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UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
ADVANCED TRAFFIC ANALYSIS CENTER

*Grand Forks Data Collection and Archival
Study – Phase IIIb*

Final Report

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Prepared for:
Grand Forks-East Grand Forks MPO

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INTRODUCTION

Prior to this project, The Grand Forks – East Grand Forks MPO and City of Grand Forks were using approx. 150 (38 intersections) of the City’s existing traffic detection cameras for traffic data collection. These cameras were set up during Phase I, II, and IIIa of the study. The data reported by these cameras are archived in separate databases and can be processed into various reports. As a part of the current project, 16 intersections are to be setup for traffic data collection.

OBJECTIVES

As part of this study, a total of 16 intersections comprising of approx. 61 cameras were to be set to collect traffic volumes and speeds. Note that one of the intersections originally part of this project had not been brought online (resulting in delayed completion). In order to avoid further delays, in lieu of the offline intersections, other area intersections which had been affected by current or past construction and required data collection to be reset were included in this project. The agreed upon intersections finally included in this phase of the study are listed in Table 1.

Table 1. Study intersections

#	Main Street	Cross Street
9*	N 5 th St	5 th Ave N
11*	N 5 th St	2 nd Ave N
33*	Gateway Dr	SB I-29 Ramps
37*	S Columbia Rd	11 th Ave S
39	S 42 nd St	11 th Ave S
40	S Columbia Rd	17 th Ave S
41	N Columbia Rd	6 th Ave N
42	S Columbia Rd	13 th Ave S
43	N 42 nd St	University Ave
44	N Washington St	2 nd Ave N
45	N Washington St	5 th Ave N
46	N Washington St	University Ave
48	S 42 nd St	17 th Ave S
49	S Columbia Rd	28 th Ave S
56*	S Columbia Rd	36 th Ave S
57*	S Washington St	40 th Ave S

METHODOLOGY

This study was divided into three major tasks:

- Data Collection Setup
- Data Processing and Archival
- Loop-based Requirement Identification

The steps involved in these tasks are discussed below:

* This intersection was either impacted by 2015/2016 construction or otherwise necessitated resetting of data collection configuration.

DATA COLLECTION SETUP

In this task, intersections were set to collect turning movement counts and mean speeds. This task comprised of intersection setup, data quality audits, and camera re-calibration (if required). Each of these steps are discussed as below.

Intersection Setup

Each of the intersections was setup to count traffic one approach at a time as all of intersections had one camera per approach. Within each approach, setup was dictated by existing conditions such as intersections geometrics and lane assignment/grouping. For any given approach, all lane groups with exclusive movements were counted separately using corresponding detector stations. However, in cases of shared lanes, two (or more) movements were combined and counted together in a single detector station. For example, at the northbound approach of N 5th St @ 5th Ave N, the rightmost lane is shared by through and right-turning movements. Therefore, in this case, the right-turn movement has been set to be counted with the through movement and is reported to the same detector station. Refer to Table 2 for detailed information on lane assignments and detector stations set per approach.

Table 2. Intersection lane assignments and detector setup per approach†

#	Main Street	Cross Street	EB			NB			SB			WB		
			L	T	R	L	T	R	L	T	R	L	T	R
9	N 5th St	5th Ave N	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
11	N 5th St	2nd Ave N	↘	N/A	↘	↘	↘	N/A	N/A	↘	↘	↘	N/A	
33	Gateway Dr	Southbound I-29 Ramp	N/A	↘	↘	N/A	↘	↘	↘	N/A	↘	↘	N/A	
37	S Columbia Rd	11th Ave S	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
39	S 42nd St	11th Ave S	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
40	S Columbia Rd	17th Ave S	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
41	N Columbia Rd	6th Ave N	↘	N/A	↘	↘	↘	↘	↘	↘	↘	↘	↘	
42	S Columbia Rd	13th Ave S	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
43	N 42nd St	University Ave	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
46	N Washington St	University Ave	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
44	N Washington St	2nd Ave N	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
45	N Washington St	5th Ave N	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
48	S 42nd St	17th Ave S	N/A	N/A	↘	↘	↘	↘	↘	N/A	↘	N/A	↘	
49	S Columbia Rd	28th Ave S	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
56	S Columbia Rd	36th Ave S	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	
57	S Washington St	40th Ave S	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	

† Notes:

1. Each arrow corresponds to a lane group and may represent multiple lanes.
2. Each dot represents a separate detector station that counts the corresponding movement(s).

Similar to previous phases of the study, the updated detector configuration files were saved on the external drive connected to the Communications Server.

Data Quality Audits

Similar to the previous phases of the study, for each of the cameras setup, random data quality audits were performed. Traffic volumes were collected manually in 15-minute intervals. The manually collected traffic counts were then compared to camera output. Hourly traffic volumes (manual vs camera) were compared using GEH statistic which is computed as follows:

$$GEH = \sqrt{\frac{(A - M)^2}{(A + M)/2}}$$

Where:

A = Autoscope camera traffic count

M = Manual traffic count

Also, lane group peak hour factors (PHF) were compared for hourly traffic volumes. For intersection turning movement counts, PHF is computed as follows:

$$PHF = \frac{V}{4 \times V_{15}}$$

Where:

V = hourly volume

V₁₅ = volume during the peak 15 minutes of flow

Camera Re-calibration/Re-aiming

It was found out that camera calibration at two of the approaches forced the detectors set near the edges of the view to be crooked. The calibration appeared to be crooked such that the calibration lines were not parallel to the direction of travel. This necessitated tweaking of calibration at the following approaches:

1. S Columbia Rd @ 13th Ave S WB, NB

The improved calibration at these cameras is expected to improve not only the traffic counts but also presence and passage detection.

LOOP-BASED REQUIREMENT IDENTIFICATION

In discussions with MnDOT officials, it was learned that the signalized intersections in East Grand Forks are isolated intersections in that they do not have fiber communications. Also, it was found out that some of the intersection hardware is slated to be upgraded in near future. Note that in East Grand Forks, both fiber communications and upgraded hardware is required to be able to collect traffic data similar to the intersections in Grand Forks.

It is recommended that in selecting intersection hardware, special attention be given to keep the devices consistent with those existing in Grand Forks. This would enable easy incorporation and setup of the East Grand Forks intersections to collect traffic data. This would also facilitate effortless incorporation of the new intersections into the Traffic Analysis web-tool such that reports including Volume Profile, Monthly Seasonal Factors, Day-of-the-week Seasonal Factors, Peak Hour Volume/Factor, AADT, MADT, and ADT may be readily created.

RESULTS

A sample comparison of the traffic volumes at the intersection of 5th St @ 2nd Ave N is shown in Table 3. It shows turning movement counts reported by the cameras as compared to manual counts. The traffic counts are compared as set by lane group per approach. As mentioned, GEH values were computed for individual hourly total volumes per lane group as well as for hourly approach total volumes. Similar to previous phases of the study, a GEH of 2.0 or less is considered good and results show less than 4% of the detector stations are greater than this value.

Table 3. Traffic Volume comparison between Autoscope and Manual Turning Movement Counts

#11. 5th ST @ 2nd Ave N									
Volume/ Factor	Source	Southbound		Northbound			Eastbound		
		Thru + RT	Total	Thru	Left	Total	Right	Left	Total
15-min interval	Manual	31	31	32	3	35	2	1	3
	Autoscope	30	30	33	3	36	2	1	3
15-min interval	Manual	40	40	32	2	34	6	2	8
	Autoscope	40	40	31	2	33	6	2	8
15-min interval	Manual	23	23	33	3	36	6	1	7
	Autoscope	22	22	35	4	39	6	1	7
15-min interval	Manual	48	48	27	1	28	9	2	11
	Autoscope	49	49	27	1	28	9	2	11
Hourly Totals	Manual	142	142	124	9	133	23	6	29
	Autoscope	141	141	126	10	136	23	6	29
	GEH	0.08	0.08	0.18	0.32	0.26	0.00	0.00	0.00
PHF	Manual	0.74	0.74	0.94	0.75	0.92	0.64	0.75	0.66
	Autoscope	0.72	0.72	0.90	0.63	0.87	0.64	0.75	0.66

Peak hour factor values by each lane group and approach are also computed for comparison. For 75% of the PHF comparisons, the values as computed from traffic counts reported by the cameras were within 0.04 of those computed from manual traffic counts. For detailed comparison of data from all the intersections, refer to Appendix 1.

Note that the detector configuration for the westbound approach of N Washington St @ University Ave needs to be redone by City staff. This is because the phase labels (as setup for detection purposes when the camera was first installed) are not cycling as expected.

All of the intersections have been added to the Traffic Analysis webpage and are ready for reporting purposes.

CONCLUSION/NEXT STEPS

The data accuracy observed in the current setup and camera output is comparable to that of previous phases of the study and falls well within acceptable ranges for accuracy.

It is expected that any further changes to detector configuration would be based on the updated detector configuration files (as saved on external drive connected to the City's Communications Server). A process should be developed to account for and to document any changes made by the City employees or contractors to detectors, to ensure traffic counting is not adversely affected.

Network-wide setup of intersections for traffic data collection has the potential to provide detailed insight into traffic characteristics of various roadway segments that form the transportation network. It is recommended that the rest of the network in Grand Forks that already has Autoscope camera based detection be set to count traffic.

As the City grows, new signalized intersection warranted in the area should be setup using similar technologies to maintain compatibility with the Traffic Analysis Tool.

APPENDIX 1: Phase IIIb Data Accuracy Tables

9. 5th St @ 5th Ave N												
Volume/ Factor	Source	Southbound			Westbound		Northbound			Eastbound		
		T + RT	Left	Total	T +LT+RT	Total	T + RT	Left	Total	T + RT	Left	Total
15-min interval	Manual	31	0	31	3	3	22	1	23	2	4	6
	Autoscope	33	0	33	4	4	24	2	26	4	4	8
15-min interval	Manual	34	1	35	1	1	24	2	26	4	2	6
	Autoscope	32	1	33	2	2	23	2	25	4	2	6
15-min interval	Manual	22	0	22	1	1	28	4	32	5	2	7
	Autoscope	20	1	21	2	2	29	5	34	6	1	7
15-min interval	Manual	22	0	22	2	2	14	1	15	3	4	7
	Autoscope	20	1	21	2	2	14	1	15	3	4	7
Hourly Totals	Manual	109	1	110	7	7	88	8	96	14	12	26
	Autoscope	105	3	108	10	10	90	10	100	17	11	28
	GEH	0.39	1.41	0.19	1.03	1.03	0.21	0.67	0.40	0.76	0.29	0.38
PHF	Manual	0.80	0.25	0.79	0.58	0.58	0.79	0.50	0.75	0.70	0.75	0.93
	Autoscope	0.80	0.75	0.82	0.63	0.63	0.78	0.50	0.74	0.71	0.69	0.88

#11. 5th ST @ 2nd Ave N									
Volume/ Factor	Source	Southbound		Northbound			Eastbound		
		T + RT	Total	Thru	Left	Total	Right	Left	Total
15-min interval	Manual	31	31	32	3	35	2	1	3
	Autoscope	30	30	33	3	36	2	1	3
15-min interval	Manual	40	40	32	2	34	6	2	8
	Autoscope	40	40	31	2	33	6	2	8
15-min interval	Manual	23	23	33	3	36	6	1	7
	Autoscope	22	22	35	4	39	6	1	7
15-min interval	Manual	48	48	27	1	28	9	2	11
	Autoscope	49	49	27	1	28	9	2	11
Hourly Totals	Manual	142	142	124	9	133	23	6	29
	Autoscope	141	141	126	10	136	23	6	29
	GEH	0.08	0.08	0.18	0.32	0.26	0.00	0.00	0.00
PHF	Manual	0.74	0.74	0.94	0.75	0.92	0.64	0.75	0.66
	Autoscope	0.72	0.72	0.90	0.63	0.87	0.64	0.75	0.66

33. Gateway Dr @ West I29 Ramps										
Volume/ Factor	Source	Southbound			Westbound			Eastbound		
		Right	Left	Total	Right	Thru	Total	Right	Thru	Total
15-min interval	Manual	4	5	9	33	142	175	43	139	182
	Autoscope	4	6	10	18	157	175	45	145	190
15-min interval	Manual	7	7	14	36	167	203	36	126	162
	Autoscope	8	7	15	27	176	203	39	133	172
15-min interval	Manual	17	4	21	31	134	165	43	114	157
	Autoscope	14	4	18	32	152	184	47	116	163
15-min interval	Manual	16	6	22	29	99	128	27	86	113
	Autoscope	18	7	25	32	110	142	31	87	118
Hourly Totals	Manual	44	22	66	129	542	671	149	465	614
	Autoscope	44	24	68	109	595	704	162	481	643
	GEH	0.00	0.42	0.24	1.83	2.22	1.26	1.04	0.74	1.16
PHF	Manual	0.65	0.79	0.75	0.90	0.81	0.83	0.87	0.84	0.84
	Autoscope	0.61	0.86	0.68	0.85	0.85	0.87	0.86	0.83	0.85

37. S Columbia Rd @ 11th Ave S																	
Volume/ Factor	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	17	107	5	129	9	3	16	28	8	118	4	130	19	17	11	47
	Autoscope	13	106	4	123	6	3	12	21	8	120	5	133	26	16	11	53
15-min interval	Manual	20	137	4	161	9	7	5	21	2	129	4	135	25	21	17	63
	Autoscope	14	136	4	154	11	9	6	26	2	137	4	143	28	21	16	65
15-min interval	Manual	24	163	7	194	3	3	11	17	6	166	9	181	27	23	26	76
	Autoscope	18	165	3	186	2	4	10	16	7	179	10	196	26	24	26	76
15-min interval	Manual	16	133	2	151	8	6	4	18	7	162	5	174	20	17	27	64
	Autoscope	14	136	3	153	10	7	3	20	7	164	5	176	21	18	26	65
Hourly Totals	Manual	77	540	18	635	29	19	36	84	23	575	22	620	91	78	81	250
	Autoscope	59	543	14	616	29	23	31	83	24	600	24	648	101	79	79	259
	GEH	2.18	0.13	1.00	0.76	0.00	0.87	0.86	0.11	0.21	1.03	0.42	1.11	1.02	0.11	0.22	0.56
PHF	Manual	0.80	0.83	0.64	0.82	0.81	0.68	0.56	0.75	0.72	0.87	0.61	0.86	0.84	0.85	0.75	0.82
	Autoscope	0.82	0.82	0.88	0.83	0.66	0.64	0.65	0.80	0.75	0.84	0.60	0.83	0.90	0.82	0.76	0.85

39. S 42nd St @ 11th Ave S														
Volume/ Factor	Source	Southbound			Westbound			Northbound				Eastbound		
		Thru	Left	Total	T +RT	Left	Total	T + RT	Thru	Left	Total	T + RT	Left	Total
15-min interval	Manual	95	15	110	19	2	21	47	53	0	100	0	0	0
	Autoscope	95	14	109	14	2	16	47	53	0	100	0	0	0
15-min interval	Manual	104	20	124	10	7	17	47	62	0	109	0	0	0
	Autoscope	103	21	124	12	6	18	44	64	0	108	1	0	1
15-min interval	Manual	85	12	97	11	0	11	51	65	0	116	1	0	1
	Autoscope	85	12	97	13	0	13	48	65	0	113	1	0	1
15-min interval	Manual	110	9	119	15	7	22	45	65	1	111	1	3	4
	Autoscope	110	8	118	18	7	25	45	65	2	112	2	3	5
Hourly Totals	Manual	394	56	450	55	16	71	190	245	1	436	2	3	5
	Autoscope	393	55	448	57	15	72	184	247	2	433	4	3	7
	GEH	0.05	0.13	0.09	0.27	0.25	0.12	0.44	0.13	0.82	0.14	1.15	0.00	0.82
PHF	Manual	0.90	0.70	0.91	0.72	0.57	0.81	0.93	0.94	0.25	0.94	0.50	0.25	0.31
	Autoscope	0.89	0.65	0.90	0.79	0.54	0.72	0.96	0.95	0.25	0.96	0.50	0.25	0.35

40. S Columbia Rd. @ 17th Ave S

Volume/ Factor	Source	Southbound				Westbound				Northbound				Eastbound		
		T + RT	Thru	Left	Total	Right	Thru	Left	Total	T + RT	Thru	Left	Total	T + RT	Left	Total
15-min interval	Manual	127	92	22	241	19	35	19	73	102	88	4	194	26	16	42
	Autoscope	122	95	21	238	23	33	13	69	98	87	5	190	24	18	42
15-min interval	Manual	131	114	15	260	25	23	18	66	96	94	30	220	15	9	24
	Autoscope	124	112	19	255	24	19	18	61	89	94	29	212	13	9	22
15-min interval	Manual	149	125	22	296	15	32	26	73	102	91	17	210	19	16	35
	Autoscope	140	125	20	285	15	27	23	65	94	86	21	201	14	16	30
15-min interval	Manual	142	115	21	278	21	22	26	69	102	90	15	207	42	21	63
	Autoscope	139	113	24	276	26	16	24	66	109	93	18	220	40	24	64
Hourly Totals	Manual	549	446	80	1075	80	112	89	281	402	363	66	831	102	62	164
	Autoscope	525	445	84	1054	88	95	78	261	390	360	73	823	91	67	158
	GEH	1.04	0.05	0.44	0.64	0.87	1.67	1.20	1.21	0.60	0.16	0.84	0.28	1.12	0.62	0.47
PHF	Manual	0.92	0.89	0.91	0.91	0.80	0.80	0.86	0.96	0.99	0.97	0.55	0.94	0.61	0.74	0.65
	Autoscope	0.94	0.89	0.88	0.92	0.85	0.72	0.81	0.95	0.89	0.96	0.63	0.94	0.57	0.70	0.62

41. N Columbia Rd @ 6th Ave N														
Volume/ Factor	Source	Southbound				Westbound		Northbound				Eastbound		
		T + RT	Thru	Left	Total	T +LT+RT	Total	T + RT	Thru	Left	Total	Right	Left	Total
15-min interval	Manual	53	51	1	105	6	6	49	33	56	138	77	20	117
	Autoscope	58	53	1	112	4	4	50	34	58	142	84	21	117
15-min interval	Manual	64	57	1	122	7	7	50	55	68	173	99	18	117
	Autoscope	64	57	1	122	7	7	51	55	66	172	107	17	124
15-min interval	Manual	47	42	0	89	4	4	62	50	75	187	90	16	106
	Autoscope	48	42	0	90	4	4	62	52	72	186	100	17	117
15-min interval	Manual	50	45	0	95	3	3	56	42	56	154	105	26	131
	Autoscope	52	45	0	97	3	3	58	42	56	156	119	25	144
Hourly Totals	Manual	214	195	2	411	20	20	217	180	255	652	371	80	471
	Autoscope	222	197	2	421	18	18	221	183	252	656	410	80	502
	GEH	0.54	0.14	0.00	0.49	0.46	0.46	0.27	0.22	0.19	0.16	1.97	0.00	1.41
PHF	Manual	0.84	0.86	0.50	0.84	0.71	0.71	0.88	0.82	0.85	0.87	0.88	0.77	0.90
	Autoscope	0.87	0.86	0.50	0.86	0.64	0.64	0.89	0.83	0.88	0.88	0.86	0.80	0.87

42. S Columbia Rd @ 13th Ave S																
Volume/ Factor	Source	Southbound				Westbound				Northbound			Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	T + RT	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	14	214	19	247	22	15	18	55	137	19	156	20	19	28	67
	Autoscope	15	223	18	256	21	15	19	55	131	14	145	18	19	29	66
15-min interval	Manual	12	153	25	190	27	12	31	70	110	17	127	23	19	12	54
	Autoscope	13	161	26	200	23	11	32	66	110	19	129	24	19	16	59
15-min interval	Manual	7	171	35	213	21	14	34	69	189	14	203	27	21	23	71
	Autoscope	6	182	34	222	19	14	35	68	190	16	206	27	22	24	73
15-min interval	Manual	17	191	23	231	22	14	23	59	153	13	166	24	15	15	54
	Autoscope	18	201	24	243	18	14	22	54	160	13	173	27	15	14	56
Hourly Totals	Manual	50	729	102	881	92	55	106	253	589	63	652	94	74	78	246
	Autoscope	52	767	102	921	81	54	108	243	591	62	653	96	75	83	254
	GEH	0.28	1.39	0.00	1.33	1.18	0.14	0.19	0.64	0.08	0.13	0.04	0.21	0.12	0.56	0.51
PHF	Manual	0.74	0.85	0.73	0.89	0.85	0.92	0.78	0.90	0.78	0.83	0.80	0.87	0.88	0.70	0.87
	Autoscope	0.72	0.86	0.75	0.90	0.88	0.90	0.77	0.89	0.78	0.82	0.79	0.89	0.85	0.72	0.87

43. N 42nd St @ University Ave																	
Volume/ Factor	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	13	29	8	50	9	25	20	54	44	31	11	86	17	21	4	42
	Autoscope	12	29	9	50	9	26	22	57	44	31	14	89	16	22	4	42
15-min interval	Manual	5	25	6	36	8	23	20	51	38	28	21	87	23	14	3	40
	Autoscope	5	24	7	36	9	20	21	50	40	30	23	93	18	13	3	34
15-min interval	Manual	9	25	10	44	5	17	16	38	21	37	21	79	22	24	4	50
	Autoscope	12	29	12	53	7	17	18	42	23	38	22	83	22	24	4	50
15-min interval	Manual	9	41	9	59	9	12	21	42	25	28	11	64	27	23	4	54
	Autoscope	11	42	9	62	13	13	20	46	24	29	12	65	20	24	4	48
Hourly Totals	Manual	36	120	33	189	31	77	77	185	128	124	64	316	89	82	15	186
	Autoscope	40	124	37	201	38	76	81	195	131	128	71	330	76	83	15	174
	GEH	0.65	0.36	0.68	0.86	1.19	0.11	0.45	0.73	0.26	0.36	0.85	0.78	1.43	0.11	0.00	0.89
PHF	Manual	0.69	0.73	0.83	0.80	0.86	0.77	0.92	0.86	0.73	0.84	0.76	0.91	0.82	0.85	0.94	0.86
	Autoscope	0.83	0.74	0.77	0.81	0.73	0.73	0.92	0.86	0.74	0.84	0.77	0.89	0.86	0.86	0.94	0.87

44. N Washington St @ 2nd Ave N															
Volume/ Factor	Source	Southbound				Westbound			Northbound				Eastbound		
		T + RT	Thru	Left	Total	Right	T + LT	Total	Thru	Thru	Left	Total	Right	T + LT	Total
15-min interval	Manual	72	77	1	150	2	7	9	82	113	12	207	2	1	3
	Autoscope	74	80	1	155	1	6	7	88	111	15	214	3	1	4
15-min interval	Manual	119	127	4	250	1	5	6	94	96	12	202	12	4	16
	Autoscope	118	129	4	251	1	6	7	92	97	11	200	13	4	17
15-min interval	Manual	81	89	1	171	3	13	16	99	114	9	222	8	1	9
	Autoscope	75	93	1	169	7	13	20	96	103	8	207	8	1	9
15-min interval	Manual	84	76	1	161	3	8	11	114	127	12	253	8	1	9
	Autoscope	81	77	1	159	3	9	12	112	115	13	240	6	1	7
Hourly Totals	Manual	356	369	7	732	9	33	42	389	450	45	884	30	7	37
	Autoscope	348	379	7	734	12	34	46	388	426	47	861	30	7	37
	GEH	0.43	0.52	0.00	0.07	0.93	0.17	0.60	0.05	1.15	0.29	0.78	0.00	0.00	0.00
PHF	Manual	0.75	0.73	0.44	0.73	0.75	0.63	0.66	0.85	0.89	0.94	0.87	0.63	0.44	0.58
	Autoscope	0.74	0.73	0.44	0.73	0.43	0.65	0.58	0.87	0.93	0.78	0.90	0.58	0.44	0.54

45. N Washington St @ 5th Ave N																	
Volume/ Factor	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	13	29	8	50	9	25	20	54	44	31	11	86	17	21	4	42
	Autoscope	12	29	9	50	9	26	22	57	44	31	14	89	16	22	4	42
15-min interval	Manual	5	25	6	36	8	23	20	51	38	28	21	87	23	14	3	40
	Autoscope	5	24	7	36	9	20	21	50	40	30	23	93	18	13	3	34
15-min interval	Manual	9	25	10	44	5	17	16	38	21	37	21	79	22	24	4	50
	Autoscope	12	29	12	53	7	17	18	42	23	38	22	83	22	24	4	50
15-min interval	Manual	9	41	9	59	9	12	21	42	25	28	11	64	27	23	4	54
	Autoscope	11	42	9	62	13	13	20	46	24	29	12	65	20	24	4	48
Hourly Totals	Manual	36	120	33	189	31	77	77	185	128	124	64	316	89	82	15	186
	Autoscope	40	124	37	201	38	76	81	195	131	128	71	330	76	83	15	174
	GEH	0.65	0.36	0.68	0.86	1.19	0.11	0.45	0.73	0.26	0.36	0.85	0.78	1.43	0.11	0.00	0.89
PHF	Manual	0.69	0.73	0.83	0.80	0.86	0.77	0.92	0.86	0.73	0.84	0.76	0.91	0.82	0.85	0.94	0.86
	Autoscope	0.83	0.74	0.77	0.81	0.73	0.73	0.92	0.86	0.74	0.84	0.77	0.89	0.86	0.86	0.94	0.87

46. Washington @ University															
Volume/ Factor	Source	Southbound			Westbound				Northbound			Eastbound			
		T + RT	Left	Total	Right	Thru	Left	Total	T + RT	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	142	8	150	6	34	18	58	154	30	184	31	28	7	66
	Autoscope	145	8	153	11	101	47	159	153	29	182	32	27	7	66
15-min interval	Manual	158	8	166	3	14	9	26	175	40	215	25	30	10	65
	Autoscope	159	8	167	4	82	44	130	173	40	213	28	29	10	67
15-min interval	Manual	147	6	153	5	18	19	42	156	38	194	33	42	6	81
	Autoscope	151	6	157	13	90	69	172	153	41	194	29	42	5	76
15-min interval	Manual	147	6	153	2	26	8	36	187	36	223	32	30	9	71
	Autoscope	151	6	157	13	69	42	124	187	39	226	34	30	11	75
Hourly Totals	Manual	594	28	622	16	92	54	162	672	144	816	121	130	32	283
	Autoscope	606	28	634	41	342	202	585	666	149	815	123	128	33	284
	GEH	0.49	0.00	0.48	4.68	16.97	13.08	21.89	0.23	0.41	0.04	0.18	0.18	0.18	0.06
PHF	Manual	0.94	0.88	0.94	0.67	0.68	0.71	0.70	0.90	0.90	0.91	0.92	0.77	0.80	0.87
	Autoscope	0.95	0.88	0.95	0.79	0.85	0.73	0.85	0.89	0.91	0.90	0.90	0.76	0.75	0.93

48. S 42nd ST @ 17th Ave S

Volume/ Factor	Source	Southbound				Westbound			Northbound		
		Right	Thru	Left	Total	Right	Left	Total	Right	Thru	Total
15-min interval	Manual	1	65	19	85	28	4	32	24	47	71
	Autoscope	1	65	22	88	29	4	33	30	48	78
15-min interval	Manual	4	71	34	109	19	3	22	14	49	63
	Autoscope	4	72	33	109	19	3	22	15	49	64
15-min interval	Manual	2	72	21	95	19	2	21	11	49	60
	Autoscope	2	72	22	96	21	2	23	11	49	60
15-min interval	Manual	5	78	22	105	25	4	29	16	57	73
	Autoscope	6	77	23	106	19	5	24	17	57	74
Hourly Totals	Manual	12	286	96	394	91	13	104	65	202	267
	Autoscope	13	286	100	399	88	14	102	73	203	276
	GEH	0.28	0.00	0.40	0.25	0.32	0.27	0.20	0.96	0.07	0.55
PHF	Manual	0.60	0.92	0.71	0.90	0.81	0.81	0.81	0.68	0.89	0.91
	Autoscope	0.54	0.93	0.76	0.92	0.76	0.70	0.77	0.61	0.89	0.88

49. S Columbia Rd @ 28th Ave S																	
Volume/ Factor	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	19	106	19	144	21	11	13	45	6	79	13	98	23	10	24	57
	Autoscope	19	110	23	152	23	12	14	49	7	80	14	101	21	8	22	51
15-min interval	Manual	12	89	20	121	15	11	13	39	7	71	11	89	26	12	28	66
	Autoscope	13	89	22	124	14	11	15	40	7	71	11	89	24	10	28	62
15-min interval	Manual	18	85	18	121	22	12	17	51	4	84	13	101	32	16	24	72
	Autoscope	17	85	20	122	25	10	16	51	5	83	14	102	31	16	22	69
15-min interval	Manual	15	106	17	138	25	13	18	56	10	88	15	113	25	14	22	61
	Autoscope	12	111	17	140	26	13	19	58	11	88	16	115	22	14	18	54
Hourly Totals	Manual	64	386	74	524	83	47	61	191	27	322	52	401	106	52	98	256
	Autoscope	61	395	82	538	88	46	64	198	30	322	55	407	98	48	90	236
	GEH	0.38	0.46	0.91	0.61	0.54	0.15	0.38	0.50	0.56	0.00	0.41	0.30	0.79	0.57	0.83	1.28
PHF	Manual	0.84	0.91	0.93	0.91	0.83	0.90	0.85	0.85	0.68	0.91	0.87	0.89	0.83	0.81	0.88	0.89
	Autoscope	0.80	0.89	0.89	0.88	0.85	0.88	0.84	0.85	0.68	0.91	0.86	0.88	0.79	0.75	0.80	0.86

56. S Columbia Rd@ 36th Ave S																	
Volume/ Factor	Source	Southbound				Westbound				Northbound				Eastbound			
		Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	13	37	20	70	18	8	0	26	1	79	12	92	1	5	16	22
	Autoscope	14	37	20	71	18	8	0	26	1	79	13	93	1	5	14	20
15-min interval	Manual	18	55	19	92	24	13	0	37	3	48	11	62	6	5	12	23
	Autoscope	19	55	19	93	21	13	0	34	3	50	11	64	8	7	13	28
15-min interval	Manual	16	41	27	84	10	5	0	15	2	38	13	53	6	11	9	26
	Autoscope	16	41	27	84	11	5	0	16	2	38	13	53	8	12	6	26
15-min interval	Manual	20	43	41	104	19	9	3	31	5	60	23	88	4	5	7	16
	Autoscope	20	44	40	104	24	10	5	39	5	60	23	88	4	5	6	15
Hourly Totals	Manual	67	176	107	350	71	35	3	109	11	225	59	295	17	26	44	87
	Autoscope	69	177	106	352	74	36	5	115	11	227	60	298	21	29	39	89
	GEH	0.24	0.08	0.10	0.11	0.35	0.17	1.00	0.57	0.00	0.13	0.13	0.17	0.92	0.57	0.78	0.21
PHF	Manual	0.84	0.80	0.65	0.84	0.74	0.67	0.25	0.74	0.55	0.71	0.64	0.80	0.71	0.59	0.69	0.84
	Autoscope	0.86	0.80	0.66	0.85	0.77	0.69	0.25	0.74	0.55	0.72	0.65	0.80	0.66	0.60	0.70	0.79

57. S Washington @ 40th Ave S															
Volume/ Factor	Source	Southbound			Westbound				Northbound			Eastbound			
		T + RT	Left	Total	Right	Thru	Left	Total	T + RT	Left	Total	Right	Thru	Left	Total
15-min interval	Manual	104	17	121	16	24	3	43	132	26	158	32	26	17	75
	Autoscope	106	15	121	17	24	3	44	130	26	156	34	26	17	77
15-min interval	Manual	128	20	148	20	20	0	40	141	27	168	28	19	14	61
	Autoscope	120	20	140	22	22	0	44	137	27	164	31	19	19	69
15-min interval	Manual	153	20	173	23	24	5	52	141	29	170	39	32	13	84
	Autoscope	155	20	175	27	24	4	55	135	30	165	46	35	13	94
15-min interval	Manual	139	24	163	19	24	3	46	116	40	156	36	36	16	88
	Autoscope	135	23	158	23	24	1	48	114	38	152	36	35	14	85
Hourly Totals	Manual	524	81	605	78	92	11	181	530	122	652	135	113	60	308
	Autoscope	516	78	594	89	94	8	191	516	121	637	147	115	63	325
	GEH	0.35	0.34	0.45	1.20	0.21	0.97	0.73	0.61	0.09	0.59	1.01	0.19	0.38	0.96
PHF	Manual	0.86	0.84	0.87	0.85	0.96	0.55	0.87	0.94	0.76	0.96	0.87	0.78	0.88	0.88
	Autoscope	0.83	0.85	0.85	0.82	0.98	0.50	0.87	0.94	0.80	0.97	0.80	0.82	0.83	0.86