2
Apr 2019	93990	3133	460	80204	85.3	13785.9	14.7
May 2019	114550	3636	595	96108	83.9	18442.1	16.1
Jun 2019	112977	3766	550	96463	85.4	16514	14.6
TOTAL	1195452	-	-	1012428	-	183024	-
AVERAGE	99621	3266	501	84369	85	15252	15

ESALS

<i>Month</i>	<i>ESALS NB Driving Lane</i>	<i>ESALS SB Driving Lane</i>	<i>Total ESALS</i>	<i>Pavement Life Decrease Months</i>
Jul 2018	5036	6999	12035	7.3
Aug 2018	5266	6869	12135	11
Sep 2018	4097	5652	9749	5.7
Oct 2018	4788	6405	11193	3.8
Nov 2018	4625	5107	9731	3.1
Dec 2018	4765	3913	8678	0.9
Jan 2019	9248	10139	19387	0.5
Feb 2019	6067	7070	13137	1.1
Mar 2019	5206	6163	11368	1.6
Apr 2019	3287	4734	8021	3.5
May 2019	5574	8427	14001	11.1
Jun 2019	7594	7207	14801	9.3
TOTAL	65553	-	-	-
AVERAGE	5463	6557	12020	5

Gross Vehicle Weight

<i>Month</i>	<i>GVW NB Driving Lane</i>	<i>GVW SB Driving Lane</i>	<i>Total GVW Kips</i>
Jul 18	558833	625054	1183887
Aug 18	583793	652111	1235903
Sep 18	502142	546473	1048616
Oct 18	543677	598248	1141925
Nov 18	532437	542085	1074522
Dec 18	495872	461558	957430
Jan 19	947836	926640	1874476
Feb 19	716071	747761	1463832
Mar 19	676622	693176	1369798
Apr 19	442890	492577	935467
May 19	590185	669683	1259868
Jun 19	613332	615581	1228913
TOTAL	7203691	7570946	14774636
AVERAGE	600308	630912	1231220

Overweight Vehicles

<i>Month</i>	<i>Total Number of Overweight Vehicles</i>	<i>Overweight / Total Volume</i>	<i>Overweight / Heavy Commercial Volume</i>	<i>Number Over 88,000 lbs</i>	<i>Number Over 98,000 lbs</i>
Jul 2018	1960	1.7	12.5	223	65
Aug 2018	1779	1.5	10.3	252	57
Sep 2018	1177	1.1	8.5	171	52
Oct 2018	1281	1.2	7.5	177	77
Nov 2018	901	0.9	5.6	94	40
Dec 2018	880	1	6.2	62	19
Jan 2019	1448	0.9	4.8	88	16
Feb 2019	1226	0.9	5.3	134	28
Mar 2019	868	0.6	4.2	141	42
Apr 2019	661	0.7	4.9	122	11
May 2019	2320	2.1	12.7	393	73
Jun 2019	2874	2.6	17.6	508	160
TOTAL	17375	-	-	2365	640
AVERAGE	1447.9	1.3	8.3	197.1	53.3

Freight

<i>Month</i>	<i>NB Freight Tons</i>	<i>SB Freight Tons</i>	<i>Total Freight</i>	<i>NB Freight %</i>	<i>SB Freight %</i>
Jul 2018	56615	72870	129484	43.7	56.3
Aug 2018	60703	72416	133119	45.6	54.4
Sep 2018	49651	61569	111220	44.6	55.4
Oct 2018	55838	73026	128864	43.3	56.7
Nov 2018	60616	62469	123084	49.2	50.8
Dec 2018	63052	47873	110925	56.8	43.2
Jan 2019	120303	105614	225917	53.3	46.7
Feb 2019	73668	93172	166840	44.2	55.8
Mar 2019	65149	73470	138619	47	53
Apr 2019	43211	58172	101383	42.6	57.4
May 2019	62585	91602	154187	40.6	59.4
Jun 2019	74561	73148	147709	50.5	49.5
TOTAL	785951	885400	1671352	-	-
AVERAGE	65495.9	73783.4	139279.3	46.8	53.2