

JANUARY 20, 2021

PROJECT NO: 1988-5783

The Town of the Blue Mountains
32 Mill Street, Box 310
Thornbury ON, N0H 2P0

**Attention: Denise McCarl, MSc MCIP RPP,
Senior Policy Planner**

**RE: TRAFFIC OPINION LETTER
LONG POINT ROAD SUBDIVISION
LOT 85, PLAN 529 PART 4 AND 5**

Dear Denise,

Terra Brook Homes retained C.F. Crozier & Associated Inc. to prepare a Traffic Opinion Letter to address the comments provided by the Town of the Blue Mountain staff on December 3rd, 2021.

This letter has been prepared in support of the Zoning By-law Amendment and Draft Plan of Subdivision Applications and reviews the following:

1. Proposed Development
2. Background Reports
3. Existing Operations
4. Trip Generation
5. Total Operations
6. Intersection Spacing
7. Sight Distance Analysis

1. Proposed Development

The Long Point Road Subdivision is located on the west side of Long Point Road between Brophy's Lane and Highway 26. The development is proposed to consist of 22 single family detached dwelling units along Street A (cul-de-sac). Street A is approximately 235 m north of Highway 26 and 165 m south of Brophy's Lane.

Attachment A contains the Draft Plan on Subdivision for reference.

2. Background Reports

The Long Point Road Subdivision was assessed as a background development within the Traffic Impact Study (TIS) for the Aquavil development (Crozier, October 2021). For the purposes of the Aquavil TIS it was assumed that the units would be fully built-out and occupied by 2025.

3. Existing Operations

To remain consistent with the Aquavil TIS (Crozier, October 2021), unadjusted turning movement counts collected by Spectrum Traffic Data Inc. were utilized in the analysis contained herein. The counts were collected during the following dates and time:

- Thursday, November 5, 2020: 6:00 a.m. to 10:00 am and 3:00 p.m. to 7:00 p.m.
- Saturday, November 7, 2020: 10:00 a.m. to 6:00 p.m.

The turning movement counts for the study intersection recorded a PHF of 0.92 in the a.m. peak hour and 0.97 in the p.m. and Saturday peak hours. However, to provide a consistent analysis with the Aquavil TIS (Crozier, October 2021), a peak hour factor of 0.88 was utilized in this analysis, as was previously requested by the MTO for Highway 26 intersections. **Attachment B** contains the collected traffic data.

Existing intersection operations were analyzed based on the collected volumes illustrated in **Figure 1. Table 1** summarizes the Levels of Service for the counts taken at the study intersection under existing 2020 traffic volume conditions. As the development is located north of the intersection, the impact on the southbound minor approach has been reviewed.

Attachment C contains the Level of Service (LOS) definitions **Attachment D** contains the detailed capacity analysis worksheets.

Table 1: 2020 Existing Levels of Service

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	Maximum v/c ratio ²
Highway 26 and Long Point Road/Grey Road 21	Stop	A.M.	C (SB)	22.5 s (SB)	0.07 (SB)
		P.M.	D (SB)	27.9 s (SB)	0.08 (SB)
		Saturday	E (SB)	37.4 s (SB)	0.15 (SB)

Note 1: The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach.

Note 2: The maximum v/c ratio represents the maximum v/c ratio for the minor road approach movements at the intersection. Any movements that experience a v/c ratio in excess of 0.85 are considered critical per the MTO TIS Guidelines.

The southbound movement at the intersection of Highway 26 and Long Point Road/Grey Road 21 experiences a LOS "E" or better during peak hours and has a maximum control delay of 37.4 seconds, and maximum volume-to-capacity ratio of 0.15. These operations demonstrate that the north approach has excess capacity to accommodate future traffic volumes. The Aquavil TIS (Crozier, October 2021) recommended that the intersection of Highway 26 and Long Point Road/Grey Road 21 be signalized, which would result in improved operations.

4. Trip Generation

The trips generated by the proposed development were forecasted using the fitted curve equations summarized in the ITE Trip Generation Manual, 11th Edition for Land Use Category 210: "Single-Family Detached Housing". The trip generation is summarized in **Table 2**.

If the proposed homes are occupied as recreational secondary homes, as is common in the area, we would expect the trip generation to be less than what is detailed in **Table 2**.

Attachment E contains relevant ITE Excerpts.

Table 2: Trip Generation

Development	Unit Type	Number of Units	Roadway Peak Hour	Number of Trips		
				Inbound	Outbound	Total
Long Point Road	Single Family Detached	22	Weekday A.M.	5	14	19
			Weekday P.M.	15	9	24
			Saturday	15	14	29

As presented in **Table 2**, the subdivision is expected to generate 19 a.m. peak hour, 24 p.m. peak hour and 29 Saturday peak hour two-way trips. Trips were distributed to the boundary road network based on the observed travel patterns at Highway 26 and Long Point Road.

Figure 2 illustrates the trip distribution and **Figure 3** illustrates the trip assignment utilized in this assessment. In the pre-consultation notes provided by the Town, the eastbound left-turn movement was identified as a key concern. The proposed development is anticipated to increase the eastbound left-turn movement by 1, 5 and 7 vehicles in the a.m., p.m., and Saturday peak hours, respectively.

5. Total Operations

Total intersection operations were analyzed based on the total volumes illustrated in **Figure 4**. The total volumes were established based on the addition of the site generated traffic to the existing 2020 volumes.

Table 3 summarizes the Levels of Service for the total traffic volume conditions. The Level of Service (LOS) definitions are included in **Attachment C** and detailed capacity analysis worksheets are included in **Attachment D**.

Table 3: Total Levels of Service

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	Maximum v/c ratio ²
Highway 26 and Long Point Road/Grey Road 21	Stop	A.M.	C (SB)	23.8 s (SB)	0.14 (SB)
		P.M.	D (SB)	33.4 s (SB)	0.15 (SB)
		Saturday	E (SB)	37.9 s (SB)	0.25 (SB)

Note 1: The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach.

Note 2: The maximum v/c ratio represents the maximum v/c ratio for the minor road approach movements at the intersection. Any movements that experience a v/c ratio in excess of 0.85 are considered critical per the MTO TIS Guidelines.

The addition of the site generated traffic is anticipated to have a minimal impact on the operations of the north approach. The southbound movement is expected to have unchanged Levels of Service, with a maximum control delay increase of 5.5 seconds in the p.m. peak hour and a maximum volume-to-capacity ratio increase of 0.10 during the Saturday peak hour.

Additionally, the intersection is planned for future signalization which would improve the intersection operations. Eastbound left-turn volumes on Highway 26 are anticipated to be 3, 6 and 15 vehicles in the a.m., p.m., and Saturday peak hours, respectively. The eastbound left-turn movement is anticipated to operate with a LOS A and 95th percentile queues less than one vehicle.

6. Intersection Spacing

As part of the Aquavil TIS, a new east-west roadway is proposed which would result in the re-alignment of Long Point Road. Intersection spacing was reviewed to ensure the proposed development access (Street A) meets the requirement outlined in the Town of the Blue Mountains Engineering Standards (Section 4.5.9). The results are summarized in **Table 4**.

Table 4: Intersection Spacing

Segment	Required Spacing	Proposed Spacing (approx.)
Brophy's Lane to Street A	60 m	165 m
Street A to Aquavil Street B/Long Point Road	60 m	115 m

As presented in **Table 4** there is adequate spacing between the intersections, even with the re-alignment of Long Point Road. **Attachment F** contains relevant excerpts from the Town's Engineering Standards. **Attachment G** illustrates the available intersection spacing.

7. Sight Distance Analysis

Long Point Road is a relatively flat and straight roadway between Brophy's Lane and Highway 26. Available sight distance was reviewed based on the worst case (Case B1 (Table 9.9.4) from TAC GDGCR) for a 60 km/h design speed. **Table 5** outlines the available sight distance based on the existing geometry of Long Point Road.

Table 5: Sight Distance Analysis

Intersection	Required Stopping Sight Distance	Required Intersection Sight Distance	Existing Available Sight Distance	
			North	South
Street A and Long Point Road	85 m	130 m	+400 m	+200

As presented in **Table 5**, there is adequate sight distance available to support Street A. **Attachment H** contains relevant TAC excerpts.

It is noted that when Long Point Road is realigned, the available sight distance will be approximately 115 m. While this is less than the minimum requirement identified above, vehicles will be approaching from turning movements and are not anticipated to attain operating speed prior to the access. It is also noted that vehicles will predominately turn right out of the site to travel towards Highway 26 as there are no public destinations to the north of the site.

8. Conclusion

The proposed development consists of 22 single family detached dwelling units. These units are forecasted to generate 19, 24 and 29 trips in the weekday a.m., p.m., and Saturday peak hours, respectively.

The proposed development was considered as a background development as part of the Aquavil TIS (Crozier, November 2021). The operations of the intersection of Highway 26 and Long Point Road were assessed based on turning movement counts collected in November 2020. The southbound movements are currently operating at a LOS 'E' or better with excess capacity to accommodate future growth.

The addition of the site generated traffic is anticipated to have a minimal impact on the operations of the north approach, with a maximum increase in control delay of 5.5 seconds in the p.m. peak hour and a maximum volume-to-capacity ratio increase of 0.10 during the Saturday peak hour. It is noted that the intersection of Highway 26 and Long Point Road is planned to be signalized in the future, which would improve the intersection operations.

Street A of the Long Point Road Subdivision will be located between the existing intersection of Brophy's Lane and Long Point Road and the future intersection of Aquavil Street B and Long Point Road. The intersection spacing exceeds the minimum 60 m identified in the Town's Engineering Standards.

Long Point Road is a relatively flat and straight roadway between Brophy's Lane and Highway 26. Adequate sight distance is provided to the north and south of the proposed location of Street A, based on the existing alignment of Long Point Road. The re-alignment of Long Point Road would reduce the available sight distance to the south to approximately 115 m. It is noted that vehicles approaching from the south would do so via turning movements and are therefore not anticipated to attain operating speed in advance of the site access. It is also anticipated that vehicles will predominately turn right out of the site to travel towards Highway 26 as there are no public destinations to the north of the site.

The Long Point Subdivision can be supported from an operations, intersection spacing and sight distance perspective.

Should you have any questions or require any further information, please do not hesitate to contact the undersigned.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.



Madeleine Ferguson, P.Eng.
Manager of Transportation
/kh

C.F. CROZIER & ASSOCIATES INC.



Kerianne Hagan, E.I.T.
Engineering Intern, Transportation

J:\1900\1988-Terrabrook Homes\5783-Longpoint Road\Letters\5783_Long Point Road TOL.docx

Enclosed:

Attachment A: Draft Plan of Subdivision
Attachment B: Collected Traffic Data
Attachment C: Level of Service Definitions
Attachment D: Detailed Capacity Analysis Worksheets
Attachment E: ITE Excerpts
Attachment F: Town Engineering Standard Excerpts
Attachment G: Intersection Spacing Diagram
Attachment H: TAC Excerpts

Figure 1: Existing Volumes
Figure 2: Trip Distribution
Figure 3: Trip Assignment
Figure 4: Total Volumes

ATTACHMENT A

Draft Plan of Subdivision

ATTACHMENT B

Collected Traffic Data



Turning Movement Count (5 . HWY 26 & LONG POINT RD / GREY RD 21)

Start Time	N Approach LONG POINT RD						E Approach HWY 26						S Approach GREY RD 21						W Approach HWY 26						Int. Total (15 min)	Int. Total (1 hr)	
	Right N:W	Thru N:S	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Thru E:W	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	Left S:W	UTurn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	Left W:N	UTurn W:W	Peds W:	Approach Total			
06:00:00	0	0	0	0	0	0	0	29	1	0	0	30	1	0	4	0	0	5	0	17	0	0	0	17	52		
06:15:00	0	0	0	0	0	0	0	24	0	0	0	24	0	0	4	0	0	4	5	26	2	0	0	33	61		
06:30:00	0	1	1	0	0	2	1	39	0	0	0	40	0	2	10	0	0	12	7	42	0	0	0	49	103		
06:45:00	0	2	0	0	0	2	0	53	2	0	0	55	3	2	11	0	0	16	8	27	0	0	0	35	108	324	
07:00:00	1	1	0	0	0	2	3	60	1	0	0	64	2	0	11	0	0	13	13	47	1	0	0	61	140	412	
07:15:00	1	0	1	0	0	2	3	76	4	0	0	83	1	2	14	0	0	17	18	64	1	0	0	83	185	536	
07:30:00	0	2	2	0	0	4	1	91	2	0	0	94	3	0	14	0	0	17	15	73	0	0	1	88	203	636	
07:45:00	0	1	1	0	0	2	0	101	5	0	0	106	6	2	21	0	0	29	17	73	1	0	0	91	228	756	
08:00:00	0	2	3	0	0	5	0	95	8	0	0	103	7	2	19	0	0	28	21	81	0	0	0	102	238	854	
08:15:00	1	1	2	0	0	4	2	109	5	0	0	116	13	1	20	0	0	34	23	99	0	0	0	122	276	945	
08:30:00	1	1	1	0	0	3	2	100	12	0	0	114	8	0	18	0	0	26	35	98	1	0	0	134	277	1019	
08:45:00	0	0	3	0	0	3	3	97	7	0	0	107	5	0	22	0	0	27	15	71	1	0	0	87	224	1015	
09:00:00	0	2	1	0	0	3	1	97	8	0	0	106	2	2	21	0	0	25	22	87	0	0	0	109	243	1020	
09:15:00	0	1	5	0	0	6	1	88	5	0	0	94	6	2	23	0	0	31	17	55	1	0	0	73	204	948	
09:30:00	0	3	2	0	0	5	2	78	5	0	0	85	7	2	12	0	0	21	26	88	0	0	0	114	225	896	
09:45:00	1	0	4	0	0	5	3	90	6	1	0	100	4	2	15	0	0	21	14	88	0	0	0	102	228	900	
BREAK																											
15:00:00	0	2	3	0	0	5	1	87	7	0	0	95	15	0	15	0	0	30	20	118	2	0	0	140	270		
15:15:00	0	4	2	0	0	6	2	120	15	0	0	137	15	0	27	0	0	42	24	101	0	0	0	125	310		
15:30:00	0	3	1	0	0	4	3	90	10	0	0	103	6	3	19	0	0	28	30	120	0	0	0	150	285		
15:45:00	1	2	0	0	0	3	3	111	6	0	0	120	16	0	14	0	0	30	21	116	1	0	0	138	291	1156	
16:00:00	3	2	0	0	0	5	2	93	4	0	0	99	8	0	24	0	0	32	22	115	0	0	0	137	273	1159	
16:15:00	2	3	0	0	0	5	3	97	11	0	0	111	8	1	20	0	0	29	27	147	0	0	0	174	319	1168	
16:30:00	0	1	1	0	0	2	4	119	9	0	0	132	11	1	25	0	0	37	37	126	1	0	0	164	335	1218	
16:45:00	2	0	1	0	0	3	1	118	6	0	0	125	10	0	18	0	0	28	36	122	0	0	0	158	314	1241	
17:00:00	0	1	0	0	0	1	0	122	5	0	0	127	12	1	27	0	0	40	37	125	0	0	0	162	330	1298	
17:15:00	0	0	0	0	0	0	0	101	8	0	0	109	9	0	26	0	0	35	27	129	1	0	0	157	301	1280	
17:30:00	0	0	1	0	0	1	1	94	3	0	0	98	12	2	17	0	0	31	16	96	0	0	0	112	242	1187	
17:45:00	0	1	1	0	0	2	0	78	7	1	0	86	9	1	11	0	0	21	15	82	0	0	0	97	206	1079	
18:00:00	1	0	1	0	0	2	3	80	3	0	0	86	3	0	12	0	0	15	8	71	1	0	0	80	183	932	
18:15:00	0	1	3	0	0	4	1	68	2	1	0	72	2	2	12	0	0	16	12	48	0	0	0	60	152	783	
18:30:00	0	0	1	0	0	1	0	53	5	0	0	58	2	0	10	0	0	12	11	61	0	0	0	72	143	684	
18:45:00	0	0	0	0	0	0	0	62	1	0	0	63	0	1	11	0	0	12	10	37	0	0	0	47	122	600	
Grand Total	14	37	41	0	0	92	46	2720	173	3	0	2942	206	31	527	0	0	764	609	2650	14	0	1	3273	7071	-	
Approach%	15.2%	40.2%	44.6%	0%		-	1.6%	92.5%	5.9%	0.1%		-	27%	4.1%	69%	0%		-	18.6%	81%	0.4%	0%		-	-	-	
Totals %	0.2%	0.5%	0.6%	0%		1.3%	0.7%	38.5%	2.4%	0%		41.6%	2.9%	0.4%	7.5%	0%		10.8%	8.6%	37.5%	0.2%	0%		46.3%	-	-	
Heavy	2	9	6	0		-	12	117	5	0		-	6	3	27	0		-	35	96	1	0		-	-	-	
Heavy %	14.3%	24.3%	14.6%	0%		-	26.1%	4.3%	2.9%	0%		-	2.9%	9.7%	5.1%	0%		-	5.7%	3.6%	7.1%	0%		-	-	-	
Bicycles	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	
Bicycle %	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	



Peak Hour: 08:15 AM - 09:15 AM Weather: Clear Sky (12.3 °C)

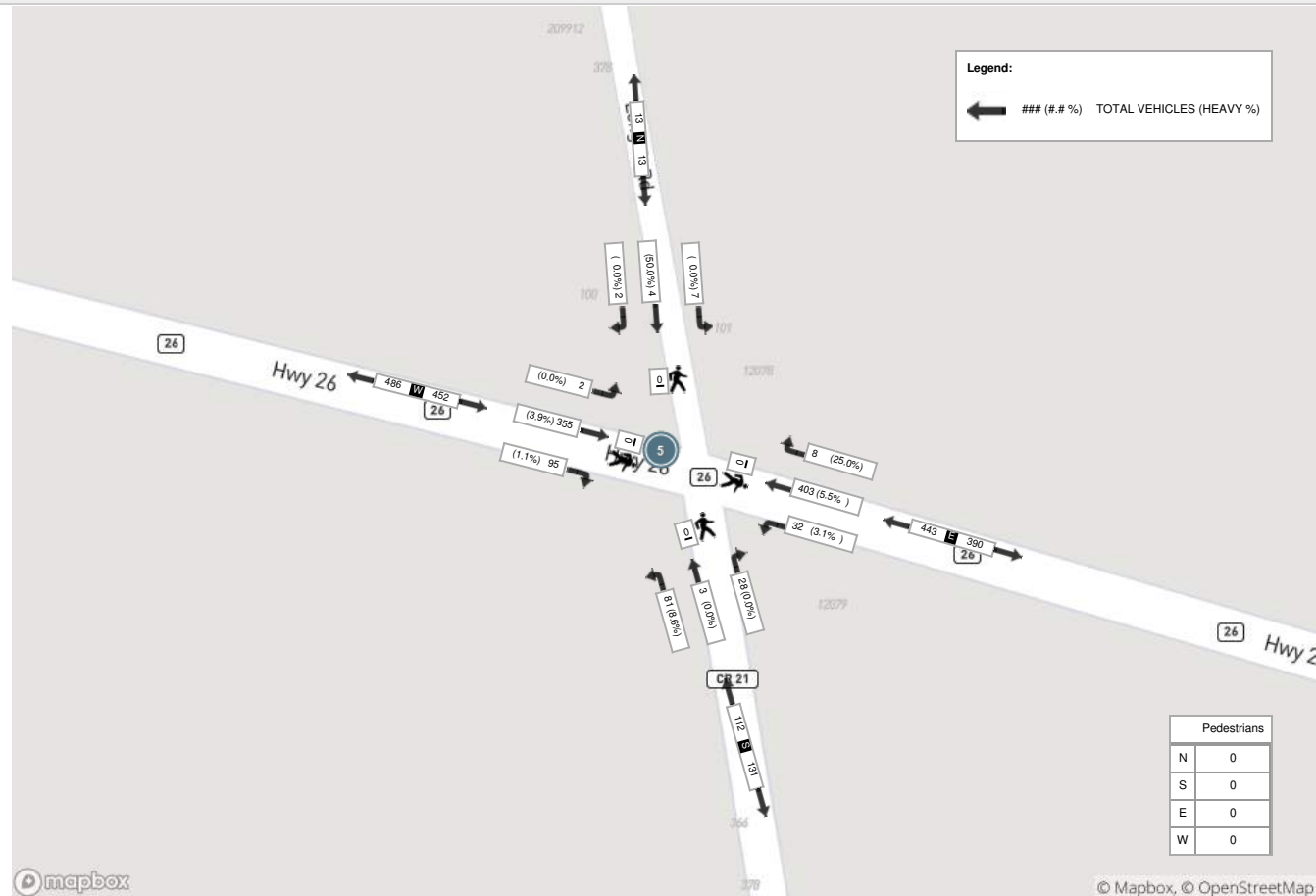
Start Time	N Approach LONG POINT RD						E Approach HWY 26						S Approach GREY RD 21						W Approach HWY 26						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
08:15:00	1	1	2	0	0	4	2	109	5	0	0	116	13	1	20	0	0	34	23	99	0	0	0	122	276
08:30:00	1	1	1	0	0	3	2	100	12	0	0	114	8	0	18	0	0	26	35	98	1	0	0	134	277
08:45:00	0	0	3	0	0	3	3	97	7	0	0	107	5	0	22	0	0	27	15	71	1	0	0	87	224
09:00:00	0	2	1	0	0	3	1	97	8	0	0	106	2	2	21	0	0	25	22	87	0	0	0	109	243
Grand Total	2	4	7	0	0	13	8	403	32	0	0	443	28	3	81	0	0	112	95	355	2	0	0	452	1020
Approach%	15.4%	30.8%	53.8%	0%		-	1.8%	91%	7.2%	0%		-	25%	2.7%	72.3%	0%		-	21%	78.5%	0.4%	0%		-	-
Totals %	0.2%	0.4%	0.7%	0%		1.3%	0.8%	39.5%	3.1%	0%		43.4%	2.7%	0.3%	7.9%	0%		11%	9.3%	34.8%	0.2%	0%		44.3%	-
PHF	0.5	0.5	0.58	0		0.81	0.67	0.92	0.67	0		0.95	0.54	0.38	0.92	0		0.82	0.68	0.9	0.5	0		0.84	-
Heavy	0	2	0	0		2	2	22	1	0		25	0	0	7	0		7	1	14	0	0		15	-
Heavy %	0%	50%	0%	0%		15.4%	25%	5.5%	3.1%	0%		5.6%	0%	0%	8.6%	0%		6.3%	1.1%	3.9%	0%	0%		3.3%	-
Lights	2	2	7	0		11	6	381	31	0		418	28	3	74	0		105	94	341	2	0		437	-
Lights %	100%	50%	100%	0%		84.6%	75%	94.5%	96.9%	0%		94.4%	100%	100%	91.4%	0%		93.8%	98.9%	96.1%	100%	0%		96.7%	-
Single-Unit Trucks	0	1	0	0		1	1	18	1	0		20	0	0	3	0		3	0	11	0	0		11	-
Single-Unit Trucks %	0%	25%	0%	0%		7.7%	12.5%	4.5%	3.1%	0%		4.5%	0%	0%	3.7%	0%		2.7%	0%	3.1%	0%	0%		2.4%	-
Buses	0	1	0	0		1	1	0	0	0		1	0	0	2	0		2	1	0	0	0		1	-
Buses %	0%	25%	0%	0%		7.7%	12.5%	0%	0%	0%		0.2%	0%	0%	2.5%	0%		1.8%	1.1%	0%	0%	0%		0.2%	-
Articulated Trucks	0	0	0	0		0	0	4	0	0		4	0	0	2	0		2	0	3	0	0		3	-
Articulated Trucks %	0%	0%	0%	0%		0%	0%	1%	0%	0%		0.9%	0%	0%	2.5%	0%		1.8%	0%	0.8%	0%	0%		0.7%	-
Bicycles on Road	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	-
Bicycles on Road %	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
Pedestrians%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-



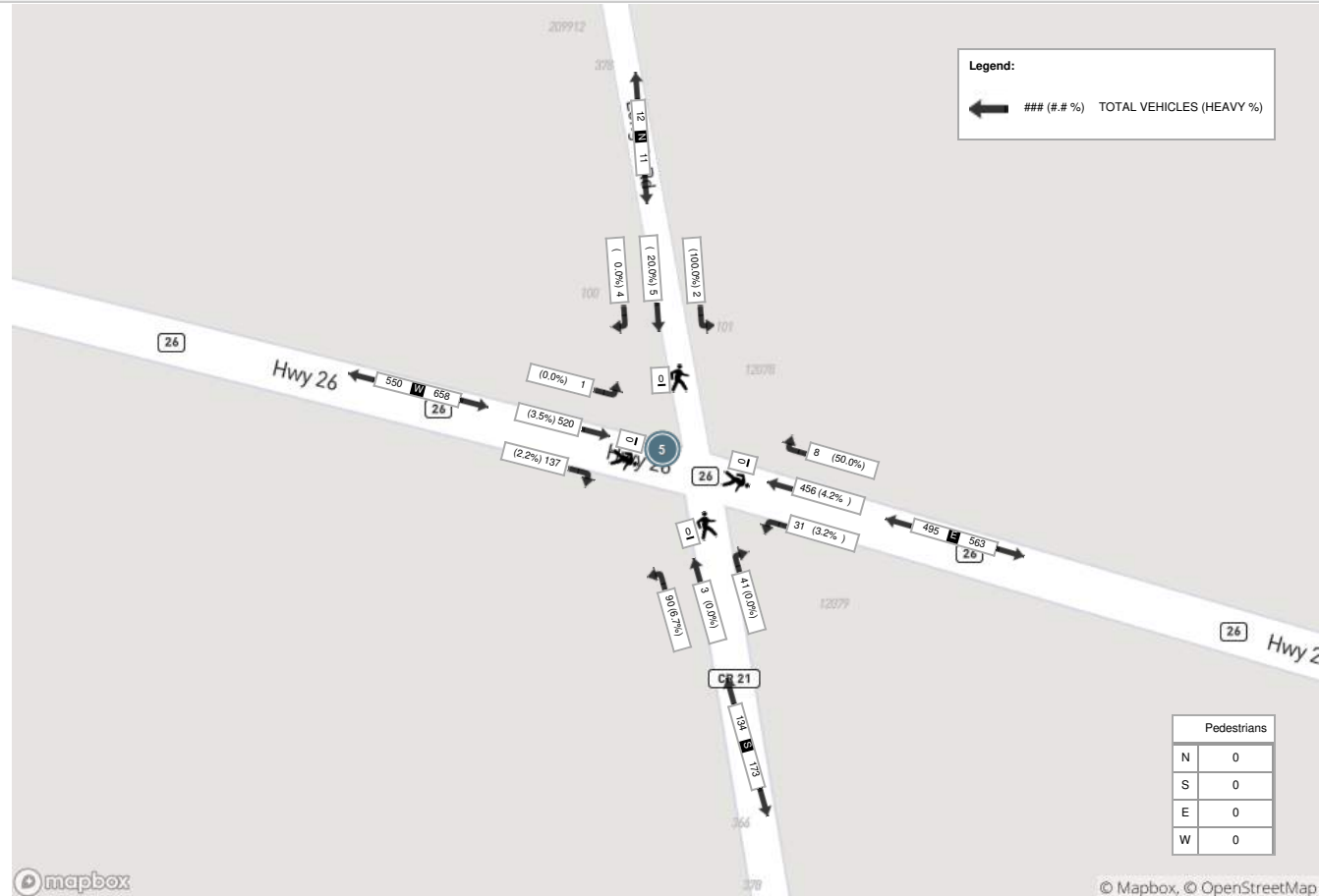
Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (17.57 °C)

Start Time	N Approach LONG POINT RD						E Approach HWY 26						S Approach GREY RD 21						W Approach HWY 26						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
16:15:00	2	3	0	0	0	5	3	97	11	0	0	111	8	1	20	0	0	29	27	147	0	0	0	174	319
16:30:00	0	1	1	0	0	2	4	119	9	0	0	132	11	1	25	0	0	37	37	126	1	0	0	164	335
16:45:00	2	0	1	0	0	3	1	118	6	0	0	125	10	0	18	0	0	28	36	122	0	0	0	158	314
17:00:00	0	1	0	0	0	1	0	122	5	0	0	127	12	1	27	0	0	40	37	125	0	0	0	162	330
Grand Total	4	5	2	0	0	11	8	456	31	0	0	495	41	3	90	0	0	134	137	520	1	0	0	658	1298
Approach%	36.4%	45.5%	18.2%	0%		-	1.6%	92.1%	6.3%	0%		-	30.6%	2.2%	67.2%	0%		-	20.8%	79%	0.2%	0%		-	-
Totals %	0.3%	0.4%	0.2%	0%		0.8%	0.6%	35.1%	2.4%	0%		38.1%	3.2%	0.2%	6.9%	0%		10.3%	10.6%	40.1%	0.1%	0%		50.7%	-
PHF	0.5	0.42	0.5	0		0.55	0.5	0.93	0.7	0		0.94	0.85	0.75	0.83	0		0.84	0.93	0.88	0.25	0		0.95	-
Heavy	0	1	2	0		3	4	19	1	0		24	0	0	6	0		6	3	18	0	0		21	-
Heavy %	0%	20%	100%	0%		27.3%	50%	4.2%	3.2%	0%		4.8%	0%	0%	6.7%	0%		4.5%	2.2%	3.5%	0%	0%		3.2%	-
Lights	4	4	0	0		8	4	437	30	0		471	41	3	84	0		128	134	502	1	0		637	-
Lights %	100%	80%	0%	0%		72.7%	50%	95.8%	96.8%	0%		95.2%	100%	100%	93.3%	0%		95.5%	97.8%	96.5%	100%	0%		96.8%	-
Single-Unit Trucks	0	0	2	0		2	3	12	1	0		16	0	0	5	0		5	2	14	0	0		16	-
Single-Unit Trucks %	0%	0%	100%	0%		18.2%	37.5%	2.6%	3.2%	0%		3.2%	0%	0%	5.6%	0%		3.7%	1.5%	2.7%	0%	0%		2.4%	-
Buses	0	1	0	0		1	1	0	0	0		1	0	0	0	0		0	1	0	0	0		1	-
Buses %	0%	20%	0%	0%		9.1%	12.5%	0%	0%	0%		0.2%	0%	0%	0%	0%		0%	0.7%	0%	0%	0%		0.2%	-
Articulated Trucks	0	0	0	0		0	0	7	0	0		7	0	0	1	0		1	0	4	0	0		4	-
Articulated Trucks %	0%	0%	0%	0%		0%	0%	1.5%	0%	0%		1.4%	0%	0%	1.1%	0%		0.7%	0%	0.8%	0%	0%		0.6%	-
Bicycles on Road	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	-
Bicycles on Road %	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
Pedestrians%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-

Peak Hour: 08:15 AM - 09:15 AM Weather: Clear Sky (12.3 °C)



Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (17.57 °C)





Turning Movement Count (5 . HWY 26 & LONG POINT RD / GREY RD 21)

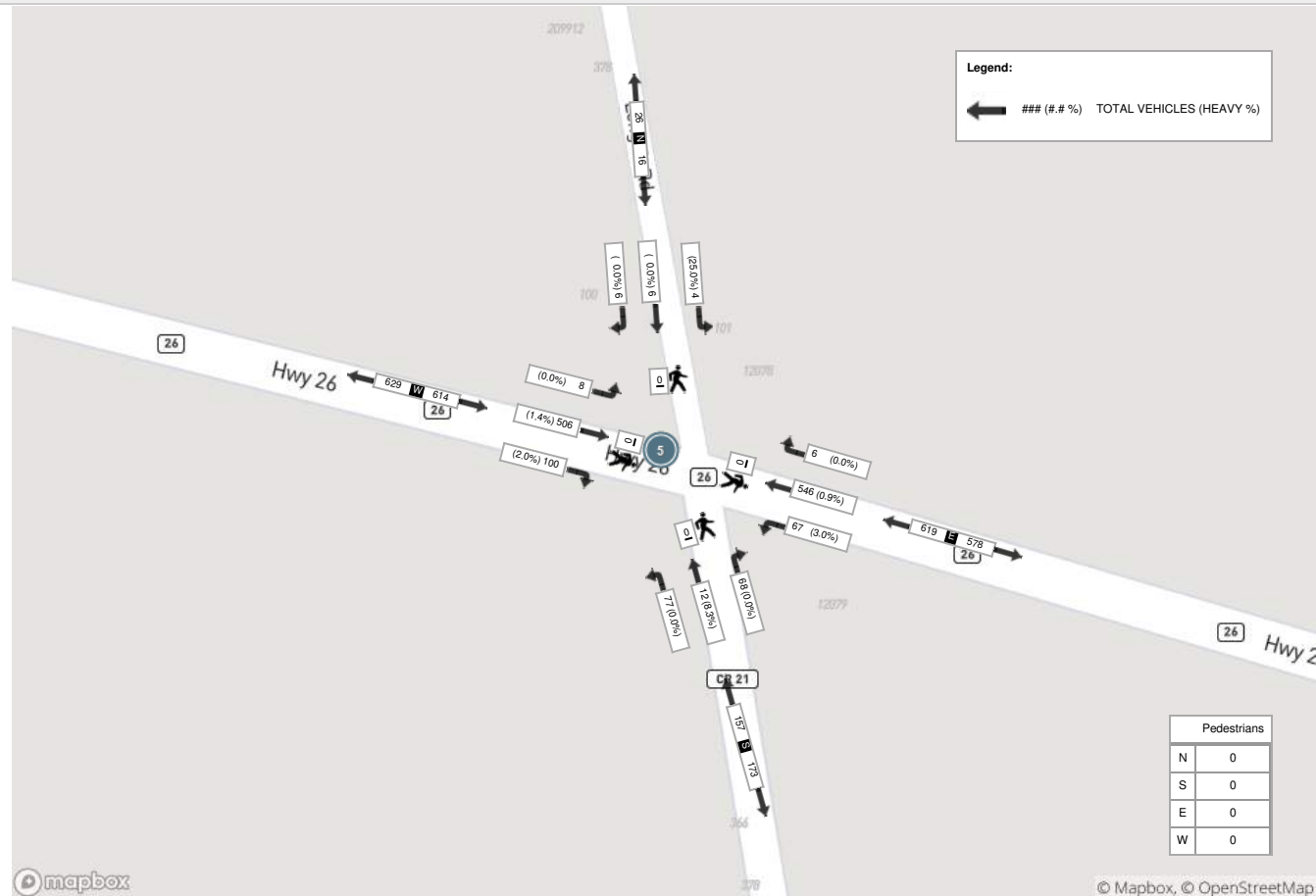
Start Time	N Approach LONG POINT RD						E Approach HWY 26						S Approach GREY RD 21						W Approach HWY 26						Int. Total (15 min)	Int. Total (1 hr)
	Right N-W	Thru N-S	Left N-E	UTurn N-N	Peds N:	Approach Total	Right E-N	Thru E-W	Left E-S	UTurn E-E	Peds E:	Approach Total	Right S-E	Thru S-N	Left S-W	UTurn S-S	Peds S:	Approach Total	Right W-S	Thru W-E	Left W-N	UTurn W-W	Peds W:	Approach Total		
10:00:00	0	2	1	0	0	3	1	95	19	0	0	115	3	2	11	0	0	16	17	84	0	0	0	101	235	
10:15:00	1	4	0	0	0	5	1	87	11	0	0	99	12	2	13	0	0	27	20	87	0	0	0	107	238	
10:30:00	1	1	0	0	0	2	3	118	9	0	0	130	4	0	30	0	0	34	16	98	1	0	0	115	281	
10:45:00	1	2	1	0	0	4	1	112	18	0	0	131	7	2	19	0	0	28	22	104	0	0	0	126	289	1043
11:00:00	1	2	0	0	0	3	3	116	7	0	0	126	10	6	18	0	0	34	18	104	0	0	0	122	285	1093
11:15:00	2	7	3	0	0	12	1	113	9	0	0	123	8	4	17	0	0	29	18	88	0	0	0	106	270	1125
11:30:00	1	4	0	0	0	5	2	105	12	0	0	119	9	1	20	0	0	30	28	75	3	0	0	106	260	1104
11:45:00	2	0	1	0	0	3	4	106	15	0	0	125	7	1	22	0	0	30	17	127	0	0	0	144	302	1117
12:00:00	4	1	2	0	0	7	2	127	19	0	0	148	10	4	22	0	0	36	19	128	0	0	0	147	338	1170
12:15:00	1	3	1	0	0	5	0	132	9	0	0	141	11	1	15	0	0	27	22	113	1	0	0	136	309	1209
12:30:00	1	1	2	0	0	4	1	157	21	0	0	179	10	1	17	0	0	28	26	103	1	0	0	130	341	1290
12:45:00	2	3	1	0	0	6	8	125	18	0	0	151	6	3	30	0	1	39	27	109	1	0	0	137	333	1321
13:00:00	2	4	3	0	0	9	2	135	13	0	0	150	16	6	21	0	0	43	19	118	0	0	0	137	339	1322
13:15:00	0	0	1	0	0	1	2	117	13	0	0	132	16	2	27	0	0	45	16	122	0	0	0	138	316	1329
13:30:00	2	1	1	0	0	4	0	130	19	0	0	149	10	2	15	0	0	27	30	129	1	0	0	160	340	1328
13:45:00	1	2	3	0	0	6	1	130	20	0	0	151	18	0	17	0	2	35	21	130	0	0	0	151	343	1338
14:00:00	2	1	2	0	0	5	1	108	13	0	0	122	27	1	22	0	0	50	30	139	1	0	0	170	347	1346
14:15:00	3	0	2	0	0	5	0	137	17	0	0	154	21	1	18	0	0	40	31	115	1	0	0	147	346	1376
14:30:00	2	3	0	0	0	5	1	136	19	0	0	156	18	2	18	0	0	38	17	126	3	0	0	146	345	1381
14:45:00	1	3	2	0	0	6	2	142	16	0	0	160	15	7	28	0	0	50	14	131	2	0	0	147	363	1401
15:00:00	0	0	0	0	0	0	3	131	15	0	0	149	14	2	13	0	0	29	38	134	2	0	0	174	352	1406
15:15:00	0	1	1	0	0	2	1	119	11	0	0	131	17	2	22	0	0	41	32	107	2	0	0	141	315	1375
15:30:00	0	0	3	0	0	3	2	128	11	1	0	142	17	1	23	0	0	41	26	142	3	0	0	171	357	1387
15:45:00	0	0	2	0	0	2	0	117	13	0	0	130	15	9	18	0	0	42	29	133	1	0	0	163	337	1361
16:00:00	0	0	1	0	0	1	1	132	20	0	0	153	19	1	21	0	0	41	20	135	1	0	0	156	351	1360
16:15:00	1	2	1	0	0	4	2	102	9	0	0	113	16	1	17	0	0	34	22	130	0	0	0	152	303	1348
16:30:00	1	0	1	0	0	2	0	68	16	0	0	84	15	0	18	0	0	33	23	137	0	0	0	160	279	1270
16:45:00	0	2	3	0	0	5	2	101	13	0	0	116	14	2	8	0	0	24	19	119	2	0	0	140	285	1218
17:00:00	0	2	0	0	0	2	3	110	11	0	0	124	8	1	14	0	0	23	18	114	0	0	0	132	281	1148
17:15:00	1	0	3	0	0	4	0	74	12	0	0	86	10	0	15	0	0	25	6	91	2	0	0	99	214	1059
17:30:00	2	1	1	0	0	4	3	91	10	0	0	104	9	1	12	0	0	22	21	104	2	0	0	127	257	1037
17:45:00	0	0	0	0	0	0	0	73	7	0	0	80	14	2	15	0	0	31	17	92	1	0	0	110	221	973
Grand Total	35	52	42	0	0	129	53	3674	445	1	0	4173	406	70	596	0	3	1072	699	3668	31	0	0	4398	9772	-
Approach%	27.1%	40.3%	32.6%	0%		-	1.3%	88%	10.7%	0%		-	37.9%	6.5%	55.6%	0%		-	15.9%	83.4%	0.7%	0%		-	-	-
Totals %	0.4%	0.5%	0.4%	0%		1.3%	0.5%	37.6%	4.6%	0%		42.7%	4.2%	0.7%	6.1%	0%		11%	7.2%	37.5%	0.3%	0%		45%	-	-
Heavy	0	0	1	0		-	0	35	2	0		-	1	1	4	0		-	12	34	0	0		-	-	-
Heavy %	0%	0%	2.4%	0%		-	0%	1%	0.4%	0%		-	0.2%	1.4%	0.7%	0%		-	1.7%	0.9%	0%	0%		-	-	-
Bicycles	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-
Bicycle %	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-



Peak Hour: 02:15 PM - 03:15 PM Weather: Overcast Clouds (16.49 °C)

Start Time	N Approach LONG POINT RD						E Approach HWY 26						S Approach GREY RD 21						W Approach HWY 26						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
14:15:00	3	0	2	0	0	5	0	137	17	0	0	154	21	1	18	0	0	40	31	115	1	0	0	147	346
14:30:00	2	3	0	0	0	5	1	136	19	0	0	156	18	2	18	0	0	38	17	126	3	0	0	146	345
14:45:00	1	3	2	0	0	6	2	142	16	0	0	160	15	7	28	0	0	50	14	131	2	0	0	147	363
15:00:00	0	0	0	0	0	0	3	131	15	0	0	149	14	2	13	0	0	29	38	134	2	0	0	174	352
Grand Total	6	6	4	0	0	16	6	546	67	0	0	619	68	12	77	0	0	157	100	506	8	0	0	614	1406
Approach%	37.5%	37.5%	25%	0%		-	1%	88.2%	10.8%	0%		-	43.3%	7.6%	49%	0%		-	16.3%	82.4%	1.3%	0%		-	-
Totals %	0.4%	0.4%	0.3%	0%		1.1%	0.4%	38.8%	4.8%	0%		44%	4.8%	0.9%	5.5%	0%		11.2%	7.1%	36%	0.6%	0%		43.7%	-
PHF	0.5	0.5	0.5	0		0.67	0.5	0.96	0.88	0		0.97	0.81	0.43	0.69	0		0.79	0.66	0.94	0.67	0		0.88	-
Heavy	0	0	1	0		1	0	5	2	0		7	0	1	0	0		1	2	7	0	0		9	-
Heavy %	0%	0%	25%	0%		6.3%	0%	0.9%	3%	0%		1.1%	0%	8.3%	0%	0%		0.6%	2%	1.4%	0%	0%		1.5%	-
Lights	6	4	3	0		13	6	540	65	0		611	68	11	76	0		155	97	499	8	0		604	-
Lights %	100%	66.7%	75%	0%		81.3%	100%	98.9%	97%	0%		98.7%	100%	91.7%	98.7%	0%		98.7%	97%	98.6%	100%	0%		98.4%	-
Single-Unit Trucks	0	0	1	0		1	0	5	2	0		7	0	1	0	0		1	0	5	0	0		5	-
Single-Unit Trucks %	0%	0%	25%	0%		6.3%	0%	0.9%	3%	0%		1.1%	0%	8.3%	0%	0%		0.6%	0%	1%	0%	0%		0.8%	-
Buses	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	1	0	0	0		1	-
Buses %	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	1%	0%	0%	0%		0.2%	-
Articulated Trucks	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	1	2	0	0		3	-
Articulated Trucks %	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	1%	0.4%	0%	0%		0.5%	-
Bicycles on Road	0	2	0	0		2	0	1	0	0		1	0	0	1	0		1	1	0	0	0		1	-
Bicycles on Road %	0%	33.3%	0%	0%		12.5%	0%	0.2%	0%	0%		0.2%	0%	0%	1.3%	0%		0.6%	1%	0%	0%	0%		0.2%	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
Pedestrians%	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-

Peak Hour: 02:15 PM - 03:15 PM Weather: Overcast Clouds (16.49 °C)



ATTACHMENT C

Level of Service Definitions

Level of Service Definitions

Two-Way Stop Controlled Intersections

Level of Service	Control Delay per Vehicle (seconds)	Interpretation
A	≤ 10	EXCELLENT. Large and frequent gaps in traffic on the main roadway. Queuing on the minor street is rare.
B	> 10 and ≤ 15	VERY GOOD. Many gaps exist in traffic on the main roadway. Queuing on the minor street is minimal.
C	> 15 and ≤ 25	GOOD. Fewer gaps exist in traffic on the main roadway. Delay on minor approach becomes more noticeable.
D	> 25 and ≤ 35	FAIR. Infrequent and shorter gaps in traffic on the main roadway. Queue lengths develop on the minor street.
E	> 35 and ≤ 50	POOR. Very infrequent gaps in traffic on the main roadway. Queue lengths become noticeable.
F	> 50	UNSATISFACTORY. Very few gaps in traffic on the main roadway. Excessive delay with significant queue lengths on the minor street.

Adapted from Highway Capacity Manual 2000, Transportation Research Board

ATTACHMENT D

Detailed Capacity Analysis Worksheets

HCM Unsignalized Intersection Capacity Analysis

1: Grey Road 21/Long Point Road & Highway 26

Existing Conditions A.M.

12-13-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	355	95	32	403	8	81	3	28	7	4	2
Future Volume (Veh/h)	2	355	95	32	403	8	81	3	28	7	4	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	403	108	36	458	9	92	3	32	8	5	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	467			511			942	946	403	970	1045	458
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	467			511			942	946	403	970	1045	458
tC, single (s)	4.1			4.1			7.2	6.5	6.2	7.1	7.0	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.0	3.3	3.5	4.5	3.3
p0 queue free %	100			97			59	99	95	96	97	100
cM capacity (veh/h)	1105			1049			224	254	652	215	182	607
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	405	108	494	9	127	15						
Volume Left	2	0	36	0	92	8						
Volume Right	0	108	0	9	32	2						
cSH	1105	1700	1049	1700	269	221						
Volume to Capacity	0.00	0.06	0.03	0.01	0.47	0.07						
Queue Length 95th (m)	0.0	0.0	0.8	0.0	17.9	1.6						
Control Delay (s)	0.1	0.0	1.0	0.0	29.7	22.5						
Lane LOS	A		A		D	C						
Approach Delay (s)	0.0		1.0		29.7	22.5						
Approach LOS					D	C						
Intersection Summary												
Average Delay			4.0									
Intersection Capacity Utilization			60.6%		ICU Level of Service		B					
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

1: Grey Road 21/Long Point Road & Highway 26

Existing Conditions P.M.

12-13-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	520	137	31	456	8	90	3	41	2	5	4
Future Volume (Veh/h)	1	520	137	31	456	8	90	3	41	2	5	4
Sign Control	Free				Free				Stop		Stop	
Grade	0%				0%				0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	1	591	156	35	518	9	102	3	47	2	6	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	527			747			1189	1190	591	1230	1337	518
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	527			747			1189	1190	591	1230	1337	518
tC, single (s)	4.1			4.1			7.2	6.5	6.2	8.1	6.7	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.0	3.3	4.4	4.2	3.3
p0 queue free %	100			96			32	98	91	98	96	99
cM capacity (veh/h)	1050			857			149	181	511	86	135	562
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	592	156	553	9	152	13						
Volume Left	1	0	35	0	102	2						
Volume Right	0	156	0	9	47	5						
cSH	1050	1700	857	1700	192	170						
Volume to Capacity	0.00	0.09	0.04	0.01	0.79	0.08						
Queue Length 95th (m)	0.0	0.0	1.0	0.0	41.5	1.9						
Control Delay (s)	0.0	0.0	1.1	0.0	71.2	27.9						
Lane LOS	A		A		F	D						
Approach Delay (s)	0.0		1.1		71.2	27.9						
Approach LOS					F	D						
Intersection Summary												
Average Delay				8.0								
Intersection Capacity Utilization				70.4%	ICU Level of Service				C			
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

1: Grey Road 21/Long Point Road & Highway 26

Existing Conditions Saturday
12-13-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	506	100	67	546	6	77	12	68	4	6	6
Future Volume (Veh/h)	8	506	100	67	546	6	77	12	68	4	6	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	9	575	114	76	620	7	88	14	77	5	7	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	627			689			1376	1372	575	1449	1479	620
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	627			689			1376	1372	575	1449	1479	620
tC, single (s)	4.1			4.1			7.1	6.6	6.2	7.3	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.1	3.3	3.7	4.0	3.3
p0 queue free %	99			92			19	89	85	93	94	99
cM capacity (veh/h)	965			901			108	129	521	70	115	492
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	584	114	696	7	179	19						
Volume Left	9	0	76	0	88	5						
Volume Right	0	114	0	7	77	7						
cSH	965	1700	901	1700	167	130						
Volume to Capacity	0.01	0.07	0.08	0.00	1.07	0.15						
Queue Length 95th (m)	0.2	0.0	2.1	0.0	68.1	3.8						
Control Delay (s)	0.3	0.0	2.1	0.0	145.4	37.4						
Lane LOS	A		A		F	E						
Approach Delay (s)	0.2		2.1		145.4	37.4						
Approach LOS					F	E						
Intersection Summary												
Average Delay			17.7									
Intersection Capacity Utilization			85.2%		ICU Level of Service		E					
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

1: Grey Road 21/Long Point Road & Highway 26

Total Conditions A.M.
12-14-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	355	95	32	403	11	81	4	28	15	9	4
Future Volume (Veh/h)	3	355	95	32	403	11	81	4	28	15	9	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	3	403	108	36	458	12	92	5	32	17	10	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage veh												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	470			511			949	951	403	974	1047	458
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	470			511			949	951	403	974	1047	458
tC, single (s)	4.1			4.1			7.2	6.5	6.2	7.1	7.0	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.0	3.3	3.5	4.5	3.3
p0 queue free %	100			97			57	98	95	92	94	99
cM capacity (veh/h)	1102			1049			216	252	652	212	181	607
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	406	108	494	12	129	32						
Volume Left	3	0	36	0	92	17						
Volume Right	0	108	0	12	32	5						
cSH	1102	1700	1049	1700	260	223						
Volume to Capacity	0.00	0.06	0.03	0.01	0.50	0.14						
Queue Length 95th (m)	0.1	0.0	0.8	0.0	19.4	3.7						
Control Delay (s)	0.1	0.0	1.0	0.0	31.7	23.8						
Lane LOS	A		A		D	C						
Approach Delay (s)	0.1		1.0		31.7	23.8						
Approach LOS					D	C						
Intersection Summary												
Average Delay			4.6									
Intersection Capacity Utilization			60.8%		ICU Level of Service		B					
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

1: Grey Road 21/Long Point Road & Highway 26

Total Conditions P.M.
12-14-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	520	137	31	456	16	90	5	41	6	6	8
Future Volume (Veh/h)	6	520	137	31	456	16	90	5	41	6	6	8
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	7	591	156	35	518	18	102	6	47	7	7	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	536			747			1206	1211	591	1243	1349	518
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	536			747			1206	1211	591	1243	1349	518
tC, single (s)	4.1			4.1			7.2	6.5	6.2	8.1	6.7	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.0	3.3	4.4	4.2	3.3
p0 queue free %	99			96			29	97	91	92	95	98
cM capacity (veh/h)	1042			857			143	175	511	83	132	562
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	598	156	553	18	155	23						
Volume Left	7	0	35	0	102	7						
Volume Right	0	156	0	18	47	9						
cSH	1042	1700	857	1700	184	150						
Volume to Capacity	0.01	0.09	0.04	0.01	0.84	0.15						
Queue Length 95th (m)	0.2	0.0	1.0	0.0	45.7	4.0						
Control Delay (s)	0.2	0.0	1.1	0.0	81.8	33.4						
Lane LOS	A		A		F	D						
Approach Delay (s)	0.1		1.1		81.8	33.4						
Approach LOS					F	D						
Intersection Summary												
Average Delay				9.4								
Intersection Capacity Utilization				70.5%	ICU Level of Service			C				
Analysis Period (min)				15								

HCM Unsignalized Intersection Capacity Analysis

1: Grey Road 21/Long Point Road & Highway 26

Total Conditions Saturday
12-14-2021

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	506	100	67	546	11	77	19	68	6	11	16
Future Volume (Veh/h)	15	506	100	67	546	11	77	19	68	6	11	16
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	17	575	114	76	620	12	88	22	77	7	12	18
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	632			689			1405	1393	575	1469	1495	620
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	632			689			1405	1393	575	1469	1495	620
tC, single (s)	4.1			4.1			7.1	6.6	6.2	7.3	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.1	3.3	3.7	4.0	3.3
p0 queue free %	98			92			9	82	85	89	89	96
cM capacity (veh/h)	960			901			96	124	521	64	112	492
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	592	114	696	12	187	37						
Volume Left	17	0	76	0	88	7						
Volume Right	0	114	0	12	77	18						
cSH	960	1700	901	1700	151	146						
Volume to Capacity	0.02	0.07	0.08	0.01	1.24	0.25						
Queue Length 95th (m)	0.4	0.0	2.1	0.0	82.9	7.2						
Control Delay (s)	0.5	0.0	2.1	0.0	209.2	37.9						
Lane LOS	A		A		F	E						
Approach Delay (s)	0.4		2.1		209.2	37.9						
Approach LOS					F	E						
Intersection Summary												
Average Delay			25.8									
Intersection Capacity Utilization			86.0%	ICU Level of Service				E				
Analysis Period (min)			15									

ATTACHMENT E

ITE Excerpts

Land Use: 210

Single-Family Detached Housing

Description

A single-family detached housing site includes any single-family detached home on an individual lot. A typical site surveyed is a suburban subdivision.

Specialized Land Use

Data have been submitted for several single-family detached housing developments with homes that are commonly referred to as patio homes. A patio home is a detached housing unit that is located on a small lot with little (or no) front or back yard. In some subdivisions, communal maintenance of outside grounds is provided for the patio homes. The three patio home sites total 299 dwelling units with overall weighted average trip generation rates of 5.35 vehicle trips per dwelling unit for weekday, 0.26 for the AM adjacent street peak hour, and 0.47 for the PM adjacent street peak hour. These patio home rates based on a small sample of sites are lower than those for single-family detached housing (Land Use 210), lower than those for single-family attached housing (Land Use 251), and higher than those for senior adult housing -- single-family (Land Use 251). Further analysis of this housing type will be conducted in a future edition of *Trip Generation Manual*.

Additional Data

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (<https://www.ite.org/technical-resources/topics/trip-and-parking-generation/>).

For 30 of the study sites, data on the number of residents and number of household vehicles are available. The overall averages for the 30 sites are 3.6 residents per dwelling unit and 1.5 vehicles per dwelling unit.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Arizona, California, Connecticut, Delaware, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Minnesota, Montana, New Jersey, North Carolina, Ohio, Ontario (CAN), Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Vermont, Virginia, and West Virginia.

Source Numbers

100, 105, 114, 126, 157, 167, 177, 197, 207, 211, 217, 267, 275, 293, 300, 319, 320, 356, 357, 367, 384, 387, 407, 435, 522, 550, 552, 579, 598, 601, 603, 614, 637, 711, 716, 720, 728, 735, 868, 869, 903, 925, 936, 1005, 1007, 1008, 1010, 1033, 1066, 1077, 1078, 1079

Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,

One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban

Number of Studies: 192

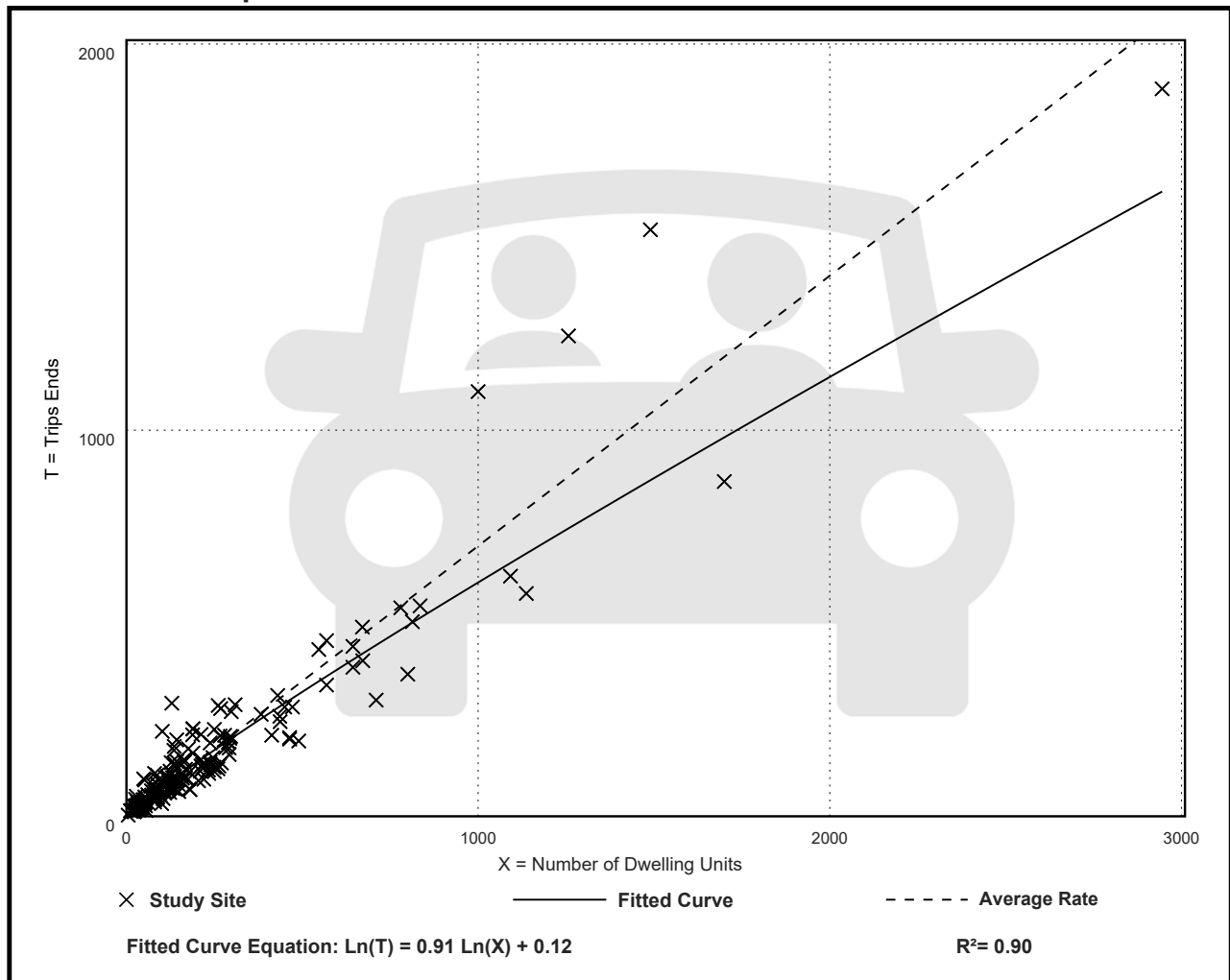
Avg. Num. of Dwelling Units: 226

Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.70	0.27 - 2.27	0.24

Data Plot and Equation



Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,

One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban

Number of Studies: 208

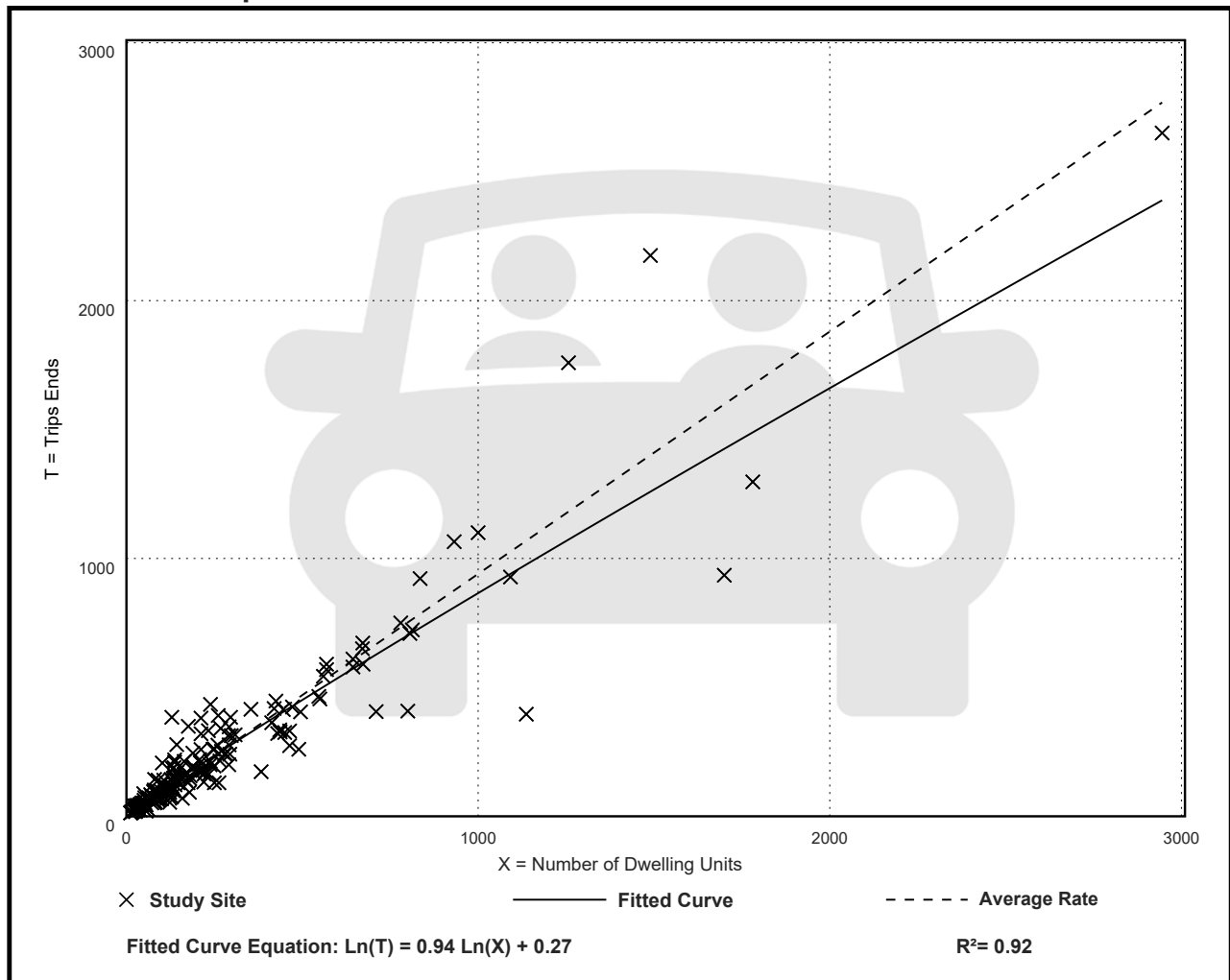
Avg. Num. of Dwelling Units: 248

Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.94	0.35 - 2.98	0.31

Data Plot and Equation



Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units

On a: Saturday, Peak Hour of Generator

Setting/Location: General Urban/Suburban

Number of Studies: 42

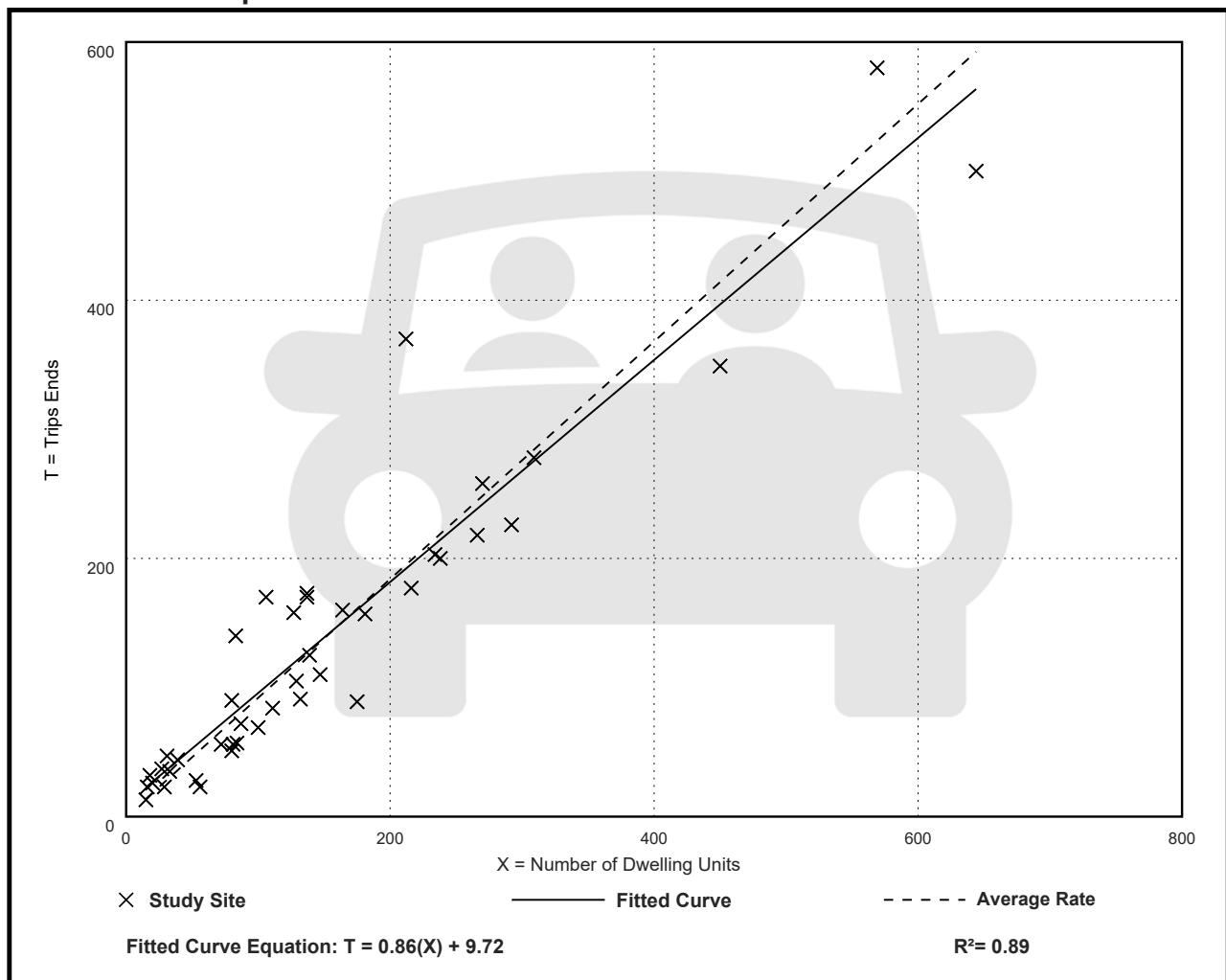
Avg. Num. of Dwelling Units: 152

Directional Distribution: 54% entering, 46% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.92	0.41 - 1.78	0.27

Data Plot and Equation



ATTACHMENT F

Town of Engineering Standard Excerpts



The Blue Mountains Engineering Standards

**Revised April 2009
AODA Update July 2018**

Minimum K Vales

Classification or Design Speed	K	
	Crest VC Min Stopping Site Distance	Sag VC Headlight Control
Lane / Local	7	12
Collector	7	12
50 km/hr	7	12
60 km/hr	15	20
70 km/hr	22	25
80 km/hr	35	30

The minimum length of vertical curve is 30 m except for:

- Smoothing vertical curves for super-elevation runoff and tangent runout, which can be reduced to 15 m and 20 m respectively,
- Adverse design conditions, reduced lengths may be permitted.

In the vicinity of sag vertical curves, the cross slope shall be adjusted as necessary to maintain a minimum lip of gutter grade of 0.5% to the lowpoint.

4.5.7 Super-elevation

Super-elevation is required on Collector and Arterial Roadways with a design speed of 50 km/hr and over and is to conform to the guidelines in the TAC Manual.

4.5.8 Intersections

Roadways should be designed to intersect at right angle, however, roadways may intersect at angle up to 80° and such angle should be maintained for a minimum distance of 40 m. Intersections on curves are to be avoided. Where intersections must be placed on a curve, calculations and drawings must be submitted confirming the adequacy of intersection sight distance requirements in the TAC manual.

4.5.8 Fire Routes

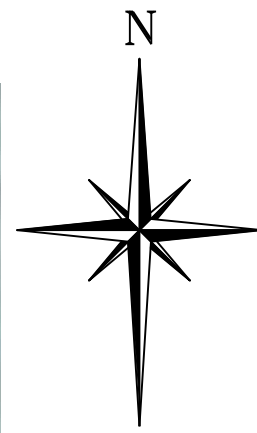
All public and private roadways shall conform to the Town's Fire Route By-law, 2001-88.

4.5.9 Intersection Spacing

Intersections should be spaced a minimum of 60 m apart on local and collector roads and 80 m apart on arterial roads.

ATTACHMENT G

Intersection Spacing Diagram



1. THIS DRAWING IS THE EXCLUSIVE PROPERTY OF C.F. CROZIER & ASSOCIATES INC. AND THE REPRODUCTION OF ANY PART WITHOUT PRIOR WRITTEN CONSENT OF THIS OFFICE IS STRICTLY PROHIBITED.
2. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO THIS OFFICE PRIOR TO CONSTRUCTION.
3. THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT.
4. DO NOT SCALE THE DRAWINGS.
5. ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

TEMPORARY BENCHMARKS

TBM#1-
TBM#2-
TBM#3-

***ADD REFERENCE TO SURVEY/SOURCE

No.	ISSUE	DATE: MM/DD/YYYY
0	ISSUED FOR 1st SUBMISSION	12/20/2021

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

Project	LONG POINT ROAD SUBDIVISION	
Drawing	INTERSECTION DISTANCE	



Admiral Building
1 First Street, Suite 200
Collingwood, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	R.L.	Design By	R.L.	Project	1988-5783
Check By	K.H.	Check By	K.H.	Scale	1:500
				Drawing	FIG

ATTACHMENT H

TAC Excerpts

Table 9.9.3: Time Gap for Case B1, Left Turn from Stop

Design Vehicle	Time Gap (t_g)(s) at Design Speed of Major Road
Passenger car	7.5
Single-unit truck	9.5
Combination truck (WB 19 and WB 20)	11.5
Longer truck	To be established by road authority

Notes: Time gaps are for a stopped vehicle to turn left onto a two-lane highway with no median and with grades of 3% or less. The table values should be adjusted as follows:

- For multi-lane highways: For left turns onto two-lane highways with more than two lanes, add 0.5 s for passenger cars and 0.7 s for trucks for each additional lane, from the left, in excess of one, to be crossed by the turning vehicle.
- For minor approach grades: If the approach grade is an upgrade that exceeds 3%, add 0.2 s for each percent grade for left turns.
- Some road authorities use higher values for certain specialized vehicles (e.g., Alberta uses 22 s for very long log trucks).

The intersection sight distance along the major road (distance b in **Figure 9.9.2**) is determined by:

$$ISD = 0.278 V_{\text{major}} t_g \quad (9.9.1)$$

Where:

ISD = intersection sight distance (length of the leg of sight triangle along the major road) (m)

V_{major} = design speed of the major road (km/h)

t_g = time gap for minor road vehicle to enter the major road (s)

For example, a passenger car turning left onto a two-lane major road should be provided sight distance equivalent to a time gap of 7.5 s in major-road traffic. If the design speed of the major road is 100 km/h, this corresponds to a sight distance of $0.278(100)(7.5) = 208.5$ or 210 m, rounded for design.

A passenger car turning left onto a four-lane undivided roadway will need to cross two near lanes, rather than one. This increases the recommended gap in major-road traffic from 7.5 to 8.0 s. The corresponding value of sight distance for this example would be 223 m. If the minor-road approach to such an intersection is located on a 4% upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in **Table 9.9.4**. **Figure 9.9.4** includes design values, based on the time gaps for the design vehicles included in **Table 9.9.3**.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3%, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

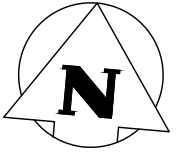
Table 9.9.4: Design Intersection Sight Distance – Case B1, Left Turn From Stop

Design Speed (km/h)	Stopping Sight Distance (m)	Intersection Sight Distance for Passenger Cars	
		Calculated (m)	Design (m)
20	20	41.7	45
30	35	62.6	65
40	50	83.4	85
50	65	104.3	105
60	85	125.1	130
70	105	146.0	150
80	130	166.8	170
90	160	187.7	190
100	185	208.5	210
110	220	229.4	230
120	250	250.2	255
130	285	271.1	275

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3% or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right turns (case B2) will provide sufficient sight distance for a passenger car to cross the near roadway to reach the median. Possible exceptions are addressed in the discussion of case B3.

FIGURES

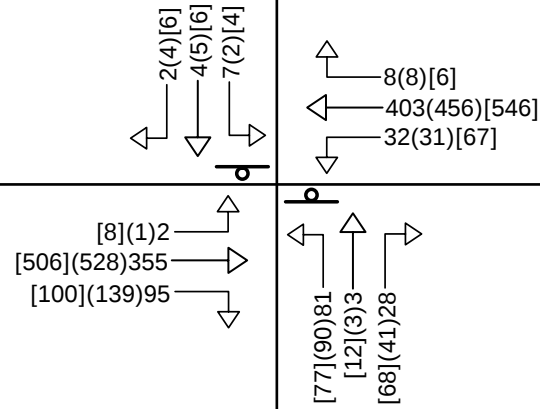


LONG POINT ROAD

GREY ROAD 21

HIGHWAY 26

HIGHWAY 26



LEGEND:

◫ STOP CONTROL

AM(PM)[SAT] PEAK HOUR VOLUMES

Project

LONG POINT ROAD SUBDIVISION
TERRABROOK HOMES

Drawing

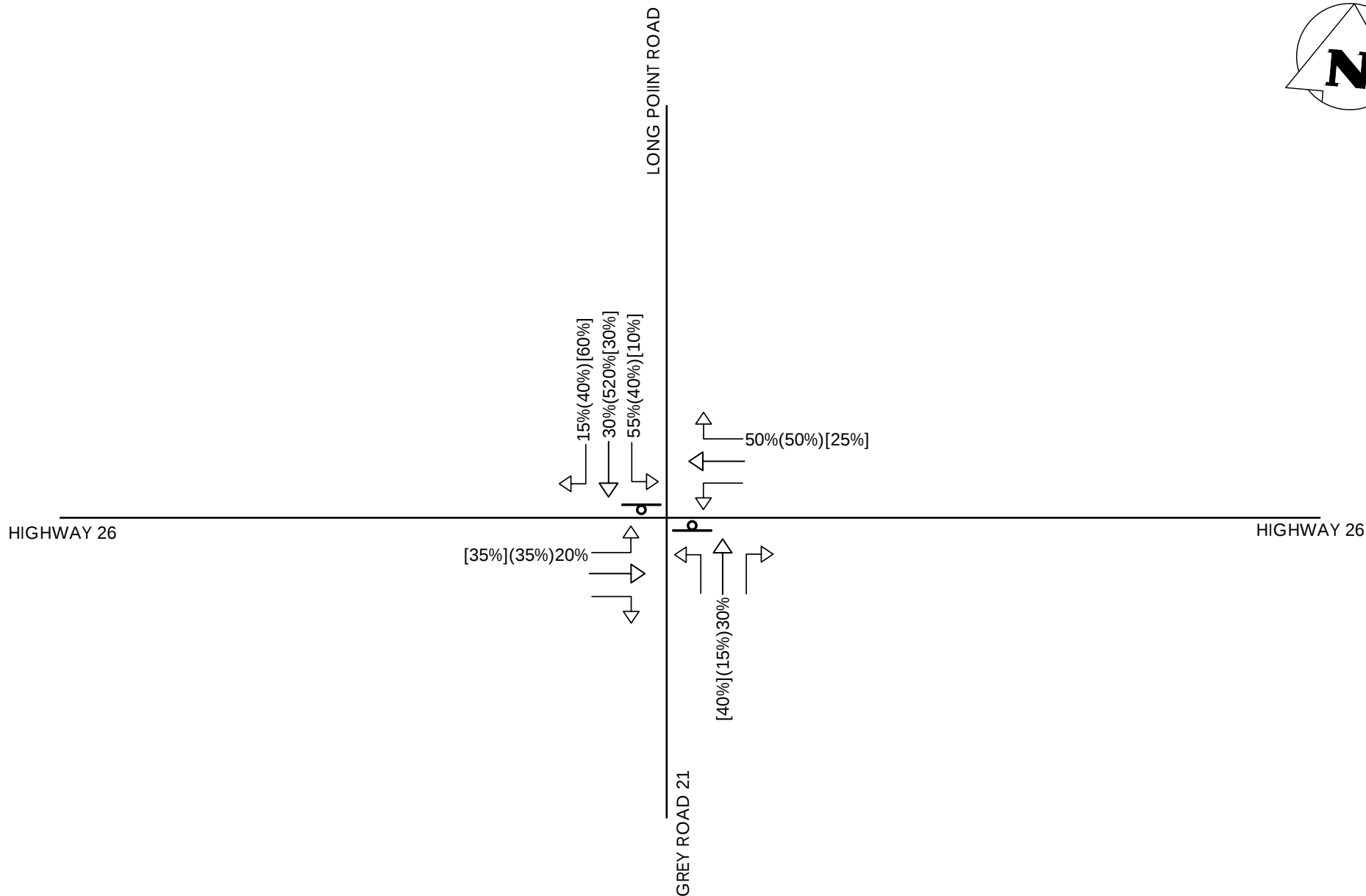
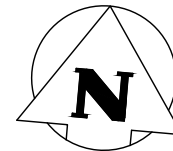
EXISTING VOLUMES



CROZIER
CONSULTING ENGINEERS

ADMIRAL BUILDING
1 FIRST STREET, SUITE 200
COLLINGWOOD, ON L9Y 1A1
705 446-3510 T
705 446-3520 F
WWW.CFCROZIER.CA

Drawn By	KH	Design By	KH	Project	1988-5783
Scale	N.T.S.	Date	2021.12.14	Check By	KH
					Drawing
					FIG.1



LEGEND:



STOP CONTROL

AM(PM)[SAT]

PEAK HOUR
DISTRIBUTION

Project

LONG POINT ROAD SUBDIVISION
TERRABROOK HOMES

Drawing

TRIP DISTRIBUTION



CROZIER
CONSULTING ENGINEERS

ADMIRAL BUILDING
1 FIRST STREET, SUITE 200
COLLINGWOOD, ON L9Y 1A1
705 446-3510 T
705 446-3520 F
WWW.CFCROZIER.CA

Drawn By KH

Design By KH

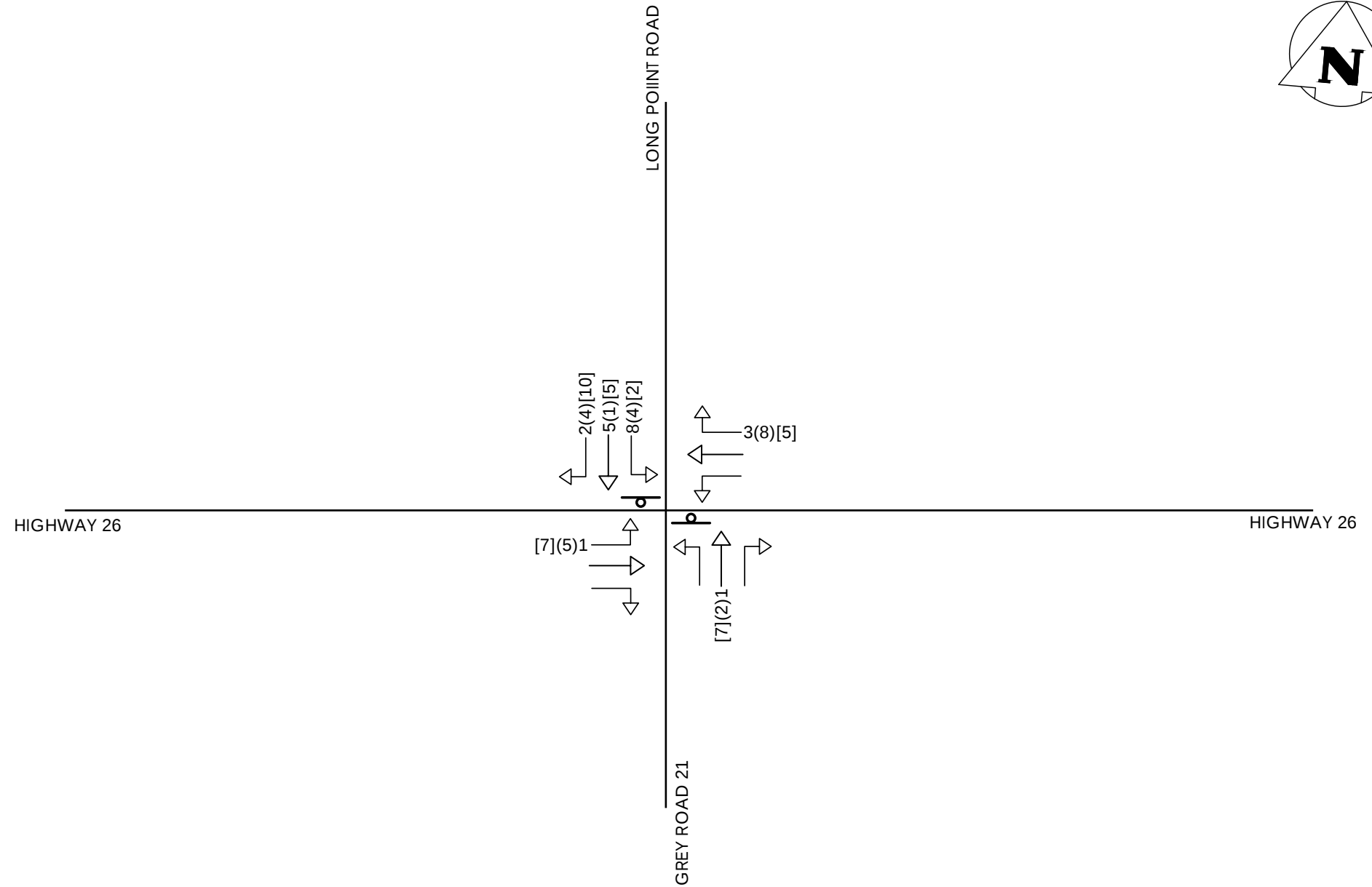
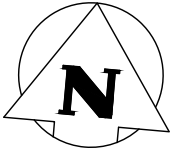
Project 1988-5783

Scale N.T.S.

Date 2021.12.14

Check By KH

Drawing FIG.2



LEGEND:

◫ STOP CONTROL

AM(PM)[SAT] PEAK HOUR VOLUMES

Project

LONG POINT ROAD SUBDIVISION
TERRABROOK HOMES

Drawing

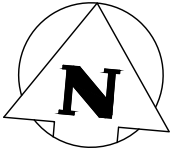
TRIP ASSIGNMENT



CROZIER
CONSULTING ENGINEERS

ADMIRAL BUILDING
1 FIRST STREET, SUITE 200
COLLINGWOOD, ON L9Y 1A1
705 446-3510 T
705 446-3520 F
WWW.CFCROZIER.CA

Drawn By	KH	Design By	KH	Project	1988-5783
Scale	N.T.S.	Date	2021.12.14	Check By	KH
					Drawing
					FIG.3



LONG POINT ROAD

4(8)[16]
9(6)[11]
15(6)[6]

11(16)[11]
403(456)[546]
32(31)[67]

HIGHWAY 26

HIGHWAY 26

[15](6)3
[506](520)355
[100](137)95

[77](90)81
[19](5)4
[68](41)28

GREY ROAD 21

LEGEND:

STOP CONTROL

AM(PM)[SAT] PEAK HOUR VOLUMES

Project

LONG POINT ROAD SUBDIVISION
TERRABROOK HOMES

Drawing

TOTAL VOLUMES



CROZIER
CONSULTING ENGINEERS

ADMIRAL BUILDING
1 FIRST STREET, SUITE 200
COLLINGWOOD, ON L9Y 1A1
705 446-3510 T
705 446-3520 F
WWW.CFCROZIER.CA

Drawn By	KH	Design By	KH	Project	1988-5783
Scale	N.T.S.	Date	2021.12.14	Check By	KH
					Drawing
					FIG.4