

## **5. CLASSIFIER RESULTS**

### **5.1 OVERVIEW OF GENERAL RESULTS**

In Section 5.2, the results of the comparison of the individual vehicle-by-vehicle classifier outputs to the ground truth (from videotape) data are presented and discussed. The results will be discussed for each of the two 48-hour testing sessions. The results presented here include classification, axle spacing measurement, wheelbase measurement, and overall length measurement accuracy. The results for the whole tests as well as the parametric results versus percent trucks, air temperature, and pavement temperature are presented for each classifier.

In Section 5.3, the parametric results versus percent trucks, air temperature, and pavement temperature are summarized for all the classifiers and tests. General trends of performance are presented and discussed.

### **5.2 TEST RESULTS FROM INDIVIDUAL CLASSIFIERS**

The results of each classifier model and sensor configuration for each of the two 48-hour tests are presented in the following subsections. The overall classification matrix for each is depicted as well as table demonstrating the parametric results.

### 5.2.1 Mikros Systems TEL-2CM

The Mikros Systems model TEL-2CM classifier used an L-P-L sensor configuration and Philips Vibracoax piezoelectric axle sensors. The results for the individual tests are presented below.

#### 5.2.1.1 First 48-Hour Test

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 26. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 70.3% of the vehicles (82.5% if class 2-3 errors not included). The number of vehicle axles was miscounted 13.91% (percent sensor errors) of the time. Less than 1.0% of the vehicles classified by the Mikros equipment were suspected to be the result of a split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 27. The Mikros classifier measures axles spacings, wheelbase and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table II contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	3318	15	0	142	0	0	0	0	0	0	0	0	0	0
3	7	953	319	1	893	1	0	34	1	0	0	0	0	0	0
4	0	0	0	13	10	6	0	0	0	0	0	0	0	0	0
5	0	9	9	4	273	3	0	6	5	0	0	0	0	0	0
6	0	1	1	2	0	166	8	2	4	3	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	3	0	2	2	0	0	115	4	0	0	0	0	0	0
9	0	3	0	0	0	0	0	3	1329	153	0	0	8	0	0
10	0	0	0	0	0	0	0	0	5	10	0	0	1	0	0
11	0	0	0	0	0	0	0	1	1	0	49	0	0	0	0
12	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	1	1	0	0	0	0	11	1	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.0100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	95.5	0.4	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.3	43.1	14.4	0.0	40.4	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	44.8	34.5	20.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	2.9	2.9	1.3	88.3	1.0	0.0	1.9	1.6	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.5	0.5	1.1	0.0	88.8	4.3	1.1	2.1	1.6	0.0	0.0	0.0	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	2.4	0.0	1.6	1.6	0.0	0.0	91.3	3.2	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	88.8	10.2	0.0	0.0	0.5	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.2	62.5	0.0	0.0	6.2	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	96.1	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0100.0	0.0	0.0	0.0	0.0	0.0
13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	7.1	7.1	0.0	0.0	0.0	0.0	78.6	7.1	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 18299  
 #Vendor: 8476  
 #mistyped: 2357  
 #sensor err: 1106  
 #extra Vend: 402  
 #Missing Vend: 10283  
 #Correct: 5592  
 #Splits: 61  
 #Combinations: 3

Figure 26. Classification Matrix for Mikros Systems TEL-2CM  
 1st 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	10.818	11.181	6	18
30.0-34.9	0.000	0.000	0	0
35.0-39.9	0.513	0.496	3	4
40.0-44.9	0.441	0.799	11	23
45.0-49.9	0.180	0.441	12	25
50.0-54.9	0.159	0.368	206	482
55.0-59.9	0.143	1.162	710	1577
60.0-64.9	0.083	0.988	1735	3777
65.0-69.9	0.045	0.706	1530	2661
70.0-74.9	0.009	0.526	631	872
75.0-79.9	0.030	0.299	152	168
>80	-0.130	0.578	18	19
Overall	0.099	1.113	5014	9626

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	39.353	27.719	6
30.0-34.9	0.000	0.000	0
35.0-39.9	3.787	2.020	3
40.0-44.9	3.344	2.570	11
45.0-49.9	3.053	1.725	12
50.0-54.9	3.253	1.989	206
55.0-59.9	2.764	2.225	710
60.0-64.9	2.329	1.979	1735
65.0-69.9	1.701	1.669	1530
70.0-74.9	1.186	1.868	631
75.0-79.9	0.925	1.074	152
>80	0.477	0.673	18
Overall	2.093	2.549	5014

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	32.455	23.527	6
30.0-34.9	0.000	0.000	0
35.0-39.9	0.683	0.489	3
40.0-44.9	0.921	1.323	11
45.0-49.9	0.376	0.371	12
50.0-54.9	0.372	0.874	206
55.0-59.9	0.316	0.921	710
60.0-64.9	0.180	1.025	1735
65.0-69.9	0.079	0.787	1530
70.0-74.9	0.012	0.585	631
75.0-79.9	0.033	0.376	152
>80	-0.137	0.714	18
Overall	0.191	1.637	5014

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	707.43	432.02	6
30.0-34.9	0.000	0.000	0
35.0-39.9	118.802	8.723	3
40.0-44.9	113.416	14.954	11
45.0-49.9	111.109	7.331	12
50.0-54.9	111.339	7.713	206
55.0-59.9	109.764	11.145	710
60.0-64.9	107.675	5.616	1735
65.0-69.9	107.137	6.382	1530
70.0-74.9	106.106	7.773	631
75.0-79.9	105.907	7.457	152
>80	103.09	4.32	18
Overall	108.43	26.62	5014

Figure 27. Measurement Accuracy Versus Speed (MPH)  
Mikros TEL-2CM - 1st 48-Hour Test

**Table II. Accuracy Summary for Mikros Systems TEL-2CM  
1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	13.91	70.3	82.5	0.099	1.113	2.093	2.549	108.43	26.62
<b>% Trucks</b>									
0-20	13.57	67.4	82.5	0.099	1.035	1.716	1.657	107.84	7.05
20-40	13.93	70.8	82.1	0.101	1.204	2.121	2.811	108.80	31.73
40-60	14.86	77.6	86.8	0.091	0.672	2.679	2.027	107.04	5.684
60-80	12.09	78.0	83.5	0.129	0.634	3.351	1.990	107.63	5.838
<b>Air Temp</b>									
50-59	14.87	66.9	83.7	0.117	0.767	2.172	2.418	108.84	26.77
60-69	15.45	71.2	82.6	0.115	0.985	2.403	2.916	108.34	29.81
70-79	13.14	72.7	83.1	0.101	1.322	2.140	2.864	108.42	33.04
80-89	13.25	70.1	81.5	0.080	1.181	1.918	2.240	108.30	20.61
<b>Pav Temp</b>									
60- 69	13.63	69.8	84.6	0.084	0.512	2.421	1.906	108.32	6.63
70- 79	15.94	70.6	82.6	0.112	0.992	2.342	2.965	108.40	31.53
80- 89	12.83	72.6	83.1	0.131	1.338	2.238	3.360	109.36	41.40
90- 99	11.78	71.9	81.8	0.084	1.002	2.187	2.651	108.95	32.37
100-109	12.38	72.9	83.9	0.091	2.033	1.791	1.719	107.71	7.109
110-119	14.29	69.2	81.0	0.061	0.993	1.813	1.966	107.64	6.97

### 5.2.1.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 28. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 63.5% of the vehicles (78.8% if class 2-3 errors not included). The number of vehicle axles was miscounted 4.81% (percent sensor errors) of the time. Approximately 1.7% of the vehicles classified by the Mikros equipment were suspected to be the result of a split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 29. The Mikros classifier measures axles spacings, wheelbase and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table III contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	7	0	0	0	0	0	1	0	0	0	0	0	0	0
2	1	3381	46	4	324	4	0	19	55	2	0	0	0	0	0
3	0	1074	286	9	799	6	0	57	44	3	0	0	0	0	0
4	0	4	0	14	0	3	0	0	0	0	0	0	0	0	0
5	0	17	5	17	79	1	0	7	8	1	0	0	0	0	0
6	0	11	1	0	3	20	0	0	2	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	8	1	0	3	0	0	39	3	0	0	0	0	0	0
9	0	71	5	1	16	0	0	1	800	13	1	0	0	0	0
10	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
11	0	2	0	0	0	0	0	0	0	0	27	0	0	0	0
12	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	11.1	77.8	0.0	0.0	0.0	0.0	0.0	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	88.1	1.2	0.1	8.4	0.1	0.0	0.5	1.4	0.1	0.0	0.0	0.0	0.0	0.0
3	0.0	47.1	12.6	0.4	35.1	0.3	0.0	2.5	1.9	0.1	0.0	0.0	0.0	0.0	0.0
4	0.0	19.0	0.0	66.7	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	12.6	3.7	12.6	58.5	0.7	0.0	5.2	5.9	0.7	0.0	0.0	0.0	0.0	0.0
6	0.0	29.7	2.7	0.0	8.1	54.1	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	14.8	1.9	0.0	5.6	0.0	0.0	72.2	5.6	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	7.8	0.6	0.1	1.8	0.0	0.0	0.1	88.1	1.4	0.1	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	50.0	0.0	0.0
11	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.1	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

#Real: 20107  
 #Vendor: 9076  
 #mistyped: 2676  
 #sensor err: 352  
 #extra Vend: 1611  
 #Missing Vend: 12546  
 #Correct: 4648  
 #Splits: 15  
 #Combinations: 117

Figure 28. Classification Matrix for Mikros Systems TEL-2CM  
 2nd 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	11.359	9.308	3	12
30.0-34.9	0.070	0.000	1	1
35.0-39.9	0.000	0.000	0	0
40.0-44.9	-0.030	0.000	1	1
45.0-49.9	0.038	0.250	14	17
50.0-54.9	0.103	0.621	176	342
55.0-59.9	0.108	0.777	541	1043
60.0-64.9	-0.016	0.895	1277	2265
65.0-69.9	-0.093	0.744	1477	2208
70.0-74.9	-0.144	0.550	807	1004
75.0-79.9	-0.132	0.874	274	305
>80	-0.414	1.309	46	49
Overall	-0.022	0.988	4617	7247

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	52.643	3.020	3
30.0-34.9	-3.240	0.000	1
35.0-39.9	0.000	0.000	0
40.0-44.9	-0.420	0.000	1
45.0-49.9	-1.651	2.395	14
50.0-54.9	-2.497	3.907	176
55.0-59.9	-1.938	3.407	541
60.0-64.9	-2.142	3.931	1277
65.0-69.9	-2.334	3.249	1477
70.0-74.9	-2.165	4.382	807
75.0-79.9	-2.186	4.410	274
>80	-2.647	3.827	46
Overall	-2.167	4.031	4617

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	45.440	3.691	3
30.0-34.9	0.070	0.000	1
35.0-39.9	0.000	0.000	0
40.0-44.9	-0.030	0.000	1
45.0-49.9	0.047	0.237	14
50.0-54.9	0.199	0.857	176
55.0-59.9	0.208	1.176	541
60.0-64.9	-0.029	1.166	1277
65.0-69.9	-0.138	1.065	1477
70.0-74.9	-0.179	0.739	807
75.0-79.9	-0.147	1.001	274
>80	-0.441	2.098	46
Overall	-0.035	1.581	4617

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	797.02	174.35	3
30.0-34.9	84.571	0.022	1
35.0-39.9	0.000	0.000	0
40.0-44.9	97.375	0.000	1
45.0-49.9	91.924	11.376	14
50.0-54.9	90.844	13.006	176
55.0-59.9	92.207	11.494	541
60.0-64.9	91.828	25.673	1277
65.0-69.9	89.888	12.344	1477
70.0-74.9	90.659	31.711	807
75.0-79.9	89.547	21.132	274
>80	88.01	12.46	46
Overall	91.29	28.32	4617

Figure 29. Measurement Accuracy Versus Speed (MPH)  
 MIKROS TEL-2CM - 2nd 48-Hour Test



**Table III. Accuracy Summary for Mikros Systems TEL-2CM  
2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	4.81	63.5	78.8	-0.022	0.988	-2.167	4.031	91.29	28.32
<b>% Trucks</b>									
0-20	4.06	62.7	78.7	-0.002	0.995	-2.277	3.872	90.46	27.95
20-40	7.62	65.2	78.5	-0.065	0.999	-1.837	4.524	93.77	29.97
40-60	0.00	78.9	84.6	-0.116	0.432	-0.717	1.594	98.09	06.09
<b>Air Temp</b>									
60-69	2.32	66.5	80.4	-0.033	0.887	-1.955	3.925	92.72	29.24
70-79	7.30	60.5	77.0	-0.024	1.020	-2.305	4.156	90.29	24.36
80-89	1.62	65.7	81.2	0.046	1.400	-2.392	3.770	90.22	42.90
<b>Pav Temp</b>									
60- 69	00.83	67.6	79.5	-0.049	1.023	-1.28	4.332	96.63	42.44
70- 79	03.50	67.3	81.5	-0.028	1.014	-2.004	4.652	92.95	30.77
80- 89	08.63	60.9	77.7	0.003	0.857	-2.441	4.193	89.99	18.38
90- 99	12.46	53.9	73.6	-0.025	1.263	-2.719	3.613	87.83	13.33
100-109	05.21	62.3	78.2	-0.033	0.605	-2.362	3.008	89.09	12.03
110-119	00.96	65.2	79.9	0.011	1.034	-2.502	3.389	88.87	29.16

5.2.1.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table IV. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last full days recorded of the seven days.

**Table IV. Long-Term Count/Classification Accuracy  
Mikros Systems TEL-2CM**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	26995	23717	3278	113.82	108.23	113.59
Axes	65759	57450	8309	114.46	109.02	114.65
Class 1	53	6	47	883.33	700.00	550.00
Class 2	13919	14533	-614	95.78	91.02	95.04
Class 3	8645	1168	7477	740.15	660.45	989.27
Class 4	75	161	-86	46.58	59.57	21.54
Class 5	671	4263	-3592	15.74	12.05	25.66
Class 6	196	163	33	120.25	125.64	117.89
Class 7	2	0	2	--	--	--
Class 8	220	530	-310	41.51	45.45	84.87
Class 9	3073	2679	394	114.71	110.12	116.27
Class 10	27	140	-113	19.29	18.60	23.81
Class 11	88	69	19	127.54	117.24	129.41
Class 12	26	0	26	--	--	--
Class 13	0	5	-5	0.00	0.00	0.00
Class 15	0	0	0	--	--	--

## 5.2.2 Peek Traffic Inc. TrafiCOMP III

The Peek Traffic Inc. model TrafiCOMP III classifier used a P-L-P sensor configuration and Philips Vibracoax piezoelectric axle sensors. The results of the individual tests are presented below.

### 5.2.2.1 First 48-Hour Test

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 30. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 75.3% of the vehicles (93.0% if class 2-3 errors not included). The number of vehicle axles was miscounted 3.71% (percent sensor errors) of the time. Note that the TrafiCOMP III output was *not* time stamped with seconds and manual aligning of the data was required. Therefore, identification of splits and combinations could not be accomplished.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 31. The TrafiCOMP III classifier measures axles spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table V contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3
2	10	6682	31	0	3	1	0	5	0	0	0	0	0	0	58
3	8	2826	1550	0	29	0	0	79	1	0	0	0	0	0	41
4	0	0	2	47	9	6	0	1	0	0	0	0	0	0	0
5	2	26	173	60	331	0	0	40	0	0	0	0	0	0	15
6	0	0	2	4	5	415	0	3	8	0	0	0	0	0	2
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	2	0	0	0	0	280	1	0	0	0	0	0	3
9	1	0	1	1	0	4	0	349	2673	0	0	0	0	0	133
10	0	0	0	0	0	0	0	1	9	20	0	0	0	0	3
11	0	0	0	0	0	0	0	0	1	0	84	0	0	0	2
12	0	0	0	0	0	0	0	0	0	0	0	27	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	1	2	0	0	1	0	4	4	0	0	1	0	0	21

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0
2	0.1	98.4	0.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9
3	0.2	62.3	34.2	0.0	0.6	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.9
4	0.0	0.0	3.1	72.3	13.8	9.2	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.3	4.0	26.7	9.3	51.2	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	2.3
6	0.0	0.0	0.5	0.9	1.1	94.5	0.0	0.7	1.8	0.0	0.0	0.0	0.0	0.0	0.5
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.7	0.0	0.0	0.0	0.0	97.9	0.3	0.0	0.0	0.0	0.0	0.0	1.0
9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	11.0	84.5	0.0	0.0	0.0	0.0	0.0	4.2
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	27.3	60.6	0.0	0.0	0.0	0.0	9.1
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	96.6	0.0	0.0	0.0	2.3
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0100.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0100.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	2.9	5.9	0.0	0.0	2.9	0.0	11.8	11.8	0.0	0.0	2.9	0.0	0.0	61.8

#Real: 16120  
 #Vendor: 16120  
 #mistyped: 3987  
 #sensor err: 598  
 #extra Vend: 0  
 #Missing Vend: 0  
 #Correct: 12133  
 #Splits: 0  
 #Combinations: 0

Figure 30. Classification Matrix for Peek TrafiCOMP III  
 1st 48-Hour Test

**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	7.506	7.256	4	5
30.0-34.9	0.140	0.100	2	2
35.0-39.9	0.203	0.160	6	11
40.0-44.9	0.260	0.303	18	36
45.0-49.9	0.175	0.246	68	132
50.0-54.9	0.166	0.291	427	897
55.0-59.9	0.193	0.371	1646	3494
60.0-64.9	0.164	0.432	4867	10307
65.0-69.9	0.162	0.270	3366	4965
70.0-74.9	0.186	0.150	1295	1316
75.0-79.9	0.191	0.144	321	321
>80	0.170	0.101	34	34
Overall	0.172	0.399	12054	21520

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	9.382	16.119	4
30.0-34.9	0.140	0.100	2
35.0-39.9	0.372	0.144	6
40.0-44.9	0.519	0.380	18
45.0-49.9	0.340	0.310	68
50.0-54.9	0.349	0.408	427
55.0-59.9	0.409	0.569	1646
60.0-64.9	0.347	0.628	4867
65.0-69.9	0.238	0.320	3366
70.0-74.9	0.189	0.149	1295
75.0-79.9	0.191	0.144	321
>80	0.170	0.101	34
Overall	0.307	0.601	12054

**Figure 31. Measurement Accuracy Versus Speed (MPH)  
Peak TraficOMP III - 1st 48-Hour Test**

**Table V. Accuracy Summary for Peek TrafiCOMP III  
1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	3.71	75.3	93.0	0.172	0.399	*	*	*	*
<b>% Trucks</b>									
0-20	2.58	72.8	93.6	0.195	0.469	*	*	*	*
20-40	3.74	75.4	93.1	0.166	0.394				
40-60	5.46	80.4	90.9	0.159	0.327				
60-80	8.04	79.1	88.2	0.194	0.337				
<b>Air Temp</b>									
50-59	3.54	69.6	91.9	0.151	0.466	*	*	*	*
60-69	4.93	76.8	91.8	0.175	0.387				
70-79	3.88	76.0	92.8	0.181	0.299				
80-89	3.20	76.4	94.0	0.172	0.419				
<b>Pav Temp</b>									
60- 69	4.72	71.6	91.3	0.148	0.483	*	*	*	*
70- 79	4.19	77.5	92.8	0.171	0.380				
80- 89	3.96	77.1	93.8	0.174	0.373				
90- 99	3.66	75.3	92.6	0.161	0.248				
100-109	2.39	76.0	95.0	0.181	0.296				
110-119	3.52	76.7	93.4	0.177	0.508				

\* - Does Not Measure Overall Vehicle Length

### 5.2.2.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 32. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 74.8% of the vehicles (93.2% if class 2-3 errors not included). The number of vehicle axles was miscounted 3.53% (percent sensor errors) of the time. Note that the TrafiCOMP III output was not time stamped with seconds and manual aligning of the data was required. Therefore, identification of splits and combinations could not be accomplished.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 33. The TrafiCOMP III classifier measures axles spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table VI contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
2	93	7438	45	0	2	2	0	3	6	1	1	0	0	0	34
3	59	2926	1483	0	136	4	0	61	2	0	0	0	1	0	45
4	0	0	2	30	5	7	0	0	0	0	0	0	0	0	1
5	3	7	45	48	161	1	0	37	0	1	0	0	0	0	10
6	0	0	2	3	1	182	0	4	3	0	0	0	0	0	0
7	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
8	1	1	1	1	0	1	0	261	0	0	0	0	0	0	7
9	0	5	1	2	3	2	0	286	2398	3	2	0	0	0	134
10	0	0	1	0	0	1	0	1	1	16	0	0	0	0	2
11	1	0	0	0	0	0	0	0	0	0	85	0	0	0	2
12	0	0	0	0	0	0	0	0	0	0	0	27	0	0	0
13	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.2	97.5	0.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.4
3	1.3	62.0	31.4	0.0	2.9	0.1	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.0
4	0.0	0.0	4.4	66.7	11.1	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2
5	1.0	2.2	14.4	15.3	51.4	0.3	0.0	11.8	0.0	0.3	0.0	0.0	0.0	0.0	3.2
6	0.0	0.0	1.0	1.5	0.5	93.3	0.0	2.1	1.5	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7
8	0.4	0.4	0.4	0.4	0.0	0.4	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	2.6
9	0.0	0.2	0.0	0.1	0.1	0.1	0.0	10.1	84.6	0.1	0.1	0.0	0.0	0.0	4.7
10	0.0	0.0	4.5	0.0	0.0	4.5	0.0	4.5	4.5	72.7	0.0	0.0	0.0	0.0	9.1
11	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.6	0.0	0.0	0.0	2.3
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0

#Real: 16158  
 #Vendor: 16158  
 #mistyped: 4072  
 #sensor err: 571  
 #extra Vend: 0  
 #Missing Vend: 0  
 #Correct: 12086  
 #Splits: 0  
 #Combinations: 0

Figure 32. Classification Matrix for Peek TrafficOMP III  
 2nd 48-Hour Test



**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	-0.000	0.000	1	1
30.0-34.9	-0.067	0.178	3	3
35.0-39.9	0.074	0.378	4	7
40.0-44.9	0.055	0.373	23	36
45.0-49.9	0.119	0.343	107	172
50.0-54.9	0.077	0.349	530	1000
55.0-59.9	0.073	0.381	1719	3313
60.0-64.9	0.063	0.381	4747	9383
65.0-69.9	0.053	0.326	3300	4766
70.0-74.9	0.067	0.226	1264	1297
75.0-79.9	0.098	0.191	298	298
>80	0.113	0.217	24	24
Overall	0.064	0.356	12020	20298

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	-0.000	0.000	1
30.0-34.9	-0.067	0.178	3
35.0-39.9	0.130	0.218	4
40.0-44.9	0.087	0.221	23
45.0-49.9	0.192	0.332	107
50.0-54.9	0.146	0.277	530
55.0-59.9	0.141	0.318	1719
60.0-64.9	0.125	0.319	4747
65.0-69.9	0.077	0.263	3300
70.0-74.9	0.069	0.238	1264
75.0-79.9	0.098	0.191	298
>80	0.113	0.217	24
Overall	0.109	0.293	12020

**Figure 33. Measurement Accuracy Versus Speed (MPH)  
Peak TrafficOMP III - 2nd 48-Hour Test**

**Table VI. Accuracy Summary for Peak TrafiCOMP III  
2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
Total	3.53	74.8	93.2	0.064	0.356	*	*	*	*
% Trucks									
0-20	2.96	73.5	93.7	0.069	0.340	*	*	*	*
20-40	3.74	75.6	93.1	0.061	0.361				
40-60	6.09	77.9	89.8	0.069	0.407				
Air Temp									
60-69	4.57	72.3	90.8	0.059	0.364	*	*	*	*
70-79	3.29	75.5	93.8	0.045	0.331				
80-89	2.93	75.9	94.7	0.107	0.389				
Pav Temp									
60- 69	6.24	68.3	88.3	0.061	0.385				
70- 79	3.95	74.8	92.0	0.062	0.347				
80- 89	3.23	76.4	94.1	0.036	0.334	*	*	*	*
90- 99	3.44	74.4	93.9	0.049	0.346				
100-109	2.43	76.1	95.0	0.088	0.365				
110-119	2.91	74.8	93.2	0.069	0.363				

\* - Does Not Measure Overall Vehicle Length

5.2.2.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table VII. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table VII. Long-Term Count/Classification Accuracy  
Peek TraficOMP III**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	64734	62433	2301	103.69	103.02	102.36
Axles	165917	N/A	N/A	N/A	N/A	N/A
Class 1	103	604	-501	17.05	16.05	15.19
Class 2	31124	41126	-10002	75.68	76.58	75.40
Class 3	19417	6377	13040	304.48	292.89	267.08
Class 4	138	283	-145	48.76	31.82	37.21
Class 5	1921	1157	764	166.03	99.43	176.77
Class 6	746	736	10	101.36	100.00	101.64
Class 7	9	4	5	225.00	--	--
Class 8	862	2204	-1342	39.11	47.44	43.95
Class 9	9981	8427	1554	118.44	117.17	118.31
Class 10	109	86	23	126.74	136.36	141.67
Class 11	254	248	6	102.42	100.00	102.27
Class 12	70	77	-7	90.91	100.00	100.00
Class 13	0	36	-36	0.00	--	0.00
Class 15	0	1068	-1068	0.00	0.00	0.00

### 5.2.3 Peek Traffic Inc. GK-6000

The Peek Traffic Inc. model GK-6000 classifier was configured to monitor two lanes each using a P-P sensor configuration and Philips Vibracoax axle sensors. Although configured for two lanes, both sets of sensors were placed in the same lane of traffic (the test lane). The results from both sets of sensors are presented below.

#### 5.2.3.1 First 48-Hour Test

The classification matrices for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figures 34 and 35 for lanes 1 and 2, respectively. The classification matrix is presented in both absolute numbers, and percentages. The classifier designated lane 1 correctly classified 73.7% of the vehicles (90.1% if class 2-3 errors not included). The number of vehicle axles was miscounted 6.29% (percent sensor errors) of the time. The classifier designated lane 2 correctly classified 77.1% of the vehicles (92.4% if class 2-3 errors not included). The number of vehicle axles was miscounted 4.02% (percent sensor errors) of the time. Approximately 2.5% of the vehicles classified by either of the lanes were the result of a suspect split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figures 36 and 37 for lanes 1 and 2, respectively. The GK-6000 classifier measures axle spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Tables VIII and IX contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature for lanes 1 and 2, respectively.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2	3	3444	224	5	32	10	0	15	69	3	1	0	0	0	0
3	4	1393	973	5	58	9	0	26	49	0	0	0	0	0	0
4	0	0	3	32	0	6	0	1	0	0	0	0	0	0	0
5	1	60	103	70	214	2	1	20	12	1	0	0	0	0	0
6	3	18	6	10	1	308	0	1	13	1	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	13	10	5	1	3	4	184	7	0	0	0	0	0	0
9	31	100	36	19	11	18	40	12	2067	0	1	0	1	0	0
10	2	3	0	0	0	0	0	0	4	14	0	0	2	0	0
11	0	1	0	1	0	0	0	1	2	0	33	0	0	0	0
12	0	1	0	0	0	0	0	0	0	0	7	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	2	2	3	2	1	3	1	1	0	0	1	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.0100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.1 90.5	5.9	0.1	0.8	0.3	0.0	0.4	1.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3	0.2 55.3	38.7	0.2	2.3	0.4	0.0	1.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	7.1	76.2	0.0	14.3	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.2 12.4	21.3	14.5	44.2	0.4	0.2	4.1	2.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0
6	0.8	5.0	1.7	2.8	0.3	85.3	0.0	0.3	3.6	0.3	0.0	0.0	0.0	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.4	5.7	4.4	2.2	0.4	1.3	1.8	80.7	3.1	0.0	0.0	0.0	0.0	0.0	0.0
9	1.3	4.3	1.5	0.8	0.5	0.8	1.7	0.5	88.5	0.0	0.0	0.0	0.0	0.0	0.0
10	8.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	56.0	0.0	0.0	8.0	0.0	0.0
11	0.0	2.6	0.0	2.6	0.0	0.0	0.0	2.6	5.3	0.0	86.8	0.0	0.0	0.0	0.0
12	0.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.5	0.0	0.0	0.0
13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	12.5	12.5	18.8	12.5	6.2	18.8	6.2	6.2	0.0	0.0	6.2	0.0	0.0	0.0

#Real: 18593  
 #Vendor: 11567  
 #mistyped: 2594  
 #sensor err: 621  
 #extra Vend: 1339  
 #Missing Vend: 8406  
 #Correct: 7276  
 #Splits: 133  
 #Combinations: 92

Figure 34. Classification Matrix for Peek GK-6000 (Lane 1)  
 1st 48-Hour Test

Axle Spacing Statistics

Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.040	0.000	1	1
30.0-34.9	0.140	0.000	1	1
35.0-39.9	0.090	0.095	4	5
40.0-44.9	-0.032	0.240	6	15
45.0-49.9	0.218	0.859	25	61
50.0-54.9	0.179	3.415	188	468
55.0-59.9	0.131	1.597	858	2016
60.0-64.9	0.075	1.366	2095	4913
65.0-69.9	0.126	1.386	2632	4985
70.0-74.9	0.116	0.644	1186	1625
75.0-79.9	0.106	0.462	203	217
>80	0.178	0.220	32	32
Overall	0.110	1.449	7231	14339

Wheelbase Statistics

Speeds	Mean	STD	Vehicles
<30	0.040	0.000	1
30.0-34.9	0.140	0.000	1
35.0-39.9	0.113	0.137	4
40.0-44.9	-0.080	0.363	6
45.0-49.9	0.531	1.845	25
50.0-54.9	0.447	2.969	188
55.0-59.9	0.308	1.464	858
60.0-64.9	0.175	1.358	2095
65.0-69.9	0.239	1.841	2632
70.0-74.9	0.159	0.826	1186
75.0-79.9	0.113	0.471	203
>80	0.178	0.220	32
Overall	0.218	1.545	7231

Figure 35. Measurement Accuracy Versus Speed (MPH)  
 Peek GK-6000 (Lane 1) - 1st 48-Hour Test

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	3686	218	9	28	11	0	12	48	3	1	0	0	0	0
3	3	1413	1036	8	59	9	2	25	40	0	0	0	0	0	0
4	0	0	2	41	1	7	0	0	1	0	0	0	0	0	0
5	0	54	111	74	241	1	2	17	12	1	0	0	0	0	0
6	2	15	5	12	1	342	0	1	11	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	9	8	4	1	1	4	212	5	0	0	0	0	0	0
9	10	65	23	10	9	5	22	5	2583	0	0	0	1	0	0
10	0	3	0	0	0	0	0	0	4	17	0	0	2	0	0
11	0	0	0	2	0	0	1	2	3	0	70	0	0	0	0
12	0	1	0	0	0	0	0	0	0	0	0	21	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	2	3	3	3	3	2	1	1	0	0	1	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	0.0	91.7	5.4	0.2	0.7	0.3	0.0	0.3	1.2	0.1	0.0	0.0	0.0	0.0	0.0
3	0.1	54.5	39.9	0.3	2.3	0.3	0.1	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	3.8	78.8	1.9	13.5	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	10.5	21.6	14.4	47.0	0.2	0.4	3.3	2.3	0.2	0.0	0.0	0.0	0.0	0.0
6	0.5	3.9	1.3	3.1	0.3	87.9	0.0	0.3	2.8	0.0	0.0	0.0	0.0	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.4	3.7	3.3	1.6	0.4	0.4	1.6	86.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.4	2.4	0.8	0.4	0.3	0.2	0.8	0.2	94.5	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	11.5	0.0	0.0	0.0	0.0	0.0	0.0	15.4	65.4	0.0	0.0	7.7	0.0	0.0
11	0.0	0.0	0.0	2.6	0.0	0.0	1.3	2.6	3.8	0.0	89.7	0.0	0.0	0.0	0.0
12	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.5	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	10.5	15.8	15.8	15.8	15.8	10.5	5.3	5.3	0.0	0.0	5.3	0.0	0.0	0.0

#Real: 18592  
 #Vendor: 12220  
 #mistyped: 2449  
 #sensor err: 430  
 #extra Vend: 1129  
 #Missing Vend: 7513  
 #Correct: 8249  
 #Splits: 135  
 #Combinations: 123

Figure 36. Classification Matrix for Peek GK-6000 (Lane 2)  
 1st 48-Hour Test

**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.000	0.000	0	0
30.0-34.9	-0.010	0.050	2	2
35.0-39.9	0.133	0.127	3	4
40.0-44.9	0.017	0.228	6	12
45.0-49.9	0.198	0.830	27	66
50.0-54.9	0.079	2.934	198	506
55.0-59.9	0.283	6.629	976	2356
60.0-64.9	0.043	1.115	2388	5870
65.0-69.9	0.084	1.351	3001	6091
70.0-74.9	0.080	0.567	1335	1947
75.0-79.9	0.113	0.489	244	272
>80	0.169	0.247	33	33
<b>Overall</b>	<b>0.098</b>	<b>2.722</b>	<b>8213</b>	<b>17159</b>

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	0.000	0.000	0
30.0-34.9	-0.010	0.050	2
35.0-39.9	0.177	0.184	3
40.0-44.9	0.033	0.407	6
45.0-49.9	0.483	1.790	27
50.0-54.9	0.202	2.246	198
55.0-59.9	0.683	16.064	976
60.0-64.9	0.105	1.072	2388
65.0-69.9	0.170	1.859	3001
70.0-74.9	0.117	0.710	1335
75.0-79.9	0.126	0.524	244
>80	0.169	0.247	33
<b>Overall</b>	<b>0.204</b>	<b>5.702</b>	<b>8213</b>

**Figure 37. Measurement Accuracy Versus Speed (MPH)  
Peek GK-6000 (Lane 2) - 1st 48-Hour Test**



**Table VIII. Accuracy Summary for Peek GK-6000 (Lane 1)  
1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	6.29	73.7	90.1	0.110	1.449	*	*	*	*
<b>% Trucks</b>									
0-20	4.31	73.9	92.2	0.114	0.643				
20-40	6.09	73.8	90.2	0.113	1.568	*	*	*	*
40-60	25.62	71.9	71.9	-0.002	0.704				
60-80	53.57	46.4	46.4	0.100	0.952				
<b>Air Temp</b>									
50-59	52.59	42.2	43.1	-0.001	1.411				
60-69	3.02	86.5	92.4	0.012	0.664	*	*	*	*
70-79	4.12	77.6	92.2	0.087	1.533				
80-89	6.11	71.8	90.4	0.148	1.551				
<b>Pav Temp</b>									
60- 69	51.61	44.5	45.2	-0.010	1.170				
70- 79	3.59	84.7	91.7	0.031	0.667				
80- 89	4.59	78.6	92.8	0.067	1.561	*	*	*	*
90- 99	3.59	77.3	92.3	0.143	2.227				
100-109	4.88	71.0	91.6	0.177	1.664				
110-119	7.00	71.3	89.4	0.116	0.763				

\* - Does Not Calculate Overall Vehicle Length

**Table IX. Accuracy Summary for Peek GK-6000 (Lane 2)  
1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	4.02	77.1	92.4	0.098	2.722	*	*	*	*
<b>% Trucks</b>									
0-20	2.43	76.1	93.5	0.083	0.486				
20-40	4.12	76.5	92.2	0.075	1.426	*	*	*	*
40-60	5.17	92.8	93.1	-0.019	0.579				
60-80	16.30	84.4	84.4	1.119	15.00				
<b>Air Temp</b>									
50-59	7.72	86.2	86.6	-0.044	0.703				
60-69	3.38	89.6	92.9	-0.029	0.556	*	*	*	*
70-79	3.29	78.6	92.7	0.065	1.547				
80-89	4.08	74.2	92.4	0.113	1.364				
<b>Pav Temp</b>									
60- 69	11.30	85.31	85.6	0.414	9.463				
70- 79	3.08	88.9	93.1	-0.020	0.537				
80- 89	3.85	80.1	93.1	0.043	1.622	*	*	*	*
90- 99	3.28	77.2	92.5	0.113	2.123				
100-109	3.24	73.9	93.4	0.133	1.244				
110-119	4.41	74.0	92.0	0.094	0.821				

### 5.2.3.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations for lanes 1 and 2 are presented in Figures 38 and 40. The classification matrix is presented in both absolute numbers, and percentages. The classifier designated lane 1 correctly classified 79.0% of the vehicles (96.2% if class 2-3 errors not included). The number of vehicle axles was miscounted 1.19% (percent sensor errors) of the time. The classifier designated lane 2 correctly classified 79.1% of the vehicles (96.2% if class 2-3 errors not included). The number of vehicle axles was miscounted 1.07% (percent sensor errors) of the time. Less than 0.5% of the vehicles classified by either of the lanes were the result of a suspect split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figures 39 and 41 for lanes 1 and 2, respectively. The GK-6000 classifier measures axles spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Tables X and XI contain summaries of the results from lanes 1 and 2, respectively, of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	5501	174	0	6	1	2	2	10	1	1	0	0	0	0
3	0	2080	1541	4	219	2	2	19	4	0	0	0	0	0	0
4	0	1	1	26	3	6	0	0	0	0	0	0	0	0	0
5	0	5	45	73	176	0	2	17	3	0	0	0	0	0	0
6	0	2	1	6	0	168	0	1	7	0	0	0	0	0	0
7	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
8	0	2	6	1	0	1	3	231	0	0	0	0	0	0	0
9	0	6	4	0	1	0	2	3	2575	0	2	0	0	0	0
10	0	0	1	0	0	0	0	0	3	17	0	1	0	0	0
11	0	0	0	0	0	0	1	0	1	0	63	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0
13	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.0	66.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	96.5	3.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	53.7	39.8	0.1	5.7	0.1	0.1	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	2.7	2.7	70.3	8.1	16.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	1.6	14.0	22.7	54.8	0.0	0.6	5.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	1.1	0.5	3.2	0.0	90.8	0.0	0.5	3.8	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.8	2.5	0.4	0.0	0.4	1.2	94.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.2	0.2	0.0	0.0	0.0	0.1	0.1	99.3	0.0	0.1	0.0	0.0	0.0	0.0
10	0.0	0.0	4.5	0.0	0.0	0.0	0.0	13.6	77.3	0.0	4.5	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.5	0.0	96.9	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 20116  
 #Vendor: 13671  
 #mistyped: 2750  
 #sensor err: 155  
 #extra Vend: 539  
 #Missing Vend: 6978  
 #Correct: 10325  
 #Splits: 17  
 #Combinations: 23

Figure 38. Classification Matrix for Peek GK-6000 (Lane 1)  
 2nd 48-Hour Test

**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.360	0.000	1	1
30.0-34.9	0.000	0.000	0	0
35.0-39.9	0.067	0.454	1	4
40.0-44.9	0.049	0.316	18	24
45.0-49.9	0.056	0.267	52	96
50.0-54.9	0.006	0.333	313	655
55.0-59.9	0.003	0.361	1243	2653
60.0-64.9	-0.009	0.354	3049	6662
65.0-69.9	0.007	0.369	3599	6385
70.0-74.9	0.027	0.294	1697	2228
75.0-79.9	-0.014	0.746	258	304
>80	0.081	0.291	40	40
Overall	0.004	0.363	10271	19052

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	0.360	0.000	1
30.0-34.9	0.000	0.000	0
35.0-39.9	0.270	0.000	1
40.0-44.9	0.066	0.209	18
45.0-49.9	0.103	0.248	52
50.0-54.9	0.012	0.315	313
55.0-59.9	0.007	0.388	1243
60.0-64.9	-0.019	0.389	3049
65.0-69.9	0.013	0.351	3599
70.0-74.9	0.036	0.285	1697
75.0-79.9	-0.016	1.012	258
>80	0.081	0.291	40
Overall	0.007	0.387	10271

**Figure 39. Measurement Accuracy Versus Speed (MPH)  
Peek GK-6000 (Lane 1) - 2nd 48-Hour Test**

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	5810	182	0	5	0	3	3	8	0	1	0	0	0	0
3	0	2146	1590	2	227	0	2	17	6	0	0	0	1	0	0
4	0	0	1	28	4	7	0	0	0	0	0	0	0	0	0
5	0	5	44	73	171	0	3	20	3	0	0	1	0	0	0
6	1	2	0	5	1	170	0	2	5	0	0	0	0	0	0
7	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
8	0	1	5	1	1	1	3	239	0	0	0	0	0	0	0
9	12	2	6	0	0	0	4	2	2624	0	2	0	0	0	0
10	0	0	4	0	0	0	0	0	3	16	0	1	0	0	0
11	0	0	0	1	0	0	0	0	0	0	60	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0
13	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.0	66.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	96.6	3.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	53.8	39.8	0.1	5.7	0.0	0.1	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	2.5	70.0	10.0	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	1.6	13.8	22.8	53.4	0.0	0.9	6.2	0.9	0.0	0.0	0.3	0.0	0.0	0.0
6	0.5	1.1	0.0	2.7	0.5	91.4	0.0	1.1	2.7	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.4	2.0	0.4	0.4	0.4	1.2	95.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.5	0.1	0.2	0.0	0.0	0.0	0.2	0.1	98.9	0.0	0.1	0.0	0.0	0.0	0.0
10	0.0	0.0	16.7	0.0	0.0	0.0	0.0	0.0	12.5	66.7	0.0	4.2	0.0	0.0	0.0
11	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	98.4	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 20116  
 #Vendor: 14180  
 #mistyped: 2842  
 #sensor err: 145  
 #extra Vend: 563  
 #Missing Vend: 6486  
 #Correct: 10729  
 #Splits: 11  
 #Combinations: 24

Figure 40. Classification Matrix for Peek GK-6000 (Lane 2)  
 2nd 48-Hour Test

Axles Spacing Statistics

Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.370	0.210	2	2
30.0-34.9	0.000	0.000	0	0
35.0-39.9	0.117	0.460	1	4
40.0-44.9	-0.010	0.315	15	21
45.0-49.9	0.040	0.262	51	101
50.0-54.9	0.010	0.325	314	636
55.0-59.9	0.007	0.349	1257	2665
60.0-64.9	-0.009	0.337	3149	6764
65.0-69.9	0.003	0.353	3757	6653
70.0-74.9	0.022	0.273	1826	2411
75.0-79.9	0.041	0.274	275	316
>80	0.030	0.308	42	42
Overall	0.003	0.335	10689	19615

Wheelbase Statistics

Speeds	Mean	STD	Vehicles
<30	0.370	0.210	2
30.0-34.9	0.000	0.000	0
35.0-39.9	0.470	0.000	1
40.0-44.9	-0.014	0.237	15
45.0-49.9	0.079	0.256	51
50.0-54.9	0.020	0.327	314
55.0-59.9	0.015	0.390	1257
60.0-64.9	-0.018	0.360	3149
65.0-69.9	0.005	0.338	3757
70.0-74.9	0.028	0.265	1826
75.0-79.9	0.047	0.278	275
>80	0.030	0.308	42
Overall	0.005	0.338	10689

Figure 41. Measurement Accuracy Versus Speed (MPH)  
 Peek GK-6000 (Lane 2) - 2nd 48-Hour Test

**Table X. Accuracy Summary for Peek GK-6000 (Lane 1)  
2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	1.19	79.0	96.2	0.004	0.363	*	*	*	*
<b>% Trucks</b>									
0-20	0.94	77.1	96.7	0.023	0.329	*	*	*	*
20-40	1.50	80.4	95.5	-0.001	0.401				
40-60	1.54	92.3	96.9	-0.084	0.305				
<b>Air Temp</b>									
60-69	1.46	82.5	95.5	-0.047	0.322	*	*	*	*
70-79	1.15	78.5	96.5	-0.012	0.338				
80-89	1.18	78.7	96.5	0.070	0.379				
<b>Pav Temp</b>									
60- 69	2.13	89.4	89.4	-0.075	0.364				
70- 79	1.37	86.0	96.0	-0.063	0.318				
80- 89	1.58	80.8	96.5	-0.014	0.334	*	*	*	*
90- 99	1.10	77.1	96.0	0.008	0.332				
100-109	0.97	77.6	96.1	0.048	0.397				
110-119	1.08	75.2	98.0	0.035	0.286				

\* - Does Not Measure Overall Vehicle Length



**Table XI. Accuracy Summary for Peek GK-6000 (Lane 2)  
2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
Total	1.07	79.1	96.2	0.003	0.335	*	*	*	*
% Trucks									
0-20	0.83	77.3	96.6	0.014	0.316	*	*	*	*
20-40	1.27	80.5	95.7	-0.003	0.360				
40-60	3.41	89.8	95.1	-0.038	0.286				
Air Temp									
60-69	1.73	82.0	95.5	-0.036	0.307	*	*	*	*
70-79	1.07	78.6	96.2	-0.031	0.305				
80-89	0.77	78.9	97.0	0.056	0.355				
Pav Temp									
60- 69	3.12	95.3	95.3	-0.043	0.334				
70- 79	1.15	84.9	96.8	-0.016	0.305				
80- 89	1.62	80.6	96.5	-0.025	0.313	*	*	*	*
90- 99	0.87	77.4	96.3	-0.003	0.318				
100-109	0.72	77.9	96.0	0.043	0.328				
110-119	0.80	75.0	98.0	0.027	0.299				

\* - Does Not Measure Overall Vehicle Length

5.2.3.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Tables XII and XIII for lanes 1 and 2, respectively. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table XII. Long-Term Count/Classification Accuracy  
Peek GK-6000 (Lane 1)**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	44841	32872	11969	136.41	144.59	121.37
Axles	118765	N/A	N/A	N/A	134.04	N/A
Class 1	58	10	48	580.00	433.33	400.00
Class 2	20744	16769	3975	123.70	130.28	118.99
Class 3	12746	4110	8636	310.12	307.37	275.70
Class 4	87	278	-191	31.29	25.00	25.00
Class 5	1399	1006	393	139.07	82.00	139.44
Class 6	589	504	85	116.87	103.77	105.98
Class 7	6	42	-36	14.29	40.00	12.50
Class 8	735	742	-7	99.06	98.60	96.53
Class 9	8101	7093	1008	114.21	108.23	102.78
Class 10	96	61	35	157.38	155.56	130.77
Class 11	215	180	35	119.44	104.76	104.65
Class 12	65	67	-2	97.01	92.86	92.86
Class 13	0	29	-29	0.00	0.00	0.00
Class 15	0	1981	-1981	0.00	--	0.00

**Table XIII. Long-Term Count/Classification Accuracy  
Peek GK-6000 (Lane 2)**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	44841	36240	8601	123.73	140.28	116.07
Axes	118765	N/A	N/A	N/A	131.13	N/A
Class 1	58	60	-2	96.67	100.00	100.00
Class 2	20744	17242	3502	120.31	124.79	121.20
Class 3	12746	4282	8464	297.66	299.74	282.07
Class 4	87	305	-218	28.52	24.14	24.62
Class 5	1399	1080	319	129.54	80.79	137.25
Class 6	589	538	51	109.48	100.92	107.83
Class 7	6	49	-43	12.24	40.00	20.00
Class 8	735	808	-73	90.97	96.58	93.30
Class 9	8101	7761	340	104.38	106.80	101.92
Class 10	96	68	28	141.18	175.00	130.77
Class 11	215	200	15	107.50	125.71	102.27
Class 12	65	70	-5	92.86	144.44	92.86
Class 13	0	28	-28	0.00	0.00	0.00
Class 15	0	3749	-3749	0.00	--	0.00

#### **5.2.4 PAT Equipment Corporation, Inc. AVC-100 (P-L-P)**

PAT Equipment Corporation, Inc. loaned two model AVC-100 classifier for use in the project. The first was setup in a P-L-P sensor configuration using Atochem Roadtrax Series 'P' axle sensors. The equipment appeared to operate normally during all of the testing sessions. However, the reporting software provided by PAT Equipment Corporation failed to convert the binary data files into ASCII (text) data files which could be used to perform data reduction. After this problem was discussed with the technical representative from PAT Equipment Corporation the binned data for part of the seven day test was recovered. No data from either 48 hour test was recovered.

5.2.4.1 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XIV. The totals for the portion of the seven days recovered for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days. Since only a portion of the test data was recovered, the first day listed in the table refers to 12:45 pm on 9-13-93 through 10:45 am on 9-14-93, and the last day refers to 4:15 pm on 9-15-93 to 4:15 pm on 9-16-93.

**Table XIV. Long-Term Count/Classification Accuracy  
PAT AVC-100 (P-L-P)**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	39400	44537	-5137	88.47	101.87	101.92
Axles	104608	N/A	N/A	N/A	N/A	N/A
Class 1	60	18	42	333.33	200.00	240.00
Class 2	18062	14334	3728	126.01	72.42	74.76
Class 3	11417	2467	8950	462.79	261.15	262.70
Class 4	76	29	47	262.07	109.09	133.33
Class 5	1161	435	726	266.90	225.00	197.74
Class 6	458	286	172	160.14	113.00	113.76
Class 7	5	4	1	125.00	100.00	--
Class 8	620	1791	-1171	34.62	25.70	26.63
Class 9	7196	3824	3372	188.18	131.43	131.09
Class 10	84	24	60	350.00	257.14	212.50
Class 11	201	112	89	179.46	120.00	132.35
Class 12	60	33	27	181.82	120.00	144.44
Class 13	0	16	-16	0.00	0.00	0.00
Class 15	0	21164	-21164	0.00	0.00	0.00

### 5.2.5 PAT Equipment Corporation, Inc. AVC-100 (L-P-L)

The second PAT Equipment Corporation, Inc. mode AVC-100 classifier used an L-P-L sensor configuration with Philips Vibracoax axle sensors. The AVC-100 used for the second (L-P-L) configuration did not have sufficient memory to store vehicle-by-vehicle records for the testing periods. Therefore, the data was recorded by a portable computer via the serial port on the classifier. No conversion was necessary and thus data reduction was accomplished for the second PAT configuration.

#### 5.2.5.1 First 48-Hour Test

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 42. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 76.6% of the vehicles (95.0% if class 2-3 errors not included). The number of vehicle axles was miscounted 1.49% (percent sensor errors) of the time. Less than 1.0% of the vehicles classified were the result of a suspected split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 43. The PAT classifier measures axles spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XV contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
2	0	7447	167	0	20	4	0	8	11	0	1	0	1	0	23
3	0	3109	1617	3	38	6	0	176	12	0	0	0	0	0	15
4	0	4	3	25	26	5	0	1	0	0	0	0	0	0	1
5	0	62	215	1	348	0	0	43	1	0	0	0	0	0	22
6	2	11	4	3	0	416	0	0	12	1	0	0	0	0	4
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	2	0	0	0	0	0	284	1	0	0	0	0	0	11
9	0	35	3	0	2	0	0	8	3348	0	0	0	1	0	27
10	0	0	0	0	0	0	0	0	5	23	0	0	10	0	0
11	0	1	0	0	0	0	0	1	1	0	89	0	0	0	1
12	0	1	0	0	0	0	0	0	0	0	0	26	0	0	1
13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	17	6	0	0	1	0	0	11

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
2	0.0	96.9	2.2	0.0	0.3	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.3
3	0.0	62.5	32.5	0.1	0.8	0.1	0.0	3.5	0.2	0.0	0.0	0.0	0.0	0.0	0.3
4	0.0	6.2	4.6	38.5	40.0	7.7	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5
5	0.0	9.0	31.1	0.1	50.3	0.0	0.0	6.2	0.1	0.0	0.0	0.0	0.0	0.0	3.2
6	0.4	2.4	0.9	0.7	0.0	91.8	0.0	0.0	2.6	0.2	0.0	0.0	0.0	0.0	0.9
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.7	0.0	0.0	0.0	0.0	0.0	95.3	0.3	0.0	0.0	0.0	0.0	0.0	3.7
9	0.0	1.0	0.1	0.0	0.1	0.0	0.0	0.2	97.8	0.0	0.0	0.0	0.0	0.0	0.8
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	60.5	0.0	0.0	26.3	0.0	0.0
11	0.0	1.1	0.0	0.0	0.0	0.0	0.0	1.1	1.1	0.0	95.7	0.0	0.0	0.0	1.1
12	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	92.9	0.0	0.0	3.6
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.6	17.1	0.0	0.0	2.9	0.0	0.0	31.4

#Real: 18591  
 #Vendor: 19476  
 #mistyped: 4163  
 #sensor err: 265  
 #extra Vend: 1363  
 #Missing Vend: 615  
 #Correct: 13634  
 #Splits: 151  
 #Combinations: 14

Figure 42. Classification Matrix for PAT AVC-100 (L-P-L)  
 1st 48-Hour Test

Axis Spacing Statistics

Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.498	0.507	19	19
30.0-34.9	0.330	0.228	3	3
35.0-39.9	0.179	0.316	11	18
40.0-44.9	0.174	0.347	24	51
45.0-49.9	0.117	0.255	134	262
50.0-54.9	0.108	0.318	825	1794
55.0-59.9	0.175	4.057	2860	6104
60.0-64.9	0.045	0.527	4815	9745
65.0-69.9	0.035	0.605	3863	5859
70.0-74.9	0.014	0.496	863	1028
75.0-79.9	-0.044	0.546	159	172
>80	-0.163	0.664	24	24
Overall	0.078	2.055	13600	25079

Wheelbase Statistics

Speeds	Mean	STD	Vehicles
<30	0.498	0.507	19
30.0-34.9	0.330	0.228	3
35.0-39.9	0.257	0.317	11
40.0-44.9	0.306	0.507	24
45.0-49.9	0.189	0.379	134
50.0-54.9	0.188	0.510	825
55.0-59.9	0.317	9.378	2860
60.0-64.9	0.053	0.786	4815
65.0-69.9	0.021	0.762	3863
70.0-74.9	0.010	0.665	863
75.0-79.9	-0.051	0.671	159
>80	-0.163	0.664	24
Overall	0.106	4.353	13600

Figure 43. Measurement Accuracy Versus Speed (MPH)  
PAT AVC-100 (L-P-L) - 1st 48-Hour Test



**Table XV. Accuracy Summary for PAT AVC-100 (L-P-L)  
1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	1.49	76.6	95.0	0.078	2.055	*	*	*	*
<b>% Trucks</b>									
0-20	1.08	73.8	95.5	0.061	0.452				
20-40	1.63	76.5	94.8	0.072	0.527	*	*	*	*
40-60	1.05	85.0	96.9	-0.014	0.363				
60-80	0.51	86.5	97.0	0.433	9.701				
<b>Air Temp</b>									
50-59	0.90	73.3	96.5	-0.036	0.516				
60-69	1.14	79.6	95.6	0.106	4.530	*	*	*	*
70-79	1.42	76.5	94.6	0.093	0.348				
80-89	1.82	76.4	94.5	0.107	0.564				
<b>Pav Temp</b>									
60- 69	1.13	75.4	95.8	0.077	5.346				
70- 79	1.18	79.3	95.6	0.030	0.488				
80- 89	1.49	76.9	95.2	0.079	0.386	*	*	*	*
90- 99	1.46	76.2	94.1	0.102	0.381				
100-109	1.48	76.7	95.4	0.119	0.393				
110-119	2.06	76.2	93.9	0.100	0.666				

\* - Overall Vehicle Length Not Calculated

### 5.2.5.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 44. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 76.6% of the vehicles (95.1% if class 2-3 errors not included). The number of vehicle axles was miscounted 0.51% (percent sensor errors) of the time. Less than 0.2% of the vehicle classified were the result of a suspected split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 45. The PAT classifier measures axles spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XVI contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	9263	224	1	0	1	0	11	4	0	0	0	0	0	88
3	0	3405	2087	0	1	0	0	185	3	0	0	0	0	0	222
4	0	0	5	18	19	8	0	1	0	0	0	0	0	0	0
5	0	9	257	1	62	0	0	40	0	0	0	0	0	0	17
6	0	2	2	1	0	186	0	3	7	0	0	0	0	0	0
7	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
8	0	0	2	0	0	1	0	254	1	0	0	0	0	0	10
9	0	5	2	2	0	0	0	2	2965	0	2	0	0	0	14
10	0	0	4	0	0	0	0	0	3	16	0	0	2	0	1
11	0	0	0	0	0	0	0	0	0	0	87	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0
13	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	20.0	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	96.6	2.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9
3	0.0	57.7	35.4	0.0	0.0	0.0	0.0	3.1	0.1	0.0	0.0	0.0	0.0	0.0	3.8
4	0.0	0.0	9.8	35.3	37.3	15.7	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	2.3	66.6	0.3	16.1	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	4.4
6	0.0	1.0	1.0	0.5	0.0	92.5	0.0	1.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
8	0.0	0.0	0.7	0.0	0.0	0.4	0.0	94.8	0.4	0.0	0.0	0.0	0.0	0.0	3.7
9	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.1	99.1	0.0	0.1	0.0	0.0	0.0	0.5
10	0.0	0.0	15.4	0.0	0.0	0.0	0.0	0.0	11.5	61.5	0.0	0.0	7.7	0.0	3.8
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	50.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 20116  
 #Vendor: 20710  
 #mistyped: 4584  
 #sensor err: 99  
 #extra Vend: 1103  
 #Missing Vend: 519  
 #Correct: 14967  
 #Splits: 22  
 #Combinations: 12

Figure 44. Classification Matrix for PAT AVC-100 (L-P-L)  
 2nd 48-Hour Test

**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	-2.773	3.958	7	7
30.0-34.9	0.070	0.000	1	1
35.0-39.9	-0.193	0.180	3	3
40.0-44.9	-0.142	0.299	34	53
45.0-49.9	-0.013	0.795	115	172
50.0-54.9	-0.173	0.343	606	1145
55.0-59.9	-0.207	0.380	2839	5465
60.0-64.9	-0.260	0.399	4912	9192
65.0-69.9	-0.280	0.439	4733	6988
70.0-74.9	-0.278	0.349	1383	1585
75.0-79.9	-0.379	0.684	286	312
>80	-0.376	0.699	34	34
Overall	-0.252	0.420	14953	24957

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	-2.773	3.958	7
30.0-34.9	0.070	0.000	1
35.0-39.9	-0.193	0.180	3
40.0-44.9	-0.251	0.440	34
45.0-49.9	-0.046	1.316	115
50.0-54.9	-0.386	0.584	606
55.0-59.9	-0.439	0.689	2839
60.0-64.9	-0.526	0.748	4912
65.0-69.9	-0.437	0.768	4733
70.0-74.9	-0.325	0.525	1383
75.0-79.9	-0.416	1.087	286
>80	-0.376	0.699	34
Overall	-0.450	0.743	14953

**Figure 45. Measurement Accuracy Versus Speed (MPH)  
PAT AVC-100 (L-P-L) - 2nd 48-Hour Test**

**Table XVI. Accuracy Summary for PAT AVC-100 (L-P-L)  
2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
Total	0.51	76.6	95.1	-0.252	0.420	*	*	*	*
% Trucks									
0-20	0.48	74.7	95.0	-0.244	0.401	*	*	*	*
20-40	0.61	78.4	95.2	-0.251	0.429				
40-60	0.15	84.0	96.2	-0.278	0.505				
Air Temp									
60-69	0.24	76.6	95.5	-0.291	0.436	*	*	*	*
70-79	0.60	76.1	94.9	-0.253	0.412				
80-89	0.60	77.9	95.6	-0.193	0.403				
Pav Temp									
60- 69	0.27	76.3	94.8	-0.327	0.382				
70- 79	0.15	77.9	96.0	-0.269	0.428				
80- 89	0.57	77.6	95.1	-0.245	0.422	*	*	*	*
90- 99	0.73	75.9	95.1	-0.250	0.425				
100-109	0.72	75.9	94.3	-0.223	0.426				
110-119	0.64	72.4	95.2	-0.221	0.316				

\* - Does Not Measure Overall Vehicle Length

### 5.2.5.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XVII. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table XVII. Long-Term Count/Classification Accuracy  
PAT AVC-100 (L-P-L)**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	60846	60634	212	100.35	99.78	100.18
Axles	156689	N/A	N/A	N/A	100.12	N/A
Class 1	93	11	82	845.45	1300.00	600.00
Class 2	29130	39145	-10015	74.42	75.73	74.60
Class 3	18047	7929	10118	227.61	208.65	207.11
Class 4	133	79	54	168.35	127.27	133.33
Class 5	1822	239	1583	762.34	407.32	972.22
Class 6	726	723	3	100.41	103.70	103.33
Class 7	8	1	7	800.00	--	--
Class 8	837	1652	-815	50.67	65.14	59.01
Class 9	9627	9524	103	101.08	100.82	100.84
Class 10	104	62	42	167.74	166.67	141.67
Class 11	249	244	5	102.05	100.00	102.27
Class 12	70	77	-7	90.91	108.33	92.86
Class 13	0	24	-24	0.00	0.00	0.00
Class 15	0	924	-924	0.00	0.00	0.00

### 5.2.6 Mitron Systems Corp. MSC-3000 DCP

The Mitron Systems Corp. model MSC-3000 DCP classifier used a P-P sensor configuration with Autologger MINI axle sensors. The MITRON classifier did not generate vehicle-by-vehicle records for detailed comparison. It produced only binned records at 15 minute intervals.

The Mitron classifier was included in the first 48-hour test. Piezoelectric axle sensor failures resulted in Mitron withdrawing its classifier from the project prior to the second 48-hour test and the 7-day test.

The data recorded by the classifier was sent to Mitron Systems for reduction into the binned data format. The resulting binned data is summarized in Table XVIII. The counts included in the summary are all time periods where both the classifier and the pole camera are operating without gaps (i.e. gaps caused by tape changes).

**Table XVIII. Binned Count/Classification Accuracy  
Mitron MSC-3000 DCP - 1st 48-Hour Test**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent
# Vehicles	15886	16461	-575	96.51
# Axles	42799	N/A	N/A	N/A
Class 1	14	26	-12	53.85
Class 2	6851	9702	-2851	70.61
Class 3	4493	1993	2500	225.44
Class 4	62	117	-55	52.99
Class 5	628	581	47	108.09
Class 6	410	420	-10	97.62
Class 7	0	0	0	--
Class 8	264	361	-97	73.13
Class 9	2987	3100	-113	96.35
Class 10	31	23	8	134.78
Class 11	89	101	-12	88.12
Class 12	25	28	-3	89.29
Class 13	0	9	-9	0.00
Class 15	32	0	32	--



## 5.2.7 Electronic Control Measure HESTIA

The Electronic Control Measure model HESTIA classifier used a P-L-P sensor configuration with ECM PB2N33/25 piezoelectric axle sensors. The results of this classifier are presented below.

### 5.2.7.1 First 48-Hour Test

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 46. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 67.5% of the vehicles (86.4% if class 2-3 errors not included). The number of vehicle axles was miscounted 10.05% (percent sensor errors) of the time. About 2.2% of the vehicles classified by the HESTIA were the result of a suspected split or combination.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 47. The HESTIA classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XIX contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	2041	62	8	7	17	0	12	51	0	0	0	0	0	65
3	0	878	336	5	10	3	0	22	22	0	0	0	0	0	70
4	0	7	0	4	1	0	0	0	0	0	0	0	0	0	0
5	0	35	41	13	68	2	0	10	9	0	0	0	0	0	22
6	0	10	3	1	0	50	0	2	9	0	0	0	0	0	5
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	12	0	1	0	1	0	76	1	0	0	0	0	0	4
9	0	68	14	1	2	4	0	4	735	1	2	1	0	0	79
10	0	1	0	0	0	0	0	0	1	8	0	0	0	0	2
11	0	2	0	0	0	0	0	0	2	0	23	0	0	0	3
12	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	1	0	0	0	0	0	0	0	0	0	5

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	90.2	2.7	0.4	0.3	0.8	0.0	0.5	2.3	0.0	0.0	0.0	0.0	0.0	2.9
3	0.0	65.2	25.0	0.4	0.7	0.2	0.0	1.6	1.6	0.0	0.0	0.0	0.0	0.0	5.2
4	0.0	58.3	0.0	33.3	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	17.5	20.5	6.5	34.0	1.0	0.0	5.0	4.5	0.0	0.0	0.0	0.0	0.0	11.0
6	0.0	12.5	3.8	1.2	0.0	62.5	0.0	2.5	11.2	0.0	0.0	0.0	0.0	0.0	6.2
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	12.6	0.0	1.1	0.0	1.1	0.0	80.0	1.1	0.0	0.0	0.0	0.0	0.0	4.2
9	0.0	7.5	1.5	0.1	0.2	0.4	0.0	0.4	80.7	0.1	0.2	0.1	0.0	0.0	8.7
10	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	8.3	66.7	0.0	0.0	0.0	0.0	16.7
11	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	76.7	0.0	0.0	0.0	10.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	83.3	0.0	0.0	0.0
13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	0.0	0.0	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.3

#Real: 18369  
 #Vendor: 6543  
 #mistyped: 1616  
 #sensor err: 499  
 #extra Vend: 1401  
 #Missing Vend: 13253  
 #Correct: 3351  
 #Splits: 67  
 #Combinations: 41

Figure 46. Classification Matrix for ECM HESTIA  
 1st 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.660	1.146	48	54
30.0-34.9	0.000	0.000	0	0
35.0-39.9	0.540	0.000	1	1
40.0-44.9	0.113	0.082	3	6
45.0-49.9	0.096	0.574	27	47
50.0-54.9	0.127	0.385	154	338
55.0-59.9	0.112	0.494	579	1174
60.0-64.9	0.094	0.899	1177	2328
65.0-69.9	0.126	0.655	946	1437
70.0-74.9	0.204	0.654	258	301
75.0-79.9	0.155	0.304	45	48
>80	0.602	0.770	6	6
Overall	0.120	0.732	3244	5740

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	2.703	3.139	48
30.0-34.9	0.000	0.000	0
35.0-39.9	-0.100	0.000	1
40.0-44.9	0.203	1.020	3
45.0-49.9	0.265	2.049	27
50.0-54.9	0.534	1.485	154
55.0-59.9	0.565	1.504	579
60.0-64.9	0.590	1.808	1177
65.0-69.9	0.484	2.954	946
70.0-74.9	0.785	1.256	258
75.0-79.9	0.602	1.260	45
>80	1.795	2.048	6
Overall	0.598	2.157	3244

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	0.742	1.295	48
30.0-34.9	0.000	0.000	0
35.0-39.9	0.540	0.000	1
40.0-44.9	0.227	0.231	3
45.0-49.9	0.163	0.973	27
50.0-54.9	0.273	0.572	154
55.0-59.9	0.221	0.667	579
60.0-64.9	0.182	1.308	1177
65.0-69.9	0.189	0.796	946
70.0-74.9	0.238	0.699	258
75.0-79.9	0.165	0.325	45
>80	0.602	0.770	6
Overall	0.209	0.990	3244

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	125.35	32.30	48
30.0-34.9	0.000	0.000	0
35.0-39.9	99.446	0.030	1
40.0-44.9	98.941	2.927	3
45.0-49.9	100.870	6.272	27
50.0-54.9	101.773	5.114	154
55.0-59.9	101.840	6.205	579
60.0-64.9	102.250	6.168	1177
65.0-69.9	102.925	7.646	946
70.0-74.9	104.971	6.973	258
75.0-79.9	104.885	6.305	45
>80	113.24	15.49	6
Overall	102.95	8.25	3244

Figure 47. Measurement Accuracy Versus Speed (MPH)  
ECM HESTIA - 1st 48-Hour Test

**Table XIX. Accuracy Summary for ECM HESTIA  
1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	10.05	67.5	86.4	0.120	0.732	0.598	2.157	102.95	8.25
<b>% Trucks</b>									
0-20	5.78	73.1	92.2	0.150	0.492	0.538	1.296	102.84	6.94
20-40	10.41	66.0	85.6	0.112	0.708	0.585	2.270	103.01	8.36
40-60	11.72	75.5	85.5	0.128	1.064	0.666	2.351	101.51	5.81
60-80	28.21	69.2	79.5	0.155	1.075	2.031	2.730	103.87	4.92
<b>Air Temp</b>									
50-59	57.14	14.3	28.6	2.495	3.253	12.450	0.0 *	122.13	0.0 *
60-69	11.83	76.3	86.1	0.114	0.934	0.672	2.092	101.62	5.33
70-79	4.74	74.3	93.0	0.128	0.335	0.620	1.200	102.76	6.12
80-89	11.83	63.6	83.8	0.114	0.832	0.568	2.507	103.22	9.39
<b>Pav Temp</b>									
60- 69	48.48	42.4	51.5	0.509	2.222	1.225	4.078	100.59	9.70
70- 79	9.15	78.3	88.7	0.108	0.837	0.693	1.980	101.84	5.20
80- 89	4.97	73.6	92.7	0.120	0.334	0.579	1.233	102.54	5.87
90- 99	3.95	73.5	92.9	0.137	0.230	0.719	1.076	103.29	5.81
100-109	9.37	62.3	87.1	0.136	0.614	0.703	1.440	103.77	7.96
110-119	15.72	58.7	79.1	0.090	1.107	0.400	3.387	102.74	11.40

\* - Only 1 Vehicle Measured

### 5.2.7.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 48. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 72.0% of the vehicles (94.3% if class 2-3 errors not included). The number of vehicle axles was miscounted 6.70% (percent sensor errors) of the time. There were less than 0.7% of the vehicles classified by the HESTIA that were the result of a suspected split or combination.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 49. The HESTIA classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XIX contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2	180	8734	300	17	170	0	0	2	5	0	1	0	0	0	0
3	57	3919	1441	7	318	0	0	12	5	0	0	0	0	0	0
4	0	2	3	30	8	0	0	0	0	0	0	0	0	0	0
5	0	13	72	42	223	0	0	18	0	0	0	0	0	0	0
6	3	16	3	11	3	0	0	4	7	0	1	0	0	0	0
7	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
8	0	2	1	3	8	0	0	255	0	0	0	0	0	0	0
9	4	13	1	3	9	0	0	35	2829	0	2	0	0	0	0
10	0	0	0	0	0	0	0	0	2	14	0	0	0	0	0
11	0	0	0	0	0	0	0	0	1	0	81	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0
13	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	84.6	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.9	92.8	3.2	0.2	1.8	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3	1.0	68.1	25.0	0.1	5.5	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	4.7	7.0	69.8	18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	3.5	19.6	11.4	60.6	0.0	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	6.2	33.3	6.2	22.9	6.2	0.0	0.0	8.3	14.6	0.0	2.1	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.7	0.4	1.1	3.0	0.0	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.1	0.4	0.0	0.1	0.3	0.0	0.0	1.2	97.7	0.0	0.1	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	87.5	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	98.8	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	75.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	33.3	0.0	0.0	0.0	0.0	0.0	33.3	33.3	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 20109  
 #Vendor: 20714  
 #mistyped: 5294  
 #sensor err: 1268  
 #extra Vend: 1552  
 #Missing Vend: 1042  
 #Correct: 13642  
 #Splits: 107  
 #Combinations: 12

Figure 48. Classification Matrix for ECM HESTIA  
 2nd 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.443	1.516	12827	22174
30.0-34.9	0.000	0.000	0	0
35.0-39.9	0.000	0.000	0	0
40.0-44.9	0.000	0.000	0	0
45.0-49.9	0.000	0.000	0	0
50.0-54.9	1.800	0.000	1	1
55.0-59.9	0.000	0.000	0	0
60.0-64.9	2.130	0.000	1	1
65.0-69.9	0.000	0.000	0	0
70.0-74.9	-2.825	0.995	2	2
75.0-79.9	-1.843	0.288	3	3
>80	-3.329	1.186	14	14
Overall	0.441	1.519	12848	22195

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	2.242	3.061	12827
30.0-34.9	0.000	0.000	0
35.0-39.9	0.000	0.000	0
40.0-44.9	0.000	0.000	0
45.0-49.9	0.000	0.000	0
50.0-54.9	5.520	0.001	1
55.0-59.9	0.000	0.000	0
60.0-64.9	4.360	0.001	1
65.0-69.9	0.000	0.000	0
70.0-74.9	-6.705	1.475	2
75.0-79.9	-2.567	1.589	3
>80	-5.186	3.121	14
Overall	2.232	3.073	12848

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	20.158	19.208	12827
30.0-34.9	0.000	0.000	0
35.0-39.9	0.000	0.000	0
40.0-44.9	0.000	0.000	0
45.0-49.9	0.000	0.000	0
50.0-54.9	6.280	0.001	1
55.0-59.9	0.000	0.000	0
60.0-64.9	6.020	0.000	1
65.0-69.9	0.000	0.000	0
70.0-74.9	0.375	0.545	2
75.0-79.9	1.893	0.647	3
>80	0.711	1.609	14
Overall	20.127	19.208	12848

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	114.35	16.01	12827
30.0-34.9	0.000	0.000	0
35.0-39.9	0.000	0.000	0
40.0-44.9	0.000	0.000	0
45.0-49.9	0.000	0.000	0
50.0-54.9	131.169	0.000	1
55.0-59.9	0.000	0.000	0
60.0-64.9	128.202	0.000	1
65.0-69.9	0.000	0.000	0
70.0-74.9	71.491	5.560	2
75.0-79.9	87.673	7.255	3
>80	77.83	14.29	14
Overall	114.30	16.07	12848

Figure 49. Measurement Accuracy Versus Speed (MPH)  
ECM HESTIA - 2nd 48-Hour Test

**Table XX. Accuracy Summary for ECM HESTIA  
2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	6.70	72.0	94.3	0.441	1.519	2.232	3.073	114.30	16.07
<b>% Trucks</b>									
0-20	06.55	69.9	94.3	0.508	1.349	2.232	2.910	115.62	16.39
20-40	07.00	74.2	94.4	0.403	1.548	2.229	3.130	113.14	15.48
40-60	05.08	79.2	94.8	0.252	1.874	2.174	4.127	109.35	14.43
<b>Air Temp</b>									
60-69	05.03	70.5	93.7	0.449	1.496	2.310	3.059	114.86	16.47
70-79	06.11	72.0	94.1	0.429	1.392	2.193	3.116	114.21	16.13
80-89	10.17	74.4	96.3	0.457	1.904	2.186	2.942	113.78	15.42
<b>Pav Temp</b>									
60- 69	3.43	69.6	93.6	0.383	1.198	2.335	3.296	115.65	17.32
70- 79	5.26	73.1	94.3	0.423	1.748	2.246	3.141	113.39	15.76
80- 89	5.98	73.4	94.3	0.420	1.292	2.223	3.010	114.01	16.06
90- 99	6.91	71.5	94.0	0.452	1.282	2.259	2.883	114.59	15.61
100-109	8.76	72.3	94.5	0.460	1.646	2.122	3.280	114.06	15.75
110-119	7.41	67.7	95.7	0.515	1.617	2.160	2.506	116.58	17.54



5.2.7.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XXI. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table XXI. Long-Term Count/Classification Accuracy  
Electronic Control Measure HESTIA**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	63474	60446	3028	105.01	104.33	104.57
Axles	162780	148081	14699	109.93	110.01	108.78
Class 1	101	0	101	--	--	--
Class 2	30500	47439	-16939	64.29	64.47	64.01
Class 3	19015	2660	16355	714.85	622.16	655.24
Class 4	135	9986	-9851	1.35	0.90	0.87
Class 5	1897	55	1842	3449.09	3420.00	2875.00
Class 6	738	231	507	319.48	254.76	305.00
Class 7	8	63	-55	12.70	18.18	7.69
Class 8	848	0	848	--	--	--
Class 9	9804	0	9804	--	--	--
Class 10	106	0	106	--	--	--
Class 11	253	0	253	--	--	--
Class 12	69	0	69	--	--	--
Class 13	0	0	0	--	--	--
Class 15	0	12	-12	0.00	--	0.00

### 5.2.8 TimeMark, Inc. Delta II

The TimeMark, Inc. model Delta II classifier used a P-P sensor configuration with Philips Vibracoax piezoelectric axle sensors. The results of this classifier are presented below.

#### 5.2.8.1 First 48-Hour Test

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 50. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 78.9% of the vehicles (94.4% if class 2-3 errors not included). The number of vehicle axles was miscounted 2.83% (percent sensor errors) of the time. Approximately 1.3% of the vehicles classified by the Delta II were the result of a suspected split or combination.

There were more than 3600 vehicles missed (see "#Missing Vend:" in Figure 50) by this classifier that were recorded on video tape. Most of the other vendors (with no gaps in recording time) missed less than 2000, most of which can be accounted for by lane changes. By reviewing binned data for this classifier and the ground truth data, it was found that roughly half of the class 2 and 3 vehicles were missed by this classifier. Apparently, the sensitivity of the sensors and classifier electronics was not sufficient to detect a large number of the passenger cars and small trucks. While the classification accuracy of those detected was fairly good, a large number of vehicles were missed by this unit.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 51. The TimeMark classifier measures axles spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXII contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	5	2856	141	4	15	6	0	5	24	1	0	0	0	0	0
3	5	1150	975	2	62	2	0	13	9	0	0	0	1	0	0
4	0	0	0	17	6	1	0	0	0	0	0	0	0	0	0
5	0	23	66	62	195	0	0	7	5	0	0	0	0	0	0
6	1	2	1	6	1	229	0	0	7	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	4	5	0	2	1	0	177	1	0	0	0	0	0	0
9	2	12	4	26	0	21	0	6	2030	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	4	16	0	0	5	0	0
11	0	0	0	0	0	0	0	2	1	0	45	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	3	4	3	4	0	0	4	0	0	0	1	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	0.2	93.4	4.6	0.1	0.5	0.2	0.0	0.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0
3	0.2	51.8	43.9	0.1	2.8	0.1	0.0	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	70.8	25.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	6.4	18.4	17.3	54.5	0.0	0.0	2.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0
6	0.4	0.8	0.4	2.4	0.4	92.7	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	2.1	2.6	0.0	1.1	0.5	0.0	93.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0
9	0.1	0.6	0.2	1.2	0.0	1.0	0.0	0.3	96.6	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	64.0	0.0	0.0	20.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	2.1	0.0	93.8	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	15.8	21.1	15.8	21.1	0.0	0.0	21.1	0.0	0.0	0.0	5.3	0.0	0.0	0.0

#Real: 12068  
 #Vendor: 8915  
 #mistyped: 1753  
 #sensor err: 235  
 #extra Vend: 446  
 #Missing Vend: 3602  
 #Correct: 6557  
 #Splits: 54  
 #Combinations: 51

Figure 50. Classification Matrix for TimeMark Delta II  
 1st 48-Hour Test

**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.000	0.000	0	0
30.0-34.9	0.000	0.000	0	0
35.0-39.9	0.000	0.000	0	0
40.0-44.9	0.100	0.444	1	4
45.0-49.9	0.137	0.320	10	22
50.0-54.9	0.139	0.356	91	253
55.0-59.9	0.435	7.819	638	1638
60.0-64.9	0.089	0.662	2641	6366
65.0-69.9	0.072	0.592	2093	3834
70.0-74.9	0.059	0.351	877	1150
75.0-79.9	0.070	0.316	113	122
>80	0.002	0.339	42	42
Overall	0.124	2.791	6506	13431

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	0.000	0.000	0
30.0-34.9	0.000	0.000	0
35.0-39.9	0.000	0.000	0
40.0-44.9	0.400	0.000	1
45.0-49.9	0.302	0.380	10
50.0-54.9	0.386	0.540	91
55.0-59.9	1.115	19.817	638
60.0-64.9	0.214	0.932	2641
65.0-69.9	0.132	0.756	2093
70.0-74.9	0.078	0.374	877
75.0-79.9	0.075	0.313	113
>80	0.002	0.339	42
Overall	0.256	6.258	6506

**Figure 51. Measurement Accuracy Versus Speed (MPH)  
TimeMark Delta II - 1st 48-Hour Test**

**Table XXII. Accuracy Summary for TimeMark Delta II  
1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
Total	2.83	78.9	94.4	0.124	2.791	*	*	*	*
% Trucks									
0-20	2.77	76.3	94.3	0.121	0.496				
20-40	2.91	78.8	94.5	0.078	0.646	*	*	*	*
40-60	3.41	86.3	92.2	0.060	0.363				
60-80	0.53	93.1	96.3	0.875	12.44				
Air Temp									
50-59	3.66	76.6	90.5	0.062	0.371				
60-69	3.61	81.9	95.1	0.061	0.649	*	*	*	*
70-79	2.95	77.6	93.9	0.096	0.487				
80-89	2.68	78.3	94.8	0.088	0.684				
Pav Temp									
60-69	1.16	90.7	94.8	0.553	9.668				
70-79	3.50	81.6	94.6	0.076	0.634				
80-89	3.96	78.1	93.8	0.075	0.501	*	*	*	*
90-99	2.50	78.2	94.2	0.077	0.445				
100-109	2.65	77.4	94.7	0.101	0.642				
110-119	2.56	78.9	95.1	0.088	0.761				

\* - Does Not Calculate Overall Vehicle Length

### 5.2.8.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 52. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 77.3% of the vehicles (94.6% if class 2-3 errors not included). The number of vehicle axles was miscounted 1.97% (percent sensor errors) of the time. Approximately 1.3% of the vehicles classified by the Delta II were the result of a suspected split or combination.

There were more than 11,600 vehicles missed (see "#Missing Vend:" in Figure 54) by this classifier that were recorded on video tape. Most of the other vendors missed less than 2000, most of which can be accounted for by lane changes. By reviewing binned data for this classifier and the ground truth data, it was found that roughly half of the class 2 and 3 vehicles were missed by this classifier. Apparently, the sensitivity of the sensors and classifier electronics was not sufficient to detect a large number of the passenger cars and small trucks. While the classification accuracy of those detected was fairly good, a large number of vehicles were missed by this unit.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 53. The TimeMark classifier measures axles spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXIII contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	10	2690	152	6	13	1	0	5	11	0	1	0	0	0	0
3	5	1285	913	3	154	0	0	8	13	0	0	0	0	0	0
4	0	0	0	20	4	7	0	0	0	0	0	0	0	0	0
5	1	8	26	37	137	0	0	5	0	0	0	0	0	0	0
6	0	1	0	5	1	124	0	0	4	0	0	0	0	0	0
7	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
8	0	2	5	0	3	0	0	167	0	0	0	0	0	0	0
9	13	8	5	46	1	19	0	4	2249	0	3	0	0	0	0
10	0	0	0	0	0	1	0	0	2	13	0	1	1	0	0
11	0	0	0	0	0	0	0	0	0	0	74	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0
13	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.0100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.3	93.1	5.3	0.2	0.4	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
3	0.2	54.0	38.3	0.1	6.5	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	64.5	12.9	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.5	3.7	12.1	17.3	64.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.7	0.0	3.7	0.7	91.9	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	1.1	2.8	0.0	1.7	0.0	0.0	94.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.6	0.3	0.2	2.0	0.0	0.8	0.0	0.2	95.8	0.0	0.1	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0	11.1	72.2	0.0	5.6	5.6	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0100.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0100.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0100.0	0.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 20089  
 #Vendor: 8842  
 #mistyped: 1887  
 #sensor err: 163  
 #extra Vend: 386  
 #Missing Vend: 11625  
 #Correct: 6408  
 #Splits: 51  
 #Combinations: 39

Figure 52. Classification Matrix for TimeMark Delta II  
 2nd 48-Hour Test

**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	0.000	0.000	0	0
30.0-34.9	0.000	0.000	0	0
35.0-39.9	0.000	0.000	0	0
40.0-44.9	-0.207	0.918	3	3
45.0-49.9	-0.035	0.379	14	28
50.0-54.9	0.023	0.419	134	323
55.0-59.9	0.011	0.476	715	1870
60.0-64.9	-0.016	0.413	2673	6841
65.0-69.9	-0.033	0.413	1946	3719
70.0-74.9	-0.044	0.366	771	1027
75.0-79.9	-0.066	0.376	90	100
>80	-0.051	0.316	34	34
Overall	-0.018	0.419	6380	13945

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	0.000	0.000	0
30.0-34.9	0.000	0.000	0
35.0-39.9	0.000	0.000	0
40.0-44.9	-0.207	0.918	3
45.0-49.9	-0.071	0.450	14
50.0-54.9	0.058	0.497	134
55.0-59.9	0.027	0.616	715
60.0-64.9	-0.040	0.477	2673
65.0-69.9	-0.062	0.454	1946
70.0-74.9	-0.059	0.349	771
75.0-79.9	-0.074	0.343	90
>80	-0.051	0.316	34
Overall	-0.040	0.474	6380

**Figure 53. Measurement Accuracy Versus Speed (MPH)  
TimeMark Delta II - 2nd 48-Hour Test**



**Table XXIII. Accuracy Summary for TimeMark Delta II  
2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
Total	1.97	77.3	94.6	-0.018	0.419	*	*	*	*
% Trucks									
0-20	1.81	74.7	95.2	-0.011	0.408	*	*	*	*
20-40	2.17	78.9	93.5	-0.022	0.439				
40-60	2.53	88.8	96.1	-0.042	0.373				
Air Temp									
60-69	2.18	79.7	93.9	-0.027	0.404	*	*	*	*
70-79	1.79	76.6	94.8	-0.018	0.423				
80-89	2.53	76.4	94.6	-0.008	0.433				
Pav Temp									
60- 69	2.05	82.4	94.4	-0.041	0.409				
70- 79	1.75	81.7	94.1	-0.015	0.407				
80- 89	2.96	78.5	94.0	-0.019	0.464	*	*	*	*
90- 99	1.62	74.7	93.5	-0.019	0.403				
100-109	1.65	75.4	94.9	-0.012	0.343				
110-119	1.66	72.7	97.3	0.011	0.382				

\* - Does Not Measure Overall Vehicle Length

5.2.8.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XXIV. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last full days recorded of the seven days.

**Table XXIV. Long-Term Count/Classification Accuracy  
TimeMark Delta II**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	55173	26389	28784	209.08	198.42	248.71
Axles	140170	75831	64339	184.85	172.32	208.87
Class 1	88	292	-204	30.14	30.00	11.49
Class 2	26840	12876	13964	208.45	213.69	298.58
Class 3	16803	3754	13049	447.60	444.17	567.24
Class 4	119	358	-239	33.24	35.19	24.24
Class 5	1555	977	578	159.16	86.02	202.25
Class 6	597	659	-62	90.59	96.55	88.89
Class 7	6	2	4	300.00	--	100.00
Class 8	689	609	80	113.14	118.32	147.62
Class 9	8119	6591	1528	123.18	118.72	137.25
Class 10	91	42	49	216.67	200.00	300.00
Class 11	209	167	42	125.15	117.50	134.38
Class 12	57	50	7	114.00	130.00	130.77
Class 13	0	12	-12	0.00	0.00	0.00
Class 15	0	0	0	--	--	--

## 5.2.9 International Road Dynamics, Inc. TC/C 530-4D/4P/4L (PR-L-PR)

The International Road Dynamics, Inc. Model TC/C 530-4D/4P/4L classifier was tested with two separate sensor configurations. The first configuration used a PR-L-PR sensor configuration using Dynax AS-400 resistive piezoelectric (PR) axle sensors. The results of this classifier and sensor configuration are presented below.

### 5.2.9.1 First 48-Hour Test

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 54. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 69.3% of the vehicles (88.4% if class 2-3 errors not included). The number of vehicle axles was miscounted 8.89% (percent sensor errors) of the time. Less than 1.3% of the vehicles classified were the result of a suspected split or combination of an actual vehicle. This IRD unit missed a larger number of vehicles than expected.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 55. The TC/C 530-4D/4P/4L classifier measures axle spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXV contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2	2	5925	142	0	6	7	11	8	24	1	2	0	6	0	0
3	0	2511	1362	0	9	5	8	40	14	0	1	1	10	0	0
4	0	3	4	12	24	7	0	1	0	0	4	0	2	0	0
5	0	44	268	0	190	0	8	28	1	0	6	0	11	0	0
6	1	10	4	1	1	305	8	4	12	5	11	0	9	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	13	7	0	0	0	2	169	2	7	12	2	21	0	0
9	0	70	22	0	2	1	0	16	1625	73	29	47	561	0	0
10	0	1	0	0	0	0	0	0	1	15	0	0	7	0	0
11	0	0	1	0	0	0	0	0	1	2	22	5	32	0	0
12	0	1	0	0	0	0	0	0	0	0	0	7	10	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	3	0	0	0	1	20	3	0	0	1	2	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	85.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	96.6	2.3	0.0	0.1	0.1	0.2	0.1	0.4	0.0	0.0	0.0	0.1	0.0	0.0
3	0.0	63.4	34.4	0.0	0.2	0.1	0.2	1.0	0.4	0.0	0.0	0.0	0.3	0.0	0.0
4	0.0	5.3	7.0	21.1	42.1	12.3	0.0	1.8	0.0	0.0	7.0	0.0	3.5	0.0	0.0
5	0.0	7.9	48.2	0.0	34.2	0.0	1.4	5.0	0.2	0.0	1.1	0.0	2.0	0.0	0.0
6	0.3	2.7	1.1	0.3	0.3	82.2	2.2	1.1	3.2	1.3	3.0	0.0	2.4	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	5.5	3.0	0.0	0.0	0.0	0.9	71.9	0.9	3.0	5.1	0.9	8.9	0.0	0.0
9	0.0	2.9	0.9	0.0	0.1	0.0	0.0	0.7	66.4	3.0	1.2	1.9	22.9	0.0	0.0
10	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	4.2	62.5	0.0	0.0	29.2	0.0	0.0
11	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	1.6	3.2	34.9	7.9	50.8	0.0	0.0
12	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.9	55.6	0.0	0.0
13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	10.0	0.0	0.0	0.0	3.3	66.7	10.0	0.0	0.0	3.3	6.7	0.0	0.0

#Real: 18511  
 #Vendor: 15907  
 #mistyped: 4273  
 #sensor err: 1236  
 #extra Vend: 1681  
 #Missing Vend: 4396  
 #Correct: 9638  
 #Splits: 142  
 #Combinations: 31

Figure 54. Classification Matrix for IRD TC/C 530-4D/4P/4L (PR-L-PR) 1st 48-Hour Test

**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	2.115	5.082	8	11
30.0-34.9	0.000	0.000	0	0
35.0-39.9	0.300	0.200	1	2
40.0-44.9	0.204	0.312	13	27
45.0-49.9	0.202	0.270	69	122
50.0-54.9	0.150	0.355	327	641
55.0-59.9	0.168	0.423	1404	2595
60.0-64.9	0.158	0.610	3227	5842
65.0-69.9	0.151	0.636	3082	4532
70.0-74.9	0.150	0.416	1203	1396
75.0-79.9	0.179	0.327	206	216
>80	0.161	0.306	33	33
<b>Overall</b>	<b>0.159</b>	<b>0.578</b>	<b>9573</b>	<b>15417</b>

**Length Statistics**

Speeds	Mean	STD	Vehicles
<30	3.019	24.029	8
30.0-34.9	0.000	0.000	0
35.0-39.9	8.770	0.002	1
40.0-44.9	2.952	18.915	13
45.0-49.9	-1.006	13.535	69
50.0-54.9	-0.370	14.020	327
55.0-59.9	-0.483	14.158	1404
60.0-64.9	-0.712	12.626	3227
65.0-69.9	-1.878	9.549	3082
70.0-74.9	-2.728	6.450	1203
75.0-79.9	-2.037	3.878	206
>80	-1.830	1.619	33
<b>Overall</b>	<b>-1.321</b>	<b>11.302</b>	<b>9573</b>

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	2.907	11.496	8
30.0-34.9	0.000	0.000	0
35.0-39.9	0.600	0.000	1
40.0-44.9	0.423	0.224	13
45.0-49.9	0.356	0.335	69
50.0-54.9	0.294	0.325	327
55.0-59.9	0.311	0.393	1404
60.0-64.9	0.287	0.800	3227
65.0-69.9	0.222	0.807	3082
70.0-74.9	0.175	0.434	1203
75.0-79.9	0.188	0.330	206
>80	0.161	0.306	33
<b>Overall</b>	<b>0.256</b>	<b>0.773</b>	<b>9573</b>

**Length Percentile Statistics**

Speeds	Mean	STD	Vehicles
<30	60.71	67.81	8
30.0-34.9	0.000	0.000	0
35.0-39.9	147.663	0.040	1
40.0-44.9	129.169	102.212	13
45.0-49.9	104.251	56.669	69
50.0-54.9	105.518	63.187	327
55.0-59.9	105.300	64.520	1404
60.0-64.9	102.362	59.012	3227
65.0-69.9	94.574	42.851	3082
70.0-74.9	88.466	19.976	1203
75.0-79.9	89.575	21.583	206
>80	91.12	14.65	33
<b>Overall</b>	<b>98.35</b>	<b>51.48</b>	<b>9573</b>

**Figure 55. Measurement Accuracy Versus Speed (MPH)  
IRD TC/C 530-4D/4P/4L (PR-L-PR) - 1st 48-Hour Test**

**Table XXV. Accuracy Summary for IRD TC/C 530-4D/4P/4L  
(PR-L-PR) 1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
Total	8.89	69.3	88.4	0.159	0.578	-1.321	11.302	98.35	51.48
% Trucks									
0-20	5.52	69.8	91.6	0.186	0.458	-1.760	9.097	94.04	41.78
20-40	7.54	70.8	89.7	0.153	0.607	-1.140	11.748	99.79	53.77
40-60	33.99	52.2	64.0	0.160	0.240	-2.501	9.544	91.47	38.04
60-80	45.88	38.2	52.9	0.106	0.537	-3.205	11.505	92.35	42.93
Air Temp									
50-59	13.54	58.2	84.2	0.154	0.310	-2.836	6.852	88.36	22.75
60-69	13.16	65.6	83.6	0.142	0.716	-1.760	11.485	96.98	50.14
70-79	6.46	71.4	90.2	0.156	0.405	-1.127	11.967	100.30	55.80
80-89	5.56	73.8	91.9	0.165	0.637	-0.909	11.523	100.21	53.81
Pav Temp									
60- 69	18.54	53.5	78.4	0.196	0.761	-2.414	7.947	91.05	29.20
70- 79	14.23	65.5	82.5	0.129	0.584	-1.817	11.533	96.86	50.57
80- 89	8.73	69.1	88.2	0.135	0.322	-1.248	11.326	99.04	52.57
90- 99	3.94	73.7	92.3	0.169	0.764	-0.997	12.690	101.91	59.72
100-109	3.70	74.6	93.8	0.167	0.511	-0.808	12.650	101.45	57.36
110-119	6.88	73.5	90.9	0.165	0.590	-0.925	10.770	99.40	51.23

### 5.2.9.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 56. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 72.6% of the vehicles (92.9% if class 2-3 errors not included). The number of vehicle axles was miscounted 5.35% (percent sensor errors) of the time. There were less than 0.5% of the vehicles classified that were the result of a suspected split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 57. The TC/C 530-4D/4P/4L classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXVI contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	8762	141	0	2	1	10	13	5	1	0	0	5	0	0
3	4	3577	1823	0	35	3	5	48	6	0	0	0	5	0	0
4	0	0	3	7	23	7	3	0	0	1	2	0	1	0	0
5	0	12	146	1	164	0	6	29	0	1	0	0	8	0	0
6	1	0	3	1	1	170	1	6	8	1	0	0	4	0	0
7	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
8	0	21	12	0	0	0	2	202	0	5	6	1	11	0	0
9	4	21	16	0	0	0	0	23	2079	87	33	74	508	0	0
10	0	1	2	0	0	0	0	0	1	15	1	0	5	0	0
11	0	0	0	0	0	0	0	0	0	8	44	3	28	0	0
12	0	0	0	0	0	0	0	0	3	0	0	16	8	0	0
13	0	0	0	0	0	0	0	0	0	3	1	0	1	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	98.0	1.6	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0
3	0.1	65.0	33.1	0.0	0.6	0.1	0.1	0.9	0.1	0.0	0.0	0.0	0.1	0.0	0.0
4	0.0	0.0	6.4	14.9	48.9	14.9	6.4	0.0	0.0	2.1	4.3	0.0	2.1	0.0	0.0
5	0.0	3.3	39.8	0.3	44.7	0.0	1.6	7.9	0.0	0.3	0.0	0.0	2.2	0.0	0.0
6	0.5	0.0	1.5	0.5	0.5	86.7	0.5	3.1	4.1	0.5	0.0	0.0	2.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	8.1	4.6	0.0	0.0	0.0	0.8	77.7	0.0	1.9	2.3	0.4	4.2	0.0	0.0
9	0.1	0.7	0.6	0.0	0.0	0.0	0.0	0.8	73.1	3.1	1.2	2.6	17.9	0.0	0.0
10	0.0	4.0	8.0	0.0	0.0	0.0	0.0	0.0	4.0	60.0	4.0	0.0	20.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	53.0	3.6	33.7	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	0.0	0.0	59.3	29.6	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	20.0	0.0	20.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 19091  
 #Vendor: 19443  
 #mistyped: 5023  
 #sensor err: 981  
 #extra Vend: 998  
 #Missing Vend: 693  
 #Correct: 13298  
 #Splits: 57  
 #Combinations: 10

Figure 56. Classification Matrix for IRD TC/C 530-4D/4P/4L (PR-L-PR) 2nd 48-Hour Test



**Axles Spacing Statistics**

Speeds	Mean	STD	Veh	Axle_Spacings
<30	4.584	7.571	13	22
30.0-34.9	8.169	5.037	3	11
35.0-39.9	0.000	0.000	0	0
40.0-44.9	0.061	0.544	11	17
45.0-49.9	0.099	0.324	79	120
50.0-54.9	0.107	0.377	532	955
55.0-59.9	0.100	0.386	1950	3426
60.0-64.9	0.087	0.366	4399	7611
65.0-69.9	0.086	0.357	4320	6078
70.0-74.9	0.086	0.351	1655	1909
75.0-79.9	0.090	0.260	260	280
>80	0.095	0.489	42	42
Overall	0.099	0.515	13264	20471

**Length Statistics**

Speeds	Mean	STD	Vehicles
<30	12.499	32.407	7
30.0-34.9	34.960	3.250	3
35.0-39.9	0.000	0.000	0
40.0-44.9	0.883	10.818	11
45.0-49.9	-2.419	6.992	79
50.0-54.9	-0.657	13.238	532
55.0-59.9	-1.186	14.202	1950
60.0-64.9	-1.565	11.737	4396
65.0-69.9	-1.870	9.625	4319
70.0-74.9	-2.781	6.377	1655
75.0-79.9	-2.915	5.684	260
>80	-2.078	1.550	41
Overall	-1.739	10.952	13253

**Wheelbase Statistics**

Speeds	Mean	STD	Vehicles
<30	7.757	15.932	13
30.0-34.9	29.953	3.479	3
35.0-39.9	0.000	0.000	0
40.0-44.9	0.094	0.562	11
45.0-49.9	0.151	0.288	79
50.0-54.9	0.192	0.348	532
55.0-59.9	0.177	0.356	1950
60.0-64.9	0.150	0.305	4399
65.0-69.9	0.121	0.317	4320
70.0-74.9	0.099	0.335	1655
75.0-79.9	0.096	0.241	260
>80	0.095	0.489	42
Overall	0.153	0.783	13264

**Length Percentile Statistics**

Speeds	Mean	STD	Vehicles
<30	270.92	365.99	7
30.0-34.9	208.355	1.714	3
35.0-39.9	0.000	0.000	0
40.0-44.9	101.734	42.429	11
45.0-49.9	91.341	35.324	79
50.0-54.9	103.801	64.212	532
55.0-59.9	102.173	64.335	1950
60.0-64.9	98.521	56.811	4396
65.0-69.9	93.963	45.941	4319
70.0-74.9	87.473	23.823	1655
75.0-79.9	86.127	19.372	260
>80	89.74	14.09	41
Overall	96.21	52.28	13253

**Figure 57. Measurement Accuracy Versus Speed (MPH)  
IRD TC/C 530-4D/4P/4L (PR-L-PR) - 2nd 48-Hour Test**

**Table XXVI. Accuracy Summary for IRD TC/C 530-4D/4P/4L  
(PR-L-PR) 2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	5.35	72.6	92.9	0.099	0.515	-1.739	10.952	96.21	52.28
<b>% Trucks</b>									
0-20	3.58	72.4	94.7	0.100	0.445	-1.856	9.758	94.19	47.46
20-40	5.17	74.6	92.9	0.083	0.378	-1.581	12.028	98.34	55.54
40-60	27.07	57.4	72.0	0.299	1.677	-1.874	13.981	101.29	77.35
<b>Air Temp</b>									
60-69	9.69	67.3	88.9	0.120	0.752	-1.999	9.775	94.09	49.29
70-79	3.99	74.1	94.0	0.076	0.395	-1.701	11.412	96.86	53.27
80-89	2.30	77.2	96.0	0.131	0.421	-1.458	11.132	97.30	53.46
<b>Pav Temp</b>									
60- 69	10.19	66.4	88.6	0.129	0.734	-1.942	9.435	93.93	45.03
70- 79	11.25	67.6	87.4	0.115	0.718	-1.932	10.792	95.54	53.79
80- 89	3.27	75.9	95.1	0.075	0.357	-1.634	12.190	98.28	56.03
90- 99	1.93	74.9	95.7	0.072	0.382	-1.244	10.601	97.62	53.78
100-109	2.13	75.6	95.7	0.110	0.401	-2.032	10.650	94.51	47.30
110-119	1.54	74.5	97.1	0.087	0.362	-1.531	11.255	96.21	55.98

### 5.2.9.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XXVII. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table XXVII. Long-Term Count/Classification Accuracy  
IRD TC/C 530-4D/4P/4L (PR-L-PR)**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	61214	59545	1669	102.80	101.50	102.25
Axles	157450	N/A	N/A	N/A	95.39	N/A
Class 1	101	97	4	104.12	81.25	85.71
Class 2	29377	39427	-10050	74.51	74.39	75.20
Class 3	18134	7558	10576	239.93	228.11	207.44
Class 4	134	39	95	343.59	233.33	228.57
Class 5	1855	719	1136	258.00	141.28	261.19
Class 6	729	686	43	106.27	110.64	108.77
Class 7	9	127	-118	7.09	27.27	9.09
Class 8	832	1061	-229	78.42	97.87	90.27
Class 9	9627	7326	2301	131.41	144.44	127.30
Class 10	107	386	-279	27.72	26.67	26.56
Class 11	242	386	-76	76.10	100.00	90.00
Class 12	67	300	-233	22.33	28.57	21.31
Class 13	0	1501	-1501	0.00	0.00	0.00
Class 15	0	0	0	--	--	--

### **5.2.10 International Road Dynamics, Inc. TC/C 530-4D/4P/4L (P-L-P)**

The second sensor configuration used with the International Road Dynamics mode TC/C 530-4D/4P/4L classifier was P-L-P using Philips vibracoax axle sensors. The results of this classifier and sensor configuration are presented below.

#### **5.2.10.1 First 48-Hour Test**

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 58. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 70.8% of the vehicles (89.7% if class 2-3 errors not included). The number of vehicle axles was miscounted 7.25% (percent sensor errors) of the time. There were less than 1.0% of the vehicles classified that were the result of a suspected split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 59. The TC/C 530-4D/4P/4L classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXVIII contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	6958	145	0	8	3	1	3	23	4	1	0	4	0	0
3	3	3041	1677	0	7	2	0	56	10	2	1	0	2	0	0
4	0	2	5	12	28	17	1	0	0	1	0	0	0	0	0
5	2	50	324	0	255	3	2	25	1	1	3	0	1	0	0
6	3	5	8	2	1	403	7	0	10	1	0	0	2	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	2	27	5	0	0	0	1	241	5	1	4	0	1	0	0
9	3	71	19	0	9	2	1	14	2217	732	37	7	76	0	0
10	0	1	1	0	0	0	0	0	4	23	0	0	1	0	0
11	0	1	1	0	0	0	0	2	2	1	71	9	2	0	0
12	0	0	2	0	0	0	0	0	0	0	1	20	2	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	1	0	0	0	0	25	4	2	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	85.7	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	97.3	2.0	0.0	0.1	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.1	0.0	0.0
3	0.1	63.3	34.9	0.0	0.1	0.0	0.0	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	3.0	7.6	18.2	42.4	25.8	1.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0
5	0.3	7.5	48.6	0.0	38.2	0.4	0.3	3.7	0.1	0.1	0.4	0.0	0.1	0.0	0.0
6	0.7	1.1	1.8	0.5	0.2	91.2	1.6	0.0	2.3	0.2	0.0	0.0	0.5	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.7	9.4	1.7	0.0	0.0	0.0	0.3	84.0	1.7	0.3	1.4	0.0	0.3	0.0	0.0
9	0.1	2.2	0.6	0.0	0.3	0.1	0.0	0.4	69.5	23.0	1.2	0.2	2.4	0.0	0.0
10	0.0	3.3	3.3	0.0	0.0	0.0	0.0	0.0	13.3	76.7	0.0	0.0	3.3	0.0	0.0
11	0.0	1.1	1.1	0.0	0.0	0.0	0.0	2.2	2.2	1.1	79.8	10.1	2.2	0.0	0.0
12	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	80.0	8.0	0.0	0.0
13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	3.1	0.0	0.0	0.0	0.0	78.1	12.5	6.2	0.0	0.0	0.0	0.0	0.0

#Real: 18512  
 #Vendor: 18238  
 #mistyped: 4910  
 #sensor err: 1217  
 #extra Vend: 1181  
 #Missing Vend: 1551  
 #Correct: 11883  
 #Splits: 120  
 #Combinations: 24

Figure 58. Classification Matrix for IRD TC/C 530-4D/4P/4L (P-L-P) 1st 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	8.598	10.973	4	13
30.0-34.9	8.026	2.622	5	20
35.0-39.9	0.284	0.161	2	5
40.0-44.9	0.414	0.556	13	25
45.0-49.9	0.165	0.314	73	135
50.0-54.9	0.186	0.591	417	853
55.0-59.9	0.171	0.440	1677	3172
60.0-64.9	0.132	0.601	3929	7449
65.0-69.9	0.106	0.588	3803	5814
70.0-74.9	0.084	0.557	1567	1926
75.0-79.9	-0.091	0.903	286	339
>80	0.197	0.189	38	38
Overall	0.139	0.726	11814	19789

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	36.280	11.961	4
30.0-34.9	40.598	7.754	5
35.0-39.9	4.155	5.315	2
40.0-44.9	4.882	15.566	13
45.0-49.9	-0.987	17.623	73
50.0-54.9	0.298	14.791	417
55.0-59.9	-0.299	13.708	1677
60.0-64.9	-0.642	12.733	3929
65.0-69.9	-1.804	9.533	3803
70.0-74.9	-2.294	7.251	1567
75.0-79.9	-1.559	7.482	286
>80	-4.580	11.714	38
Overall	-1.154	11.423	11814

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	27.945	18.014	4
30.0-34.9	32.102	0.822	5
35.0-39.9	0.710	0.110	2
40.0-44.9	0.795	1.109	13
45.0-49.9	0.305	0.211	73
50.0-54.9	0.381	0.827	417
55.0-59.9	0.324	0.600	1677
60.0-64.9	0.250	0.797	3929
65.0-69.9	0.162	0.731	3803
70.0-74.9	0.103	0.754	1567
75.0-79.9	-0.108	1.445	286
>80	0.197	0.189	38
Overall	0.232	1.181	11814

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	218.95	136.20	4
30.0-34.9	250.692	84.361	5
35.0-39.9	125.312	28.191	2
40.0-44.9	127.585	84.545	13
45.0-49.9	107.863	69.720	73
50.0-54.9	108.952	66.943	417
55.0-59.9	105.853	63.239	1677
60.0-64.9	103.210	60.397	3929
65.0-69.9	95.026	42.959	3803
70.0-74.9	90.793	30.736	1567
75.0-79.9	93.685	37.820	286
>80	86.97	18.35	38
Overall	99.38	52.81	11814

Figure 59. Measurement Accuracy Versus Speed (MPH)  
IRD TC/C 530-4D/4P/4L (P-L-P) - 1st 48-Hour Test

**Table XXVIII. Accuracy Summary for IRD TC/C 530-4D/4P/4L  
(P-L-P) 1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	7.25	70.8	89.7	0.139	0.726	-1.145	11.423	99.38	52.81
<b>% Trucks</b>									
0-20	3.70	71.3	93.2	0.155	0.482	-1.546	9.088	95.15	43.27
20-40	6.33	71.7	90.7	0.132	0.690	-1.045	11.884	100.39	54.96
40-60	22.02	64.1	75.6	0.162	1.199	-0.986	12.568	101.65	56.69
60-80	31.20	55.4	65.7	0.146	1.144	-1.593	12.152	100.57	51.01
<b>Air Temp</b>									
50-59	8.41	65.3	89.4	0.125	0.634	-2.083	8.809	93.47	39.51
60-69	13.16	67.2	83.8	0.115	1.000	-1.340	12.084	99.56	54.97
70-79	8.86	69.3	87.9	0.134	0.492	-1.065	12.023	100.19	55.55
80-89	3.00	75.2	93.8	0.151	0.680	-0.845	11.571	100.76	54.41
<b>Pav Temp</b>									
60- 69	13.79	62.3	83.5	0.117	0.791	-2.017	9.423	95.02	40.61
70- 79	11.39	68.6	85.3	0.115	1.020	-1.177	12.302	100.01	56.55
80- 89	10.06	68.2	86.9	0.108	0.502	-0.946	12.244	101.06	57.92
90- 99	6.57	71.3	90.0	0.140	0.431	-1.207	12.256	100.38	55.82
100-109	2.74	74.8	94.4	0.157	0.482	-0.795	12.171	101.13	55.84
110-119	2.82	75.7	93.7	0.156	0.818	-0.785	10.907	100.36	52.62

### 5.2.10.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 60. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 73.8% of the vehicles (93.9% if class 2-3 errors not included). The number of vehicle axles was miscounted 4.37% (percent sensor errors) of the time. There were less than 0.5% of the vehicles classified that were the result of a suspected split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 61. The TC/C 530-4D/4P/4L classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXIX contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.



Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	15	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	3	8565	135	0	4	1	0	12	5	3	1	0	1	0	0
3	1	3503	1881	0	40	1	0	66	6	1	0	0	2	0	0
4	0	0	3	5	21	13	2	0	0	0	0	0	1	0	0
5	0	11	135	4	182	0	1	32	0	0	0	0	2	0	0
6	0	1	7	2	0	164	3	5	7	0	0	0	3	0	0
7	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
8	2	19	5	0	0	0	2	228	3	0	1	0	1	0	0
9	2	20	12	0	5	2	0	22	2229	507	49	2	34	0	0
10	0	2	1	0	0	0	0	2	2	17	1	0	1	0	0
11	0	1	0	0	0	0	0	0	1	0	80	2	1	0	0
12	0	0	0	0	0	0	0	0	0	0	0	27	1	0	0
13	0	0	0	0	0	0	0	1	0	4	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	93.8	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	98.1	1.5	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	63.7	34.2	0.0	0.7	0.0	0.0	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	6.7	11.1	46.7	28.9	4.4	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
5	0.0	3.0	36.8	1.1	49.6	0.0	0.3	8.7	0.0	0.0	0.0	0.0	0.5	0.0	0.0
6	0.0	0.5	3.6	1.0	0.0	85.4	1.6	2.6	3.6	0.0	0.0	0.0	1.6	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.8	7.3	1.9	0.0	0.0	0.0	0.8	87.4	1.1	0.0	0.4	0.0	0.4	0.0	0.0
9	0.1	0.7	0.4	0.0	0.2	0.1	0.0	0.8	77.3	17.6	1.7	0.1	1.2	0.0	0.0
10	0.0	7.7	3.8	0.0	0.0	0.0	0.0	7.7	7.7	65.4	3.8	0.0	3.8	0.0	0.0
11	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	94.1	2.4	1.2	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.4	3.6	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	80.0	0.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 19091  
 #Vendor: 19186  
 #mistyped: 4751  
 #sensor err: 793  
 #extra Vend: 927  
 #Missing Vend: 864  
 #Correct: 13393  
 #Splits: 49  
 #Combinations: 17

Figure 60. Classification Matrix for IRD TC/C 530-4D/4P/4L  
 (P-L-P) 2nd 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	-1.550	0.734	4	4
30.0-34.9	6.329	9.248	5	20
35.0-39.9	6.697	4.218	2	8
40.0-44.9	-0.173	0.609	5	8
45.0-49.9	0.028	0.429	63	104
50.0-54.9	0.036	0.457	441	766
55.0-59.9	0.010	0.456	1693	3062
60.0-64.9	-0.006	0.437	4163	7558
65.0-69.9	-0.013	0.394	4481	6509
70.0-74.9	-0.071	0.538	2037	2506
75.0-79.9	-0.372	1.052	384	474
>80	-0.673	1.437	70	91
Overall	-0.014	0.610	13348	21110

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	-1.835	1.075	2
30.0-34.9	34.358	5.226	5
35.0-39.9	39.695	4.985	2
40.0-44.9	-3.530	0.984	5
45.0-49.9	-0.600	10.245	63
50.0-54.9	-1.153	13.088	441
55.0-59.9	-1.460	12.965	1693
60.0-64.9	-1.992	11.524	4163
65.0-69.9	-2.329	9.538	4481
70.0-74.9	-2.894	7.127	2037
75.0-79.9	-2.796	7.840	384
>80	-3.264	4.849	70
Overall	-2.152	10.493	13346

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	-1.550	0.734	4
30.0-34.9	25.318	7.203	5
35.0-39.9	26.790	3.580	2
40.0-44.9	-0.276	0.651	5
45.0-49.9	0.047	0.418	63
50.0-54.9	0.063	0.423	441
55.0-59.9	0.018	0.440	1693
60.0-64.9	-0.010	0.441	4163
65.0-69.9	-0.018	0.393	4481
70.0-74.9	-0.087	0.764	2037
75.0-79.9	-0.459	1.833	384
>80	-0.874	2.620	70
Overall	-0.023	0.864	13348

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	89.04	5.96	2
30.0-34.9	226.454	34.741	5
35.0-39.9	274.061	81.253	2
40.0-44.9	85.133	6.336	5
45.0-49.9	99.561	53.997	63
50.0-54.9	100.988	63.026	441
55.0-59.9	100.075	60.539	1693
60.0-64.9	96.799	52.504	4163
65.0-69.9	92.142	42.962	4481
70.0-74.9	87.761	30.352	2037
75.0-79.9	88.837	36.151	384
>80	87.44	14.08	70
Overall	94.21	47.94	13346

Figure 61. Measurement Accuracy Versus Speed (MPH)  
 IRD TC/C 530-4D/4P/4L (P-L-P) - 2nd 48-Hour Test

**Table XXIX. Accuracy Summary for IRD TC/C 530-4D/4P/4L  
(P-L-P) 2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
Total	4.37	73.8	93.9	-0.014	.610	-2.152	10.493	94.21	47.94
% Trucks									
0-20	2.99	73.2	95.2	-0.001	.633	-2.252	9.326	92.19	43.53
20-40	5.26	74.9	93.1	-0.021	.581	-1.971	11.564	96.35	52.15
40-60	12.83	70.3	84.2	-0.074	.626	-2.321	12.864	99.09	56.08
Air Temp									
60-69	5.45	71.4	92.5	-0.024	.744	-2.306	9.634	93.06	44.24
70-79	4.37	74.2	94.0	-0.030	.534	-2.143	11.026	94.68	49.76
80-89	2.80	76.8	95.7	0.040	.603	-2.030	9.847	93.95	46.41
Pav Temp									
60- 69	4.23	71.9	93.6	-0.016	.793	-1.955	10.302	95.30	48.96
70- 79	7.19	71.7	91.1	-0.046	.620	-2.260	10.393	94.21	47.72
80- 89	5.53	74.1	93.0	-0.025	.528	-2.116	11.871	95.67	52.17
90- 99	2.66	74.8	95.5	-0.018	.739	-1.948	10.259	94.43	49.19
100-109	2.18	75.7	95.9	0.024	.480	-2.404	9.670	92.26	42.46
110-119	0.58	75.4	97.9	0.002	.336	-1.786	8.847	92.97	45.20

5.2.10.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XXX. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table XXX. Long-Term Count/Classification Accuracy  
IRD TC/C 530-4D/4P/4L (P-L-P)**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	61214	58925	2289	103.88	102.54	103.44
Axles	157450	N/A	N/A	N/A	100.91	N/A
Class 1	101	84	17	120.24	92.86	120.00
Class 2	29377	38695	-9318	75.92	76.42	77.13
Class 3	18134	7660	10474	236.74	225.98	208.79
Class 4	134	41	93	326.83	200.00	177.78
Class 5	1855	794	1061	233.63	127.27	246.48
Class 6	729	680	49	107.21	106.12	103.33
Class 7	9	24	-15	37.50	60.00	50.00
Class 8	832	1191	-359	69.86	82.63	75.23
Class 9	9627	7411	2216	129.90	129.52	130.14
Class 10	107	1690	-1583	6.33	6.37	5.23
Class 11	242	370	-128	65.41	60.00	65.22
Class 12	67	94	-27	71.28	80.00	72.22
Class 13	0	191	-191	0.00	0.00	0.00
Class 15	0	0	0	--	--	--

### **5.2.11 Golden River Traffic Ltd. Marksman 660**

The Golden River Traffic Ltd. mode Marksman 660 classifier used a P-L-P sensor configuration with Traffic 2000 axle sensors. The results of this configuration are presented below.

#### **5.2.11.1 First 48-Hour Test**

The classification equipment was not functioning at the time of the running of the first 48-hour test. Therefore, no data was collected or reduced for this test.

#### **5.2.11.2 Second 48-Hour Test**

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 62. The classification matrix is presented in both absolute numbers, and percentages.

The classifier correctly classified 63.9% of the vehicles (82.3% if class 2-3 errors are not included). The number of vehicle axles was miscounted 7.91% (percent sensor errors) of the time. There were less than 1.0% of the vehicles classified that were the result of a suspected split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 63.

The Marksman 660 classifier measures axle spacings and wheelbase length. The measurement error statistics (mean and deviation) for all measurements are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXXI contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	14	2	6	3	0	0	0	1	0	0	0	0	0	0
2	23	7633	450	637	27	17	0	40	120	2	13	3	10	0	0
3	12	2902	1725	685	54	10	2	73	53	0	9	4	7	0	0
4	0	6	3	34	3	0	0	0	0	0	0	0	0	0	0
5	3	39	110	65	104	4	5	19	0	1	6	0	0	0	0
6	0	1	4	17	11	139	0	3	7	0	3	2	0	0	0
7	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
8	0	1	10	23	5	1	2	174	3	2	20	7	1	0	0
9	0	19	15	6	0	1	0	201	1804	93	188	197	203	0	0
10	0	0	3	0	0	0	0	1	3	10	2	0	5	0	0
11	0	1	0	0	0	0	0	9	2	3	27	18	23	0	0
12	0	0	0	0	0	0	0	0	0	0	0	13	12	0	0
13	0	0	0	0	0	0	0	0	0	3	1	0	2	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	1	0	0	0	0	1	2	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	3.7	51.9	7.4	22.2	11.1	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0
2	0.3	85.0	5.0	7.1	0.3	0.2	0.0	0.4	1.3	0.0	0.1	0.0	0.1	0.0	0.0
3	0.2	52.4	31.2	12.4	1.0	0.2	0.0	1.3	1.0	0.0	0.2	0.1	0.1	0.0	0.0
4	0.0	13.0	6.5	73.9	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.8	11.0	30.9	18.3	29.2	1.1	1.4	5.3	0.0	0.3	1.7	0.0	0.0	0.0	0.0
6	0.0	0.5	2.1	9.1	5.9	74.3	0.0	1.6	3.7	0.0	1.6	1.1	0.0	0.0	0.0
7	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.4	4.0	9.2	2.0	0.4	0.8	69.9	1.2	0.8	8.0	2.8	0.4	0.0	0.0
9	0.0	0.7	0.6	0.2	0.0	0.0	0.0	7.4	66.2	3.4	6.9	7.2	7.4	0.0	0.0
10	0.0	0.0	12.3	0.0	0.0	0.0	0.0	4.2	12.5	41.7	8.3	0.0	20.8	0.0	0.0
11	0.0	1.2	0.0	0.0	0.0	0.0	0.0	10.8	2.4	3.6	32.5	21.7	27.7	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.0	48.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	16.7	0.0	33.3	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	25.0	0.0	0.0	0.0	0.0	25.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 20116  
 #Vendor: 20654  
 #mistyped: 6583  
 #sensor err: 1444  
 #extra Vend: 2156  
 #Missing Vend: 1681  
 #Correct: 11666  
 #Splits: 104  
 #Combinations: 41

Figure 62. Classification Matrix for Golden River Marksman 660  
 2nd 48-Hour Test

Axles Spacing Statistics

Speeds	Mean	STD	Veh	Axle_Spacings
<30	-558.115	591.180	6	18
30.0-34.9	2.098	13.125	6	18
35.0-39.9	-26.070	98.663	19	73
40.0-44.9	-15.847	70.250	28	100
45.0-49.9	-7.329	10.963	102	324
50.0-54.9	-6.438	38.716	313	625
55.0-59.9	-2.803	16.394	1146	1875
60.0-64.9	-2.876	16.509	3241	5182
65.0-69.9	-2.501	16.172	4075	6149
70.0-74.9	-2.071	21.635	2099	2636
75.0-79.9	-1.278	11.552	445	523
>80	-85.445	261.123	127	241
Overall	-4.625	45.606	11607	17764

Wheelbase Statistics

Speeds	Mean	STD	Vehicles
<30	-1674.345	1739.790	6
30.0-34.9	6.295	11.000	6
35.0-39.9	-100.165	260.605	19
40.0-44.9	-56.598	180.700	28
45.0-49.9	-23.280	16.209	102
50.0-54.9	-12.856	75.988	313
55.0-59.9	-4.587	13.629	1146
60.0-64.9	-4.599	13.778	3241
65.0-69.9	-3.775	11.416	4075
70.0-74.9	-2.601	34.359	2099
75.0-79.9	-1.502	9.046	445
>80	-162.144	592.644	127
Overall	-7.078	88.453	11607

Figure 63. Measurement Accuracy Versus Speed (MPH)  
Golden River Marksman 660 - 2nd 48-Hour Test

**Table XXXI. Accuracy Summary for Golden River Marksman 660  
2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	7.91	63.9	82.3	-4.625	45.61	*	*	*	*
<b>% Trucks</b>									
0-20	5.79	63.8	84.0	-3.235	37.58	*	*	*	*
20-40	8.30	66.0	82.8	-4.269	34.23				
40-60	26.87	51.0	62.7	-18.76	122.4				
<b>Air Temp</b>									
60-69	11.61	59.9	78.2	-7.968	75.11	*	*	*	*
70-79	6.27	65.8	84.2	-3.396	27.16				
80-89	6.02	65.0	84.6	-2.469	16.05				
<b>Pav Temp</b>									
60- 69	20.24	48.8	66.9	-2.908	26.61				
70- 79	8.81	64.0	80.9	-5.601	60.09				
80- 89	5.24	68.4	86.6	-2.975	16.36	*	*	*	*
90- 99	5.52	67.0	86.2	-3.445	35.64				
100-109	4.66	67.5	85.7	-2.586	15.85				
110-119	5.88	56.9	80.9	-0.794	12.97				



5.2.11.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XXXII. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table XXXII. Long-Term Count/Classification Accuracy  
Golden River Marksman 660**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	61389	57803	3586	106.20	97.74	110.57
Axles	157475	N/A	N/A	N/A	95.32	N/A
Class 1	99	220	-121	45.00	33.33	66.67
Class 2	29467	32698	-3231	90.12	85.11	98.45
Class 3	18347	7884	10463	232.71	207.58	211.03
Class 4	134	4467	-4333	3.00	2.38	2.58
Class 5	1862	880	982	211.59	110.16	214.72
Class 6	734	712	22	103.09	99.02	99.20
Class 7	9	37	-28	24.32	100.00	12.50
Class 8	817	1851	-1034	44.14	47.70	45.75
Class 9	9508	7233	2275	131.45	141.93	124.07
Class 10	102	283	-181	36.04	24.07	60.71
Class 11	244	642	-398	38.01	28.91	46.39
Class 12	66	485	-419	13.61	9.09	30.95
Class 13	0	411	-411	0.00	0.00	0.00
Class 15	0	0	0	--	--	--

### 5.2.12 Diamond Traffic Products TT-2001 (Autologger Maxi)

The Diamond Traffic Products model TT-2001 classifier was tested using two different sets of sensors. Each set of the sensors was used in a P-L-P configuration. The first set of sensors used Autologger Maxi piezoelectric axle sensors. The results of this classifier using the Autologger Maxi axle sensors are presented below.

#### 5.2.12.1 First 48-Hour Test

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 64. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 73.1% of the vehicles (92.0% if class 2-3 errors not included). The number of vehicle axles was miscounted 3.17% (percent sensor errors) of the time. There were less than 0.5% of the vehicles classified by the TT-2001 that were the result of a suspected split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 65. The TT-2001 classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXXIII contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	83	6526	395	3	43	10	0	3	6	0	1	0	3	0	0
3	51	2761	1761	4	38	3	0	62	1	0	1	0	5	0	0
4	0	1	4	26	27	8	0	0	0	0	0	0	0	0	0
5	5	54	314	12	238	4	2	26	4	0	0	0	2	0	0
6	33	17	8	1	1	333	4	4	7	0	0	0	10	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	6	3	7	1	0	4	249	2	1	5	0	2	0	0
9	8	38	2	0	3	0	0	92	2901	63	108	37	17	0	0
10	0	1	0	0	0	0	0	1	5	26	1	0	3	0	0
11	0	0	0	0	0	0	0	3	1	0	91	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	1	2	0	0	0	0	24	4	0	1	2	1	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	66.7	16.7	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.2	92.3	5.6	0.0	0.6	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3	1.1	58.9	37.6	0.1	0.8	0.1	0.0	1.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0
4	0.0	1.5	6.1	39.4	40.9	12.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.8	8.2	47.5	1.8	36.0	0.6	0.3	3.9	0.6	0.0	0.0	0.0	0.3	0.0	0.0
6	7.9	4.1	1.9	0.2	0.2	79.7	1.0	1.0	1.7	0.0	0.0	0.0	2.4	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.4	2.1	1.1	2.5	0.4	0.0	1.4	88.6	0.7	0.4	1.8	0.0	0.7	0.0	0.0
9	0.2	1.2	0.1	0.0	0.1	0.0	0.0	2.8	88.7	1.9	3.3	1.1	0.5	0.0	0.0
10	0.0	2.7	0.0	0.0	0.0	0.0	0.0	2.7	13.5	70.3	2.7	0.0	8.1	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	1.1	0.0	95.8	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	2.9	5.7	0.0	0.0	0.0	0.0	68.6	11.4	0.0	2.9	5.7	2.9	0.0	0.0

#Real: 18477  
 #Vendor: 17471  
 #mistyped: 4481  
 #sensor err: 528  
 #extra Vend: 751  
 #Missing Vend: 1731  
 #Correct: 12183  
 #Splits: 10  
 #Combinations: 36

Figure 64. Classification Matrix for Diamond TT-2001 (Autologger) 1st 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	1.861	4.659	16	22
30.0-34.9	4.188	5.095	6	15
35.0-39.9	3.929	7.993	16	38
40.0-44.9	1.886	3.650	23	53
45.0-49.9	0.879	2.071	60	139
50.0-54.9	0.152	0.938	383	852
55.0-59.9	0.211	5.640	1515	3164
60.0-64.9	0.014	0.460	3749	7922
65.0-69.9	-0.019	0.577	3895	6716
70.0-74.9	-0.127	1.431	1798	2425
75.0-79.9	-0.640	1.669	469	589
>80	-1.519	3.481	173	212
Overall	0.011	2.340	12103	22147

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	4.239	25.328	9
30.0-34.9	22.640	16.251	6
35.0-39.9	13.127	22.179	14
40.0-44.9	5.371	26.835	23
45.0-49.9	6.621	18.561	60
50.0-54.9	1.471	12.734	383
55.0-59.9	0.178	17.204	1515
60.0-64.9	-1.312	6.931	3746
65.0-69.9	-1.799	4.483	3894
70.0-74.9	-1.855	5.280	1797
75.0-79.9	-3.097	6.185	469
>80	-2.164	9.579	173
Overall	-1.271	8.747	12089

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	2.559	8.595	16
30.0-34.9	10.470	11.944	6
35.0-39.9	9.331	12.288	16
40.0-44.9	4.347	7.494	23
45.0-49.9	2.037	4.268	60
50.0-54.9	0.337	1.517	383
55.0-59.9	0.441	12.888	1515
60.0-64.9	0.029	0.660	3749
65.0-69.9	-0.033	0.836	3895
70.0-74.9	-0.172	1.405	1798
75.0-79.9	-0.804	2.479	469
>80	-1.861	2.928	173
Overall	0.020	4.773	12103

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	247.63	212.66	9
30.0-34.9	318.294	264.479	6
35.0-39.9	177.501	114.071	14
40.0-44.9	173.979	175.556	23
45.0-49.9	163.931	177.111	60
50.0-54.9	114.360	74.276	383
55.0-59.9	104.430	59.097	1515
60.0-64.9	97.656	39.052	3746
65.0-69.9	93.527	21.824	3894
70.0-74.9	93.072	31.101	1797
75.0-79.9	89.697	17.570	469
>80	106.16	133.96	173
Overall	97.62	45.35	12089

Figure 65. Measurement Accuracy Versus Speed (MPH)  
Diamond TT-2001 (Autologger) - 1st 48-Hour Test

**Table XXXIII. Accuracy Summary for Diamond TT-2001  
(Autologger) 1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	3.17	73.1	92.0	0.011	2.340	-1.271	8.747	97.62	45.35
<b>% Trucks</b>									
0-20	1.15	74.3	95.7	0.054	0.431	-1.419	5.523	94.46	29.70
20-40	3.96	71.3	90.5	-0.031	1.169	-1.248	7.697	98.48	49.49
40-60	1.51	84.4	95.8	0.003	0.304	-1.489	6.272	96.95	33.20
60-80	1.44	86.8	96.6	0.544	10.28	-0.379	32.202	98.98	57.29
<b>Air Temp</b>									
50-59	0.64	74.8	98.1	0.010	0.258	-1.662	3.656	93.73	26.01
60-69	1.41	79.9	95.7	0.132	4.538	-1.219	13.297	97.20	42.98
70-79	1.52	78.1	95.8	0.052	0.297	-1.278	6.564	96.41	36.63
80-89	5.16	68.9	88.7	-0.036	1.583	-1.288	7.707	98.64	56.55
<b>Pav Temp</b>									
60- 69	1.70	83.0	97.4	0.431	8.964	-0.706	27.135	98.42	53.78
70- 79	1.18	79.6	95.6	0.035	0.450	-1.349	7.117	97.05	40.53
80- 89	1.59	77.4	95.8	0.033	0.322	-1.230	6.553	96.76	37.18
90- 99	1.65	78.4	96.0	0.052	0.292	-1.424	5.655	95.53	31.28
100-109	2.72	74.3	93.9	-0.061	1.126	-1.506	6.385	96.77	55.86
110-119	7.63	62.9	83.1	-0.023	2.123	-0.985	9.298	101.36	62.40

### 5.2.12.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 66. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 11.0% of the vehicles (11.8% if class 2-3 errors not included). The number of vehicle axles was miscounted 11.65% (percent sensor errors) of the time. There were problems involving the recording software for the classifier during this test. These problems occurred after an upgrade to the software was received between the first and second 48-hour tests. The problems are associated with the data recording and not the actual classifying of vehicles.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 67. The TT-2001 classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXXIV contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	36	2	0	1	0	0	0	1	0	0	11	0	0	0
3	1	27	31	1	3	0	0	4	1	0	1	32	0	0	0
4	0	1	2	0	1	1	0	0	0	0	0	4	0	0	0
5	0	3	5	0	14	0	0	0	0	0	0	12	0	0	0
6	0	0	0	0	0	21	0	0	1	0	0	123	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	2	1	0	0	0	0	15	0	0	1	150	0	0	0
9	15	23	0	1	0	1	0	28	268	2	7	1587	3	0	0
10	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0
11	0	0	0	0	0	0	0	1	0	0	8	44	0	0	0
12	0	0	0	0	0	0	0	0	0	4	0	19	0	0	0
13	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	1.9	69.2	3.8	0.0	1.9	0.0	0.0	0.0	1.9	0.0	0.0	21.2	0.0	0.0	0.0
3	1.0	26.7	30.7	1.0	3.0	0.0	0.0	4.0	1.0	0.0	1.0	31.7	0.0	0.0	0.0
4	0.0	11.1	22.2	0.0	11.1	11.1	0.0	0.0	0.0	0.0	0.0	44.4	0.0	0.0	0.0
5	0.0	8.8	14.7	0.0	41.2	0.0	0.0	0.0	0.0	0.0	0.0	35.3	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0	0.7	0.0	0.0	84.8	0.0	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	1.2	0.6	0.0	0.0	0.0	0.0	8.9	0.0	0.0	0.6	88.8	0.0	0.0	0.0
9	0.8	1.2	0.0	0.1	0.0	0.1	0.0	1.4	13.9	0.1	0.4	82.0	0.2	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	15.1	83.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.4	0.0	82.6	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	75.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

#Real: 14519  
 #Vendor: 3951  
 #mistyped: 3332  
 #sensor err: 436  
 #extra Vend: 126  
 #Missing Vend: 10616  
 #Correct: 412  
 #Splits: 1  
 #Combinations: 79

Figure 66. Classification Matrix for Diamond TT-2001 (Autologger) 2nd 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	6.525	6.377	1	4
30.0-34.9	8.061	2.857	2	8
35.0-39.9	0.000	0.000	0	0
40.0-44.9	0.000	0.000	0	0
45.0-49.9	-0.300	0.320	1	4
50.0-54.9	-0.341	0.623	16	51
55.0-59.9	-0.155	0.481	54	186
60.0-64.9	-0.231	0.390	157	555
65.0-69.9	-0.264	0.465	138	442
70.0-74.9	-0.223	0.961	32	85
75.0-79.9	-0.120	0.273	2	5
>80	-1.660	0.000	1	1
Overall	-0.166	0.978	404	1341

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	31.890	0.000	1
30.0-34.9	37.030	0.130	2
35.0-39.9	0.000	0.000	0
40.0-44.9	0.000	0.000	0
45.0-49.9	-3.540	0.000	1
50.0-54.9	-4.438	2.040	16
55.0-59.9	-3.690	3.204	54
60.0-64.9	-3.993	1.967	157
65.0-69.9	-4.176	4.013	138
70.0-74.9	-3.863	3.861	32
75.0-79.9	-0.400	0.530	2
>80	-6.280	0.000	1
Overall	-3.717	4.613	404

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	26.100	0.000	1
30.0-34.9	32.245	1.015	2
35.0-39.9	0.000	0.000	0
40.0-44.9	0.000	0.000	0
45.0-49.9	-1.200	0.000	1
50.0-54.9	-1.088	0.916	16
55.0-59.9	-0.535	0.946	54
60.0-64.9	-0.816	0.688	157
65.0-69.9	-0.845	0.833	138
70.0-74.9	-0.592	0.760	32
75.0-79.9	-0.300	0.010	2
>80	-1.660	0.000	1
Overall	-0.552	2.789	404

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	196.93	0.00	1
30.0-34.9	212.398	1.140	2
35.0-39.9	0.000	0.000	0
40.0-44.9	0.000	0.000	0
45.0-49.9	95.056	0.000	1
50.0-54.9	91.433	7.020	16
55.0-59.9	94.871	18.648	54
60.0-64.9	93.194	6.028	157
65.0-69.9	93.096	11.563	138
70.0-74.9	92.092	11.743	32
75.0-79.9	97.301	2.904	2
>80	69.95	0.00	1
Overall	94.04	14.75	404

Figure 67. Measurement Accuracy Versus Speed (MPH)  
Diamond TT-2001 (Autologger) - 2nd 48-Hour Test



**Table XXXIV. Accuracy Summary for Diamond TT-2001  
(Autologger) 2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	11.65	11.0	11.8	-0.166	0.978	-3.717	4.613	94.04	14.75
<b>% Trucks</b>									
0-20	7.40	13.6	15.0	-0.063	1.389	-3.108	6.291	95.36	20.54
20-40	12.24	9.7	10.1	-0.250	0.444	-4.279	2.088	92.75	5.76
40-60	27.72	1.6	1.6	-0.051	0.244	-3.180	0.480	95.79	0.65
<b>Air Temp</b>									
60-69	21.42	23.6	24.3	-0.057	1.499	-3.473	6.363	95.34	17.84
70-79	10.73	11.2	12.1	-0.225	0.552	-3.802	3.632	93.43	13.50
80-89	6.86	0.3	0.3	0.096	0.243	-3.415	0.775	95.83	1.00
<b>Pav Temp</b>									
60- 69	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
70- 79	24.54	45.9	48.0	-0.097	1.351	-3.512	6.458	95.13	18.80
80- 89	11.68	24.1	26.2	-0.214	0.528	-3.813	2.552	93.16	11.35
90- 99	7.89	0.6	0.6	-0.494	0.982	-4.618	1.157	93.50	1.59
100-109	5.04	0.2	0.2	-0.049	0.370	-3.945	1.305	95.01	1.82
110-119	2.78	0.0	0.0	0.000	0.000	0.000	0.000	0.00	0.00

N/A - Data Not Available

5.2.12.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XXXV. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table XXXV. Long-Term Count/Classification Accuracy  
Diamond Traffic TT-2001 (Autologger)**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	37250	11318	25932	329.12	354.63	346.06
Axles	99403	N/A	N/A	N/A	252.10	N/A
Class 1	50	261	-211	19.16	--	11.54
Class 2	16987	1989	14998	854.05	--	851.83
Class 3	10457	1158	9299	903.02	--	726.35
Class 4	71	24	47	295.83	--	266.67
Class 5	1226	313	913	391.69	--	384.62
Class 6	533	338	195	157.69	--	122.77
Class 7	7	7	0	100.00	--	--
Class 8	644	719	-75	89.57	--	66.80
Class 9	6956	3563	3393	195.23	--	153.83
Class 10	81	70	11	115.71	--	73.91
Class 11	183	190	-7	96.32	--	72.58
Class 12	55	1681	-1626	3.27	0.93	100.00
Class 13	0	42	-42	0.00	--	0.00
Class 15	0	963	-963	0.00	0.00	--

### 5.2.13 Diamond Traffic Products (Philips Vibracoax)

The second set of sensors (also in the P-L-P configuration) used with the Diamond Traffic Products model TT-2001 classifier used Philips Vibracoax axle sensors. The results of this classifier using the Philips axle sensors are presented below.

#### 5.2.13.1 First 48-Hour Test

The classification matrix for the first 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 68. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 75.5% of the vehicles (93.9% if class 2-3 errors not included). The number of vehicle axles was miscounted 3.47% (percent sensor errors) of the time. There were less than 0.5% of the vehicles classified that were the result of a suspected split or combination of an actual vehicle.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 69. The TT-2001 classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXXVI contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	7541	62	0	2	3	0	6	7	0	0	0	1	0	0
3	1	3170	1741	0	4	3	0	59	3	1	2	0	4	0	0
4	0	0	2	22	29	9	0	0	0	0	0	0	0	0	0
5	1	41	326	0	270	3	2	27	3	0	1	0	5	0	0
6	3	5	0	2	1	404	3	2	11	0	0	0	1	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	3	3	2	0	0	2	280	5	0	3	0	0	0	0
9	2	5	0	0	0	0	0	33	2889	223	56	3	98	0	0
10	0	0	0	0	0	0	0	0	4	28	2	0	2	0	0
11	0	0	0	0	0	0	0	3	1	0	89	0	1	0	0
12	0	0	0	0	0	0	0	0	0	0	0	20	8	0	0
13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	2	0	0	0	0	25	6	0	0	1	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	85.7	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	98.9	0.8	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	63.6	34.9	0.0	0.1	0.1	0.0	1.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0
4	0.0	0.0	3.2	35.5	46.8	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.1	6.0	48.0	0.0	39.8	0.4	0.3	4.0	0.4	0.0	0.1	0.0	0.7	0.0	0.0
6	0.7	1.2	0.0	0.5	0.2	93.5	0.7	0.5	2.5	0.0	0.0	0.0	0.2	0.0	0.0
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	1.0	1.0	0.7	0.0	0.0	0.7	94.0	1.7	0.0	1.0	0.0	0.0	0.0	0.0
9	0.1	0.2	0.0	0.0	0.0	0.0	0.0	1.0	87.3	6.7	1.7	0.1	3.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	77.8	5.6	0.0	5.6	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	1.1	0.0	96.7	0.0	1.1	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.4	28.6	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	5.9	0.0	0.0	0.0	0.0	73.5	17.6	0.0	0.0	2.9	0.0	0.0	0.0

#Real: 18480  
 #Vendor: 18568  
 #mistyped: 4309  
 #sensor err: 610  
 #extra Vend: 909  
 #Missing Vend: 833  
 #Correct: 13290  
 #Splits: 24  
 #Combinations: 12

Figure 68. Classification Matrix for Diamond TT-2001 (Philips) 1st 48-Hour Test

Axles Spacing Statistics				
Speeds	Mean	STD	Veh	Axle_Spacings
<30	7.023	2.404	1	4
30.0-34.9	7.057	2.498	6	24
35.0-39.9	0.000	0.000	0	0
40.0-44.9	-0.072	2.786	3	9
45.0-49.9	0.113	0.230	38	89
50.0-54.9	0.094	0.332	397	836
55.0-59.9	0.257	5.287	1790	3578
60.0-64.9	0.091	0.454	4387	8934
65.0-69.9	0.103	0.410	4424	7209
70.0-74.9	0.130	0.263	1755	2173
75.0-79.9	0.121	0.265	330	366
>80	0.080	0.326	67	67
Overall	0.133	2.124	13198	23289

Wheelbase Statistics			
Speeds	Mean	STD	Vehicles
<30	28.090	0.000	1
30.0-34.9	28.227	0.356	6
35.0-39.9	0.000	0.000	0
40.0-44.9	-0.217	1.560	3
45.0-49.9	0.265	0.241	38
50.0-54.9	0.198	0.447	397
55.0-59.9	0.513	11.847	1790
60.0-64.9	0.185	0.609	4387
65.0-69.9	0.167	0.470	4424
70.0-74.9	0.161	0.285	1755
75.0-79.9	0.134	0.266	330
>80	0.080	0.326	67
Overall	0.234	4.436	13198

Length Statistics			
Speeds	Mean	STD	Vehicles
<30	39.010	0.000	1
30.0-34.9	38.602	0.499	6
35.0-39.9	0.000	0.000	0
40.0-44.9	-0.337	0.537	3
45.0-49.9	-1.290	1.502	38
50.0-54.9	-1.223	2.732	397
55.0-59.9	-0.876	13.647	1790
60.0-64.9	-1.385	4.181	4387
65.0-69.9	-1.260	2.248	4424
70.0-74.9	-1.069	1.379	1755
75.0-79.9	-1.052	1.156	330
>80	-1.101	1.300	67
Overall	-1.196	5.845	13198

Length Percentile Statistics			
Speeds	Mean	STD	Vehicles
<30	215.07	0.00	1
30.0-34.9	213.950	2.313	6
35.0-39.9	0.000	0.000	0
40.0-44.9	100.109	1.880	3
45.0-49.9	95.707	5.170	38
50.0-54.9	95.927	14.330	397
55.0-59.9	96.801	28.774	1790
60.0-64.9	95.033	11.194	4387
65.0-69.9	94.440	9.202	4424
70.0-74.9	94.324	8.587	1755
75.0-79.9	94.476	8.355	330
>80	94.52	11.25	67
Overall	95.06	14.46	13198

Figure 69. Measurement Accuracy Versus Speed (MPH)  
Diamond TT-2001 (Philips) - 1st 48-Hour Test

**Table XXXVI. Accuracy Summary for Diamond TT-2001  
(Philips) 1st 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	3.47	75.5	93.9	0.133	2.124	-1.196	5.845	95.06	14.46
<b>% Trucks</b>									
0-20	1.91	74.0	95.5	0.136	0.375	-1.250	2.349	94.09	11.40
20-40	3.40	75.7	93.9	0.107	0.516	-1.213	3.638	95.16	12.17
40-60	6.77	79.1	90.5	0.104	0.282	-1.466	1.312	94.75	6.01
60-80	10.43	75.9	86.1	0.764	11.31	0.689	34.369	100.01	59.84
<b>Air Temp</b>									
50-59	2.34	72.6	96.5	0.123	0.456	-1.311	2.393	94.01	10.96
60-69	5.11	75.6	91.9	0.240	4.815	-1.062	12.154	95.46	23.82
70-79	4.93	75.1	92.8	0.142	0.549	-1.266	2.823	94.64	13.44
80-89	2.62	76.8	95.1	0.114	0.525	-1.197	2.328	94.78	9.85
<b>Pav Temp</b>									
60- 69	9.00	74.7	89.1	0.604	9.789	-0.148	28.254	97.53	48.96
70- 79	4.62	75.5	92.0	0.138	0.643	-1.286	2.688	94.75	10.81
80- 89	4.94	74.5	93.1	0.139	0.566	-1.218	3.123	95.14	16.33
90- 99	4.44	75.7	93.4	0.115	0.287	-1.306	1.565	94.49	6.24
100-109	3.17	75.8	95.0	0.124	0.254	-1.216	1.611	94.41	8.09
110-119	2.18	77.8	95.1	0.109	0.683	-1.212	2.830	94.83	11.46

### 5.2.13.2 Second 48-Hour Test

The classification matrix for the second 48 hour test and the summary of number of vehicles (real and vendor), mistyped vehicles, sensor errors, extra vendor vehicles, missing vendor vehicles, correctly classified vehicles, suspected splits and suspected combinations are presented in Figure 70. The classification matrix is presented in both absolute numbers, and percentages. The classifier correctly classified 13.0% of the vehicles (16.2% if class 2-3 errors not included). The number of vehicle axles was miscounted 3.40% (percent sensor errors) of the time. There were problems involving the recording software for the classifier during this test. These problems occurred after an upgrade to the software was received between the first and second 48-hour tests. The problems are associated with the data recording and not the actual classifying of vehicles.

The measurement accuracy of the classifier as a function of vehicle speed is depicted in Figure 71. The TT-2001 classifier measures axles spacings, wheelbase length, and overall vehicle length. The measurement error statistics (mean and deviation) for all measurements, and the overall length percentile statistics are included in the figure as a function of measured vehicle speed (mph). Note that all measurements are in feet.

Table XXXVII contains a summary of the results of the classification accuracy as a function of percent vehicles with greater than two axles, air temperature and pavement temperature.

Time interval: 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2	2	903	46	0	1	0	0	1	4	2	0	13	0	0	0
3	0	337	172	0	4	1	0	14	1	0	1	106	1	0	0
4	0	1	0	2	2	3	0	0	0	0	0	8	0	0	0
5	0	0	5	0	21	0	0	4	0	0	0	25	0	0	0
6	1	0	0	0	0	22	0	0	1	0	0	145	0	1	0
7	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
8	0	0	0	0	0	0	0	21	0	0	0	168	0	0	0
9	1	2	0	0	0	0	0	1	367	31	3	1898	11	0	0
10	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0
11	0	0	0	0	0	0	0	0	1	0	11	50	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	22	1	0	0
13	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	33.3	33.3	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.2	92.9	4.7	0.0	0.1	0.0	0.0	0.1	0.4	0.2	0.0	1.3	0.0	0.0	0.0
3	0.0	52.9	27.0	0.0	0.6	0.2	0.0	2.2	0.2	0.0	0.2	16.6	0.2	0.0	0.0
4	0.0	6.2	0.0	12.5	12.5	18.8	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0
5	0.0	0.0	9.1	0.0	38.2	0.0	0.0	7.3	0.0	0.0	0.0	45.5	0.0	0.0	0.0
6	0.6	0.0	0.0	0.0	0.0	12.9	0.0	0.0	0.6	0.0	0.0	85.3	0.0	0.6	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	0.0	0.0	0.0	88.9	0.0	0.0	0.0
9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	15.9	1.3	0.1	82.0	0.5	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	17.7	80.6	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.7	4.3	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

#Real: 14539  
 #Vendor: 12658  
 #mistyped: 10305  
 #sensor err: 403  
 #extra Vend: 765  
 #Missing Vend: 2633  
 #Correct: 1542  
 #Splits: 11  
 #Combinations: 24

Figure 70. Classification Matrix for Diamond TT-2001 (Philips) 2nd 48-Hour Test



Axles Spacing Statistics					Length Statistics			
Speeds	Mean	STD	Veh	Axle_Spacings	Speeds	Mean	STD	Vehicles
<30	0.000	0.000	0	0	<30	0.000	0.000	0
30.0-34.9	0.000	0.000	0	0	30.0-34.9	0.000	0.000	0
35.0-39.9	-2.850	0.000	1	1	35.0-39.9	2.720	0.000	1
40.0-44.9	0.000	0.000	0	0	40.0-44.9	0.000	0.000	0
45.0-49.9	-0.310	0.000	1	1	45.0-49.9	-3.350	0.000	1
50.0-54.9	-0.184	0.421	25	58	50.0-54.9	-2.820	1.676	25
55.0-59.9	-0.205	0.737	150	325	55.0-59.9	-2.443	1.469	150
60.0-64.9	-0.185	0.378	415	898	60.0-64.9	-2.626	1.944	415
65.0-69.9	-0.203	0.430	587	1054	65.0-69.9	-2.376	1.336	587
70.0-74.9	-0.207	0.605	268	378	70.0-74.9	-2.030	1.416	268
75.0-79.9	-0.203	0.447	67	79	75.0-79.9	-1.972	1.301	67
>80	-0.758	0.904	23	23	>80	-2.752	2.724	23
Overall	-0.203	0.498	1537	2817	Overall	-2.382	1.600	1537

Wheelbase Statistics				Length Percentile Statistics			
Speeds	Mean	STD	Vehicles	Speeds	Mean	STD	Vehicles
<30	0.000	0.000	0	<30	0.00	0.00	0
30.0-34.9	0.000	0.000	0	30.0-34.9	0.000	0.000	0
35.0-39.9	-2.850	0.000	1	35.0-39.9	122.295	0.000	1
40.0-44.9	0.000	0.000	0	40.0-44.9	0.000	0.000	0
45.0-49.9	-0.310	0.000	1	45.0-49.9	82.275	0.000	1
50.0-54.9	-0.427	0.711	25	50.0-54.9	91.556	5.835	25
55.0-59.9	-0.444	1.104	150	55.0-59.9	91.553	5.994	150
60.0-64.9	-0.401	0.550	415	60.0-64.9	91.165	5.755	415
65.0-69.9	-0.365	0.586	587	65.0-69.9	90.733	5.467	587
70.0-74.9	-0.291	0.618	268	70.0-74.9	90.447	6.734	268
75.0-79.9	-0.240	0.465	67	75.0-79.9	89.413	7.387	67
>80	-0.758	0.904	23	>80	88.45	22.17	23
Overall	-0.373	0.661	1537	Overall	90.82	6.56	1537

Figure 71. Measurement Accuracy Versus Speed (MPH)  
Diamond TT-2001 (Philips) - 2nd 48-Hour Test

**Table XXXVII. Accuracy Summary for Diamond TT-2001  
(Philips) 2nd 48-Hour Test**

	Sensor Errors	Correct	Correct (no 2,3)	Axle Mean	Axle S.D.	Length Mean	Length S.D.	%L Mean	%L S.D.
<b>Total</b>	3.40	13.0	16.2	-0.203	0.498	-2.382	1.600	90.82	6.56
<b>% Trucks</b>									
0-20	2.42	14.3	18.2	-0.186	0.429	-2.291	1.312	90.12	5.86
20-40	3.90	12.1	14.8	-0.229	0.566	-2.492	1.873	91.26	7.31
40-60	6.74	1.1	1.1	0.078	0.255	-2.328	0.395	96.90	0.53
<b>Air Temp</b>									
60-69	4.10	28.1	34.0	-0.209	0.452	-2.435	1.998	91.45	7.15
70-79	3.41	13.1	16.6	-0.204	0.537	-2.359	1.346	90.30	6.26
80-89	2.89	0.1	0.1	0.136	0.281	-2.565	0.725	96.84	0.94
<b>Pav Temp</b>									
60- 69	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
70- 79	4.75	55.5	69.0	-0.218	0.512	-2.375	1.830	91.12	6.93
80- 89	4.33	26.6	33.4	-0.201	0.489	-2.389	1.328	90.19	6.29
90- 99	3.05	0.3	0.5	-0.324	0.971	-3.350	2.481	90.24	5.45
100-109	2.17	0.1	0.1	0.051	0.383	-2.845	1.005	96.34	1.43
110-119	2.20	0.0	0.0	0.000	0.000	0.000	0.000	0.00	0.00

N/A - Data Not Available

5.2.13.3 Seven-Day Test

The results of the 7-day test to determine long-term statistics on classification accuracy, vehicle count and axle count are summarized in Table XXXVIII. The totals for the entire seven days for the vendor and classifier are listed. Also, the difference (ground truth minus vendor) and the percent difference (ground truth \* 100 / classifier) are listed. To assess the change inaccuracy over the seven days, the percent difference is calculated for the first and last of the seven days.

**Table XXXVIII. Long-Term Count/Classification Accuracy  
Diamond Traffic TT-2001 (Philips)**

	Total Grnd Truth	Total Classifier	Total Difference	Total Percent	1st Day Percent	Last Day Percent
Vehicles	37250	30162	7088	123.50	115.75	123.31
Axles	99403	N/A	N/A	N/A	111.49	N/A
Class 1	50	54	-4	92.59	--	70.59
Class 2	16987	12112	4875	140.25	--	101.31
Class 3	10457	3108	7349	336.45	--	238.96
Class 4	71	21	50	338.10	--	177.78
Class 5	1226	432	794	283.80	--	236.49
Class 6	533	361	172	147.65	--	105.98
Class 7	7	10	-3	70.00	--	25.00
Class 8	644	617	27	104.38	--	72.93
Class 9	6956	4573	2383	152.11	--	116.71
Class 10	81	363	-282	22.31	--	12.50
Class 11	183	191	-8	95.81	--	68.18
Class 12	55	2083	-2028	2.64	0.74	86.67
Class 13	0	124	-124	0.00	--	0.00
Class 15	0	6113	-6113	0.00	0.00	--

### 5.3 CLASSIFICATION ACCURACY VERSUS SENSOR ERRORS

The classification accuracy of all the equipment tested appears to be dependent on the sensor accuracy. A sensor error, as listed in Section 5.2, is defined for this analysis as a miscount of the number of axles of a vehicle. The number of sensor errors were calculated for each of the classifier equipments and each of the 48-hour tests. A plot of the classification accuracy (percent correctly classified) versus the percent of the vehicles which had sensor errors for both test 1 and test 2 is depicted in Figure 72. The lower points on the plot are the total percent correctly classified, and upper points are the classification accuracy ignoring errors between class 2 and class 3 (the most common classification error). The classification errors appear to be linearly dependent on the sensor error (axle miscounts). By extrapolating the data, it appears that the classification accuracy would average about 78% if there were no sensor errors and 96% if errors between class 2 and 3 were ignored.

Note that data recorded by the Diamond Traffic TT-2001 classifier during the second 48-hour test was not included in the plot. The Diamond classifier had a software bug which resulted in the recording of excessive errors which would bias the results in the plot. Data from the Mitron MSC-3000 DCP classifier is not included since the Mitron classifier did not generate vehicle-by-vehicle data.

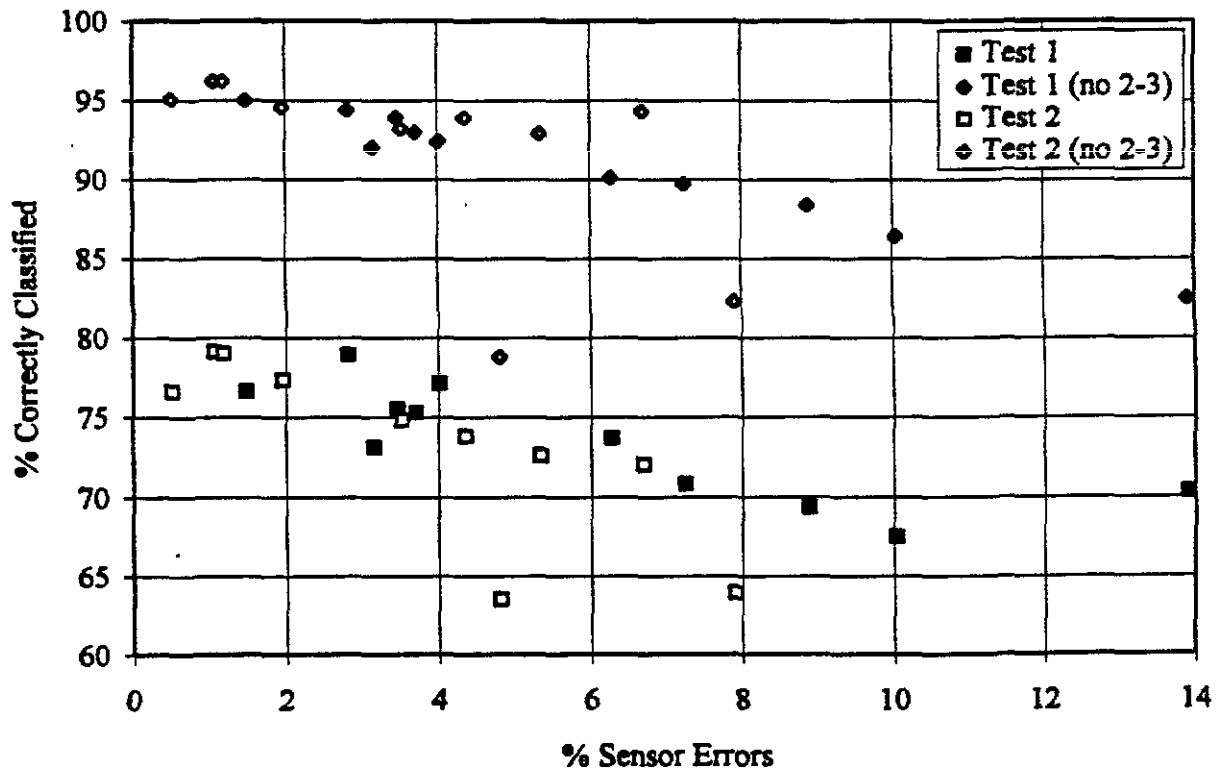


Figure 72. Classification Accuracy Versus Sensor Errors