TRAFFIC IMPACT ASSESSMENT

SECTION 1 AND PART OF THE
SOUTH ½ SECTION 12-41-1-5

LACOMBE COUNTY, ALBERTA

Prepared For
FRANK WILSON

Prepared By
A. D. WILLIAMS ENGINEERING INC.

ADWE FILE NO. i15451.00
MAY, 2008

A. D. Williams
Engineering Inc.
Consulting Engineers

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The Association of Professional Engineers, Geologists and Geophysicists of Alberta

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APPENDICES

RECOMMENDATIONS

A. D. Williams Engineering Inc. was retained by Frank Wilson to conduct a traffic impact study for a proposed subdivision in Lacombe County by Gull Lake, Alberta. Three intersections were studied for the impact of both existing and future traffic from the development over the next 25 years. The study evaluated the need for turning lanes at the intersections, requirements for signalization and illumination requirements. The other factors we considered, due to the existing roadway alignments was the available sight distance with respect to safety concerns for a driver to safely react to intersection traffic and their ability to safely bring the vehicle to a stop.

This report has been prepared based on the best information available at the time. It is intended to provide conceptual review of the specific issues. Should assumptions or parameters change, amendments to the study should be made.

Based upon the information contained herein, we have the following comments and conclusions based on full build out (25 year horizon).

Highway 12 & Range Road 1-1

1. Left turn lanes are required for the west and north legs of the intersection.
2. Right turn lanes are required for the north and east legs of the intersection.
3. Signalization is warranted when 2,740 lots are developed or when 86% of development occurs.
4. The current level of service is classified as Type ‘B’ and the level of service drops to Type ‘F’ when the subdivision is fully built (without signalization).
5. Full intersection lighting is required when signalization occurs.
6. Delineated lighting to illuminate cross street traffic when 968 lots are developed or when 31% of the development occurs.
7. Partial lighting is required when 1,723 lots are developed or when 54% of the development occurs.

Range Road 1-1 & Township Road 41-0 (South Subdivision Access Road)

1. Left turn lane is required for the east leg of the intersection.
2. Right turn lane is required for the south leg of the intersection.
3. Signalization is not required.
4. The current level of service is classified as Type 'A' and the level of service drops to Type 'D' when the subdivision is fully built.
5. Delineated lighting to illuminate cross street traffic when 2,407 lots are developed or when 76% of the development occurs.
6. Partial lighting is required when 2,597 lots are developed or when 82% of the development occurs.

Range Road 1-1 & Township Road 41-1 (North Subdivision Access Road)

1. Left and right turn lanes are not required.
2. Signalization is not required.
3. Illumination is not required.
4. The current level of service is classified as Type 'A' and the level of service drops to Type 'C' when the subdivision is fully built.

Other factors that should be considered:

- The only sight distance that did not meet specifications was the intersection sight lines on the east leg of the Highway 12 &Range Road 1-1 intersection. This is due to the incline grade on the east leg of the intersection. To reduce the intersection sight distance required on this leg, it would be recommended to reduce the posted speed limit from 100 kph to 80 kph. With the future plans for rerouting of Highway 12, it is recommended that this be evaluated on a phase by phase basis. This will allow up to date traffic counts which will show the new traffic patterns resulting from the rerouting of Highway 12.

INTRODUCTION

A. D. Williams Engineering Inc. (ADWE) was retained by Frank Wilson to review the traffic impacts for the proposed development of land in Lacombe County, Alberta. A traffic impact study was conducted for the location and the findings covered in this report. A site map is attached to **Appendix A** showing the location of the proposed subdivision in relation to Gull Lake, Alberta.

BACKGROUND

A bare land recreational vehicle condominium development is proposed in Sandy Point, Gull Lake, Alberta. This development will draw in a seasonal crowd, with peak season from May through August. A potential senior's population may lengthen the peak season from April through September. The development proposes to attract its visitors through amenities such as a public beach, marina centre, business area and recreation facilities.

Three intersections will be analyzed within this assessment. The three intersections will include a full access into the proposed subdivision from Range Road 1-1 & Township Road 41-0 (located on the south end of the subdivision), an exit/emergency access into the proposed subdivision from Range Road 1-1 & Township Road 41-1 (located on the north end of the subdivision) and the intersection of Highway 12 & Range Road 1-1.

EXISTING INFRASTRUCTURE & CONDITIONS

The existing condition of the infrastructure is as follows:

Highway 12 & Range Road 1-1

The north and south legs of the intersection consist of Range Road 1-1. The west and east legs of the intersection consist of Highway 12. The posted speed limit on the north and south legs is 80 kph. The posted speed limit on the east and west legs of the intersection is 100 kph. Highway 12 is a two lane paved roadway with a width of 7.5 metres. Highway

12 consists of driving lanes with no shoulders. Range Road 1-1 is a 7.0 metre wide gravel roadway. There is residential housing located on the southeast quadrant of the intersection. Highway 12 has a grade of approximately 2% incline to the east. The intersection is not illuminated. There is a 3.0 metre wide asphalt walking path on the north side of Highway 12. The path runs parallel (east/west) to Highway 12. The path is located 7.0 metres north of Highway 12.

Range Road 1-1 & Township Road 41-0 (South Site Access)

The north and south legs of the intersection consist of Range Road 1-1. The west leg of the intersection consists of Township Road 41-0. The posted speed limit on the north and south legs is 80 kph. The posted speed limit on the west leg of the intersection is 80 kph. Range Road 1-1 is a two lane gravel roadway with a width of 7.5 metres. Township Road 41-0 is a two lane gravel roadway with a width of 7.5 metres. The north leg of the intersection is a machinery road while the other two legs are fair weather roads. The intersection is not illuminated.

Range Road 1-1 & Township Road 41-1 (North Site Access)

This intersection consists of the south and west legs only. The south leg is a machinery road, while the west leg is a fair weather road. The south leg of the intersection is part of Range Road 1-1. The west leg of the intersection is part of Township Road 41-1. The posted speed limit on these two legs is 80 kph. Range Road 1-1 is a two lane gravel roadway with a width of 7.5 metres. Township Road 41-0 is a two lane gravel roadway with a width of 7.5 metres. The intersection is not illuminated.

Design Vehicle & Existing Intersection Turning Radius

The design vehicle used to calculate the minimum turning radii is a semi-trailer combination (WB-17). This was selected to accommodate any hauling of equipment in and out of the proposed site. The minimum turning radius for this type of vehicle is 55-18-55 metres with a three centred curve. This value has been taken from the Highway Geometric Design Guide.

Design Speed

The design speeds for the intersections are listed below:

Table 1 - Intersection Design Speed

Intersection	Design Speed
Highway 12 & Range Road 1-1	110 kph
Range Road 1-1 & Township Road 41-0 (South Site Access)	90 kph
Range Road 1-1 & Township Road 41-1 (North Site Access)	90 kph

Intersection Sight Distance & Stopping Sight Distance

The design should ensure adequate pavement widths of turning roadways and sight distances. Sight distances are factors included in this study. The intersection sight distance considers the speed and distance required for a vehicle to safely conduct a left hand turning movement at an intersection. The sight stopping distance requirements involve factors such as the driver's perception and reaction time and the safe stopping distance at various speeds. The chart listed below shows the results:

Table 2 – Intersection Sight Distance – Highway 12 & Range Road 1-1

Intersection	Intersection Sight Distance			
	Driver Side	Passenger Side	Distance Required (Driver Side)	Distance Required (Passenger Side)
Highway 12 & Range Road 1-1 (north leg)	435 m	500 m +	515 m	430 m
Highway 12 & Range Road 1-1 (south leg)	500 m +	435 m	430 m	515 m

Table 3 - Sight Stopping Distance – Highway 12 & Range Road 1-1

Intersection	Sight Stopping Distance		
	Driver Side	Passenger Side	Distance Required
Highway 12 & Range Road 1-1 (north leg)	435 m	500 m +	235 m
Highway 12 & Range Road 1-1 (south leg)	500 m +	435 m	235 m

The minimum distances required are taken from the Highway Geometric Design Guide. A correction factor was used for the effect of grade on the intersection sight distance. The only sight distance that did not meet specifications was the intersection sight lines on the east leg of the intersection. This is due to the incline grade on the east leg of the intersection. To reduce the intersection sight distance required on this leg, it would be recommended to reduce the posted speed limit from 100 kph to 80 kph.

Site Access

A review of the proposed road intersections were carried out under two considerations: proximity to other access points, and proximity to existing intersections. Separation is based on the end-point of the nearest edge of approach.

There is one approach located on the east leg of the intersection of Highway 12 & Range Road 1-1. It is located approximately 130 metres to the east of the intersection and located on the south side of Highway 12.

Consideration will have to be taken when upgrading the intersection to accommodate the future development traffic on this approach.

TRAFFIC VOLUMES

Development/ Background Traffic

Highway 12 & Range Road 1-1

There is no published Alberta Transportation traffic volume data for this section of Highway 12. A traffic count for intersection turning movements was conducted on April 14th, 2008. **Appendix B** contains the traffic count data and composition of vehicle data at the site.

The daily traffic (AADT), peak AM, and peak PM values were taken from the turning movement diagrams derived from the traffic count. The table below shows the related values.

Table 4 – Traffic Volumes: Highway 12 & Range Road 1-1

Road	AADT	AM Peak Hourly	PM Peak Hourly
Highway 12	1,915	168	224
Range Road 1-1	103	12	7

The existing traffic that is currently in this area is largely composed of passenger vehicle traffic.

Range Road 1-1 & Township Road 41-0 (South Site Access)

There is no published Alberta Transportation traffic volume data for this section of Range Road 1-1. A traffic count was not taken at this location. However, a traffic count was taken at the intersection of Highway 12 & Range Road 1-1 to the south. By interpolating this data set and adding the traffic generated by the small residential subdivision located on Range Road 1-1, the traffic volumes at this intersection can be

obtained. **Appendix B** contains the traffic count data and composition of vehicle data at the site.

The AADT, peak AM, and peak PM values were taken from the turning movement diagrams generated from the derived intersection turning movement diagrams. Table 5 shows the related values.

Table 5 – Traffic Volumes: Range Road 1-1 & Township Road 41-0

Road	AADT	AM Peak Hourly	PM Peak Hourly
Range Road 1-1	60	7	7
Township Road 41-0	60	7	7

Range Road 1-1 & Township Road 41-1 (North Site Access)

There is no published Alberta Transportation traffic volume data for this section of Range Road 1-1. A traffic count was not taken at this location. Based on a site inspection, there are a few residences on the north and west legs of the intersection. There is also a summer bible camp on the north leg of the intersection.

The AADT, peak AM, and peak PM values were derived from these field observations. Table 6 shows the related values.

Table 6 – Traffic Volumes: Range Road 1-1 & Township Road 41-1

Road	AADT	AM Peak Hourly	PM Peak Hourly
Range Road 1-1	40	5	5
Township Road 41-1	10	1	1

Projected Background Traffic

Traffic growth rates are calculated as non-compounded. In order to support the average annual growth rate used for analysis purposes, it is important to consider growth rates over

various timeframes (every 5 years). This will ensure that a reasonable average annual growth rate is used for analysis purposes. A growth rate of 3.5% was used.

Table 7 - Projected Traffic Volumes for Highway 12 & Range Road 1-1

Year	Projected AADT	Projected Peak Hour
Base Year (2008)	2,018	236
2013 (5 year)	2,371	278
2018 (10 year)	2,724	319
2023 (15 year)	3,077	360
2028 (20 year)	3,430	401
2033 (25 year)	3,783	443

Table 8 - Projected Traffic Volumes for Range Road 1-1 & Township Road 41-0 (South Site Access)

Year	Projected AADT	Projected Peak Hour
Base Year (2008)	120	14
2013 (5 year)	141	17
2018 (10 year)	162	19
2023 (15 year)	183	21
2028 (20 year)	204	24
2033 (25 year)	225	26

Table 9 - Projected Traffic Volumes for Range Road 1-1 & Township Road 41-1 (North Site Access)

Year	Projected AADT	Projected Peak Hour
Base Year (2008)	50	6
2013 (5 year)	59	7
2018 (10 year)	68	8
2023 (15 year)	77	9
2028 (20 year)	86	10
2033 (25 year)	95	11

Projected Development Traffic

The Developer has indicated that the development will consist of a bare land condominium development, a beach park, marina, 18 hole golf course, fitness centre (spa), specialty stores, fast food restaurant and gasoline service station with convenience market. The development will consist of approximately 3,175 lots. Traffic generation estimates contained herein are therefore based upon the Institute of Transportation Engineers (ITE) Manual, 7th Edition. The manual identifies a number of residential options. For the

purpose of this review, we have used the following ITE average trip-end generation:

- *Recreational Homes (Code 260)*
- *Beach Park (Code 415)*
- *Marina (Code 420)*
- *Golf Course (Code 430)*
- *Health & Fitness Club (Code 492)*
- *Specialty Retail Center (Code 814)*
- *Gasoline Service Station (Code 944)*

All relevant charts have been attached to **Appendix C**.

ITE estimates are based upon observed measurement. ITE data provides a range of trip generation rates for the specific types of development, along with suggested averages. Estimates are categorized by typical weekday and AM/PM Peak Hour of the roadway, and can be applied on a “per dwelling”, “per hole”, “per acre”, “per vehicle fuelling station” or “per 1000 square feet” rate.

ITE estimates are based upon observed measurement. ITE data provides a range of trip generation rates for the specific types of development, along with suggested averages. Estimates are categorized by AM/PM Peak Hour of the roadway.

Peak hourly traffic generation rates for the above uses are as follows:

- Peak hourly traffic generation for Recreational Homes (Code 260), is suggested as 0.30 vehicle trip ends per dwelling unit for the AM peak and 0.31 vehicle trip ends per dwelling unit for the PM peak.

- Peak hourly traffic generation for Beach Park (Code 415), is suggested as 0.48 vehicle trip ends per acre for the AM peak and 0.60 vehicle trip ends per acre for the PM peak.

- Peak hourly traffic generation for Marina (Code 420), is suggested as 0.17 vehicle trip ends per berth for the AM peak and 0.21 vehicle trip ends per berth for the PM peak.

- Peak hourly traffic generation for Golf Course (Code 430), is suggested as 3.01 vehicle trip ends per hole for the AM peak and 3.56 vehicle trip ends per hole for the PM peak.

- Peak hourly traffic generation for Health/Fitness Club (Code 492), is suggested as 1.41 vehicle trip ends per 1000 square feet gross floor area for the AM peak and 4.06 vehicle trip ends per 1000 square feet gross floor area for the PM peak.

- Peak hourly traffic generation for Specialty Retail Center (Code 814), is suggested as 6.84 vehicle trip ends per 1000 square feet gross floor area for the AM peak and 5.02 vehicle trip ends per 1000 square feet gross floor area for the PM peak.

- Peak hourly traffic generation for Gasoline/Service Station (Code 944), is suggested as 12.58 vehicle trip ends per vehicle fuelling station for the AM peak and 15.65 vehicle trip ends per vehicle fuelling station for the PM peak.

Below are tables listing the estimated peak hour volumes that will be generated due to the development traffic.

Table 10 - Estimated Peak Hour Volumes – Recreational Homes (Code 260)

Time Period	Units	Trip Rate	% In	% Out	In	Out	Total
AM Peak Hour	3175	0.30	49	51	467	486	953
PM Peak Hour	3175	0.31	44	56	433	551	984

Table 11 - Estimated Peak Hour Volumes – Beach Park (Code 415)

Time Period	Units	Trip Rate	% In	% Out	In	Out	Total
AM Peak Hour	21	0.48	59	41	6	4	10
PM Peak Hour	21	0.60	34	66	4	9	13

Table 12 - Estimated Peak Hour Volumes – Marina (Code 420)

Time Period	Units	Trip Rate	% In	% Out	In	Out	Total
AM Peak Hour	732	0.17	64	36	80	45	125
PM Peak Hour	732	0.21	51	49	79	75	154

Table 13 - Estimated Peak Hour Volumes – Golf Course (Code 430)

Time Period	Units	Trip Rate	% In	% Out	In	Out	Total
AM Peak Hour	18	3.01	47	53	25	29	54
PM Peak Hour	18	3.56	43	57	28	36	64

Table 14 - Estimated Peak Hour Volumes – Health/Fitness Club (Code 492)

Time Period	Units	Trip Rate	% In	% Out	In	Out	Total
AM Peak Hour	3	1.41	42	58	2	2	4
PM Peak Hour	3	4.06	51	49	6	6	12

Table 15 - Estimated Peak Hour Volumes – Specialty Retail Center (Code 814)

Time Period	Units	Trip Rate	% In	% Out	In	Out	Total
AM Peak Hour	1	6.84	48	52	3	4	7
PM Peak Hour	1	5.02	56	44	3	2	5

Table 16 - Estimated Peak Hour Volumes – Gasoline/Service Station (Code 944)

Time Period	Units	Trip Rate	% In	% Out	In	Out	Total
AM Peak Hour	8	12.58	50	50	50	50	100
PM Peak Hour	8	15.65	50	50	62	63	125

Converting all the Peak Hour Volumes to Average Annual Daily Traffic volumes, the anticipated daily traffic is as shown below.

Table 17 - Estimated Average Annual Daily Traffic Volumes

Type of Development	Peak Hour (In)	Peak Hour (Out)	AADT
Recreational Homes (Code 260)	467	551	8,701
Beach Park (Code 415)	6	9	128
Marina (Code 420)	80	75	1,325
Golf Course (Code 430)	29	36	556
Health and Fitness Club (Code 492)	6	6	103
Specialty Retail Center (Code 814)	3	4	60
Gasoline/Service Station (Code 944)	62	63	1,069
TOTAL	**653**	**744**	**11,942**

Development Traffic Intersection Allotting

In order to establish design traffic flows at the intersections, the following traffic flow assumptions have been made.

- The north site access (Range Road 1-1 & Township Road 41-1) will be an exit/emergency access only. This access will not allow any traffic to enter the subdivision. The south site access (Range Road 1-1 & Township Road 41-0) will be a full entry/exit access. From this, all site generated traffic will enter the subdivision from the south site access (Range Road 1-1 & Township Road 41-0). All the site generated traffic will leave the site with a 50/50 split between the two site access locations.

- All traffic will access the subdivision from Highway 12 via Range Road 1-1. All development traffic will utilize Range Road 1-1, and 70% of the traffic will go east towards Highway 2. The remaining 30% of the traffic will go west towards Bentley, Alberta and Highway 20.

Background & Development Traffic

The background traffic and development traffic have been combined for the determined projection years. The projected traffic numbers are for the peak hour volumes on each leg of the intersections. It is listed as follows:

Table 18 - Projected Traffic Volume Rates for Highway 12 & Range Road 1-1

Year	Background AADT	Development Traffic	Combined Traffic
Base Year (2008)	2,018	11,940	13,958
2013 (5 year)	2,371	11,940	14,311
2018 (10 year)	2,724	11,940	14,664
2022 (15 year)	3,077	11,940	15,017
2028 (20 year)	3,430	11,940	15,370
2033 (25 year)	3,783	11,940	15,723

Table 19 – Projected Traffic Volume Rates for Range Road 1-1 & Township Road 41-0 (South Site Access)

Year	Background AADT	Development Traffic	Combined Traffic
Base Year (2008)	120	11,940	12,060
2013 (5 year)	141	11,940	12,081
2018 (10 year)	162	11,940	12,102
2022 (15 year)	183	11,940	12,123
2028 (20 year)	204	11,940	12,144
2033 (25 year)	225	11,940	12,165

Table 20 – Projected Traffic Volume Rates for Range Road 1-1 & Township Road 41-1 (North Site Access)

Year	Background AADT	Development Traffic	Combined Traffic
Base Year (2008)	50	3,180	3,230
2013 (5 year)	54	3,180	3,234
2018 (10 year)	68	3,180	3,248
2022 (15 year)	77	3,180	3,257
2028 (20 year)	86	3,180	3,266
2033 (25 year)	95	3,180	3,275

ANALYSIS

Illumination Warrant Analysis

A warrant for illumination is based on Geometric, Operational, Environmental, and Collision factors. Charts in Transportation Association of Canada's (TAC's) guide for Illumination of Isolated Rural Intersections were used to conduct this analysis. Charts have been attached to **Appendix D**. All intersections have been analyzed and the results are shown below. The trigger points for illumination are calculated using just the recreational homes. If any of the other developments move forward (i.e. marina, golf course, beach park, etc.) then the trigger points will have to be re-calculated accordingly.

The following terminology is used in the illumination warrant:

- Full intersection lighting denotes illumination covering an intersection in a uniform manner over the traveled portion of the roadway.

- Partial lighting refers to the illumination of key decision areas, potential conflict points, and /or hazards in and on the approach to an intersection. Partial lighting may also guide a driver from one key point to the next, and (if sufficient luminaries are used) place the driver on a safe heading after leaving an illuminated area.

- Delineation lighting refers to "sentry" lighting that marks an intersection location for approaching traffic, or to the illumination of vehicles on a cross street or median crossing.

The intersection of Highway 12 & Range Road 1-1 warrants for the following types of illumination at the following trigger points:

- Full intersection lighting is required when signalization occurs.

- Delineated lighting to illuminate cross street traffic when 968 lots are developed or when 31% of the development occurs.

- Partial lighting when 1,723 lots are developed or when 54% of the development occurs.

The intersection of Range Road 1-1 & Township Road 41-0 (South Subdivision Access Road) will require the following types of illumination at the designated trigger points shown:

- Delineated lighting to illuminate cross street traffic when 2,407 lots are developed or when 76% of the development occurs.

- Partial lighting when 2,597 lots are developed or when 82% of the development occurs.

The intersection of Range Road 1-1 & Township Road 41-1 (North Subdivision Access Road) does not warrant illumination at the current traffic volumes or at full build out conditions.

Pedestrian Analysis

For this site analysis, the location has no pedestrian traffic at the proposed intersection therefore pedestrian movement accommodation is not warranted.

Intersection Analysis

An intersection configuration was designed for the projected year (2033). Figure D-7.4 from the Highway Geometric Design Guide has been used to represent initial traffic volume warrants for the intersections at the site. This review identifies the need for upgrading of the intersection, and suggests further analysis to determine whether an allowance must be made for left-turn vehicles through provision of a larger intersection configuration. A copy of the intersection types and Figure D-7.4 has been included in **Appendix E**.

Highway 12 & Range Road 1-1

For the intersection of *Highway 12 & Range Road 1-1*, the type of intersection needed is as shown below. This was taken from Figure D-7.4 and Figure D-71 of the Highway Geometric Design Guide, which is located in **Appendix E**.

Table 21 - Intersection Types For Highway 12 & Range Road 1-1

	Current Needs (2008)	Full Build-Out (2033)
South Leg	Type II	Type II
North Leg	Type II	Type IV
East Leg	Type II	Type IV
West Leg	Type II	Type IV

Left turn warrants are based upon the level of probability that a vehicle in the advancing traffic stream in the design hour will not arrive at an intersection when another vehicle, traveling in the same direction, is stopped waiting to make a left turn. Due to the type of intersection configurations required, a left turn lane is required for the west and north legs of the intersection.

The Alberta Transportation warrant for a right turn lane requires that the following three conditions are met: the main road have an average daily volume in excess of 1800 vehicles, the intersecting road have an average daily volume in excess of 900 vehicles, and a right turn volume in excess of 360 vehicles. For this analysis the three conditions were met on the north and east legs of the intersection and therefore a dedicated right lane is warranted.

Pavement widths of turning roadways depend jointly upon the dimension of the design vehicle and the radius of the turning roadway. According to Table D.6.3.2, the minimum pavement width to accommodate a WB-21 type of vehicle is 9.1 metres.

Range Road 1-1 & Township Road 41-0 (South Subdivision Access Road)

For the intersection of *Range Road 1-1 & Township Road 41-0,* the type of intersection needed is as shown below. This was taken from Figure D-7.4 and Figure D-71 of the Highway Geometric Design Guide, which is located in **Appendix E**.

Table 22 - Intersection Types For Range Road 1-1 & Township Road 41-0

	Current Needs (2008)	Full Build-Out (2033)
South Leg	Type I	Type IV
North Leg	Type I	Type II
East Leg	Type I	Type I
West Leg	Type I	Type IIV

Left turn warrants are based upon the level of probability that a vehicle in the advancing traffic stream in the design hour will not arrive at an intersection when another vehicle, traveling in the same direction, is stopped waiting to make a left turn. Due to the type of intersection configurations required, a left turn lane is required for the east leg of the intersection.

The Alberta Transportation warrant for a right turn lane requires that that the following three conditions are met: the main road have an average daily volume in excess of 1800 vehicles, the intersecting road have an average daily volume in excess of 900 vehicles, and a right turn volume in excess of 360 vehicles. For this analysis the three conditions were met on the south leg of the intersection and therefore a dedicated right lane is warranted.

Pavement widths of turning roadways depend jointly upon the dimension of the design vehicle and the radius of the turning roadway. According to Table D.6.3.2, the minimum pavement width to accommodate a WB-21 type of vehicle is 9.1 metres.

Range Road 1-1 & Township Road 41-1 (North Subdivision Access Road)

For the intersection of *Range Road 1-1 & Township Road 41-1*, the type of intersection needed is as shown in Table 23. This was taken from Figure D-7.4 and Figure D-71 of the Highway Geometric Design Guide, which is located in **Appendix E**.

Table 23 - Intersection Types For Range Road 1-1 & Township Road 41-1

	Current Needs (2007)	Full Build-Out (2032)
South Leg	Type I	Type II
North Leg	Type I	Type II
East Leg	Type I	Type II
West Leg	Type I	Type II

Left turn warrants are based upon the level of probability that a vehicle in the advancing traffic stream in the design hour will not arrive at an intersection when another vehicle, traveling in the same direction, is stopped waiting to make a left turn. Due to the type of intersection configurations required, a left turn lane is not required for the intersection.

The Alberta Transportation warrant for a right turn lane requires that that the following three conditions are met: the main road have an average daily volume in excess of 1800 vehicles, the intersecting road have an average daily volume in excess of 900 vehicles, and a right turn volume in excess of 360 vehicles. For this analysis the three conditions were not met on any of the legs of the intersection and therefore a dedicated right lane is not warranted.

Pavement widths of turning roadways depend jointly upon the dimension of the design vehicle and the radius of the turning roadway. According to Table D.6.3.2, the minimum pavement width to accommodate a WB-21 type of vehicle is 9.1 metres.

Signalization Analysis

A warrant for signalization was conducted on all of the intersections. Charts in the Manual of Uniform Traffic Control Devices for Canada, 4th Edition were used to conduct this analysis. According to the priority rating worksheet analysis the intersection must generate 80 priority points to trigger the need for signalization. Priority rating worksheets consider traffic volumes, pedestrian volumes, vehicular stops, crossing gaps and collisions; an item that is difficult to forecast over 25 years. Excluding the collision rating, the intersection does not generate enough priority points to warrant signalization. Based on the charts for warranting signalization, none of the intersections generate enough priority points to warrant signalization.

Based on the charts for warranting signalization, the intersection of Highway 12 & Range Road 1-1 generates enough priority points to warrant signalization at full build out of the subdivision.

The two other intersections (Range Road 1-1 & Township Road 41-0 and Range Road 1-1 & Township Road 41-1) do not generate enough priority points to warrant signalization by the worksheet method.

A copy of the signalization analysis worksheets has been included in **Appendix F**. The trigger for signalization is when the traffic levels generate a level of service that drops to Type 'E'.

Capacity Analysis

The capacity analysis is based on the methods outlined in the Highway Capacity Manual 2000 and HCS 2000 analysis software and includes assessments using Alberta Infrastructure and Transportation intersection configuration warrants where necessary. With respect to the Highway Capacity Manual, intersection operations are typically rated by the intersections Level of Service (LOS). LOS is based on the estimated average delay per vehicle among all traffic passing through the intersection. A low average delay merits a LOS 'A' rating, whereas high average delay merits a LOS rating of 'F'. If the level of service drops below 'D', signalization is warranted. Copies of the LOS analysis worksheets have been included in **Appendix G**.

Table 24 - Capacity Analysis/Level of Service

	Highway 12 & Range Road 1-1	**Range Road 1-1 & Township Road 41-0**	**Range Road 1-1 & Township Road 41-1**
LOS (2007)	B	A	A
LOS (Full Build Out)	F	D	C
Warrant Signalization	Yes	No	No
Trigger Point (% Developed)	86%	n/a	n/a

Based on the above analysis, the only intersection that has capacity concerns is Highway 12 & Range Road 1-1. The intersection will require signalization when 2,740 lots are developed or when 86% of development occurs.

Operational Analysis

The operational analysis is necessary to ensure that the design vehicle is capable of safely manoeuvring the intersection without interfering with the other traffic movements. The design vehicle used to calculate the minimum turning radii is a semi-trailer combination (WB-21). This was selected to accommodate any hauling of equipment in and out of the proposed site. The minimum turning radius for this type of vehicle is 55-18-55 metres with a three centred curve. This value has been taken from the Highway Geometric Design Guide. Therefore, when the new intersection is designed, it should be capable of handling the turning movements of the design vehicle.

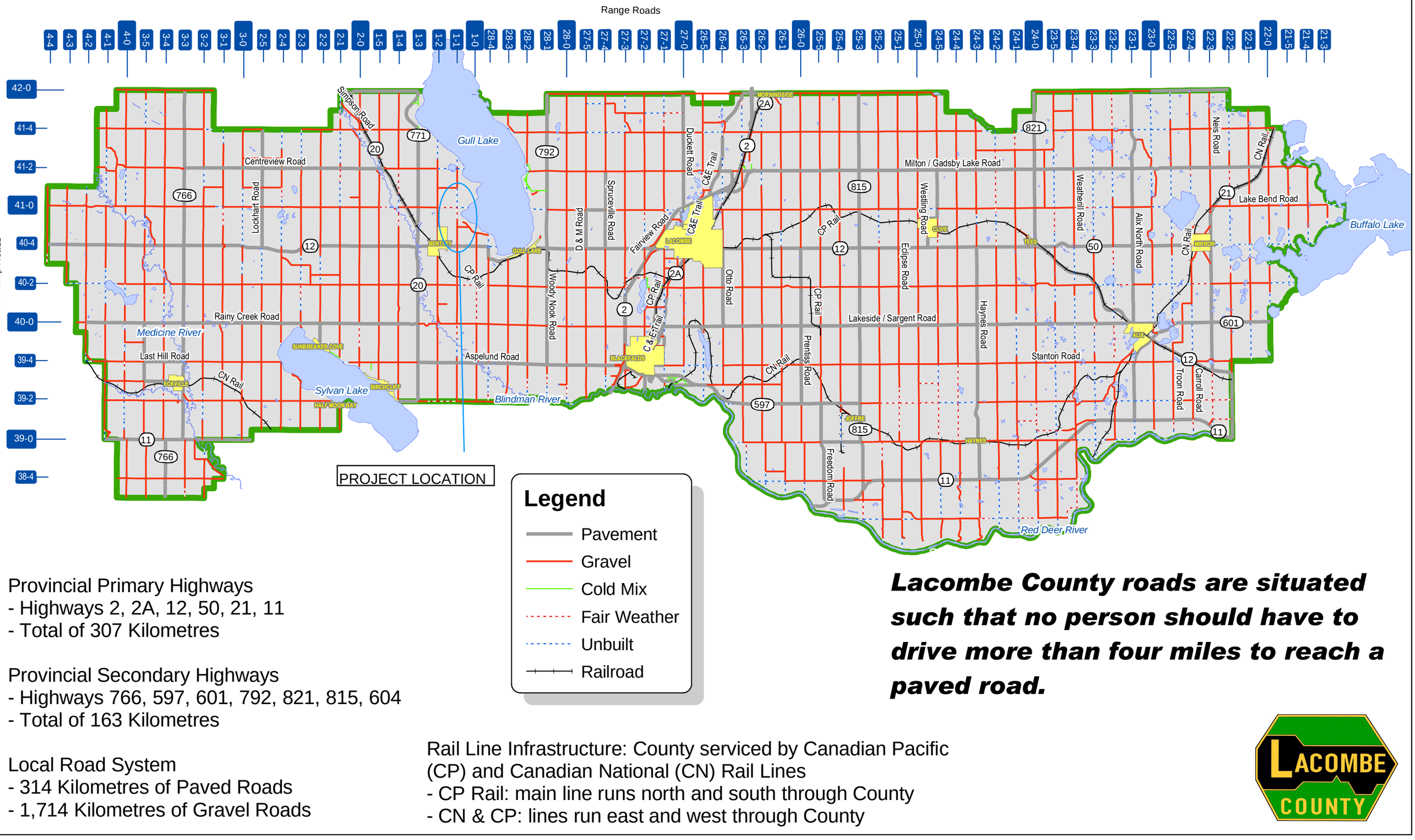
CLOSURE

This report has been prepared based upon the information referenced herein. It has been prepared in a manner consistent with good engineering judgement. Should new information come to light, A. D. Williams Engineering Inc. requests the opportunity to review this information, and our conclusions contained in this report. This report has been prepared for the exclusive use of Frank Wilson and there are no representations made by A. D. Williams Engineering Inc. to any other party. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

A P P E N D I X A

SITE MAP

Lacombe County Transportation Network



PROJECT LOCATION

Legend

- Pavement
- Gravel
- Cold Mix
- Fair Weather
- Unbuilt
- Railroad

Provincial Primary Highways
- Highways 2, 2A, 12, 50, 21, 11
- Total of 307 Kilometres

Provincial Secondary Highways
- Highways 766, 597, 601, 792, 821, 815, 604
- Total of 163 Kilometres

Local Road System
- 314 Kilometres of Paved Roads
- 1,714 Kilometres of Gravel Roads

Rail Line Infrastructure: County serviced by Canadian Pacific (CP) and Canadian National (CN) Rail Lines
- CP Rail: main line runs north and south through County
- CN & CP: lines run east and west through County

Lacombe County roads are situated such that no person should have to drive more than four miles to reach a paved road.

LACOMBE COUNTY

FRANK WILSON

PLAN SHOWING

PROPOSED BARE LAND CONDOMINIUM DEVELOPMENT

OF AREA KNOWN AS SANDY POINT
LOCATED ON THE S.W. SHORE OF GULL LAKE
BLK 8, PLAN 982 4271
BLKS 5 & 6, PLAN 982 4269
AND
BLK 9, PLAN 982 4270
WITHIN ALL OF
SEC. 1 and part of the S. 1/2 of SEC. 12
TWP. 41, RGE, 1, W. 5 MER.
GULL LAKE, ALBERTA

SCALE = 1:4000

NOTES:

–Area dealt with is bounded thus – – – – – – – –
and contains 300.9 HA (743.6 Ac.)
18 HOLE GOLF COURSE (±7340 yds, PAR 72) OPEN TO THE PUBLIC.

- 20m WIDE ROADS
- 15M WIDE ROADS
- PARKING
- OPEN SPACE / GOLF COURSE
- ENVIRONMENTAL RESERVE
- PUBLIC BEACH
- BUSINESS AREA
- R.V. STORAGE
- SEASONAL LEASE LOTS (2981 UNITS)
- DAILY RENTAL LOTS (194 UNITS)

AMENITIES

SWIMMING POOL
MARINA CENTRE
LAUNDROMATS
FIRE DEPARTMENT
HALL FACILITIES
WATER & SEWER HOOKUPS
60 AMP POWER SUPPLY PER SITE
T.V. CABLE HOOKUP PER SITE
INTERNET CONNECTION PER SITE
FITNESS CENTRE (SPA)
GROCERY STORES AND CONVENIENCE STORES
WASHROOMS
SHOWERS AND CHANGE ROOMS
TENNIS COURTS
VOLLLEY BALL COURTS
PICNIC AREAS
HORSESHOE PITS
SEWER DUMPS
FUTURE HOTEL & CASINO
VISITOR PARKING
BALL DIAMONDS
PUBLIC BEACH AREA
MUSEUM
GOLF PUTTING GREENS
BOAT & SEA DOO RENTALS
FAST FOOD BUSINESSES
PLAY GROUND AREAS
SERVICE STATIONS & GAS FILL UP
WALKING & BICYCLE PATHS
DRIVE IN THEATRE
QUAD, SNOWMOBILE & FISHING SHACK RENTALS
BOAT LAUNCH & MARINA

N.W. 1/4 Sec. 12-41-1-5
S.W. 1/4 Sec. 12-41-1-5
R/W PLAN 072 1569
R/W PLAN 012 0614
ROAD ALLOWANCE
GULL LAKE
FUTURE SAIL BOAT MARINA
RAMP
1:100 YR. FLOODLINE
BOAT LAUNCH & PARKING
PUBLIC PARKING
FIFTH MERIDIAN
ROAD ALLOWANCE
S.W. 1/4 Sec. 8-41-28-4
BATHROOM CHANGE ROOM SHOWERS
SAND VALLEY BALL
PUBLIC BEACH & PICNIC AREA
N.W. 1/4 Sec. 5-41-28-4
BUSINESS AREA
PARKING
PUTTING GREEN CLUB HOUSE PRO SHOP & RESTAURANT
DRIVING RANGE
HOTEL/CASINO & BANQUET FACILITY
MARINA
PLAY GROUND
BATHROOMS LAUNDROMAT & SHOWERS
TENNIS COURTS
HORSE SHOE PITS
TURN AROUND
LOT 3 BLK 1 PLAN 012 2668
LOT 1, BLK 1 PLAN 992 0851
N.E. 1/4 Sec. 36-40-1-5
S.W. 1/4 Sec. 5-41-28-4
LAKE

BEMOCO LAND SURVEYING LTD
#100, 6040-47th Avenue
Red Deer, Alberta
Phone No: 342-2611 FILE No: S-198-07 OUTLINE

A P P E N D I X B

TRAFFIC COUNT DATA & AADT'S

Intersection of:	Highway 12 & Range Road 1-1
Date:	2033 (Estimated)
Time:	Peak Hour

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

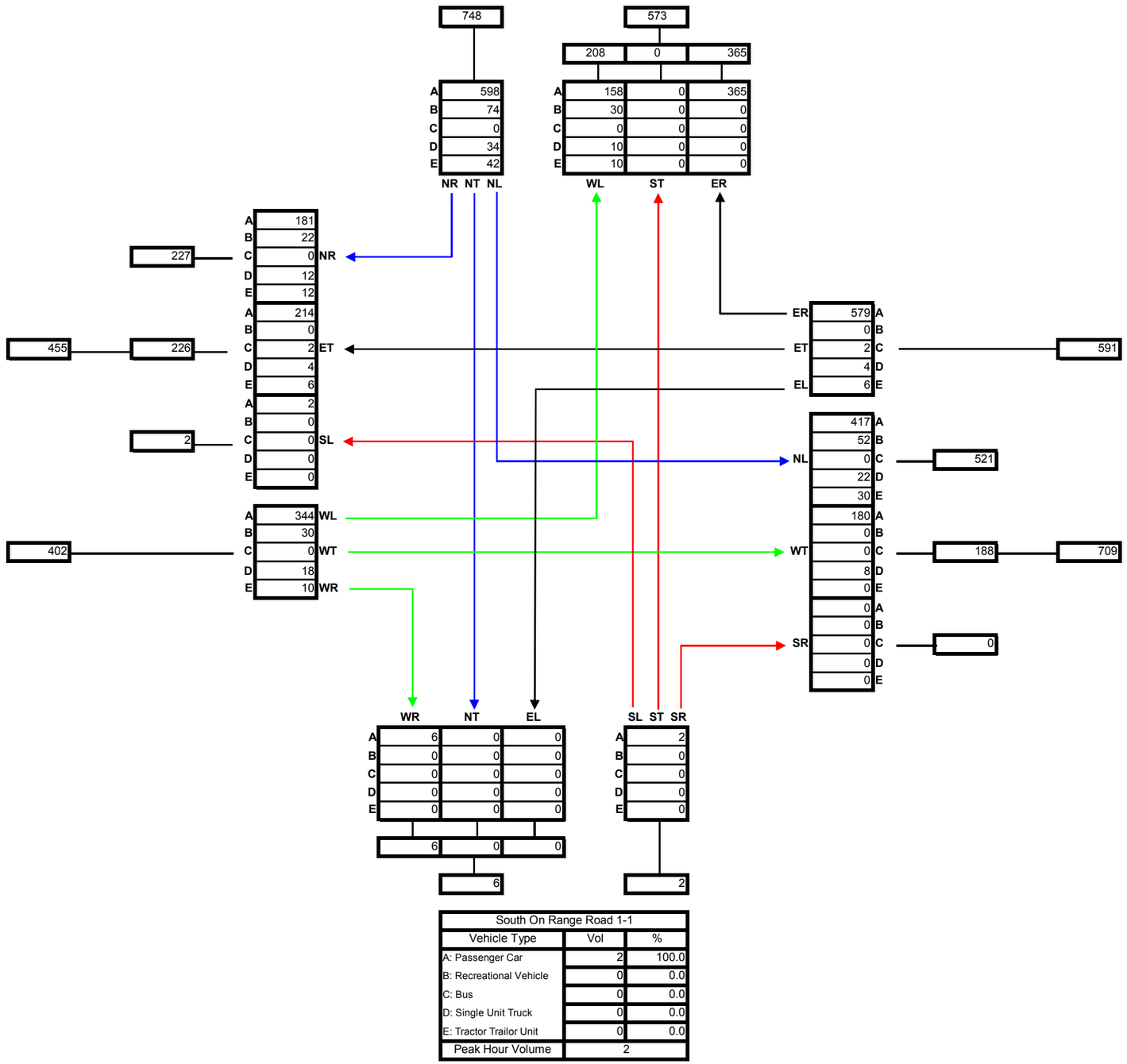
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	598	79.9
B: Recreational Vehicle	74	9.9
C: Bus	0	0.0
D: Single Unit Truck	34	4.5
E: Tractor Trailor Unit	42	5.6
Peak Hour Volume	748	

West On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	344	85.6
B: Recreational Vehicle	30	7.5
C: Bus	0	0.0
D: Single Unit Truck	18	4.5
E: Tractor Trailor Unit	10	2.5
Peak Hour Volume	402	

East On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	579	98.0
B: Recreational Vehicle	0	0.0
C: Bus	2	0.3
D: Single Unit Truck	4	0.7
E: Tractor Trailor Unit	6	1.0
Peak Hour Volume	591	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	2	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	2	



Hours	Approaching Intersection																															Totals
	From The East On (West Bound)															From The West On (East Bound)																
	Left					Through					Right					Left					Through					Right						
6:00 - 7:00 am	0	0	0	0	0	27	0	0	0	1	0	0	0	0	0	0	0	0	0	0	51	0	1	0	1	0	0	0	0	0	81
7:00 - 8:00	0	0	0	0	0	93	0	0	5	4	1	0	0	0	0	0	0	0	0	0	58	0	0	4	2	0	0	0	1	0	168
8:00 - 9:00	3	0	0	0	0	65	3	5	4	1	0	0	0	0	0	0	0	0	0	0	50	0	4	5	2	1	0	0	0	2	145
9:00 - 10:00	1	0	0	0	0	43	0	1	5	2	1	0	0	0	3	1	0	0	0	0	50	0	0	6	8	1	0	0	0	0	122
10:00 - 11:00																															0
11:00 - 12:00																															0
12:00 - 1:00 pm																															0
1:00 - 2:00																															0
2:00 - 3:00																															0
3:00 - 4:00	0	0	0	0	0	90	1	2	5	0	1	0	0	0	0	5	0	0	0	0	81	1	0	5	5	3	0	0	0	0	199
4:00 - 5:00	0	0	0	0	0	88	0	4	2	4	0	0	0	0	0	2	0	0	0	0	78	0	0	1	12	1	0	0	0	0	192
5:00 - 6:00 pm	0	0	0	0	0	114	0	1	2	3	0	0	0	0	0	1	0	0	0	0	96	0	0	4	0	3	0	0	0	0	224
Vehicle Class	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	
Totals	4	0	0	0	0	520	4	13	23	15	3	0	0	0	3	9	0	0	0	0	464	1	5	25	30	9	0	0	1	2	1131
	EL					**ET**					**ER**					**WL**					**WT**					**WR**					

Date:	14-Apr-08
Intersection:	Highway 12 & Range Road 1-1
Performed By:	Kevin Paul, E.I.T.

A	Passenger Vehicle
B	Recreational Vehicle
C	Bus
D	Single Unit Truck
E	Tractor Trailor

Hours	Approaching Intersection																														Totals	Grand Totals
	From The North On (South Bound)															From The South On (North Bound)																
	Left					Through					Right					Left					Through					Right						
6:00 - 7:00 am	1	0	0	1	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	83
7:00 - 8:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	171
8:00 - 9:00	1	0	0	0	2	0	0	1	0	0	5	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	12	157
9:00 - 10:00	1	0	0	0	1	0	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	129
10:00 - 11:00																															0	0
11:00 - 12:00																															0	0
12:00 - 1:00 pm																															0	0
1:00 - 2:00																															0	0
2:00 - 3:00																															0	0
3:00 - 4:00	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	7	206
4:00 - 5:00	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	199
5:00 - 6:00 pm	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	227
Vehicle Class	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**		
Totals	4	0	0	1	3	2	0	1	0	0	13	0	0	1	0	13	0	0	0	0	0	0	0	0	0	3	0	0	0	0	41	1172
	NL					**NT**					**NR**					**SL**					**ST**					**SR**						

Date:	14-Apr-08
Intersection:	Highway 12 & Range Road 1-1
Performed By:	Kevin Paul, E.I.T.

A	Passenger Vehicle
B	Recreational Vehicle
C	Bus
D	Single Unit Truck
E	Tractor Trailor

Intersection of:	Highway 12 & Range Road 1-1
Date:	14-Apr-08
Time:	6 am - 7 am

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

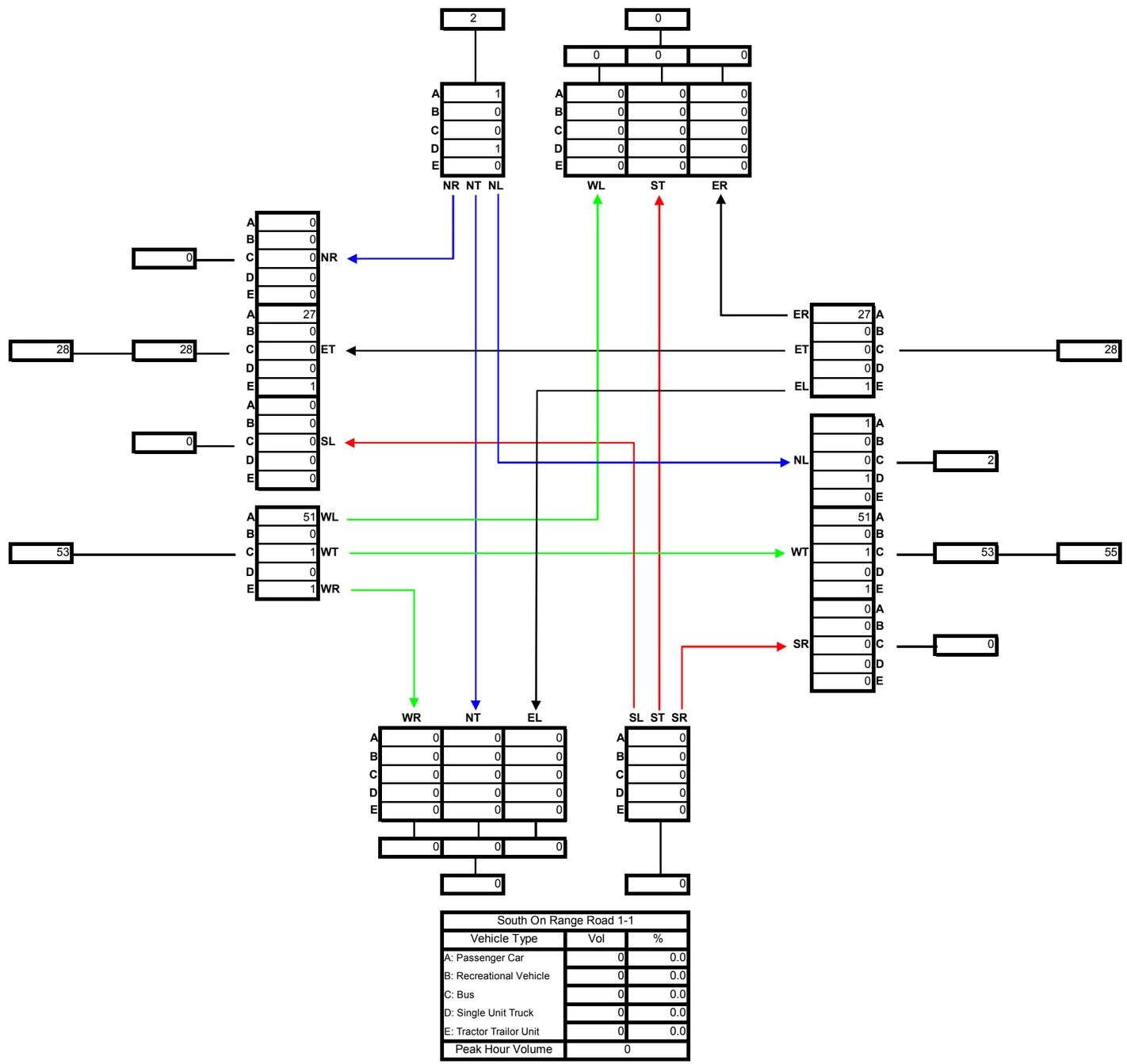
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	1	50.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	1	50.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	2	

West On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	51	96.2
B: Recreational Vehicle	0	0.0
C: Bus	1	1.9
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	1	1.9
Peak Hour Volume	53	

East On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	27	96.4
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	1	3.6
Peak Hour Volume	28	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	0	0.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	0	



Intersection of:	Highway 12 & Range Road 1-1
Date:	14-Apr-08
Time:	7 am - 8 am

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

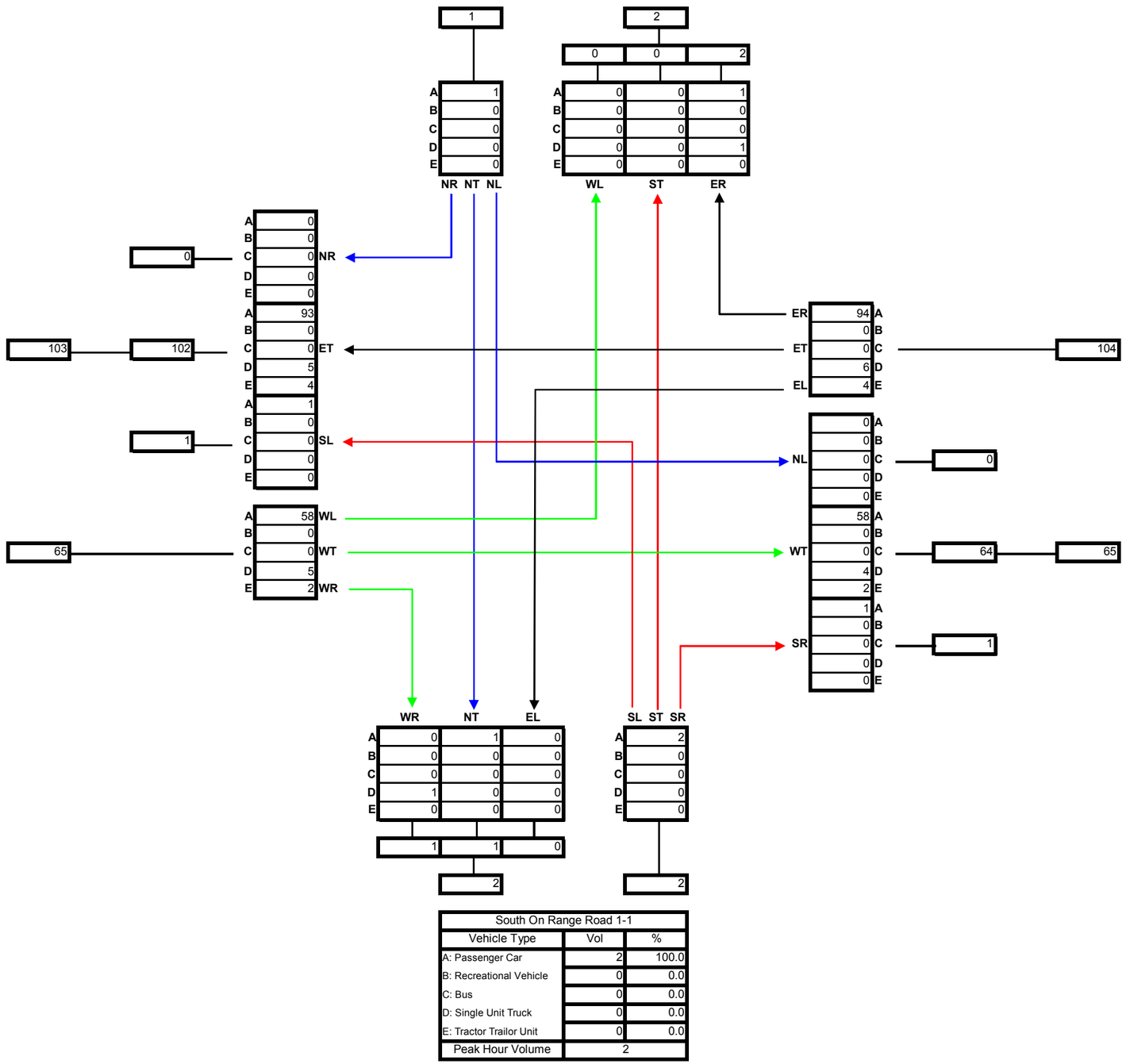
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	1	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	1	

West On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	58	89.2
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	5	7.7
E: Tractor Trailor Unit	2	3.1
Peak Hour Volume	65	

East On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	94	90.4
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	6	5.8
E: Tractor Trailor Unit	4	3.8
Peak Hour Volume	104	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	2	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	2	



Intersection of:	Highway 12 & Range Road 1-1
Date:	14-Apr-08
Time:	8 am - 9 am

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

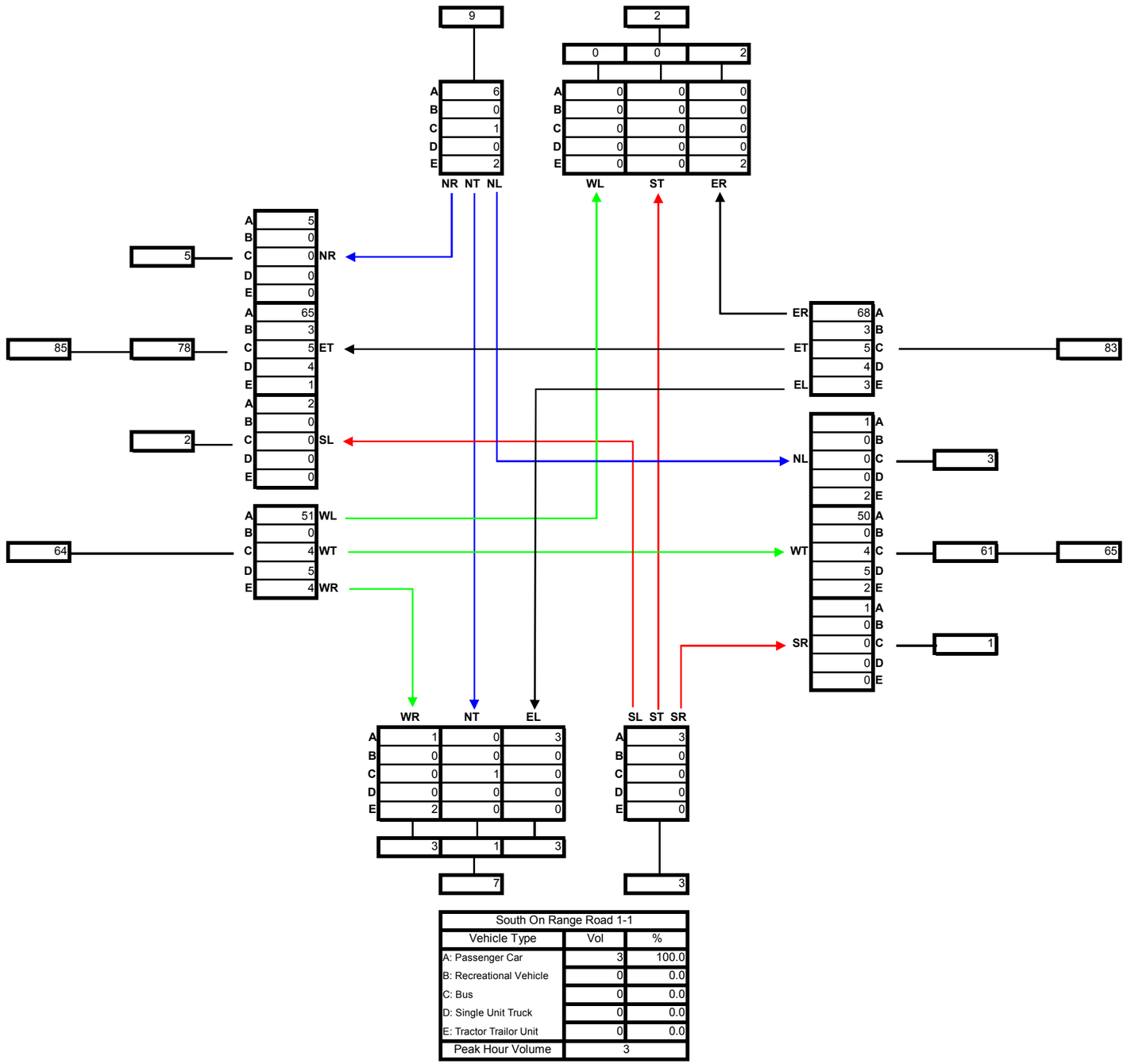
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	6	66.7
B: Recreational Vehicle	0	0.0
C: Bus	1	11.1
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	2	22.2
Peak Hour Volume	9	

West On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	51	79.7
B: Recreational Vehicle	0	0.0
C: Bus	4	6.3
D: Single Unit Truck	5	7.8
E: Tractor Trailor Unit	4	6.3
Peak Hour Volume	64	

East On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	68	81.9
B: Recreational Vehicle	3	3.6
C: Bus	5	6.0
D: Single Unit Truck	4	4.8
E: Tractor Trailor Unit	3	3.6
Peak Hour Volume	83	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	3	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	3	



Intersection of:	Highway 12 & Range Road 1-1
Date:	14-Apr-08
Time:	9 am - 10 am

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

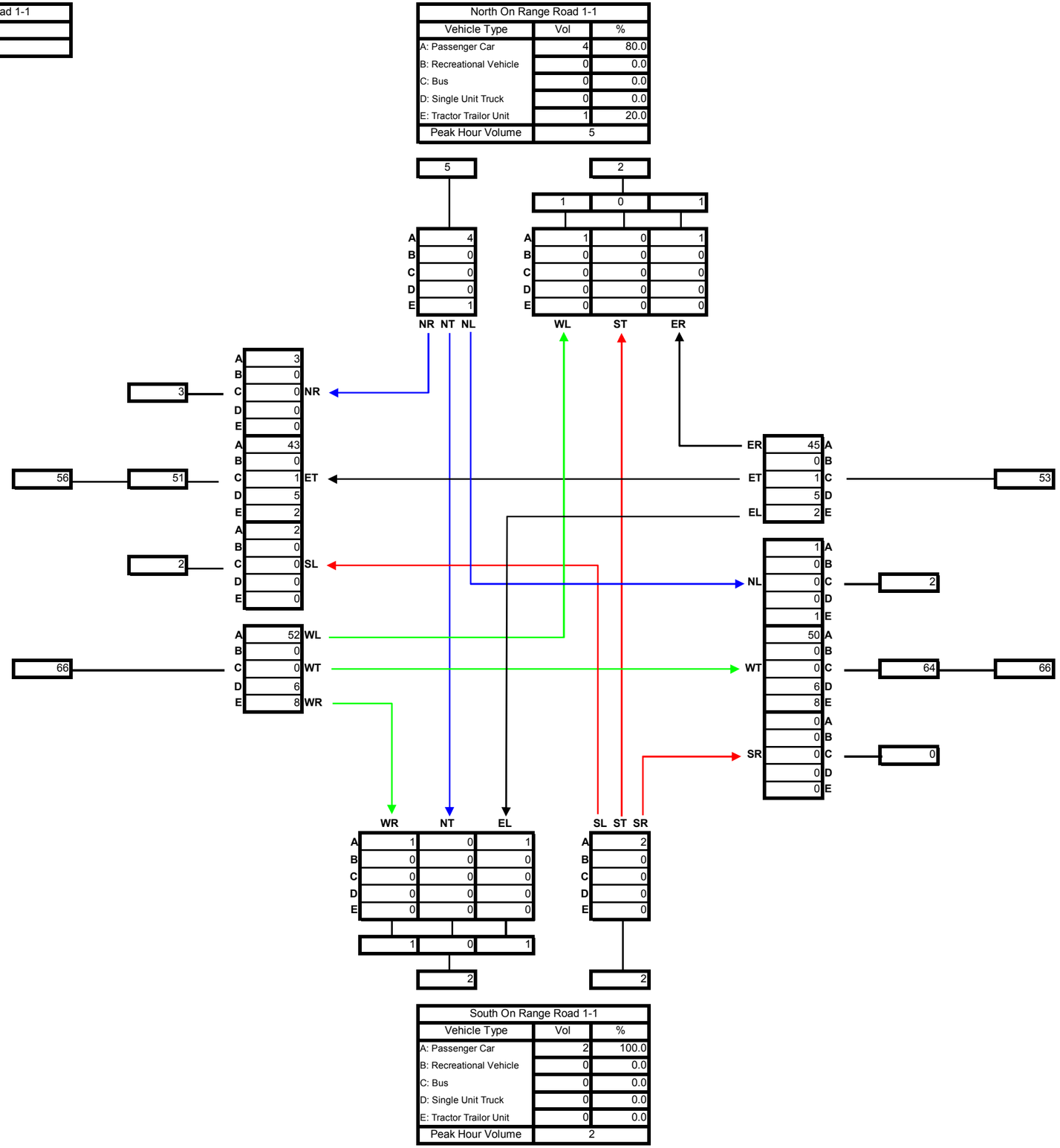
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	4	80.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	1	20.0
Peak Hour Volume	5	

West On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	52	78.8
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	6	9.1
E: Tractor Trailor Unit	8	12.1
Peak Hour Volume	66	

East On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	45	84.9
B: Recreational Vehicle	0	0.0
C: Bus	1	1.9
D: Single Unit Truck	5	9.4
E: Tractor Trailor Unit	2	3.8
Peak Hour Volume	53	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	2	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	2	



Intersection of:	Highway 12 & Range Road 1-1
Date:	14-Apr-08
Time:	3 pm - 4 pm

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

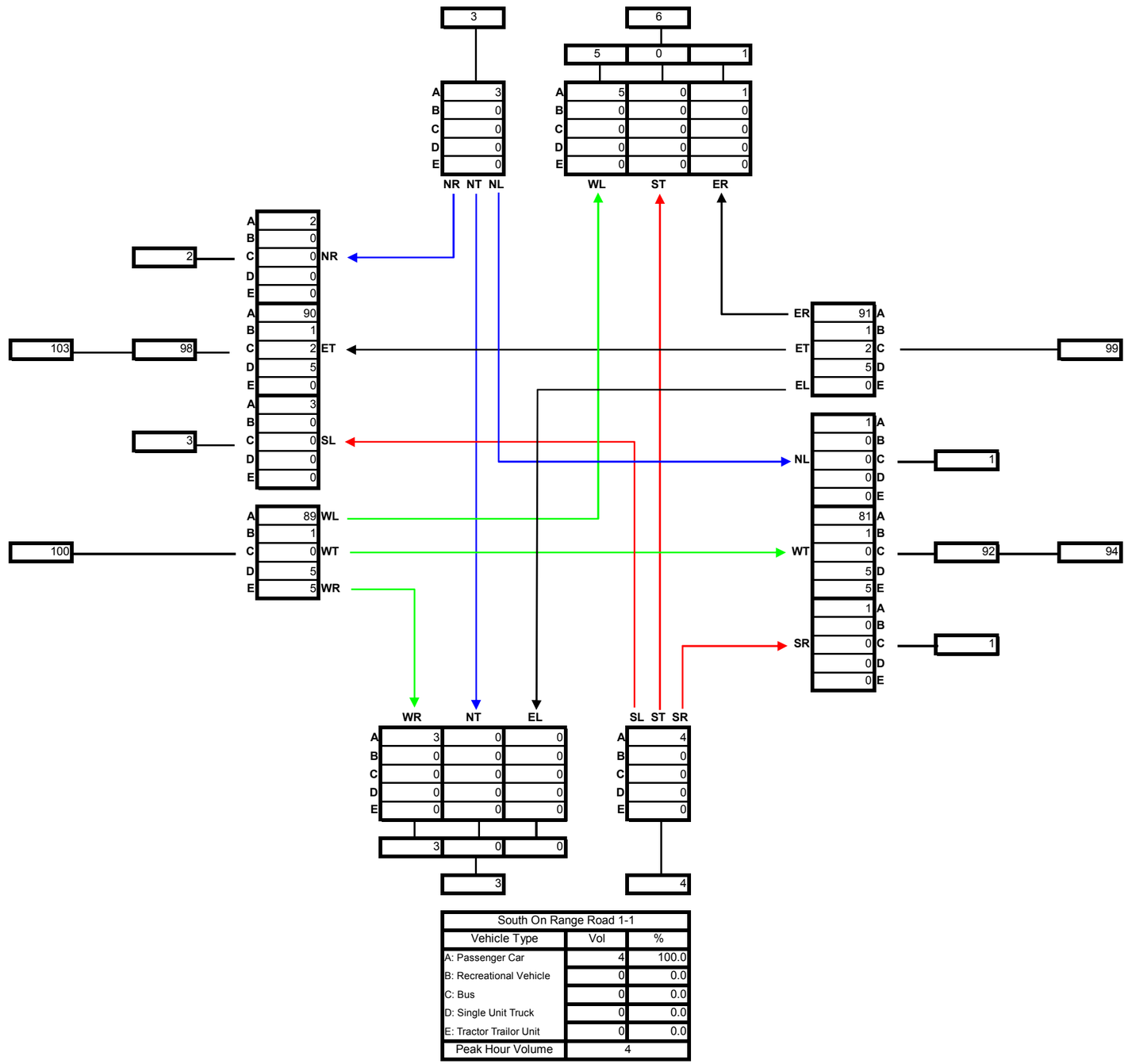
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	3	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	3	

West On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	89	89.0
B: Recreational Vehicle	1	1.0
C: Bus	0	0.0
D: Single Unit Truck	5	5.0
E: Tractor Trailor Unit	5	5.0
Peak Hour Volume	100	

East On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	91	91.9
B: Recreational Vehicle	1	1.0
C: Bus	2	2.0
D: Single Unit Truck	5	5.1
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	99	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	4	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	4	



Intersection of:	Highway 12 & Range Road 1-1
Date:	14-Apr-08
Time:	4 pm - 5 pm

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

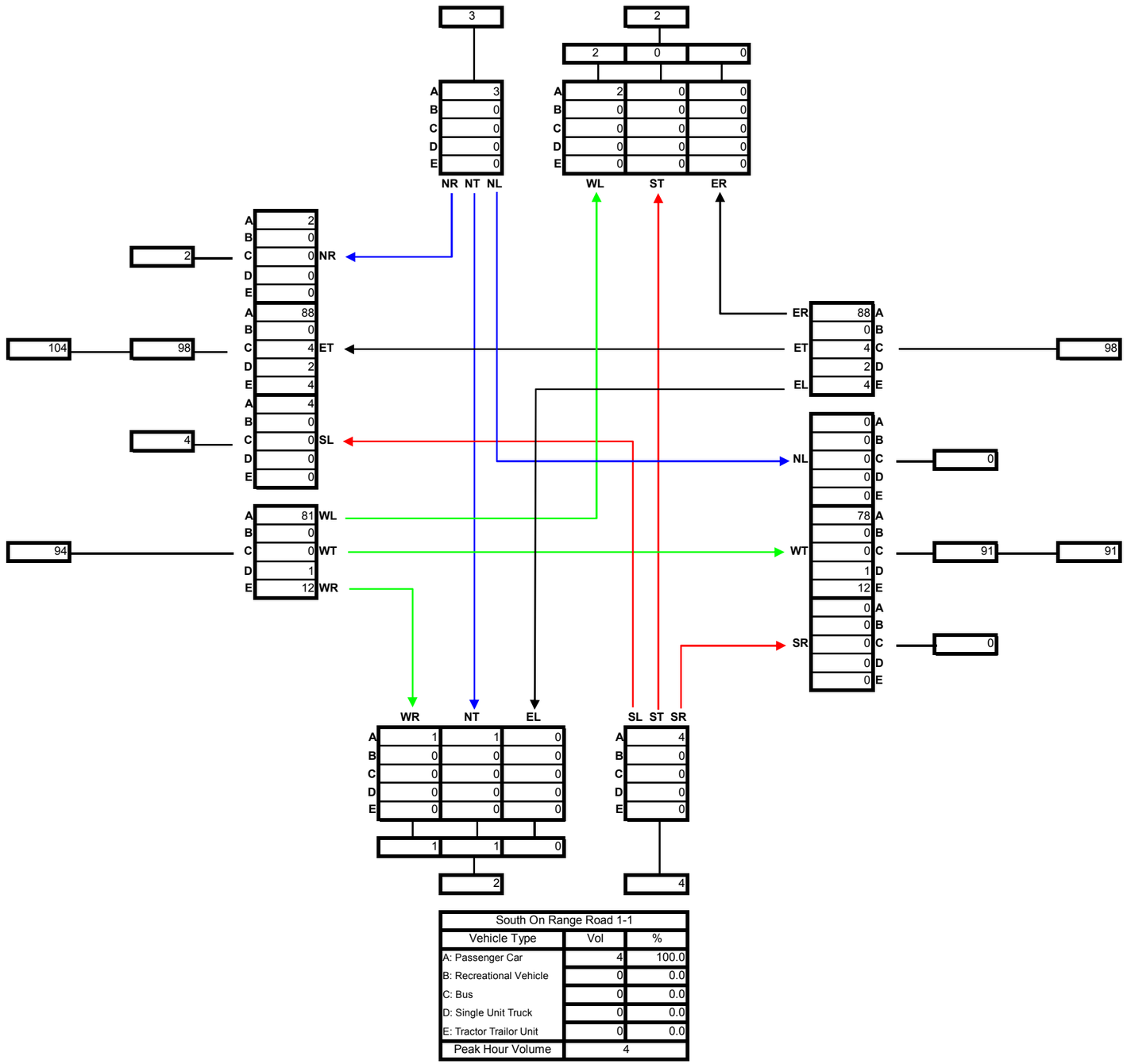
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	3	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	3	

West On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	81	86.2
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	1	1.1
E: Tractor Trailor Unit	12	12.8
Peak Hour Volume	94	

East On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	88	89.8
B: Recreational Vehicle	0	0.0
C: Bus	4	4.1
D: Single Unit Truck	2	2.0
E: Tractor Trailor Unit	4	4.1
Peak Hour Volume	98	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	4	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	4	



Intersection of:	Highway 12 & Range Road 1-1
Date:	14-Apr-08
Time:	5 pm - 6 pm

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

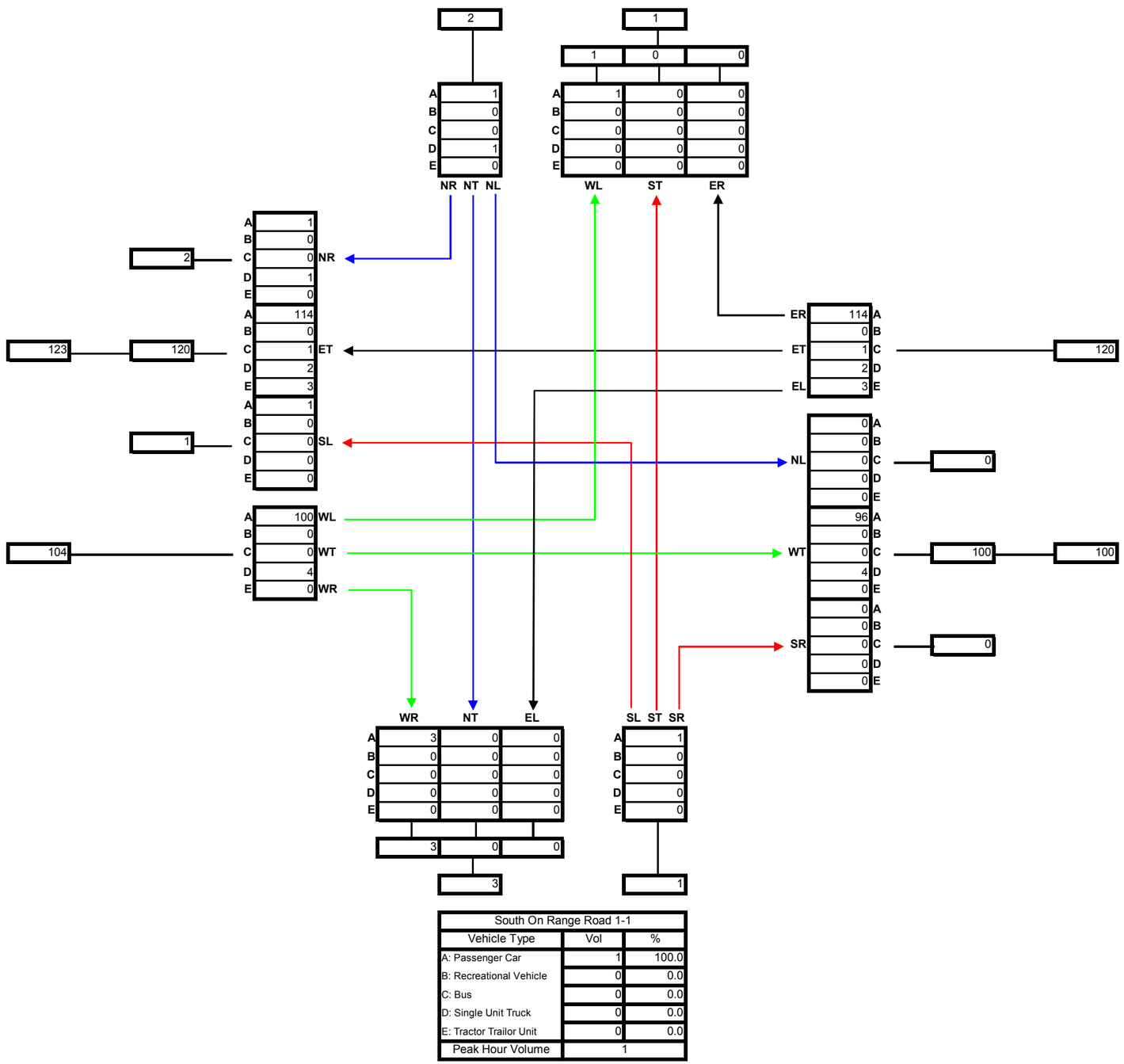
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	1	50.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	1	50.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	2	

West On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	100	96.2
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	4	3.8
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	104	

East On Highway 12		
Vehicle Type	Vol	%
A: Passenger Car	114	95.0
B: Recreational Vehicle	0	0.0
C: Bus	1	0.8
D: Single Unit Truck	2	1.7
E: Tractor Trailor Unit	3	2.5
Peak Hour Volume	120	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	1	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	1	



Intersection of:	Range Road 1-1 & Township Road 41-0
Date:	2008 (Estimated)
Time:	Peak Hour

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

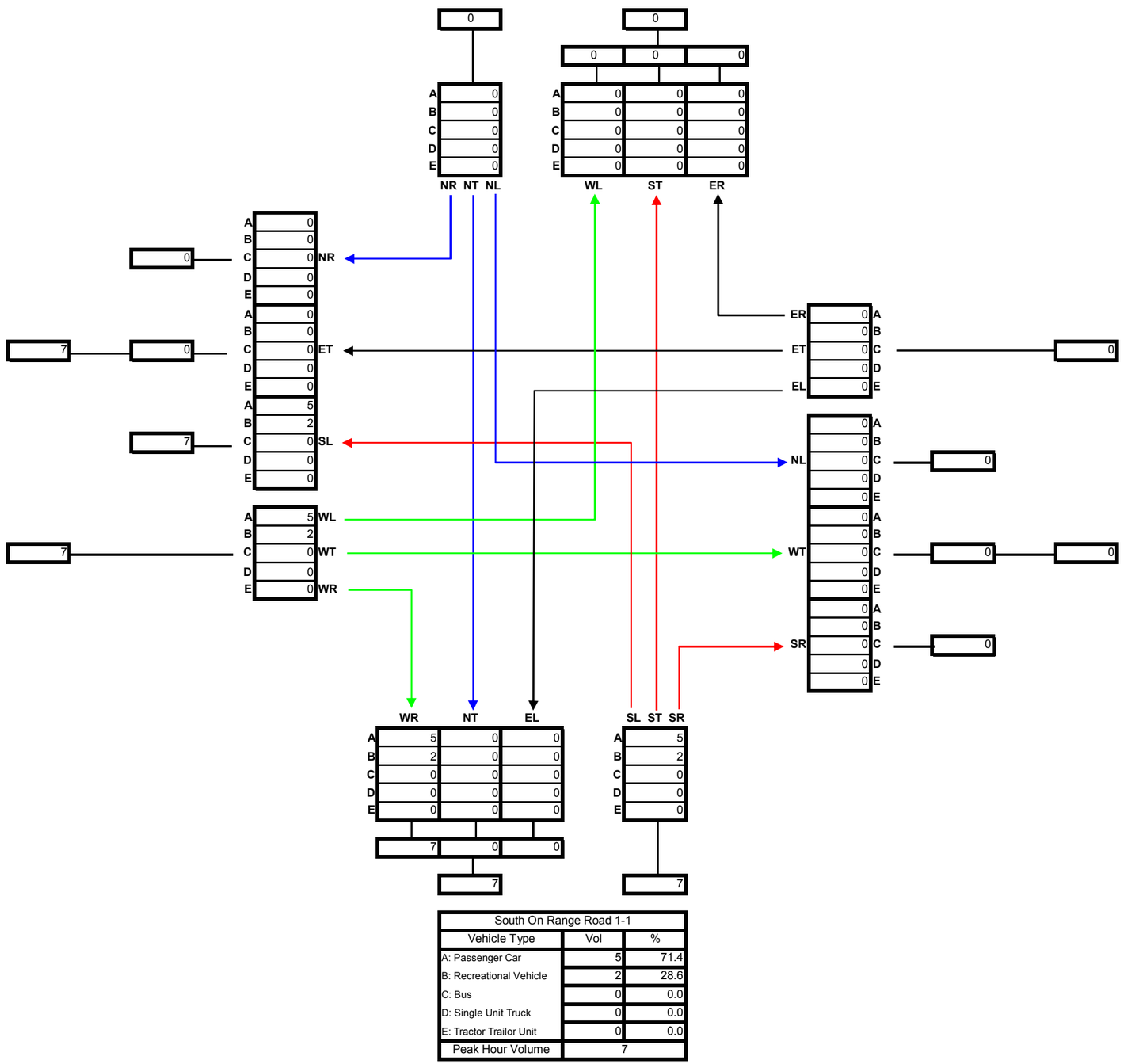
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	0	0.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	0	

West On Township Road 41-0		
Vehicle Type	Vol	%
A: Passenger Car	5	71.4
B: Recreational Vehicle	2	28.6
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	7	

East On Township Road 41-0		
Vehicle Type	Vol	%
A: Passenger Car	0	0.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	0	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	5	71.4
B: Recreational Vehicle	2	28.6
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	7	



Intersection of:	Range Road 1-1 & Township Road 41-0
Date:	2033 (Estimated)
Time:	Peak Hour

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

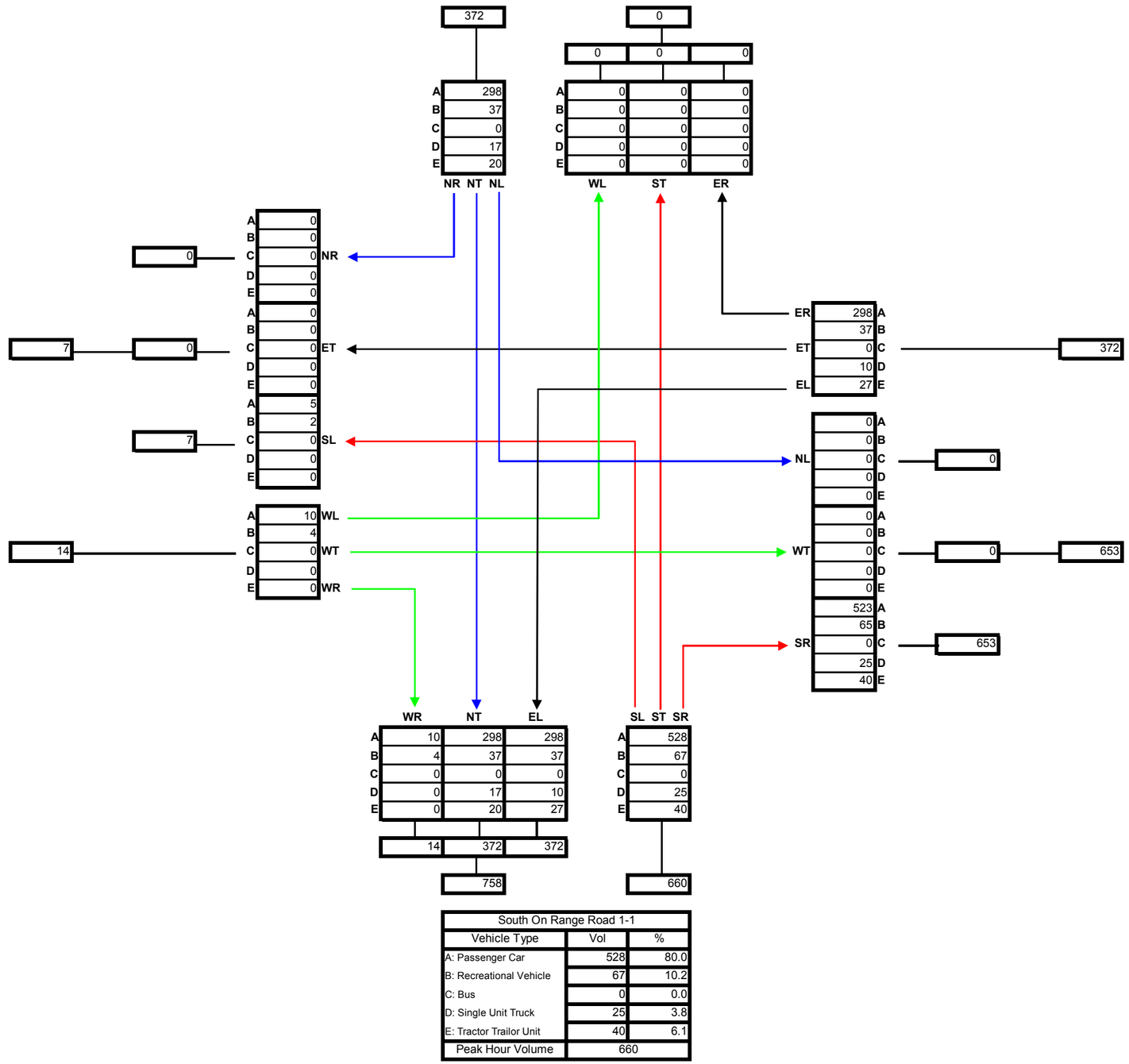
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	298	80.1
B: Recreational Vehicle	37	9.9
C: Bus	0	0.0
D: Single Unit Truck	17	4.6
E: Tractor Trailor Unit	20	5.4
Peak Hour Volume	372	

West On Township Road 41-0		
Vehicle Type	Vol	%
A: Passenger Car	10	71.4
B: Recreational Vehicle	4	28.6
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	14	

East On Township Road 41-0		
Vehicle Type	Vol	%
A: Passenger Car	298	80.1
B: Recreational Vehicle	37	9.9
C: Bus	0	0.0
D: Single Unit Truck	10	2.7
E: Tractor Trailor Unit	27	7.3
Peak Hour Volume	372	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	528	80.0
B: Recreational Vehicle	67	10.2
C: Bus	0	0.0
D: Single Unit Truck	25	3.8
E: Tractor Trailor Unit	40	6.1
Peak Hour Volume	660	



Intersection of:	Range Road 1-1 & Township Road 41-1
Date:	2007 (Estimated)
Time:	Peak Hour

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

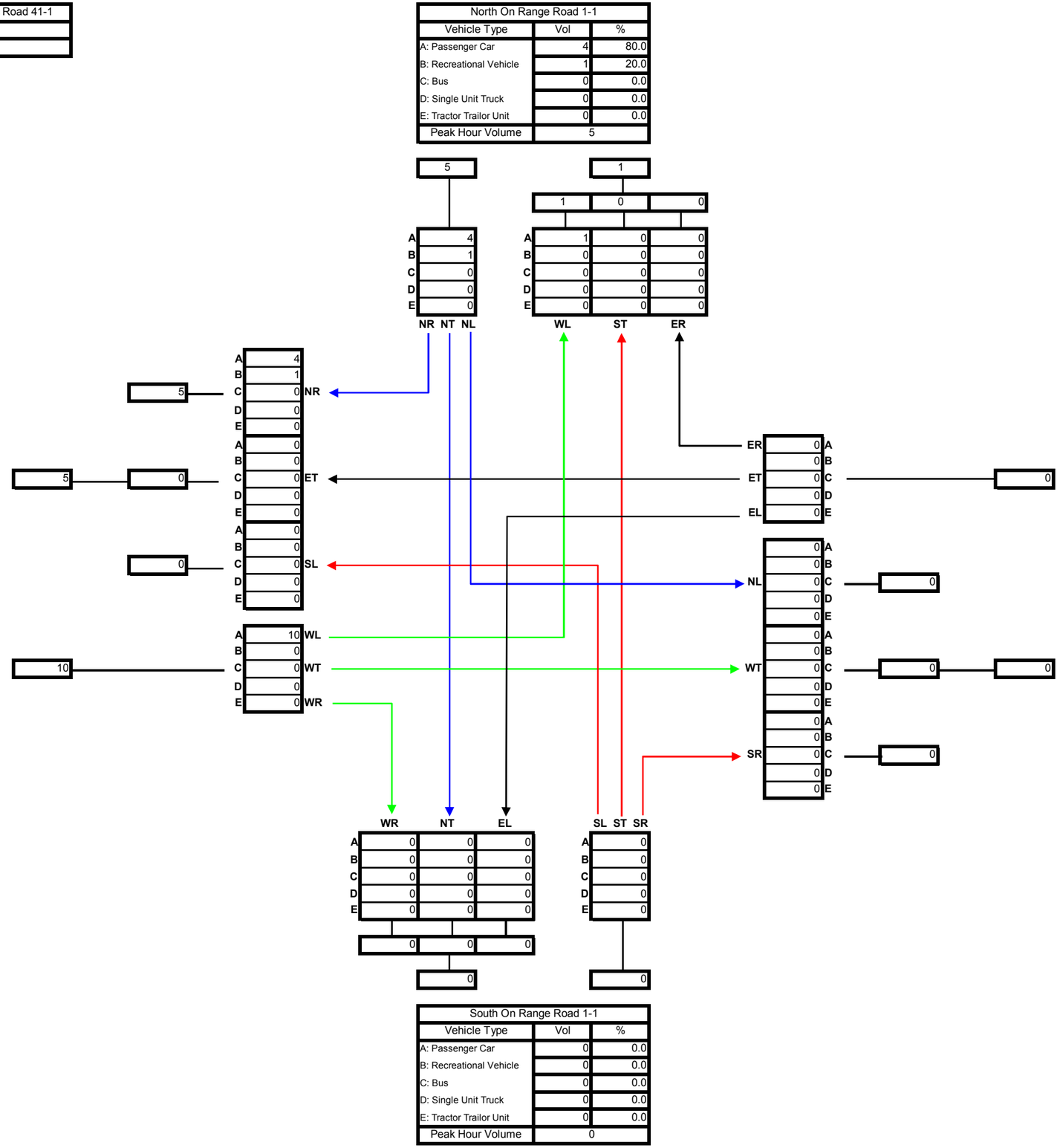
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	4	80.0
B: Recreational Vehicle	1	20.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	5	

West On Township Road 41-1		
Vehicle Type	Vol	%
A: Passenger Car	10	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	10	

East On Township Road 41-1		
Vehicle Type	Vol	%
A: Passenger Car	0	0.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	0	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	0	0.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	0	



Intersection of:	Range Road 1-1 & Township Road 41-1
Date:	2033 (Estimated)
Time:	Peak Hour

Turning Movement Abbreviations

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

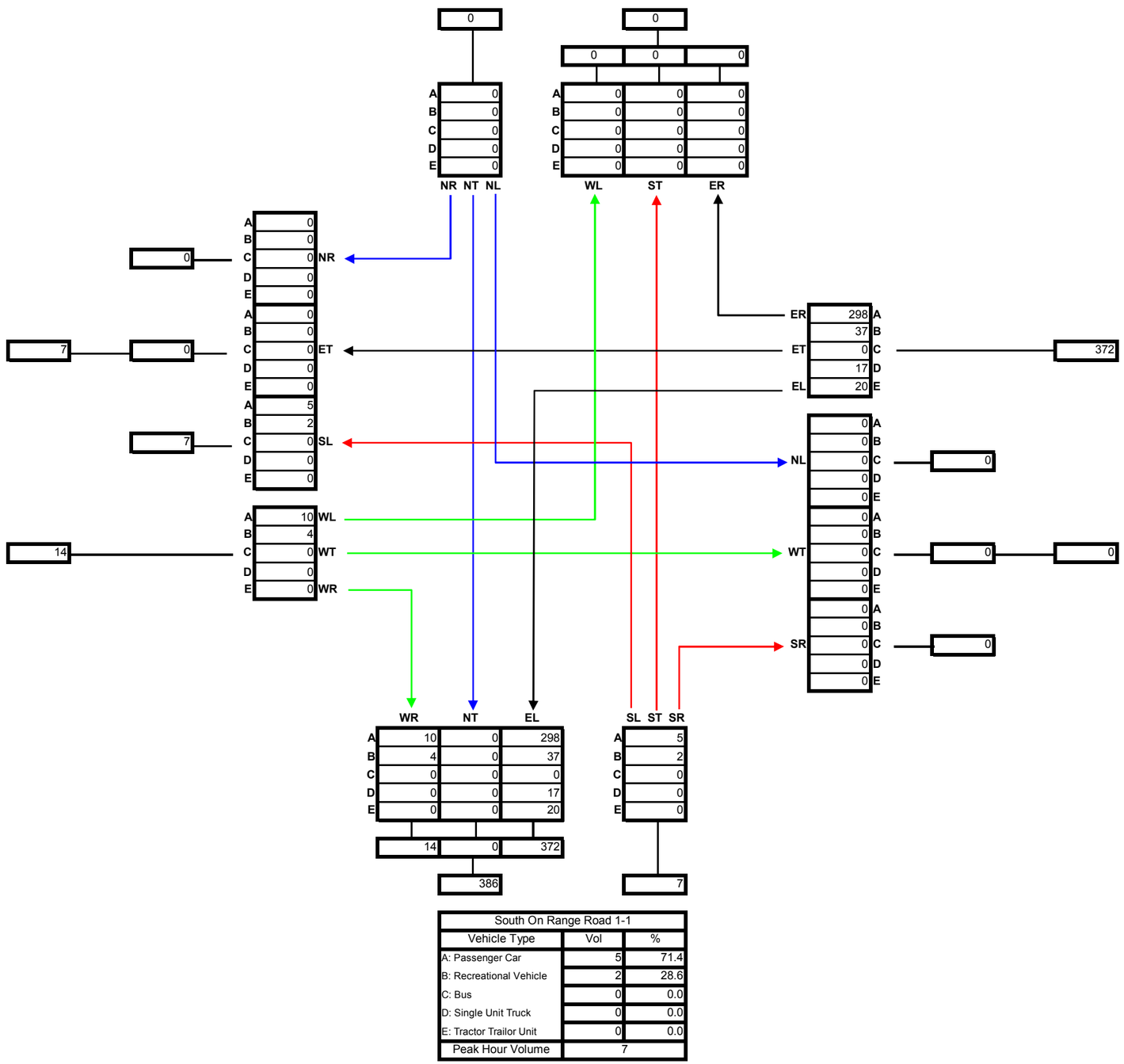
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

North On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	0	0.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	0	

West On Township Road 41-1		
Vehicle Type	Vol	%
A: Passenger Car	10	71.4
B: Recreational Vehicle	4	28.6
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	14	

East On Township Road 41-1		
Vehicle Type	Vol	%
A: Passenger Car	298	80.1
B: Recreational Vehicle	37	9.9
C: Bus	0	0.0
D: Single Unit Truck	17	4.6
E: Tractor Trailor Unit	20	5.4
Peak Hour Volume	372	

South On Range Road 1-1		
Vehicle Type	Vol	%
A: Passenger Car	5	71.4
B: Recreational Vehicle	2	28.6
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailor Unit	0	0.0
Peak Hour Volume	7	



A P P E N D I X C

TRIP GENERATION SHEETS

Land Use: 260
Recreational Homes

Description

Recreational homes are usually located in a resort containing local services and complete recreational facilities. These dwellings are often second homes used by the owner periodically or rented on a seasonal basis.

Additional Data

A large number of internal trips were made for recreational purposes in resort communities containing recreational homes.

The sites were surveyed from the late 1970s to the mid-1980s.

Source Numbers

95, 187

Recreational Homes
(260)

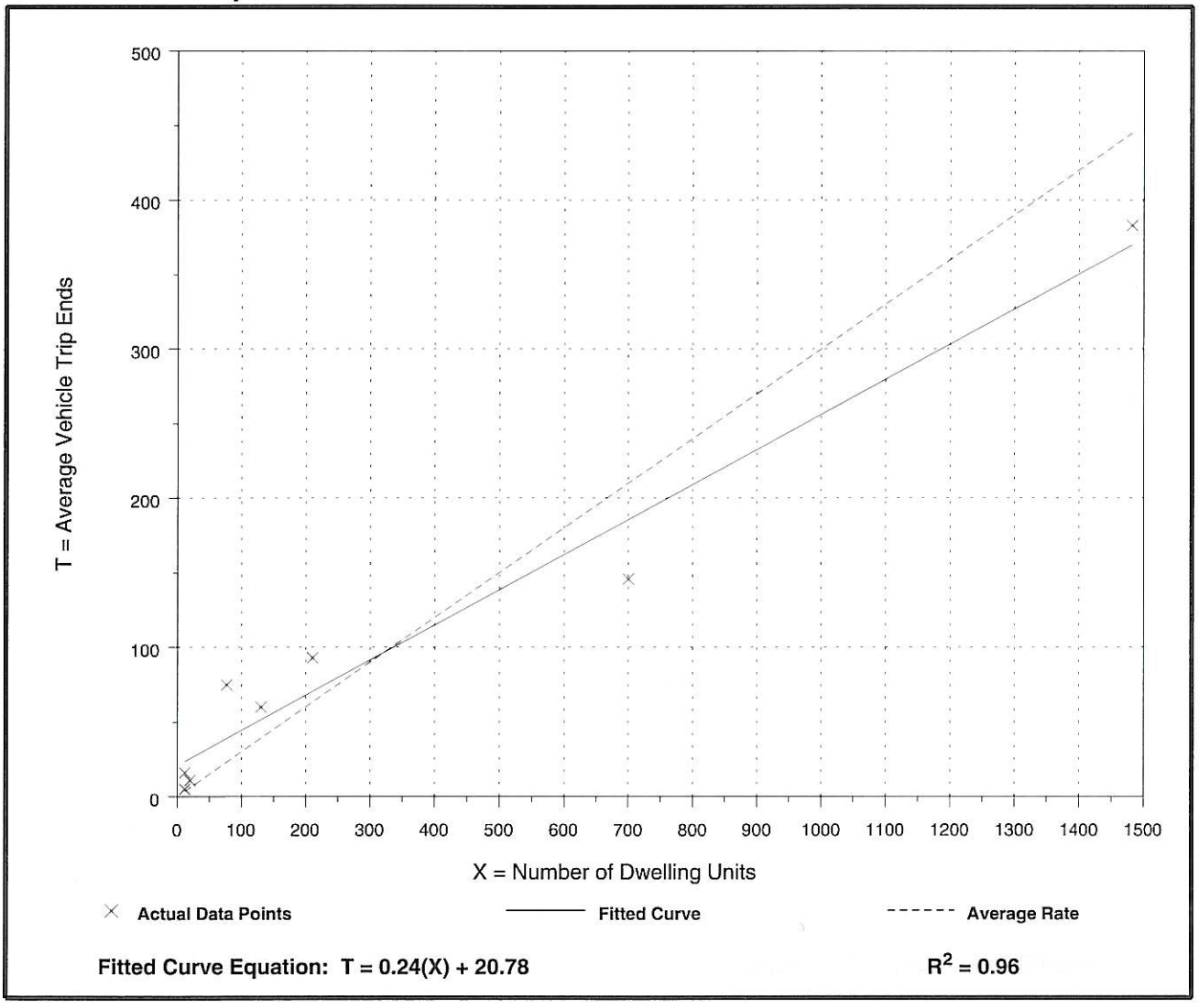
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
A.M. Peak Hour of Generator

Number of Studies: 8
Avg. Number of Dwelling Units: 331
Directional Distribution: 49% entering, 51% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.30	0.21 - 1.33	0.57

Data Plot and Equation



Fitted Curve Equation: T = 0.24(X) + 20.78

R^2 = 0.96

Recreational Homes
(260)

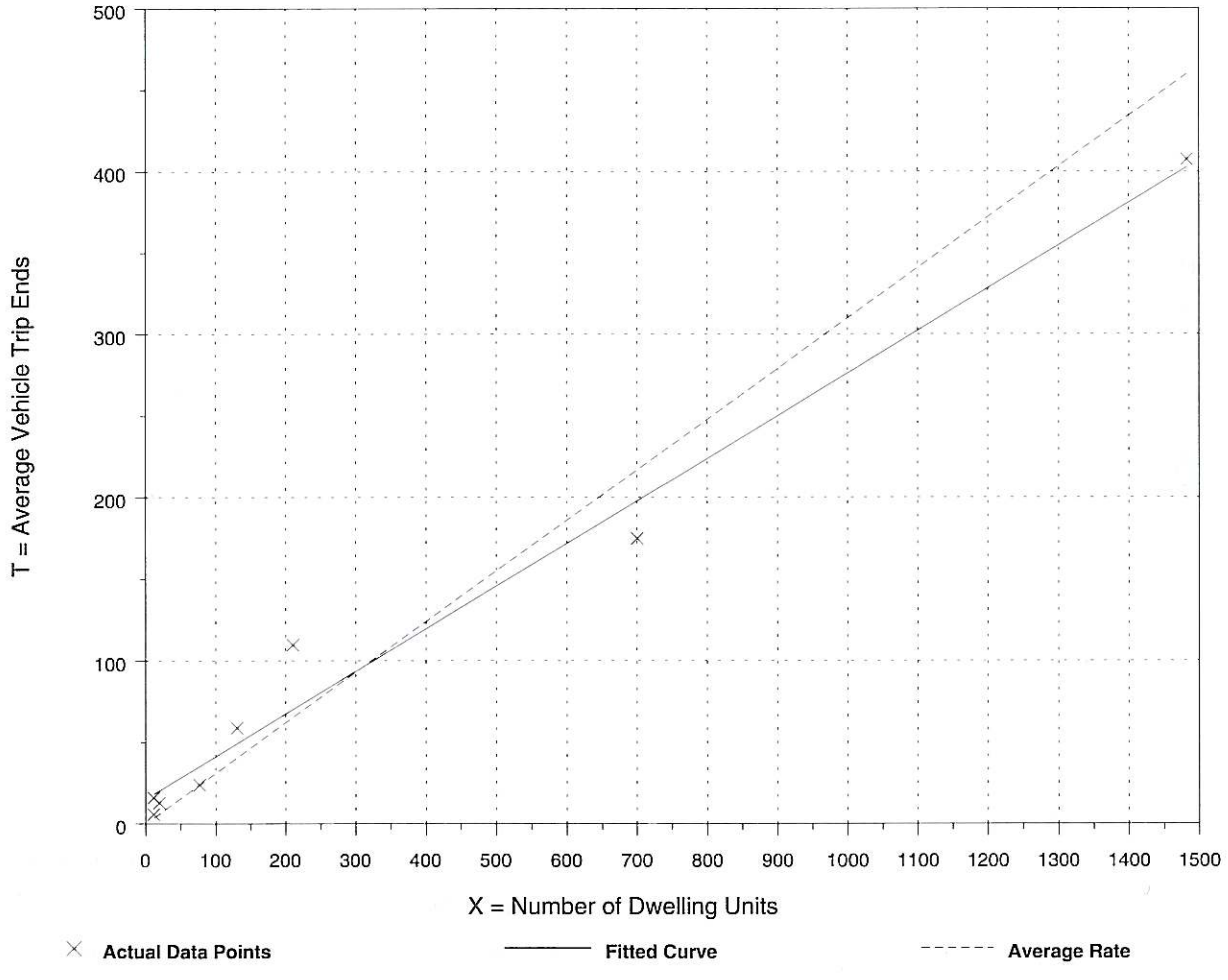
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
P.M. Peak Hour of Generator

Number of Studies: 8
Avg. Number of Dwelling Units: 331
Directional Distribution: 44% entering, 56% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.31	0.25 - 1.33	0.56

Data Plot and Equation



Fitted Curve Equation: T = 0.26(X) + 14.87

R^2 = 0.98

Land Use: 415
Beach Park

Description

Beach parks consist of a beach and possibly other facilities such as changing rooms, rest rooms, picnic facilities and hiking, fishing and camping facilities. In season, lifeguards are often provided. Seasonal use of the individual sites differs widely as a result of the varying facilities and local conditions, such as weather.

Additional Data

The sites were surveyed in the 1970s in California.

Source Numbers

11, 13, 214

Beach Park
(415)

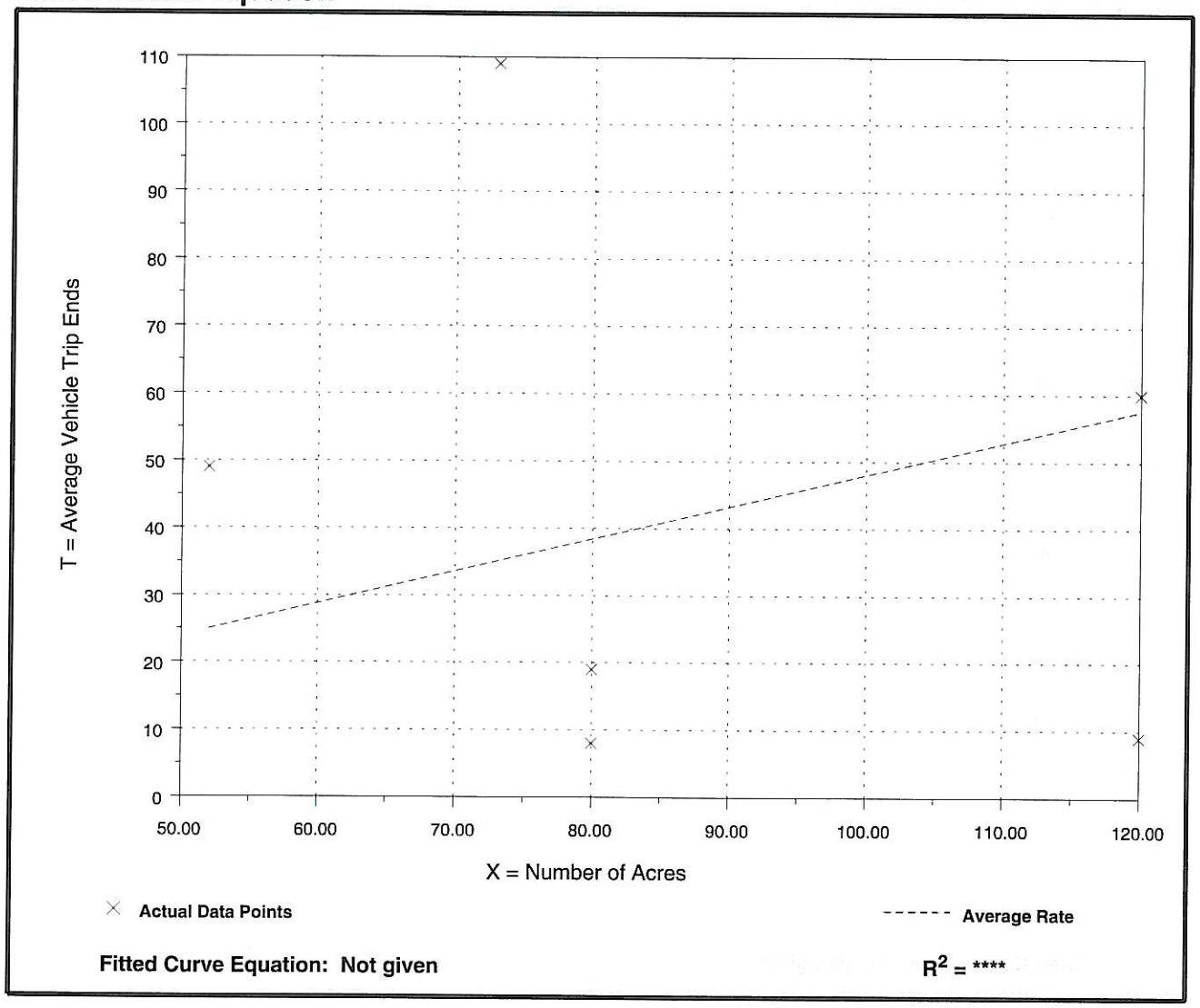
Average Vehicle Trip Ends vs: Acres
On a: Weekday,
A.M. Peak Hour of Generator

Number of Studies: 6
Average Number of Acres: 88
Directional Distribution: 59% entering, 41% exiting

Trip Generation per Acre

Average Rate	Range of Rates	Standard Deviation
0.48	0.08 - 1.49	0.84

Data Plot and Equation



Fitted Curve Equation: Not given

R^2 = ****

Beach Park
(415)

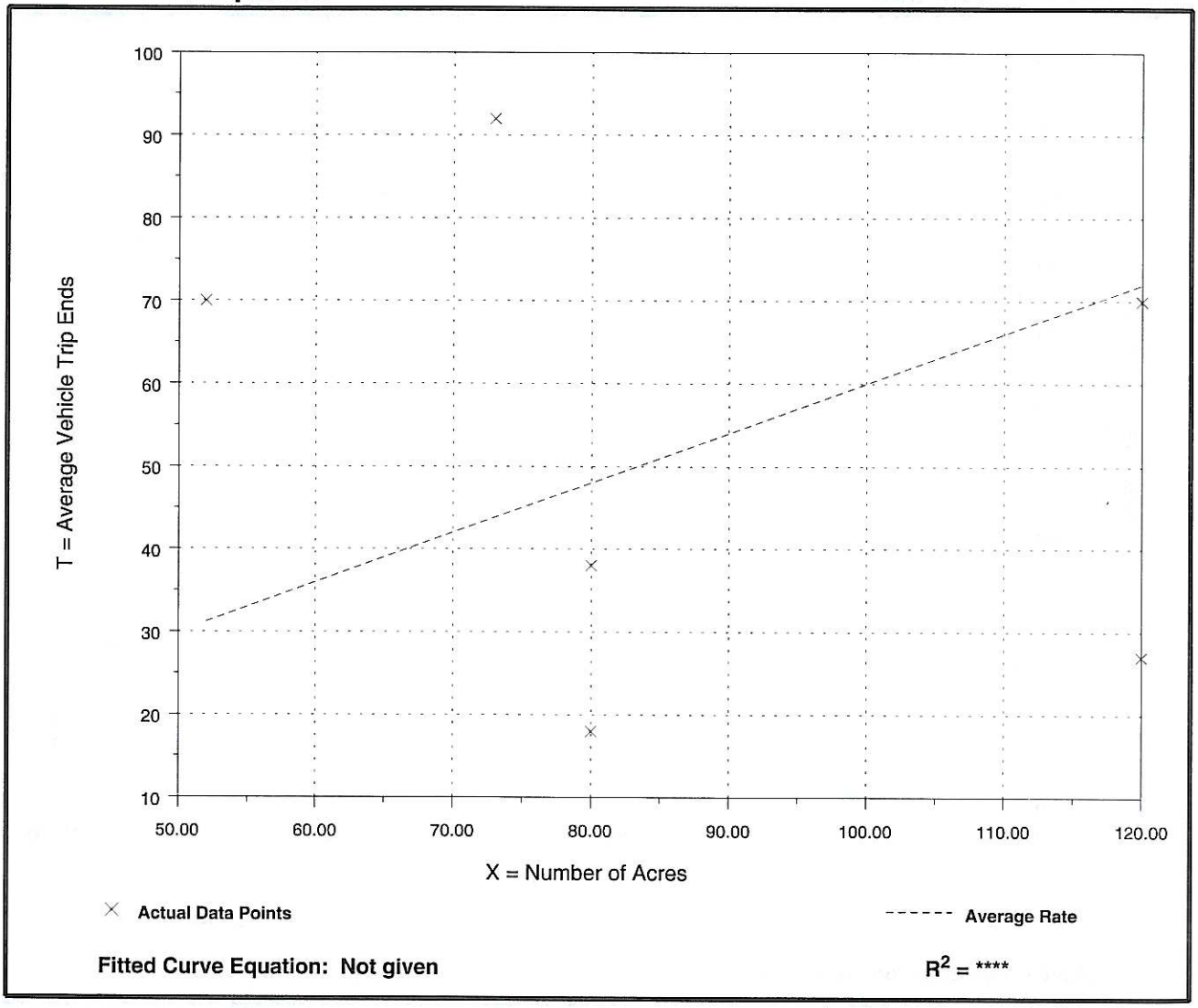
Average Vehicle Trip Ends vs: Acres
On a: Weekday,
P.M. Peak Hour of Generator

Number of Studies: 6
Average Number of Acres: 88
Directional Distribution: 34% entering, 66% exiting

Trip Generation per Acre

Average Rate	Range of Rates	Standard Deviation
0.60	0.23 - 1.35	0.87

Data Plot and Equation



Fitted Curve Equation: Not given

R^2 = ****

Land Use: 420
Marina

Description

The marinas included in this analysis are both public and private facilities. In addition to docks and berths for boats, some of the sites surveyed also have social and club activities, limited retail and restaurants.

Additional Data

The sites were surveyed from the late 1960s to the late 1980s in California and Washington. The number of boat berths ranged from 108 to 1,750; the number of acres ranged from 11 to 105; and the number of parking spaces ranged from 65 to 493.

Source Numbers

6, 12, 19, 101, 123, 265

Marina
(420)

Average Vehicle Trip Ends vs: Berths
On a: Weekday,
A.M. Peak Hour of Generator

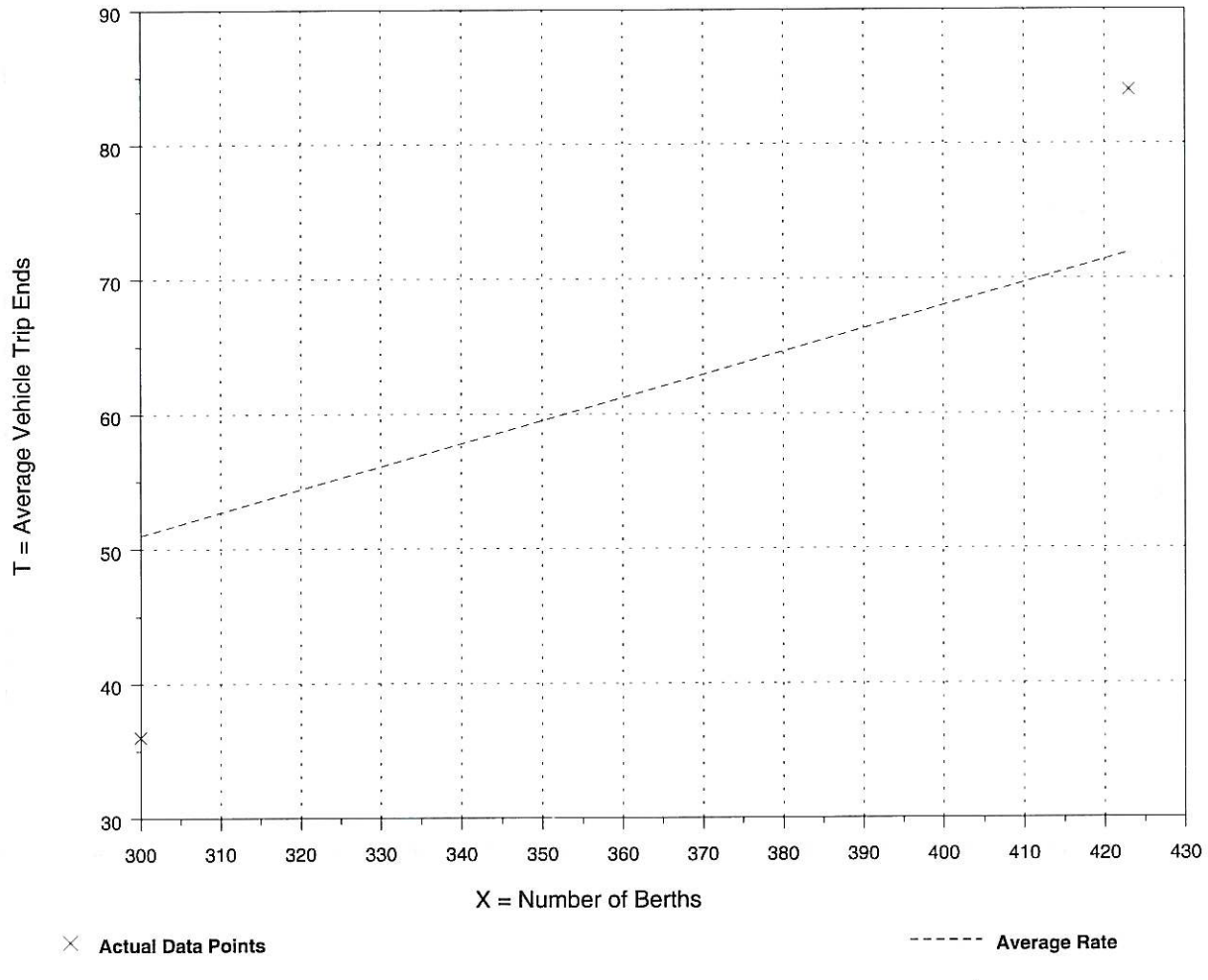
Number of Studies: 2
Average Number of Berths: 362
Directional Distribution: 64% entering, 36% exiting

Trip Generation per Berth

Average Rate	Range of Rates	Standard Deviation
0.17	0.12 - 0.20	*

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Marina
(420)

Average Vehicle Trip Ends vs: Berths
On a: Weekday,
P.M. Peak Hour of Generator

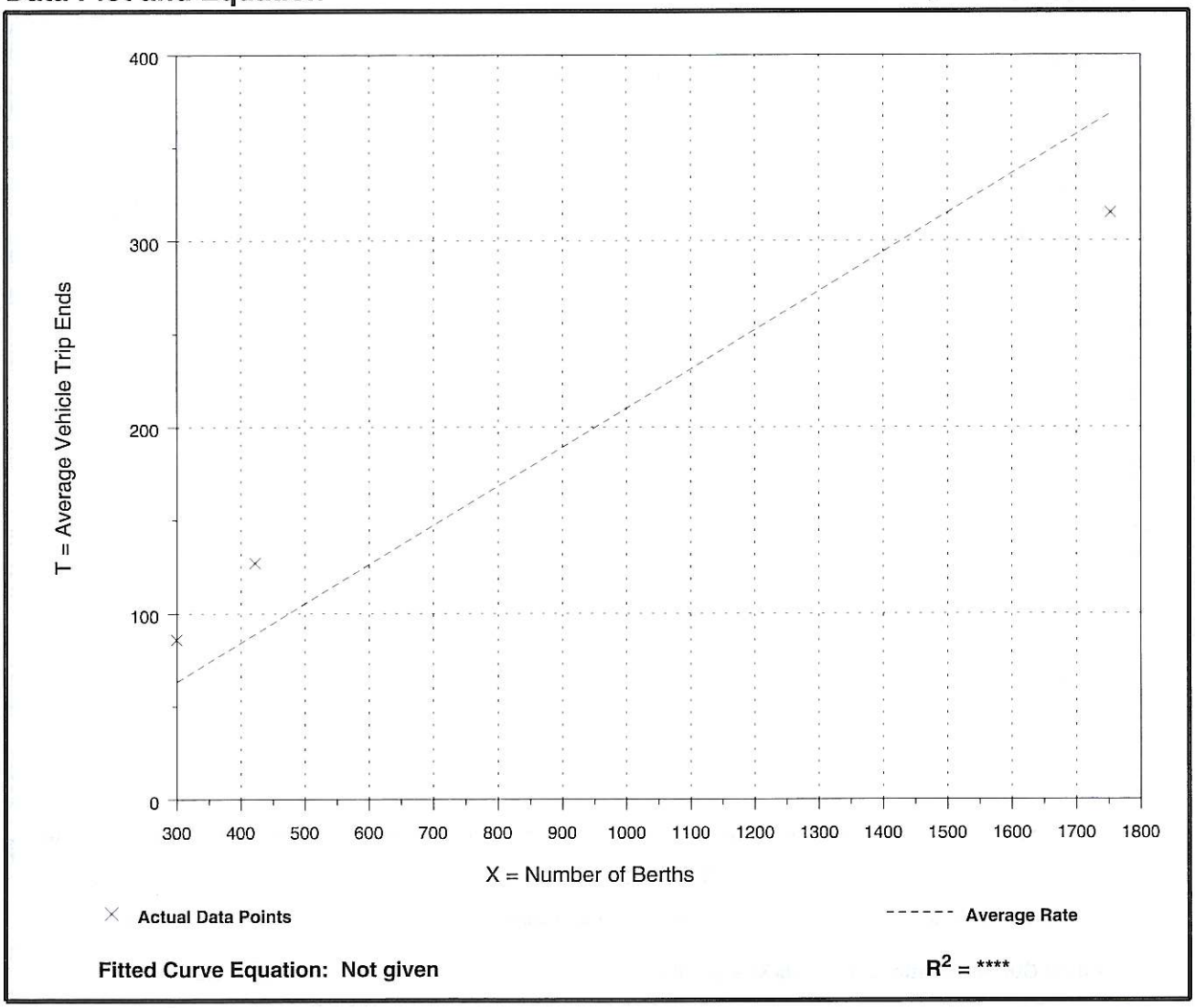
Number of Studies: 3
Average Number of Berths: 825
Directional Distribution: 51% entering, 49% exiting

Trip Generation per Berth

Average Rate	Range of Rates	Standard Deviation
0.21	0.18 - 0.30	0.46

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Land Use: 430
Golf Course

Description

The golf courses contained in this land use include 9-, 18-, 27- and 36-hole municipal courses and private country clubs. Some sites have driving ranges and clubhouses with a pro shop and/or restaurant, lounge and banquet facilities. Many of the municipal courses do not have any of these facilities. Miniature golf course (Land Use 431), golf driving range (Land Use 432) and multipurpose recreational facility (Land Use 435) are related uses.

Additional Data

The sites were surveyed from the late 1960s to the mid-1990s throughout the United States. Most of the facilities were located in suburban areas; a few were in scenic, rural areas.

Source Numbers

7, 11, 12, 13, 18, 98, 102, 214, 378, 407, 440

Golf Course
(430)

Average Vehicle Trip Ends vs: Holes
On a: Weekday,
A.M. Peak Hour of Generator

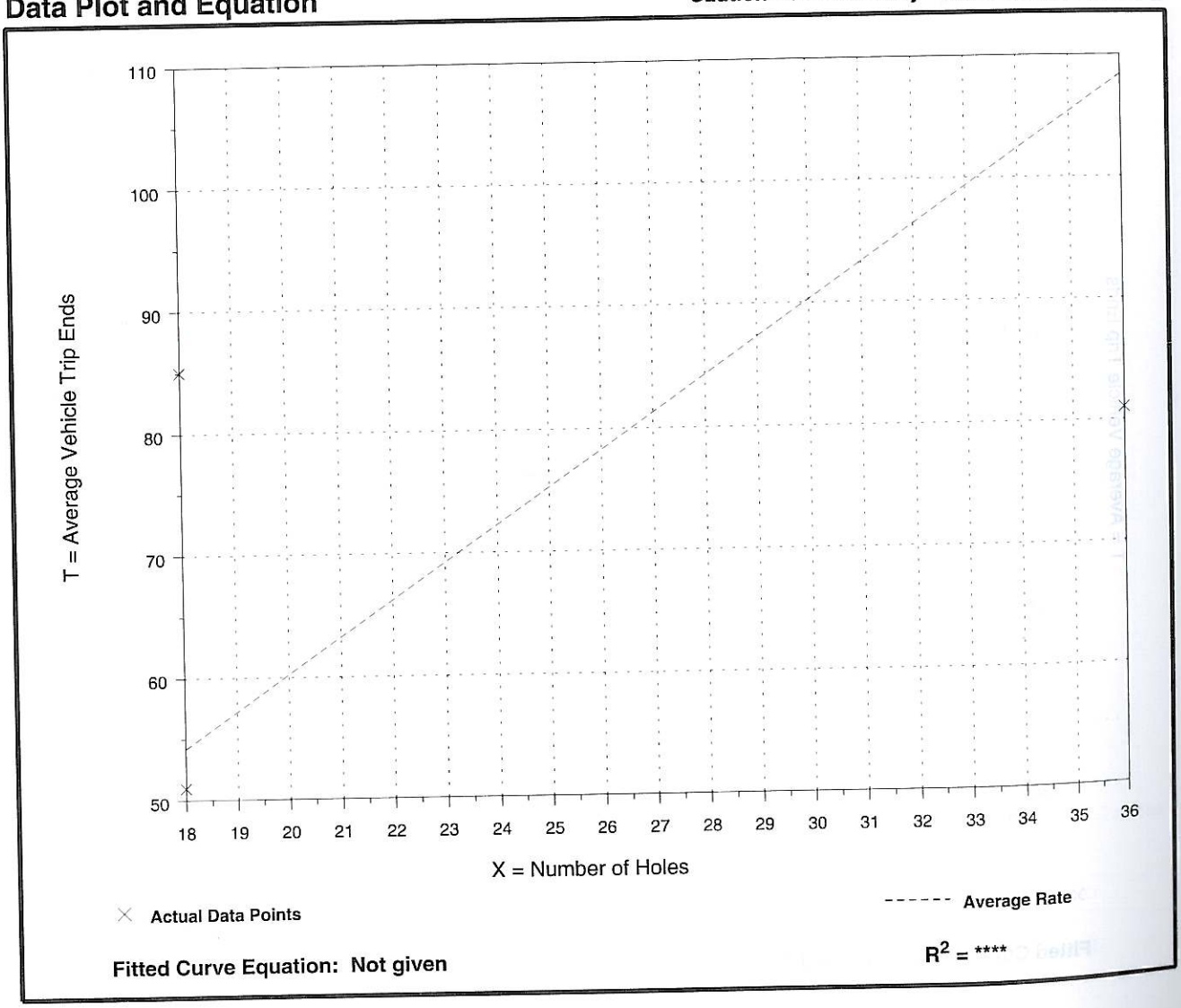
Number of Studies: 3
Average Number of Holes: 24
Directional Distribution: 47% entering, 53% exiting

Trip Generation per Hole

Average Rate	Range of Rates	Standard Deviation
3.01	2.25 - 4.72	1.99

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Golf Course
(430)

Average Vehicle Trip Ends vs: Holes
On a: Weekday,
P.M. Peak Hour of Generator

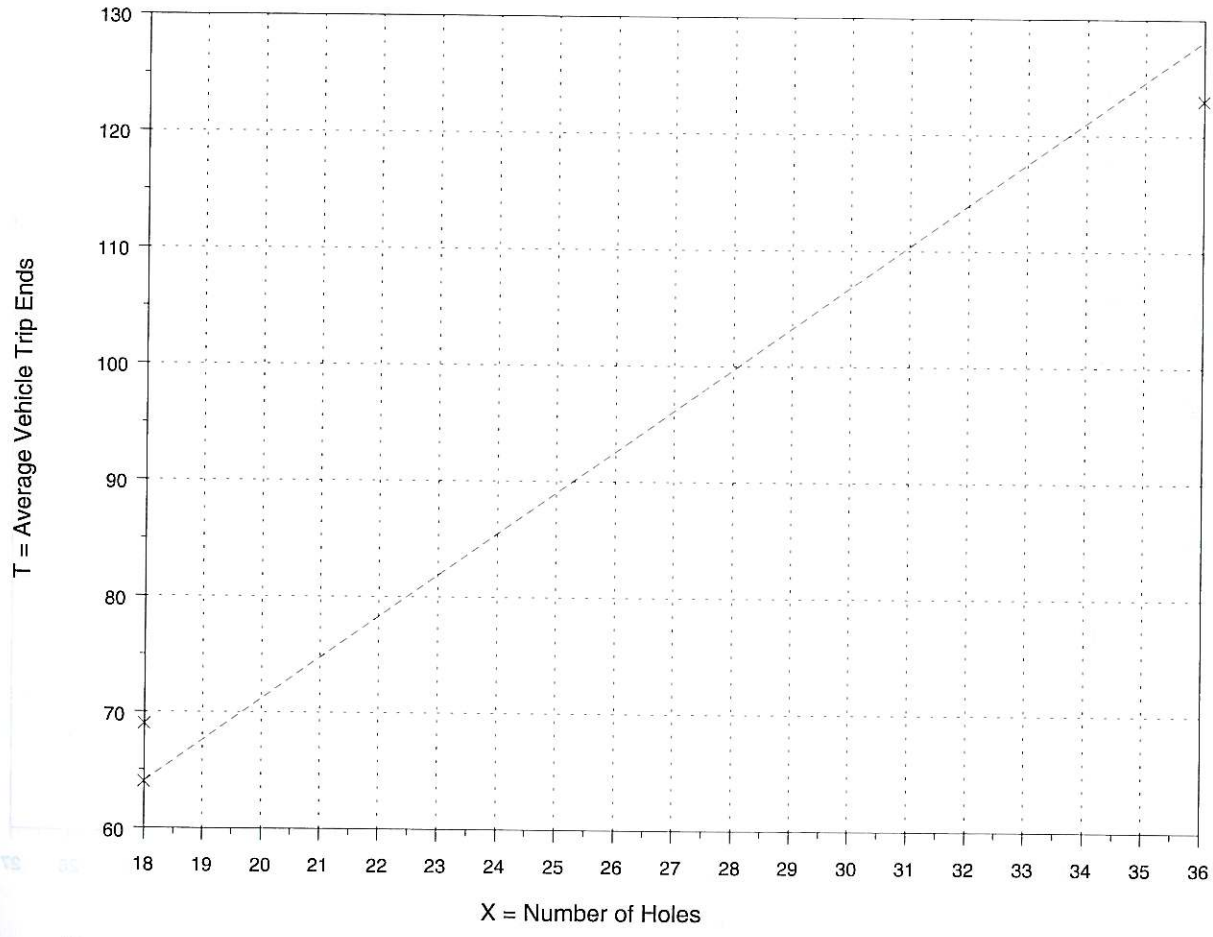
Number of Studies: 3
Average Number of Holes: 24
Directional Distribution: 43% entering, 57% exiting

Trip Generation per Hole

Average Rate	Range of Rates	Standard Deviation
3.56	3.42 - 3.83	1.87

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Land Use: 492
Health/Fitness Club

Description

Health/fitness clubs are privately owned facilities that primarily focus on individual fitness or training. Typically they provide exercise classes, weightlifting, fitness and gymnastics equipment; spas; locker rooms; and small restaurants or snack bars. This land use may also include ancillary facilities, such as swimming pools, whirlpools, saunas, tennis, racquetball and handball courts and limited retail. These facilities are membership clubs that may allow access to the general public for a fee. Racquet/tennis club (Land Use 491), athletic club (Land Use 493) and recreational community center (Land Use 495) are related land uses.

Additional Data

The sites were surveyed in 1977 in California and in 1986 and 1997 in Pennsylvania.

Source Numbers

113, 253, 571

Health/Fitness Club
(492)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
A.M. Peak Hour of Generator

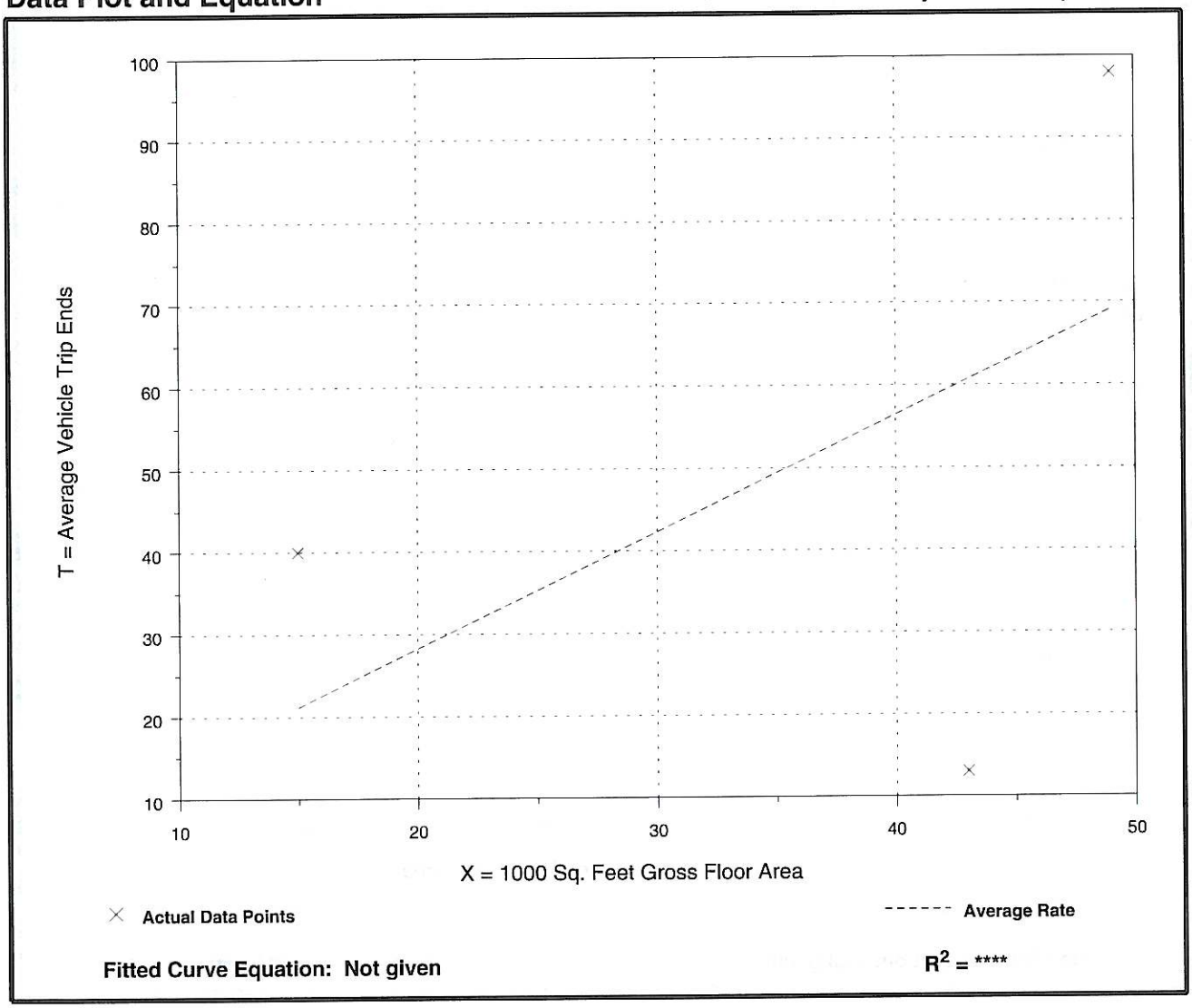
Number of Studies: 3
Average 1000 Sq. Feet GFA: 36
Directional Distribution: 42% entering, 58% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.41	0.30 - 2.67	1.50

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Health/Fitness Club
(492)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
P.M. Peak Hour of Generator

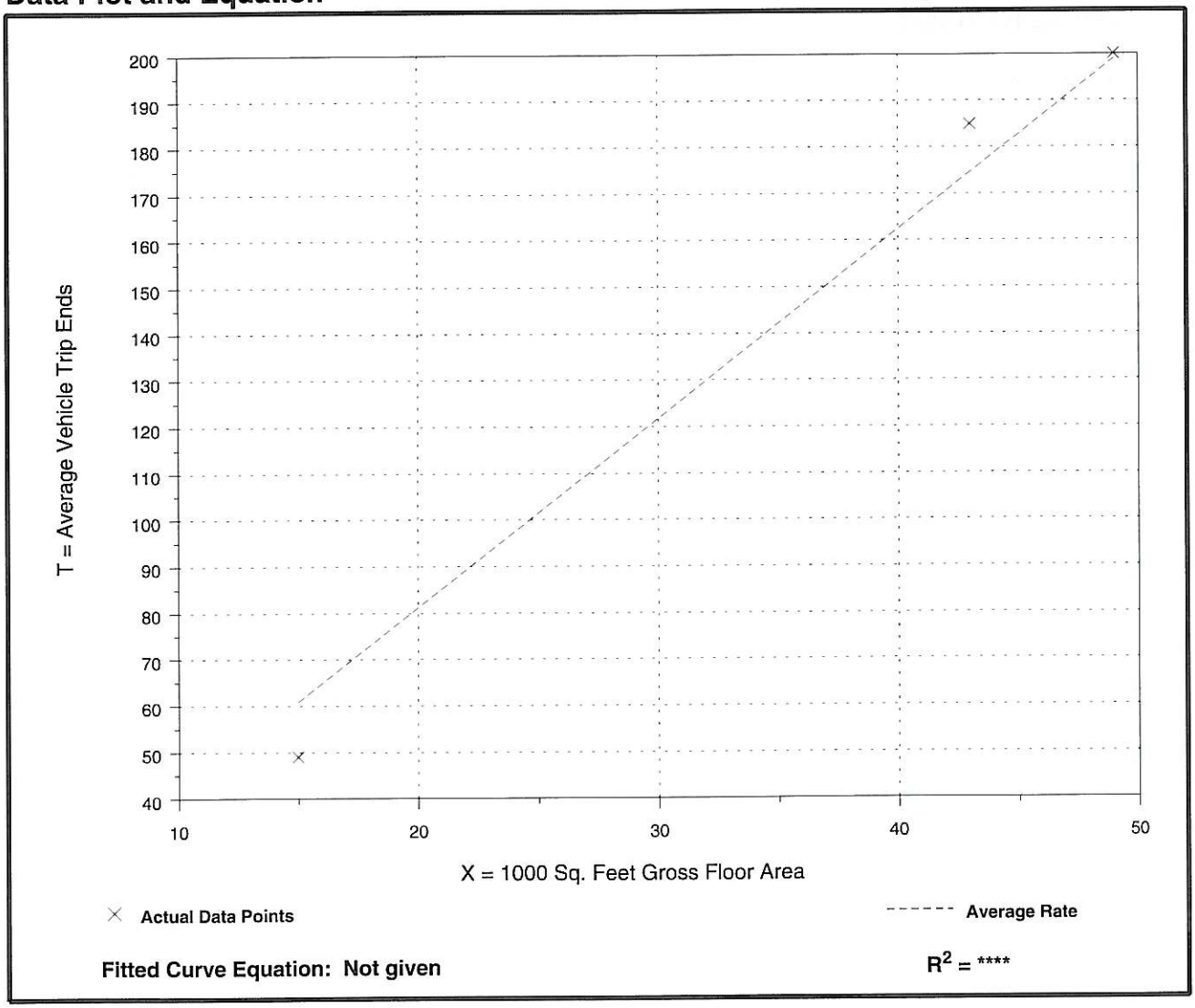
Number of Studies: 3
Average 1000 Sq. Feet GFA: 36
Directional Distribution: 51% entering, 49% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
4.06	3.27 - 4.30	2.02

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Land Use: 814
Specialty Retail Center

Description

Specialty retail centers are generally small strip shopping centers that contain a variety of retail shops and specialize in quality apparel; hard goods; and services, such as real estate offices, dance studios, florists and small restaurants. Shopping center (Land Use 820) is a related use.

Additional Data

The sites were surveyed from the late 1970s to the 2000s in California, Florida, Georgia, New York and Pennsylvania.

Source Numbers

100, 304, 305, 367, 423, 507, 577

Specialty Retail Center
(814)

Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Leasable Area**
On a: **Weekday,**
A.M. Peak Hour of Generator

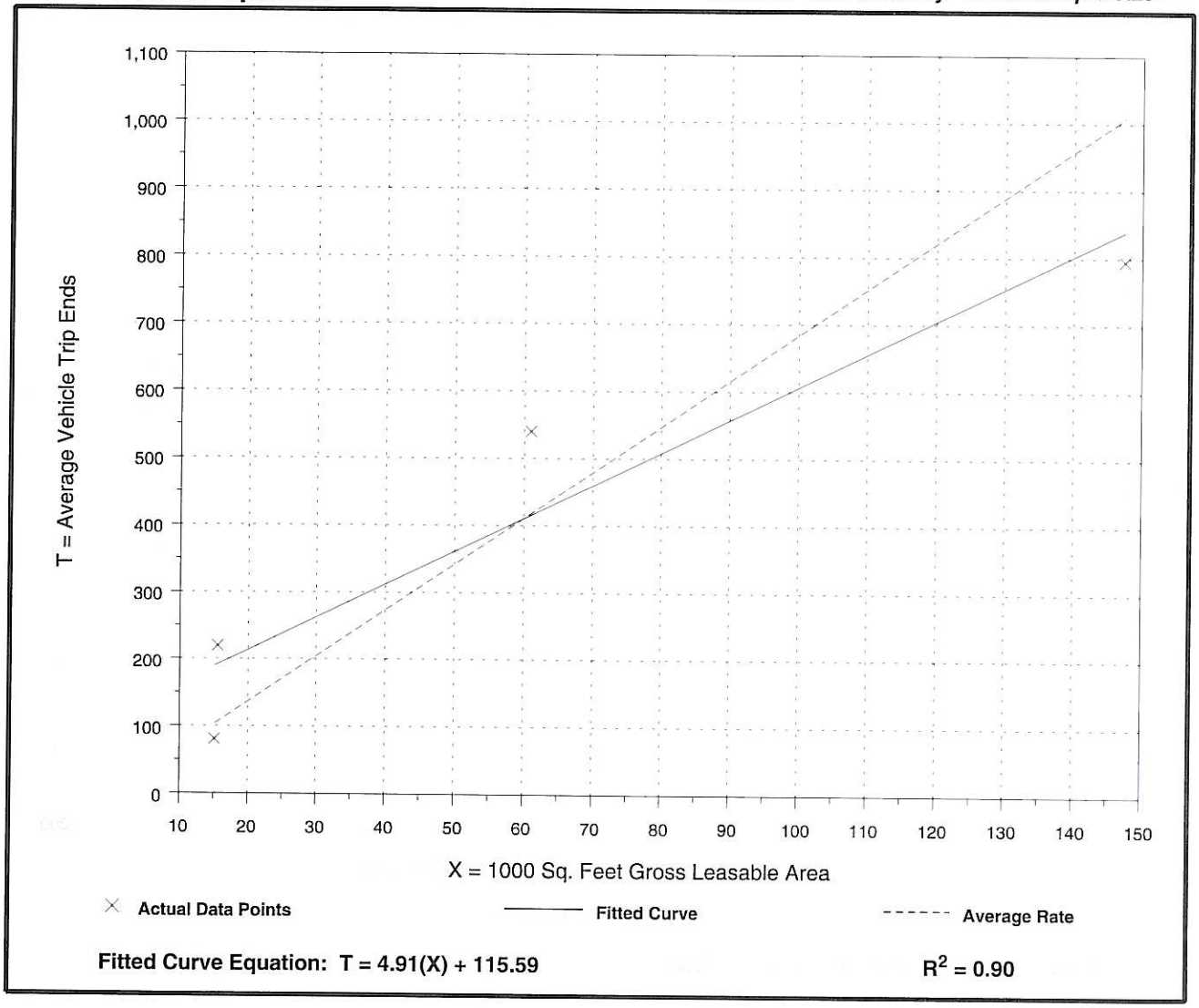
Number of Studies: 4
Average 1000 Sq. Feet GLA: 60
Directional Distribution: 48% entering, 52% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
6.84	5.33 - 14.08	3.55

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: T = 4.91(X) + 115.59

R^2 = 0.90

Specialty Retail Center
(814)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Leasable Area
On a: Weekday,
P.M. Peak Hour of Generator

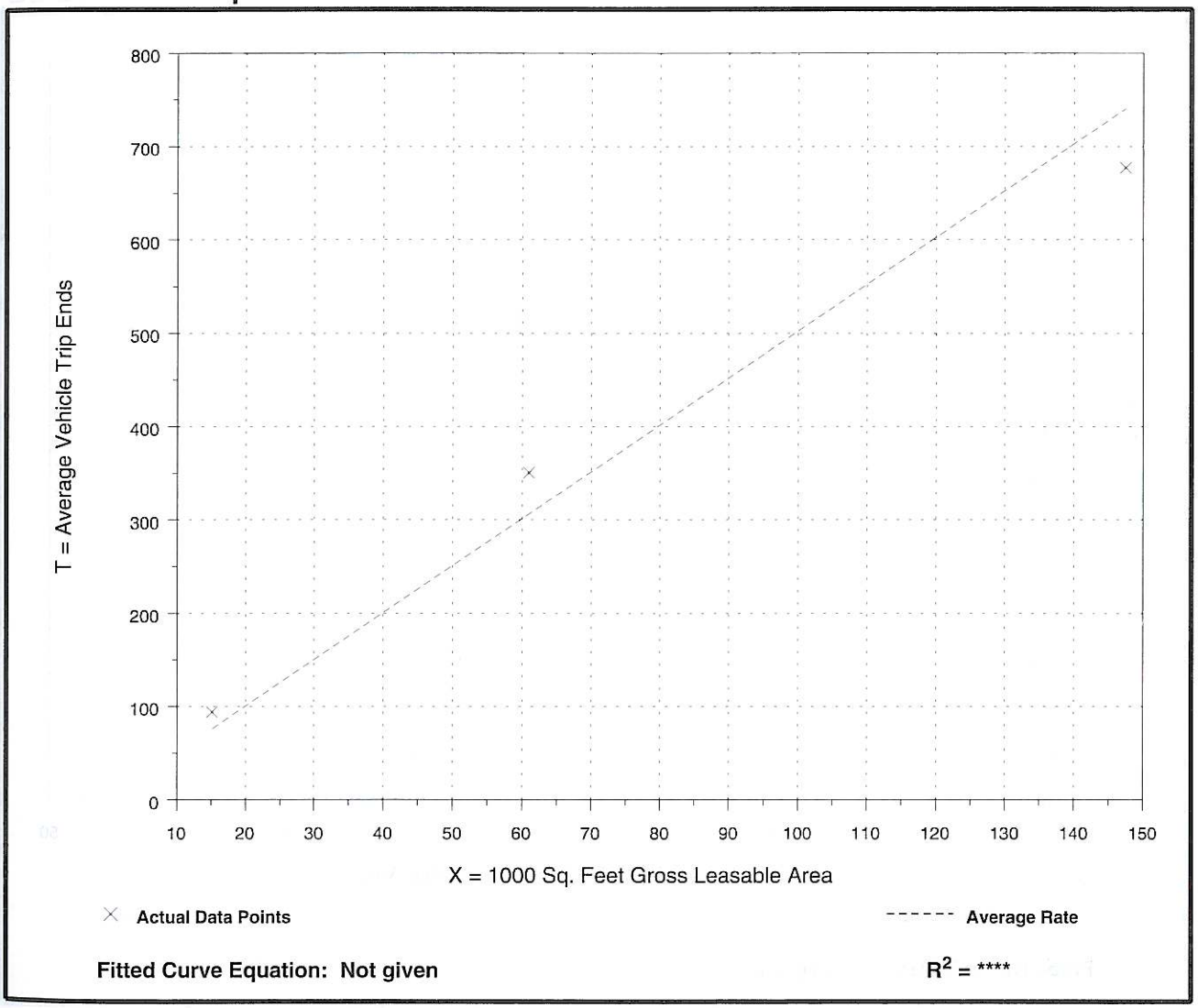
Number of Studies: 3
Average 1000 Sq. Feet GLA: 75
Directional Distribution: 56% entering, 44% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
5.02	4.59 - 6.18	2.31

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Land Use: 944
Gasoline/Service Station

Description

This land use includes gasoline/service stations where the primary business is the fueling of motor vehicles. These service stations may also have ancillary facilities for servicing and repairing motor vehicles. Service stations are generally located at intersections or interchanges. Service stations with convenience stores and car washes are not included in this land use. Convenience market with gasoline pumps (Land Use 853), gasoline/service station with convenience market (Land Use 945) and gasoline/service station with convenience market and car wash (Land Use 946) are related uses.

Additional Data

The independent variable vehicle fueling position is defined as the maximum number of vehicles that can be fueled simultaneously.

Gasoline/service stations in this land use include "pay-at-the-pump" and traditional fueling stations.

The weekday peak hours of the generator typically coincided with the peak hours of the adjacent street traffic.

The sites were surveyed from the 1970s to the 2000s throughout the United States.

Source Numbers

347, 349, 355, 440, 444, 445, 540, 551, 552, 583

Gasoline/Service Station
(944)

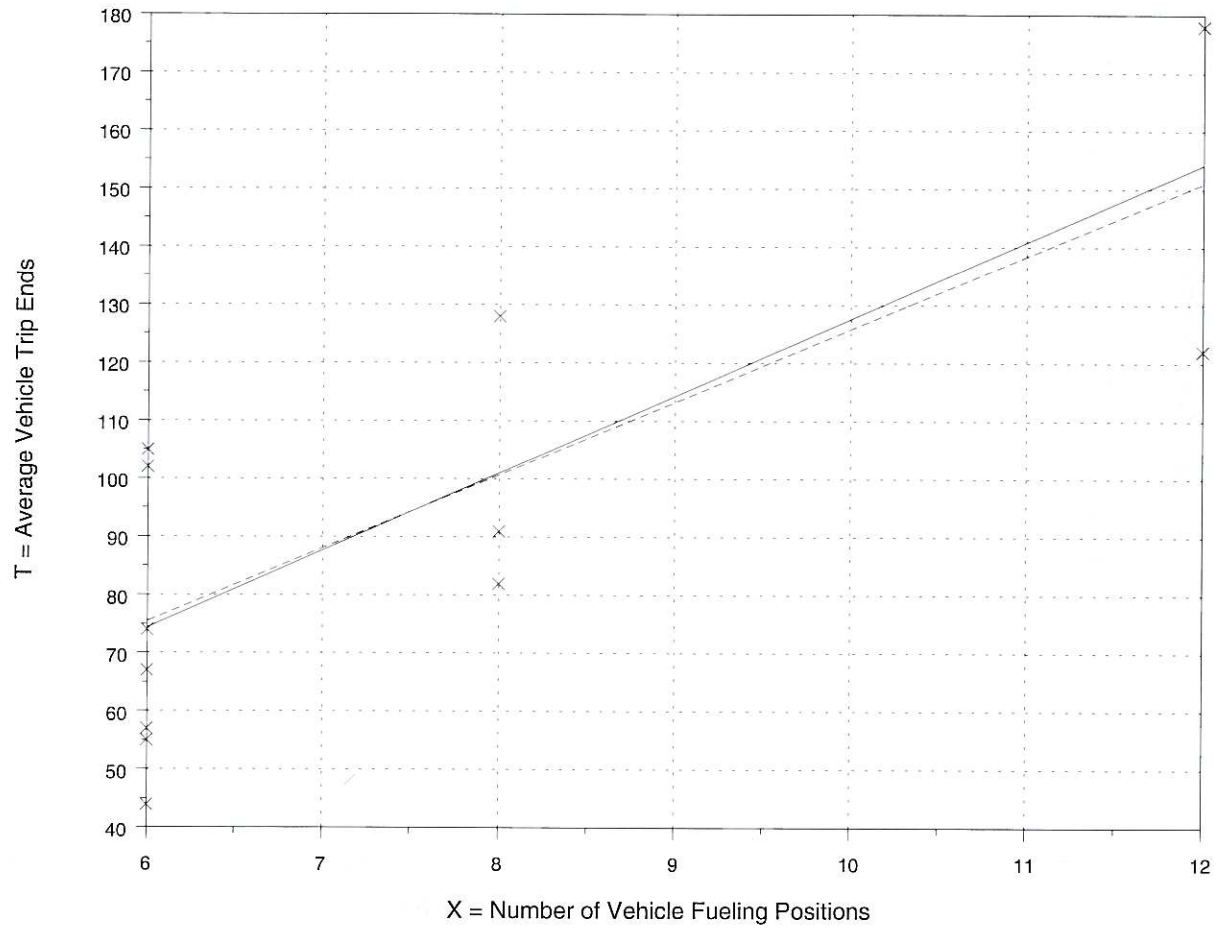
Average Vehicle Trip Ends vs: Vehicle Fueling Positions
On a: Weekday,
A.M. Peak Hour of Generator

Number of Studies: 13
Average Vehicle Fueling Positions: 8
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
12.58	7.33 - 17.50	4.55

Data Plot and Equation



Fitted Curve Equation: T = 13.30(X) - 5.40

R^2 = 0.60

Gasoline/Service Station
(944)

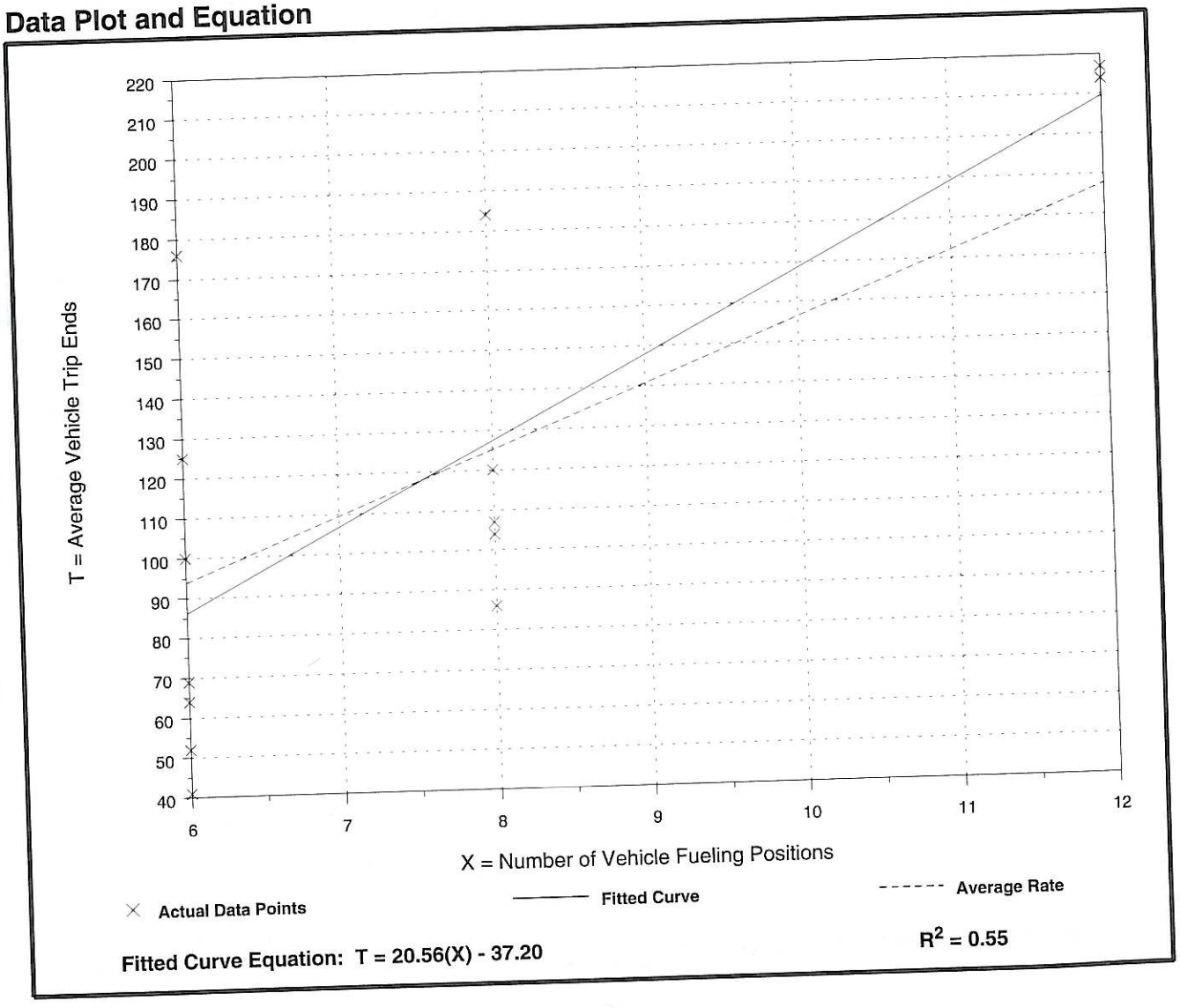
Average Vehicle Trip Ends vs: Vehicle Fueling Positions
On a: Weekday,
P.M. Peak Hour of Generator

Number of Studies: 14
Average Vehicle Fueling Positions: 8
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
15.65	6.83 - 29.33	6.62

Data Plot and Equation



Fitted Curve Equation: T = 20.56(X) - 37.20

R^2 = 0.55

A P P E N D I X D

ILLUMINATION WARRANT WORKSHEET

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 12	Main Road	**Date**	April 27, 2008
Range Road 1-1	Minor Road	**Other**	2008
Gull Lake, Alberta	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	50	2	10	Relative to the recommended minimum sight distance	OK	20
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	t			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	2.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**26**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	1915	1	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	10
AADT on Minor Road (2-way)	26	0	20		OK	0
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	1	5	Refer to Table 1(B) for ratings.	OK	5
Operating Speed or Posted Speed on Major Road (km/h)	100	4	5	Refer to Table 1(B), note #3	OK	20
Operating Speed on Minor Road (km/h)	80	3	5	Refer to Table 1(B), note #3	OK	15
					Operational Factors Subtotal	**50**

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	1	1	5	Maximum of 4 quadrants	OK	5
					Environmental Factor Subtotal	**5**

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	26
Operational Factor Subtotal	50
Environmental Factor Subtotal	5
Collision History Subtotal	0
TOTAL POINTS	**81**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 12	Main Road	**Date**	April 27, 2008
Range Road 1-1	Minor Road	**Other**	Full Build Out - 2033
Gull Lake, Alberta	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	t			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	2.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**6**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	8487	4	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	40
AADT on Minor Road (2-way)	6410	4	20		OK	80
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	1	5	Refer to Table 1(B) for ratings.	OK	5
Operating Speed or Posted Speed on Major Road (km/h)	100	4	5	Refer to Table 1(B), note #3	OK	20
Operating Speed on Minor Road (km/h)	80	3	5	Refer to Table 1(B), note #3	OK	15
					Operational Factors Subtotal	**160**

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	1	1	5	Maximum of 4 quadrants	OK	5
					Environmental Factor Subtotal	**5**

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
DELINEATION LIGHTING TO ILLUMINATE PEDESTRIANS OR CROSS STREET TRAFFIC

SUMMARY

Geometric Factors Subtotal	6
Operational Factor Subtotal	160
Environmental Factor Subtotal	5
Collision History Subtotal	0
TOTAL POINTS	**171**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Range Road 1-1	Main Road
Township Road 41-0	Minor Road
Gull Lake, Alberta	City/Town

Date April 27, 2008
Other Full Build Out - 2033

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	t			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**6**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	8821	4	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	40
AADT on Minor Road (2-way)	3300	4	20		OK	80
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	1	5	Refer to Table 1(B) for ratings.	OK	5
Operating Speed or Posted Speed on Major Road (km/h)	80	3	5	Refer to Table 1(B), note #3	OK	15
Operating Speed on Minor Road (km/h)	60	1	5	Refer to Table 1(B), note #3	OK	5
					Operational Factors Subtotal	**145**

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	2	2	5	Maximum of 4 quadrants	OK	10
					Environmental Factor Subtotal	**10**

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
DELINEATION LIGHTING TO ILLUMINATE PEDESTRIANS OR CROSS STREET TRAFFIC

SUMMARY

Geometric Factors Subtotal	6
Operational Factor Subtotal	145
Environmental Factor Subtotal	10
Collision History Subtotal	0
TOTAL POINTS	**161**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Range Road 1-1	Main Road
Township Road 41-1	Minor Road
Gull Lake, Alberta	City/Town

Date April 27, 2008
Other Full Build Out - 2033

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	80				OK	
Radius of Horizontal Curve (m)	t			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	C	0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**6**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	3299	3	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	30
AADT on Minor Road (2-way)	60	0	20		OK	0
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	1	5	Refer to Table 1(B) for ratings.	OK	5
Operating Speed or Posted Speed on Major Road (km/h)	80	3	5	Refer to Table 1(B), note #3	OK	15
Operating Speed on Minor Road (km/h)	60	1	5	Refer to Table 1(B), note #3	OK	5
					Operational Factors Subtotal	**55**

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	2	2	5	Maximum of 4 quadrants	OK	10
					Environmental Factor Subtotal	**10**

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	**0**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	6
Operational Factor Subtotal	55
Environmental Factor Subtotal	10
Collision History Subtotal	0
TOTAL POINTS	**71**

A P P E N D I X E

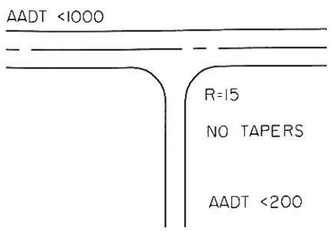
INTERSECTION ANALYSIS CHARTS & TYPES

Table D.6.3.2 Design Widths for Turning Roadways at Rural Intersections

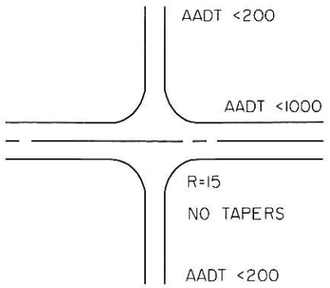
Minimum Pavement Width (m)										
R radius on inner edge of pavement (m)	Case I one-lane, one-way operation no provision for passing				Case II one-lane, one-way operation with provision for passing a stalled vehicle			Case III two-lane operation either one-way or two-way		
design traffic condition vehicle accommodation type	A (P)	B (SU)	C (WB-12)	D (WB-21)	A (P-P)	B (P-SU)	C (SU-SU)	A (P-SU)	B (SU-SU)	C (WB-12-WB-12)
15	5.4	5.4	7.0	9.1	7.0	7.6	8.8	9.4	11.0	13.1
25	4.8	5.2	5.8	7.8	6.4	6.8	8.1	8.7	9.8	11.4
35	4.5	5.0	5.4	7.1	6.0	6.6	7.5	8.4	9.4	10.4
45	4.2	4.8	5.2	6.6	5.8	6.4	7.3	8.2	9.0	10.0
60	4.2	4.8	5.0	6.0	5.8	6.4	7.2	8.2	8.8	9.4
80	4.0	4.8	5.0	5.7	5.8	6.2	7.0	8.0	8.6	9.4
100	4.0	4.8	5.0	5.4	5.5	6.2	6.8	8.0	8.5	9.0
125	4.0	4.6	4.8	5.2	5.5	6.0	6.8	8.0	8.4	8.8
150	3.7	4.6	4.6	5.1	5.5	6.0	6.7	7.8	8.4	8.8
tangent	3.7	4.6	4.6	5.1	5.2	5.8	6.4	7.6	8.2	8.2
	Width Adjustment for Edge of Pavement Treatment									
mountable curb	none				none			none		
barrier curb one side two sides	add 0.25m add 0.5m				none add 0.25m			add 0.25m add 0.5m		

Note:
1. The combination of vehicle accommodation type letters, such as P-SU for Case II, means the pavement width allows a P design vehicle to slowly pass by a stalled SU design truck or vice versa.
2. Case II C is generally used in Alberta.

TYPE I's

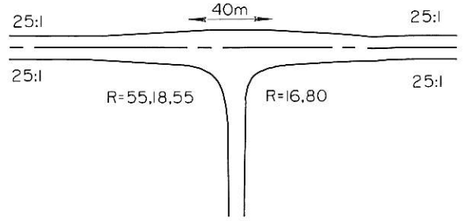


TYPE Ia



TYPE Ib

TYPE II's



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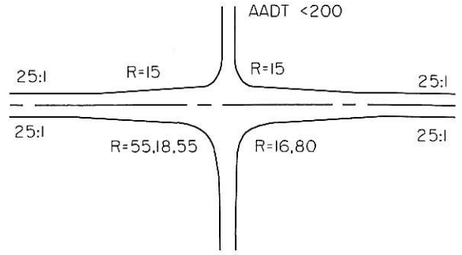

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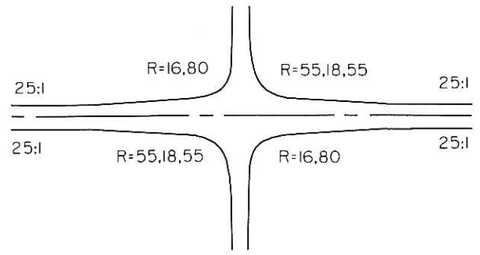
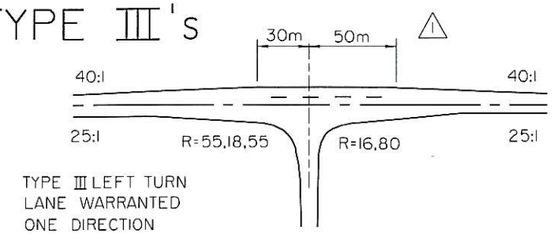


TYPE IIc

TYPE III's



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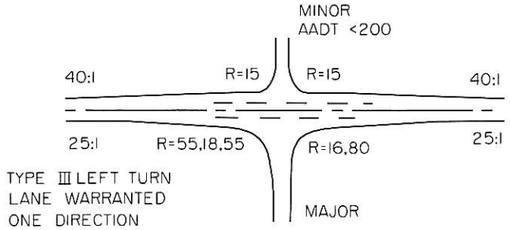

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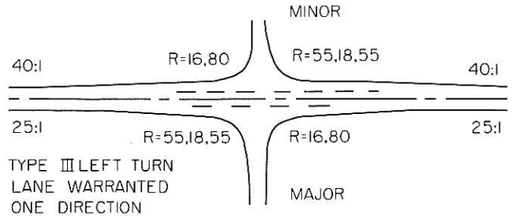

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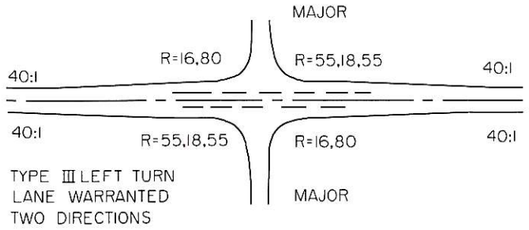
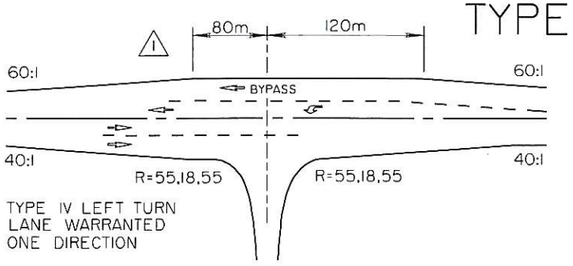


TYPE IIId

TYPE IV's



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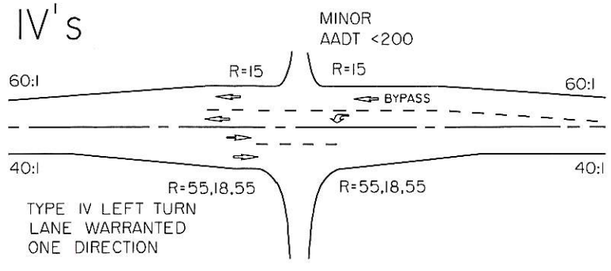
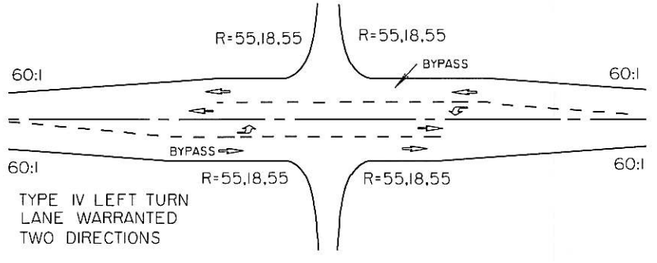
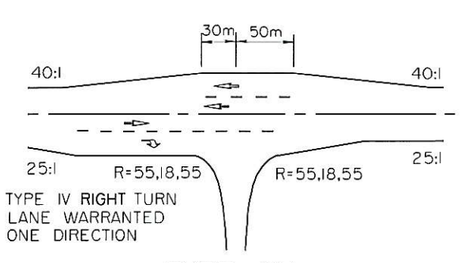


TYPE IVb



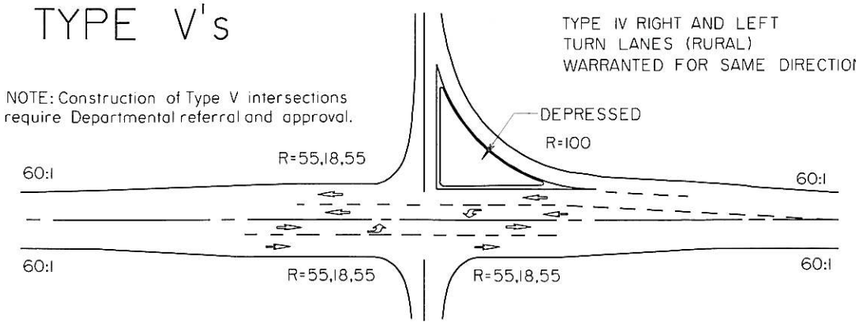
TYPE IVc



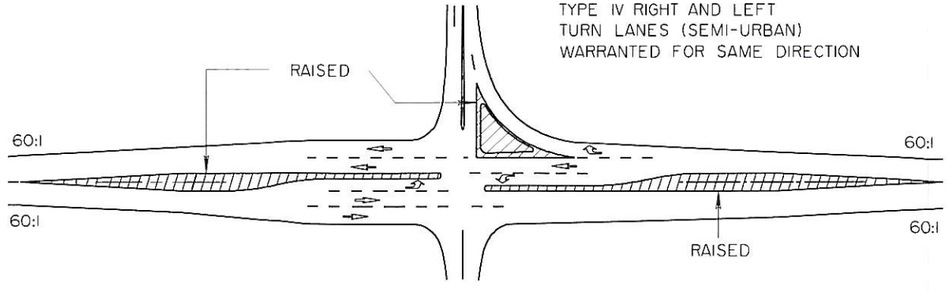
TYPE IVd

TYPE V's

NOTE: Construction of Type V intersections require Departmental referral and approval.



TYPE Vb



TYPE Vc

NOTES:
1. This is not a pavement marking drawing.
2. This figure depicts the typical layouts used for at-grade intersections. Detailed design considerations may dictate some minor alterations for particular intersections. The tapers shown here are typical for a 110 km/h design speed on the main highway.

No.	REVISIONS	BY	DATE
2			
1	REVISED LANE DIMENSIONS	TDN	06/98

Alberta INFRASTRUCTURE

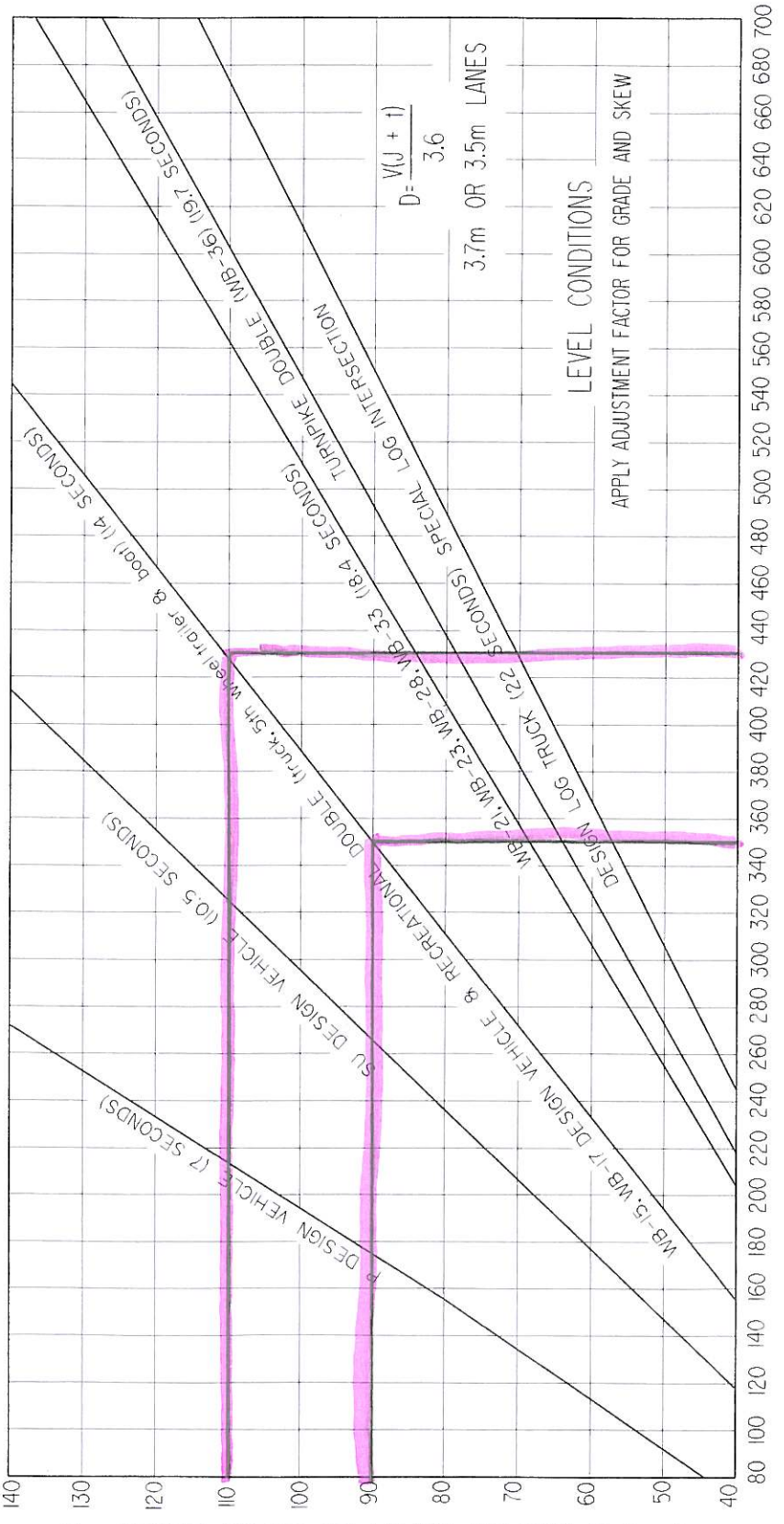
FIGURE D-7.5

Date: APRIL 1995

STANDARD AT-GRADE INTERSECTION LAYOUTS FOR TWO-LANE HIGHWAYS

Prepared By: LT	Checked By: B.K.	Scale: N.T.S.	PAGE D-III

FIGURE D-4.2.2.2 SIGHT DISTANCES FOR LEFT TURN ONTO HIGHWAY *



NOTES:

1. To determine the sight distance requirements at an intersection, the designer should select the longest vehicle or vehicle with the greatest I.S.D. need, that uses the intersection on a regular basis, i.e., daily. Because of the various eye heights, the I.S.D. available for several design vehicles may have to be checked.
2. The usefulness of intersection sight distances in excess of 500m has been debated and will be the subject of future research into gap acceptance by large trucks on rural highways in Alberta. Changes to this table may be made based on that research.

* INTERSECTION SIGHT DISTANCE (I.S.D.)

- THE I.S.D.'s SHOWN IN THIS FIGURE ARE BASED ON THE DISTANCE TRAVELLED AT DESIGN SPEED DURING A CRITICAL TIME (SHOWN ON THE FIGURE IN SECONDS). THE CRITICAL TIME INCLUDES THE TIME TAKEN FOR THE MANOEUVRE (LEFT TURN FROM THE MINOR ROAD) PLUS 2 SECONDS FOR PERCEPTION/REACTION TIME.
- THE INTERSECTION SIGHT DISTANCE AVAILABLE IS TO BE DETERMINED USING AN EYE HEIGHT (BASED ON THE DESIGN VEHICLE) LOCATED AT THE JUNCTION AND AN OBJECT HEIGHT OF 1.3m (REPRESENTING THE ROOF OF A PASSENGER VEHICLE) ON THE THROUGH ALIGNMENT. THE EYE HEIGHTS TO BE USED ARE SHOWN IN FIGURE D-5a.

correction factor:

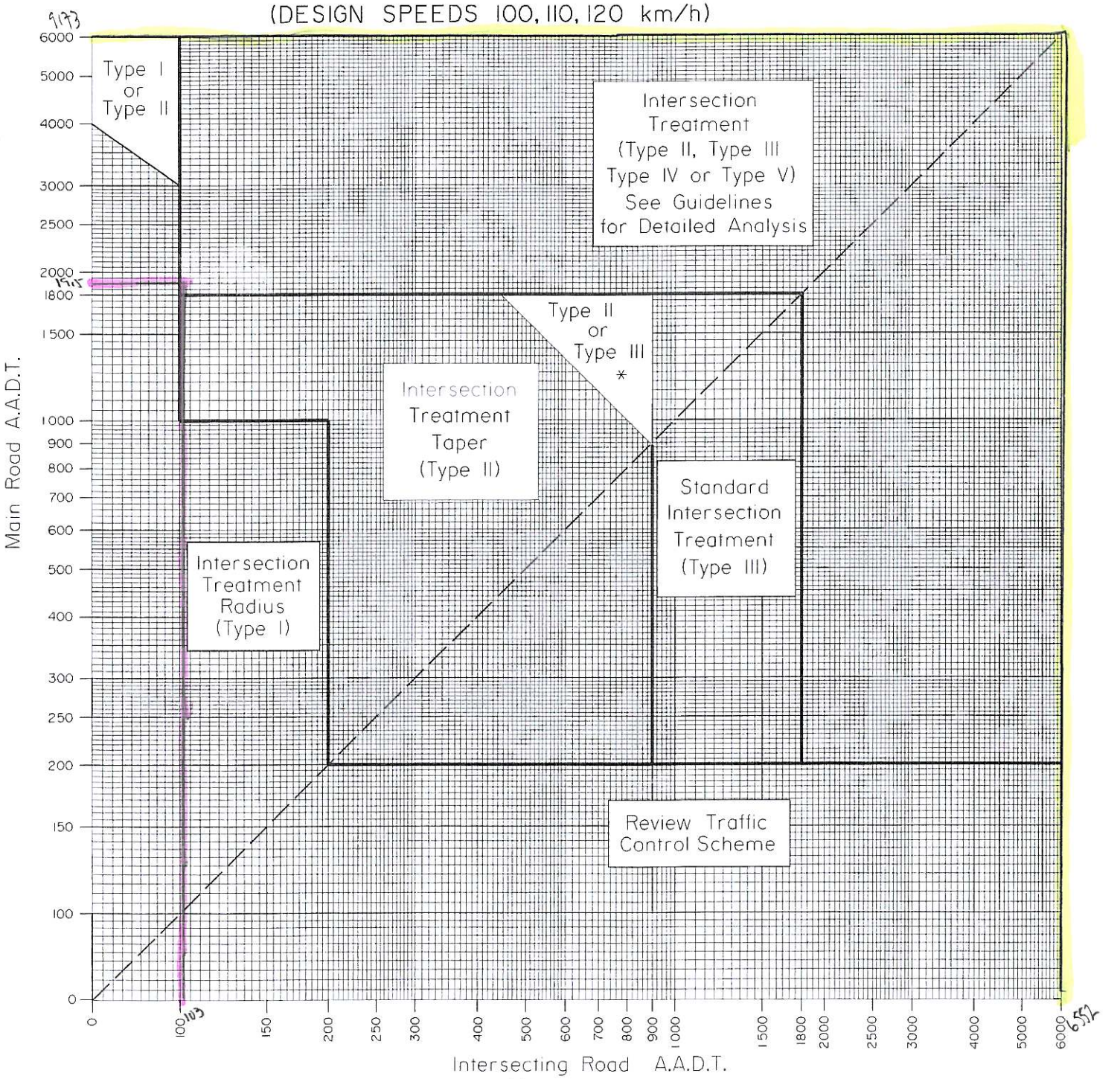
+ 2% → 1.2

* THIS CHART IS BASED ON CRITERIA USED BY AASHTO FOR "SIGHT DISTANCE" AT STOP LOCATIONS. THE SET OF CRITERIA IS DESCRIBED AS CASE IIIB IN THE AASHTO PUBLICATION "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS, 1994"

REVISIONS	No. 2	BY		DATE	
	No. 1	BY BK	ADDED NOTE	DATE	AUG / 99

2008 →
2033 →

FIGURE D-7.4 TRAFFIC VOLUME WARRANT CHART FOR AT-GRADE INTERSECTION TREATMENT ON TWO-LANE RURAL HIGHWAYS (DESIGN SPEEDS 100, 110, 120 km/h)

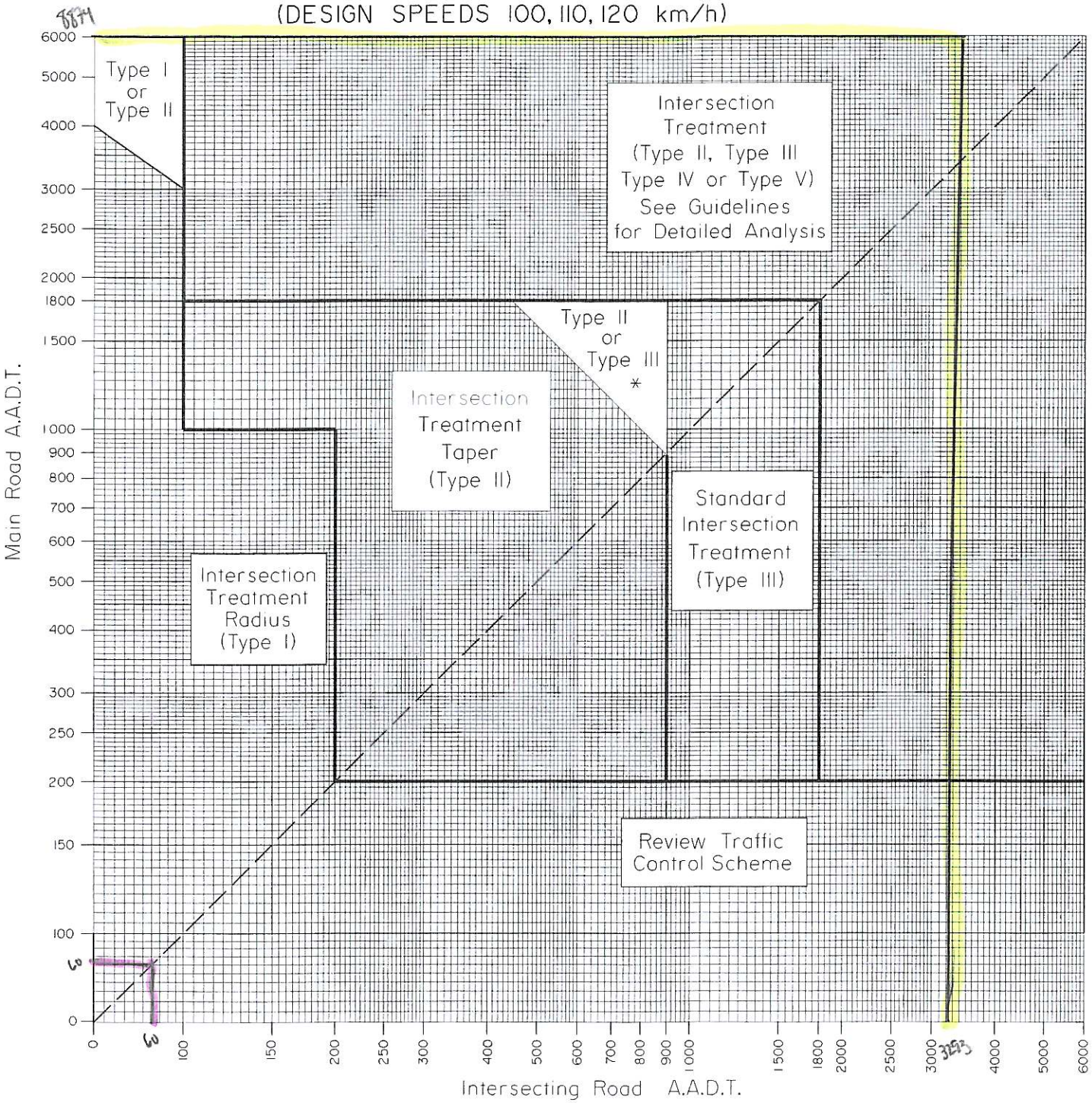


Notes:

1. If main road, or intersecting road, is <100 AADT provide Type I Intersection Treatment (15m radius), except as shown for the higher volume main roads on this chart (Type I or II zone) where engineering judgement may be used to select the appropriate treatment.
2. If main road is >4000 AADT Review Access Management
   - — — If Intersecting Road AADT is > Main Road AADT: Review Traffic Control Scheme
3. Use projected traffic volumes for design
   Sloping line is defined by Main Road AADT x Intersecting Road AADT = 800,000

2008 →
2033 →

FIGURE D-7.4 TRAFFIC VOLUME WARRANT CHART FOR AT-GRADE INTERSECTION TREATMENT ON TWO-LANE RURAL HIGHWAYS (DESIGN SPEEDS 100, 110, 120 km/h)

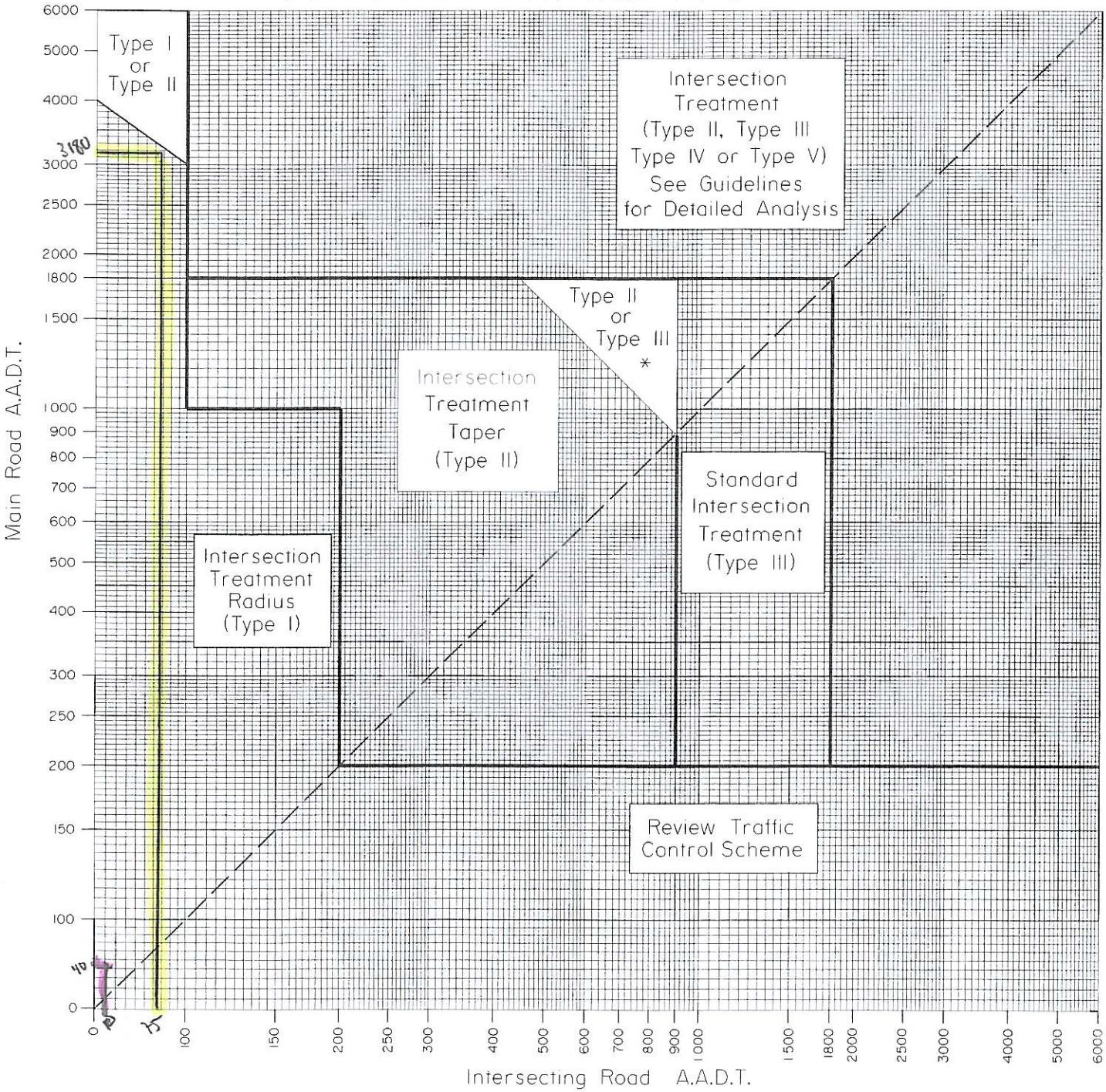


Notes:

1. If main road, or intersecting road, is <100 AADT provide Type I Intersection Treatment (15m radius), except as shown for the higher volume main roads on this chart (Type I or II zone) where engineering judgement may be used to select the appropriate treatment.
2. If main road is >4000 AADT Review Access Management
   - — — If Intersecting Road AADT is > Main Road AADT: Review Traffic Control Scheme
3. Use projected traffic volumes for design
   Sloping line is defined by Main Road AADT x Intersecting Road AADT = 800,000

2008 →
2033 →

FIGURE D-7.4 TRAFFIC VOLUME WARRANT CHART FOR AT-GRADE INTERSECTION TREATMENT ON TWO-LANE RURAL HIGHWAYS (DESIGN SPEEDS 100, 110, 120 km/h)

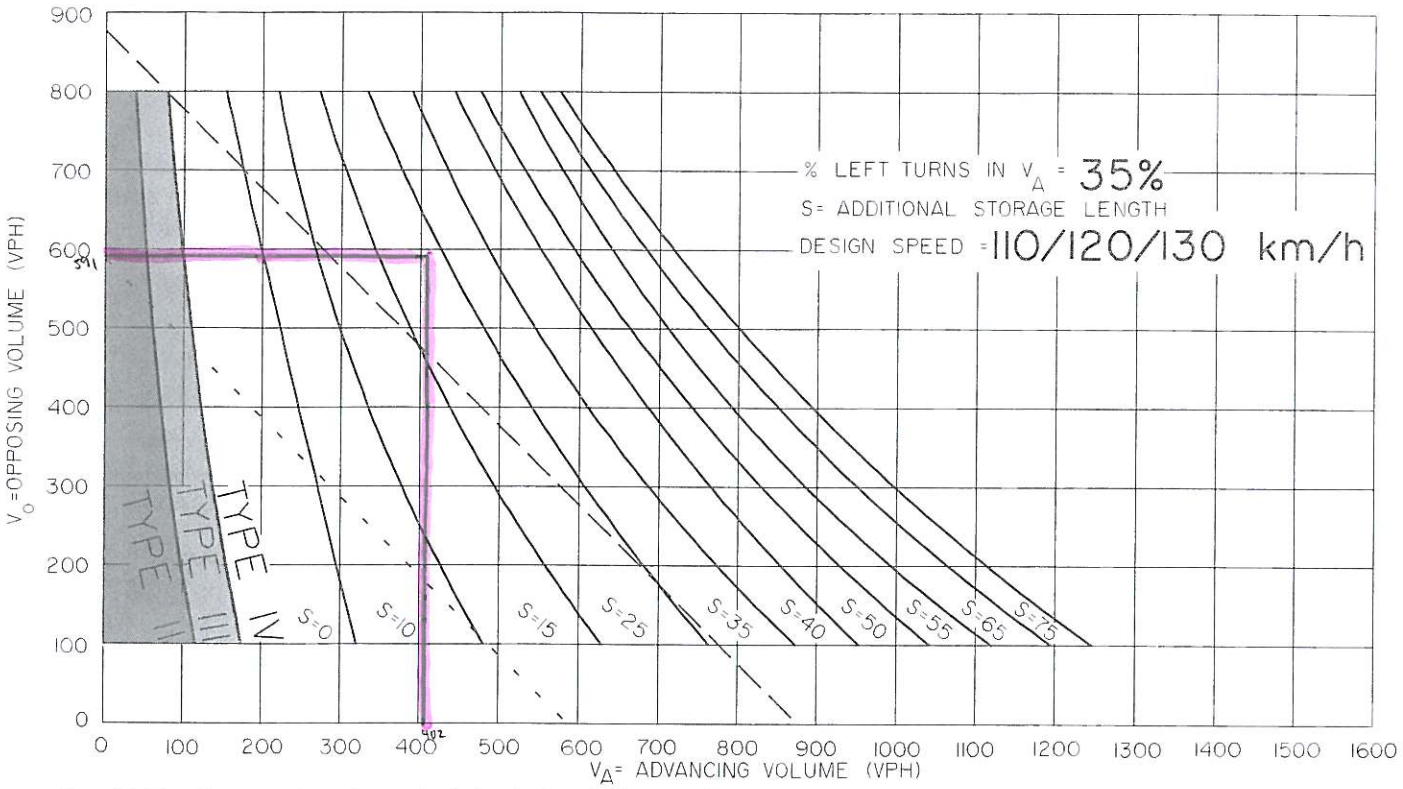


Notes:

1. If main road, or intersecting road, is <100 AADT provide Type I Intersection Treatment (15m radius), except as shown for the higher volume main roads on this chart (Type I or II zone) where engineering judgement may be used to select the appropriate treatment.
2. If main road is >4000 AADT Review Access Management
   - — — If Intersecting Road AADT is > Main Road AADT: Review Traffic Control Scheme
3. Use projected traffic volumes for design
   Sloping line is defined by Main Road AADT x Intersecting Road AADT = 800,000

FIGURE D-7.6-7d WARRANTS FOR LEFT TURN LANES AND STORAGE REQUIREMENTS FOR TWO-LANE HIGHWAYS DESIGN SPEED 110/120/130 KM/H, LEFT TURN 35%, 40%

2032 -



S = Additional storage length required, that is, in addition to what is shown on the appropriate Type IV standard drawing. Designers should check additional storage requirements for trucks, also see Table D.7.6a.

- - - - Traffic signals may be warranted in rural areas, or urban areas, with restricted flow.

—— —— Traffic signals may be warranted in "free flow" urban areas.

Notes:

1. The traffic signal warrant lines are provided for reference only. For detailed analysis of the requirements for signals, contact Roadway Engineering Branch.
2. Warrant for Type I treatment is shown in Figure D-7.4.

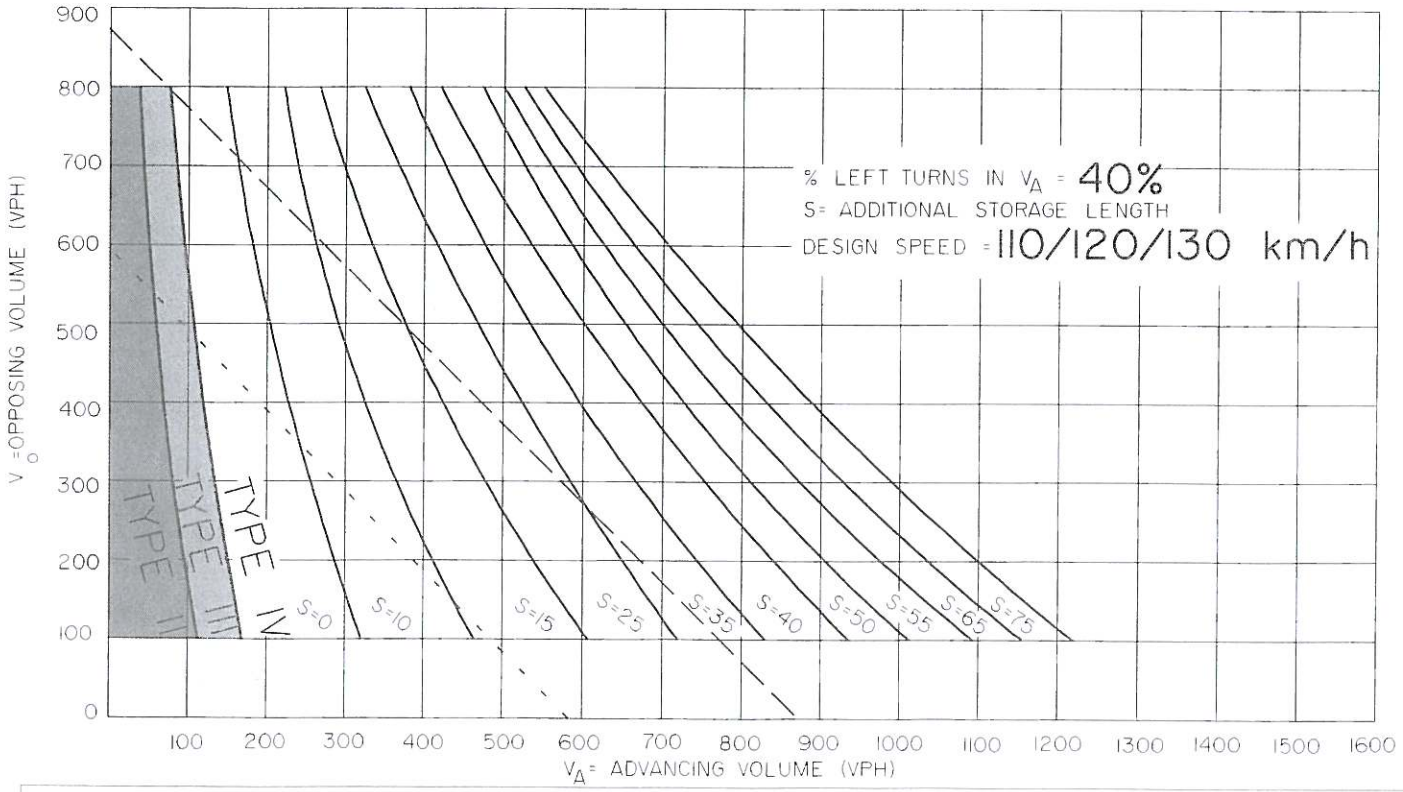
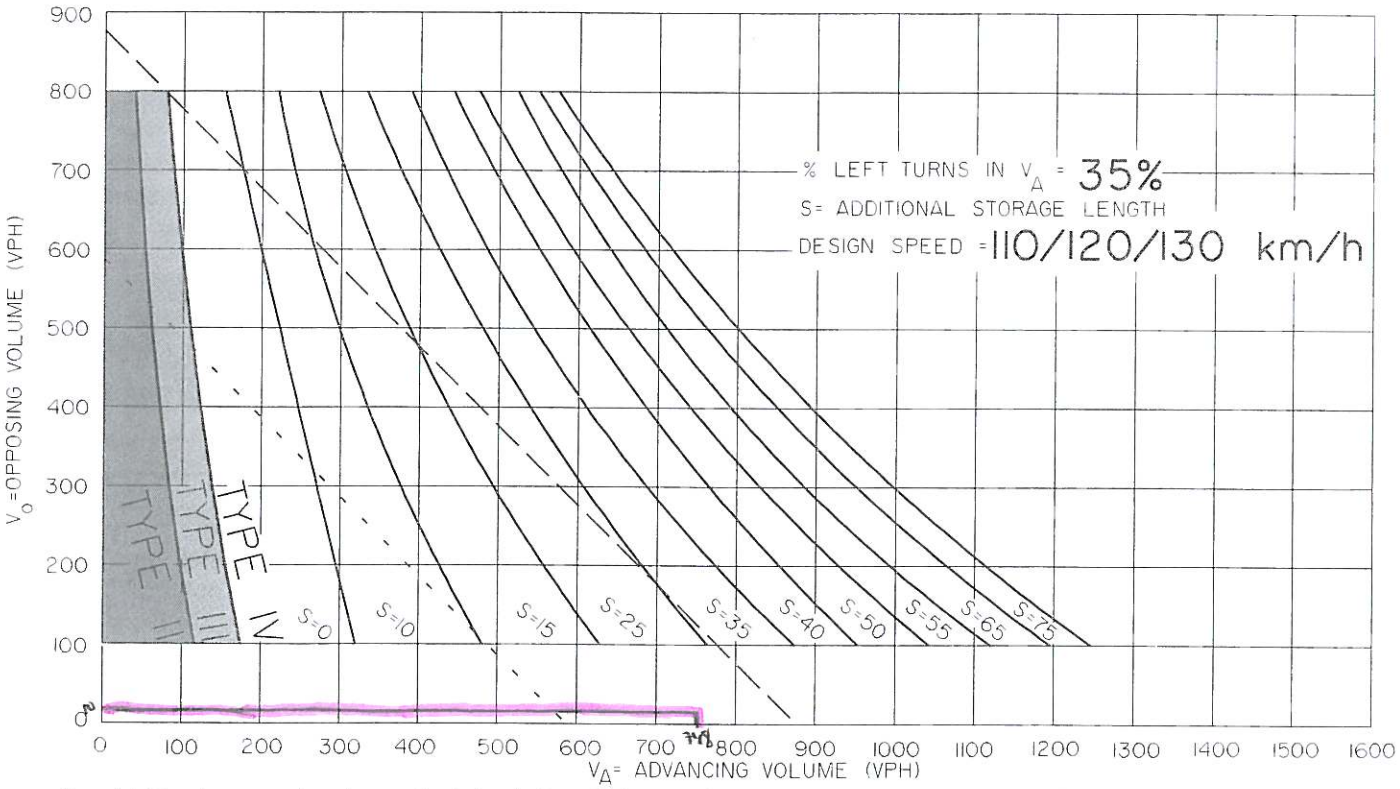


FIGURE D-7.6-7d WARRANTS FOR LEFT TURN LANES AND STORAGE REQUIREMENTS FOR TWO-LANE HIGHWAYS DESIGN SPEED 110/120/130 KM/H, LEFT TURN 35%, 40%

2032 -



S = Additional storage length required, that is, in addition to what is shown on the appropriate Type IV standard drawing. Designers should check additional storage requirements for trucks, also see Table D.7.6a.

- - - - Traffic signals may be warranted in rural areas, or urban areas, with restricted flow.

—— —— Traffic signals may be warranted in "free flow" urban areas.

Notes:

1. The traffic signal warrant lines are provided for reference only. For detailed analysis of the requirements for signals, contact Roadway Engineering Branch.
2. Warrant for Type I treatment is shown in Figure D-7.4.

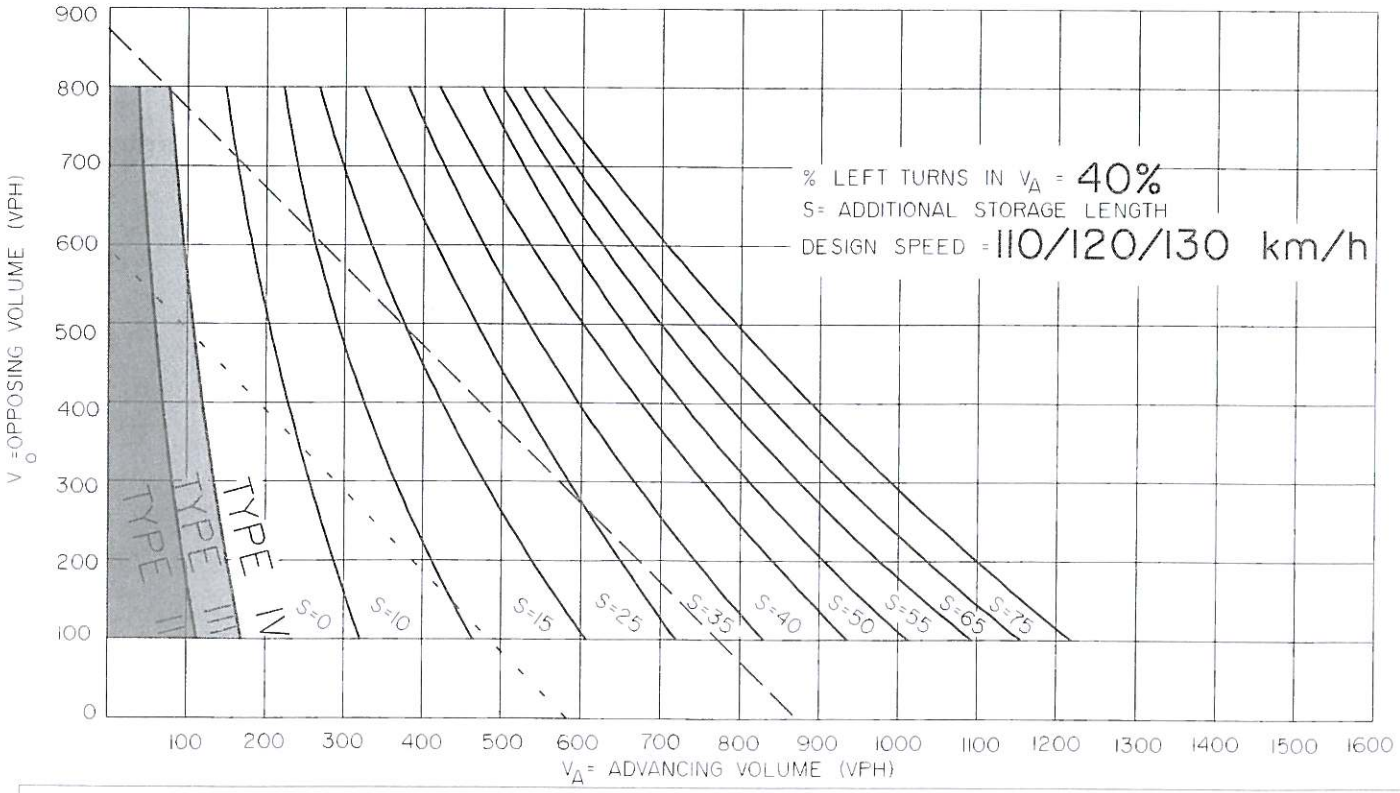
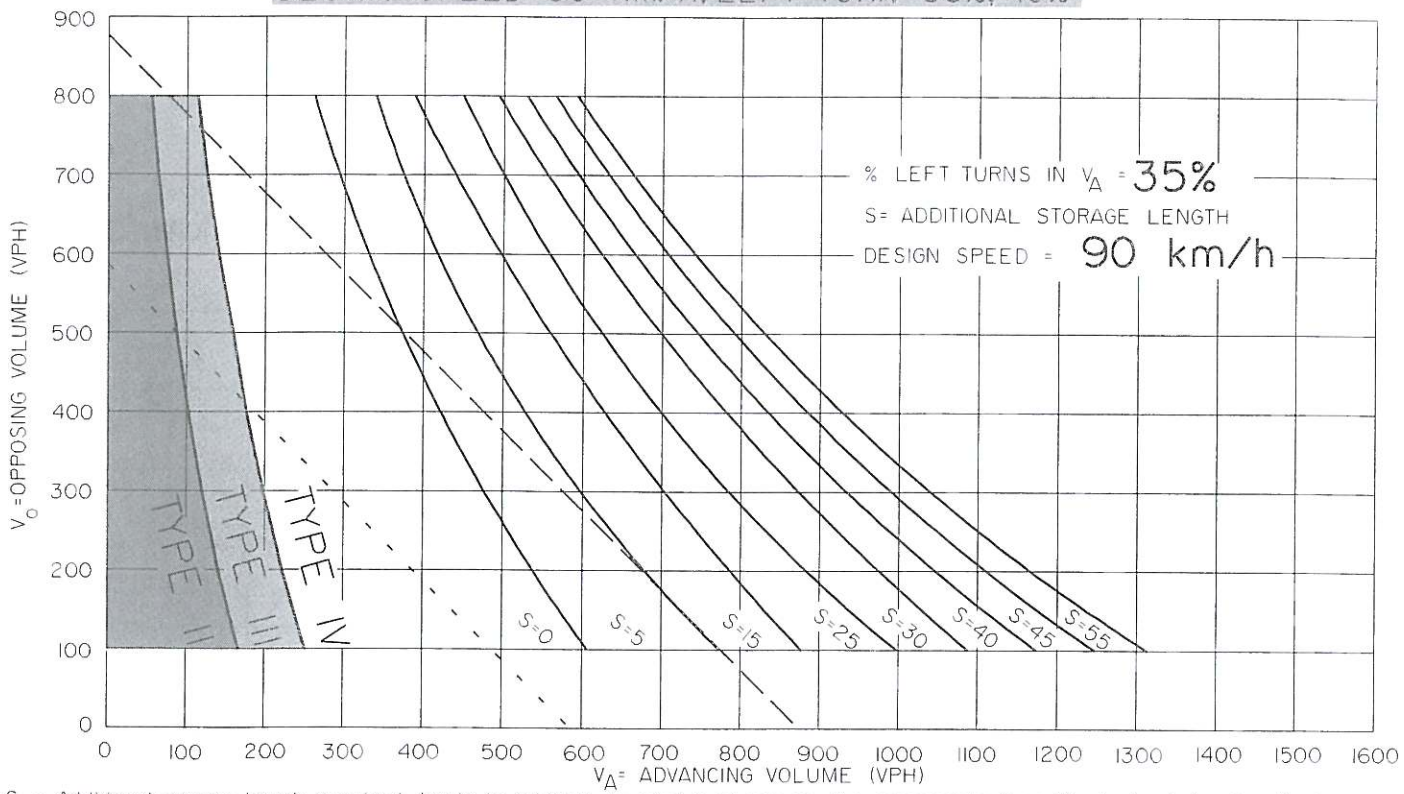


FIGURE D-7.6-5d WARRANTS FOR LEFT TURN TREATMENT AND STORAGE REQUIREMENTS FOR TWO-LANE HIGHWAYS DESIGN SPEED 90 KM/H, LEFT TURN 35%, 40%

2032 –



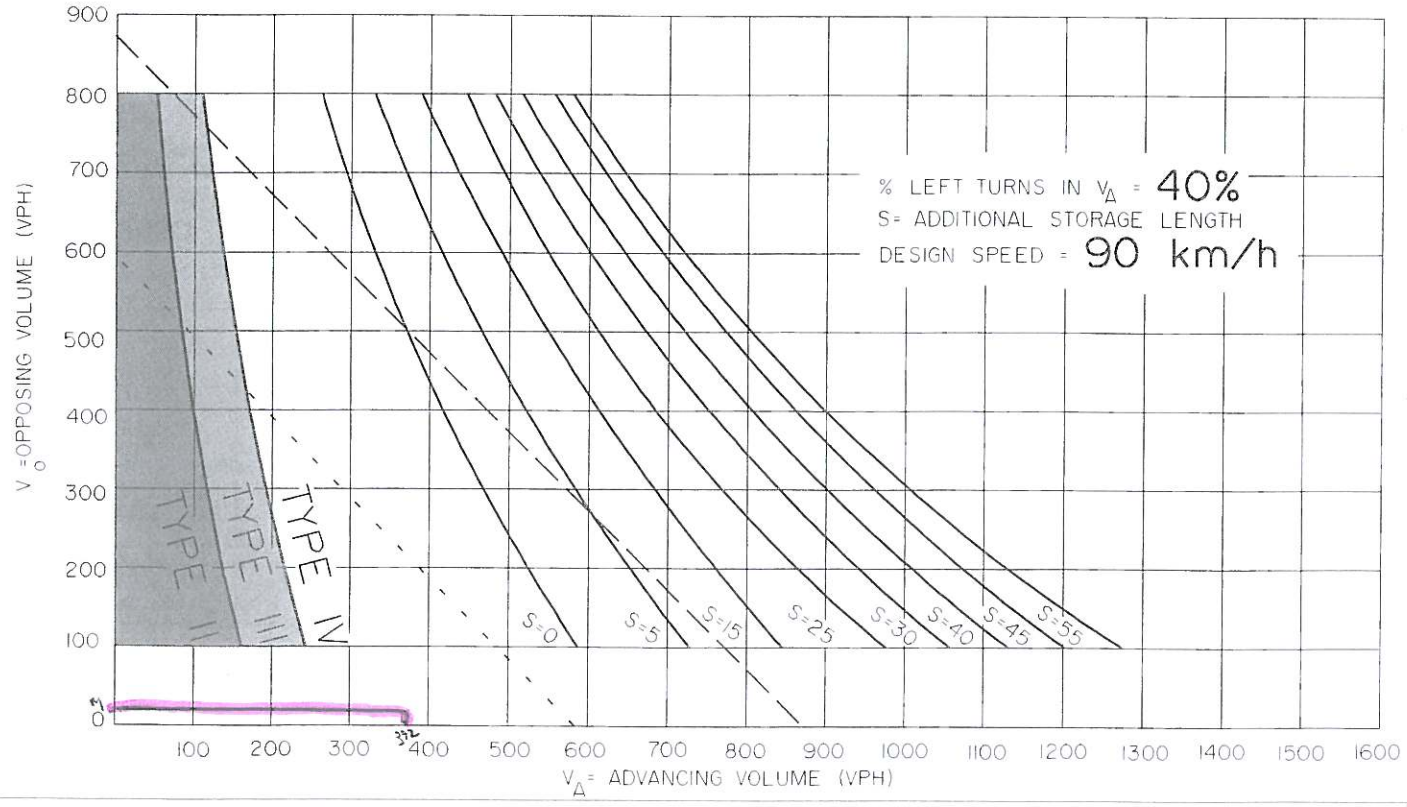
S = Additional storage length required, that is, in addition to what is shown on the appropriate Type IV standard drawing. Designers should check additional storage requirements for trucks, also see Table D.7.6a.

- - - - Traffic signals may be warranted in rural areas, or urban areas, with restricted flow.

—— —— —— Traffic signals may be warranted in "free flow" urban areas.

Notes:

1. The traffic signal warrant lines are provided for reference only. For detailed analysis of the requirements for signals, contact Roadway Engineering Branch.
2. Warrant for Type I treatment is shown in Figure D-7.4.



A P P E N D I X F

SIGNALIZATION WARRANT WORKSHEET

FIGURE B2-6

TRAFFIC CONTROL SIGNAL INSTALLATION WARRANT AND PRIORITY RATING WORK SHEET

Location Hwy 12 & RR1-1 Year 2032 Date of Count April 27, 2005

I Collisions (Figure B2-1)

Priority points = P_a 2

II Crossing Gaps, Progression, Delay and Vehicular Stops

A. One-Way Street (Figure B2-2)

Priority points	=	P_1	x	V_{tew}	x	F_{eew}		
E-W Street - E. of int.	=	___	x	___	x	___	=	___
E-W Street - W. of int.	=	___	x	___	x	___	=	___
Priority points	=	P_1	x	V_{tns}	x	F_{ens}		
N-S street - N. of int.	=	___	x	___	x	___	=	___
N-S street - S. of int.	=	___	x	___	x	___	=	___

B. Two-Way Street (Figure B2-3)

Priority points =	=	P_2	x	V_{tew}	x	F_{eew}			
E-W Street - E. of int.	=	2.0	x	5.05	x	1.0	=	10.1	
E-W Street - W. of int.	=	2.0	x	3.44	x	1.0	=	6.88	
Priority points	=	P_2	x	V_{tns}	x	F_{ens}			
N-S street - N. of int.	=	2.0	x	6.39	x	1.0	=	12.78	
N-S street - S. of int.	=	2.0	x	0.02	x	1.0	=	0.04	29.8 *

III Crossing Gaps, Intersecting Volumes, and Pedestrian Volumes

A. Through Street One-Way (Figures B2-4 and B2-5)

1). Priority points

= (Vaew + Pew) x (Vans + Pns) x Fow x Fr
= (___ + ___) x (___ + ___) x ___ x 2 = ___

2). Priority points

= P_3 x F_t = ___

B. Through Street Two-Way

Priority points

= (Vaew + Pew) x (Vans + Pns) x Fow
= (8.49 + 0.0) x (6.41 + 0.0) x 1.0 = 54.4 54.4

TOTAL PRIORITY POINTS 84.2

NOTE: Complete I; the appropriate equation for each intersection leg in Section II A and/or II B; and either Section IIIA or III B.

* **Maximum points for II = + 80**

FIGURE B2-6

FIGURE B2-6

TRAFFIC CONTROL SIGNAL INSTALLATION WARRANT AND PRIORITY RATING WORK SHEET

Location Hwy RR1-1 & TR41-0 Year 2032 Date of Count Apr. 27, 2008

I Collisions (Figure B2-1)

Priority points = P_a 0

II Crossing Gaps, Progression, Delay and Vehicular Stops

A. One-Way Street (Figure B2-2)

		P_1		V_{tew}		F_{eew}		
Priority points	=		x		x			
E-W Street - E. of int.	=	___	x	___	x	___	=	___
E-W Street - W. of int.	=	___	x	___	x	___	=	___

		P_1		V_{tns}		F_{ens}		
Priority points	=		x		x			
N-S street - N. of int.	=	___	x	___	x	___	=	___
N-S street - S. of int.	=	___	x	___	x	___	=	___

B. Two-Way Street (Figure B2-3)

		P_2		V_{tew}		F_{eew}		
Priority points =	=		x		x			
E-W Street - E. of int.	=	2.0	x	3.18	x	1.0	=	6.36
E-W Street - W. of int.	=	2.0	x	0.12	x	1.0	=	0.24

		P_2		V_{tns}		F_{ens}			
Priority points	=		x		x				
N-S street - N. of int.	=	2.0	x	3.18	x	1.0	=	6.36	
N-S street - S. of int.	=	2.0	x	5.64	x	1.0	=	11.28	24.24 *

III Crossing Gaps, Intersecting Volumes, and Pedestrian Volumes

A. Through Street One-Way (Figures B2-4 and B2-5)

1). Priority points

= (V_{aew} + P_{ew}) x (V_{ans} + P_{ns}) x F_{ow} x F_r
= (___ + ___) x (___ + ___) x ___ x ___ = ___

2). Priority points

= P_3 x F_t = ___

B. Through Street Two-Way

Priority points

= (V_{aew} + P_{ew}) x (V_{ans} + P_{ns}) x F_{ow}
= (3.3 + 8.0) x (8.82 + 0.0) x 1.0 = 29.11 29.11

TOTAL PRIORITY POINTS 53.35

NOTE: Complete I; the appropriate equation for each intersection leg in Section II A and/or II B; and either Section IIIA or III B.

* **Maximum points for II = + 80**

FIGURE B2-6

FIGURE B2-6

TRAFFIC CONTROL SIGNAL INSTALLATION WARRANT AND PRIORITY RATING WORK SHEET

Location RD1-1 & TR 41-1 Year 2032 Date of Count Apr. 27, 2008

I Collisions (Figure B2-1)

Priority points = P_a 8

II Crossing Gaps, Progression, Delay and Vehicular Stops

A. One-Way Street (Figure B2-2)

Priority points	=	P_1	x	V_{tew}	x	F_{eew}		
E-W Street - E. of int.	=	___	x	___	x	___	=	___
E-W Street - W. of int.	=	___	x	___	x	___	=	___
Priority points	=	P_1	x	V_{tns}	x	F_{ens}		
N-S street - N. of int. =		___	x	___	x	___	=	___
N-S street - S. of int.	=	___	x	___	x	___	=	___

B. Two-Way Street (Figure B2-3)

Priority points =	=	P_2	x	V_{tew}	x	F_{eew}			
E-W Street - E. of int.	=	2.0	x	0.12	x	1.0	=	0.24	
E-W Street - W. of int.	=	2.0	x	3.18	x	1.0	=	6.36	
Priority points	=	P_2	x	V_{tns}	x	F_{ens}			
N-S street - N. of int.	=	2.0	x	0.0	x	1.0	=	0.0	
N-S street - S. of int.	=	2.0	x	0.06	x	1.0	=	0.12	6.72*

III Crossing Gaps, Intersecting Volumes, and Pedestrian Volumes

A. Through Street One-Way (Figures B2-4 and B2-5)

1). Priority points

= (V_{aew} + P_{ew}) x (V_{ans} + P_{ns}) x F_{ow} x F_r
= (___ + ___) x (___ + ___) x ___ x ___ = ___

2). Priority points

= P_3 x F_t = ___

B. Through Street Two-Way

Priority points

= (V_{aew} + P_{ew}) x (V_{ans} + P_{ns}) x F_{ow}
= (3.3 + 0.0) x (0.06 + 0.0) x 1.0 = 0.198 0.198

TOTAL PRIORITY POINTS 6.92

NOTE: Complete I; the appropriate equation for each intersection leg in Section II A and/or II B; and either Section IIIA or III B.

* **Maximum points for II = + 80**

FIGURE B2-6

A P P E N D I X G

CAPACITY ANALYSIS

hwy12&rr11_2008
HCS+: Unsignalized Intersections Release 5.21

TWO-WAY STOP CONTROL SUMMARY

Analyst: Kevin Paul, E.I.T.
Agency/Co.: A. D. Williams Engineering Inc
Date Performed: 27/04/2008
Analysis Time Period: Peak Hour
Intersection: Highway 12 & Range Road 1-1
Jurisdiction: Lacombe County
Units: U. S. Customary
Analysis Year: 2008
Project ID:
East/West Street: Highway 12
North/South Street: Range Road 1-1
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	100	3	0	120	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR	1	100	3	0	120	0
Percent Heavy Vehicles	10	--	--	10	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	1	0	0	0	0	2
Peak Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR	1	0	0	0	0	2
Percent Heavy Vehicles	10	10	10	10	10	10
Percent Grade (%)		0			2	
Flared Approach: Exists?/Storage		No /			No /	
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR			LTR	
v (vph)	1	0		1			2	
C(m) (vph)	1420	1440		712			910	
v/c	0.00	0.00		0.00			0.00	
95% queue length	0.00	0.00		0.00			0.01	
Control Delay	7.5	7.5		10.1			9.0	
LOS	A	A		B			A	
Approach Delay				10.1			9.0	
Approach LOS				B			A	

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Kevin Paul, E.I.T.
Agency/Co.: A. D. Williams Engineering Inc
Date Performed: 27/04/2008
Analysis Time Period: Peak Hour
Intersection: Highway 12 & Range Road 1-1
Jurisdiction: Lacombe County
Units: U. S. Customary
Analysis Year: 2008
Project ID:
East/West Street: Highway 12
North/South Street: Range Road 1-1
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	1	100	3	0	120	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Peak-15 Minute Volume	0	25	1	0	30	0
Hourly Flow Rate, HFR	1	100	3	0	120	0
Percent Heavy Vehicles	10	--	--	10	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	1	0	0	0	0	2
Peak Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Peak-15 Minute Volume	0	0	0	0	0	0
Hourly Flow Rate, HFR	1	0	0	0	0	2
Percent Heavy Vehicles	10	10	10	10	10	10
Percent Grade (%)		0			2	
Flared Approach: Exists?/Storage			No /			No /
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	100	120
Shared ln volume, major rt vehicles:	3	0
Sat flow rate, major th vehicles:	1700	1700
Sat flow rate, major rt vehicles:	1700	1700
Number of major street through lanes:	1	1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	10	10	10	10	10	10	10	10
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Grade/100			0.00	0.00	0.00	0.02	0.02	0.02
t(3,lt)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage	4.2	4.2	7.2	6.6	6.3	7.2	6.6	6.3
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20	2.20	3.50	4.00	3.30	3.50	4.00	3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	10	10	10	10	10	10	10	10
t(f)	2.3	2.3	3.6	4.1	3.4	3.6	4.1	3.4

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				
Total Saturation Flow Rate, s (vph)				
Arrival Type				
Effective Green, g (sec)				
Cycle Length, C (sec)				
Rp (from Exhibit 16-11)				
Proportion vehicles arriving on green P				

g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	120	103	225	224	102	224	225	120
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process	7		8		10		11	
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s	1500		1500		1500		1500	
P(x)								
V(c,u,x)								
C(r,x)								

C(plat,x)

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	102	120
Potential Capacity	932	910
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	932	910
Probability of Queue free St.	1.00	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	103	120
Potential Capacity	1440	1420
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1440	1420
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.	1.00	1.00
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	224	225
Potential Capacity	661	660
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	661	660
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	225	224
Potential Capacity	714	715
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	1.00
Maj. L, Min T Adj. Imp Factor.	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	712	715

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	224	225

Potential Capacity	661	660
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	661	660

Result for 2 stage process:		
a		
y		
C t	661	660
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	225	224
Potential Capacity	714	715
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	1.00
Maj. L, Min T Adj. Imp Factor.	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity	712	715

Results for Two-stage process:		
a		
y		
C t	712	715

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	1	0	0	0	0	2
Movement Capacity (vph)	712	661	932	715	660	910
Shared Lane Capacity (vph)		712			910	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	712	661	932	715	660	910
Volume	1	0	0	0	0	2
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						

n max		
C sh	712	910
SUM C sep		
n		
C act		

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR			LTR	
v (vph)	1	0		1			2	
C(m) (vph)	1420	1440		712			910	
v/c	0.00	0.00		0.00			0.00	
95% queue length	0.00	0.00		0.00			0.01	
Control Delay	7.5	7.5		10.1			9.0	
LOS	A	A		B			A	
Approach Delay				10.1			9.0	
Approach LOS				B			A	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5	100	120
v(i2), Volume for stream 3 or 6	3	0
s(il), Saturation flow rate for stream 2 or 5	1700	1700
s(i2), Saturation flow rate for stream 3 or 6	1700	1700
P*(oj)	1.00	1.00
d(M,LT), Delay for stream 1 or 4	7.5	7.5
N, Number of major street through lanes	1	1
d(rank,1) Delay for stream 2 or 5	0.0	0.0

hwy12&rr11_2033
HCS+: Unsignalized Intersections Release 5.21

TWO-WAY STOP CONTROL SUMMARY

Analyst: Kevin Paul, E.I.T.
Agency/Co.: A. D. Williams Engineering Inc
Date Performed: 27/04/2008
Analysis Time Period: Peak Hour
Intersection: Highway 12 & Range Road 1-1
Jurisdiction: Lacombe County
Units: U. S. Customary
Analysis Year: 2033
Project ID: i15451.00
East/West Street: Highway 12
North/South Street: Range Road 1-1
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	208	188	6	0	226	365
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR	208	188	6	0	226	365
Percent Heavy Vehicles	10	--	--	10	--	--
Median Type/Storage	Undivided /					
RT Channelized?						No
Lanes	1	1	0	0	1	1
Configuration	L	TR		LT		R
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	2	0	0	521	0	227
Peak Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR	2	0	0	521	0	227
Percent Heavy Vehicles	10	10	10	10	10	10
Percent Grade (%)		0			2	
Flared Approach: Exists?/Storage			No /			/
Lanes	0	1	0	1	1	1
Configuration		LTR		L	T	R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L	LT		LTR		L	T	R
v (vph)	208	0		2		521	0	227
C(m) (vph)	946	1333		104		232	229	794
v/c	0.22	0.00		0.02		2.25	0.00	0.29
95% queue length	0.84	0.00		0.06		149.72	0.00	1.20
Control Delay	9.9	7.7		40.3		2290	20.7	11.3
LOS	A	A		E		F	C	B
Approach Delay				40.3			1599	
Approach LOS				E			F	

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Kevin Paul, E.I.T.
Agency/Co.: A. D. Williams Engineering Inc
Date Performed: 27/04/2008
Analysis Time Period: Peak Hour
Intersection: Highway 12 & Range Road 1-1
Jurisdiction: Lacombe County
Units: U. S. Customary
Analysis Year: 2033
Project ID: i15451.00
East/West Street: Highway 12
North/South Street: Range Road 1-1
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	208	188	6	0	226	365
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Peak-15 Minute Volume	52	47	2	0	56	91
Hourly Flow Rate, HFR	208	188	6	0	226	365
Percent Heavy Vehicles	10	--	--	10	--	--
Median Type/Storage	Undivided		/			
RT Channelized?						No
Lanes	1	1 0		0	1	1
Configuration	L	TR		LT	R	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	2	0	0	521	0	227
Peak Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Peak-15 Minute Volume	0	0	0	130	0	57
Hourly Flow Rate, HFR	2	0	0	521	0	227
Percent Heavy Vehicles	10	10	10	10	10	10
Percent Grade (%)		0			2	
Flared Approach: Exists?/Storage			No /			/
RT Channelized?						No
Lanes	0	1 0		1	1	1
Configuration		LTR		L	T	R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		226
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	10	10	10	10	10	10	10	10
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Grade/100			0.00	0.00	0.00	0.02	0.02	0.02
t(3,lt)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage	4.2	4.2	7.2	6.6	6.3	7.2	6.6	6.3
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20	2.20	3.50	4.00	3.30	3.50	4.00	3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	10	10	10	10	10	10	10	10
t(f)	2.3	2.3	3.6	4.1	3.4	3.6	4.1	3.4

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				
Total Saturation Flow Rate, s (vph)				
Arrival Type				
Effective Green, g (sec)				
Cycle Length, C (sec)				
Rp (from Exhibit 16-11)				
Proportion vehicles arriving on green P				

g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	591	194	1129	1198	191	833	836	226
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process	7		8		10		11	
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s	1500		1500		1500		1500	
P(x)								
V(c,u,x)								
C(r,x)								

C(plat,x)

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	191	226
Potential Capacity	831	794
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	831	794
Probability of Queue free St.	1.00	0.71
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	194	591
Potential Capacity	1333	946
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1333	946
Probability of Queue free St.	1.00	0.78
Maj L-Shared Prob Q free St.	1.00	
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	1198	836
Potential Capacity	179	294
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.78	0.78
Movement Capacity	140	229
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	1129	833
Potential Capacity	175	279
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.78	0.78
Maj. L, Min T Adj. Imp Factor.	0.83	0.83
Cap. Adj. factor due to Impeding mvmnt	0.59	0.83
Movement Capacity	104	232

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	1198	836

Potential Capacity	179	294
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.78	0.78
Movement Capacity	140	229
Result for 2 stage process:		
a		
y		
C t	140	229
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	1129	833
Potential Capacity	175	279
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.78	0.78
Maj. L, Min T Adj. Imp Factor.	0.83	0.83
Cap. Adj. factor due to Impeding mvmnt	0.59	0.83
Movement Capacity	104	232
Results for Two-stage process:		
a		
y		
C t	104	232

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	2	0	0	521	0	227
Movement Capacity (vph)	104	140	831	232	229	794
Shared Lane Capacity (vph)		104				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	104	140	831	232	229	794
Volume	2	0	0	521	0	227
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						

n max	
C sh	104
SUM C sep	
n	
C act	

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	L	LT		LTR		L	T	R
v (vph)	208	0		2		521	0	227
C(m) (vph)	946	1333		104		232	229	794
v/c	0.22	0.00		0.02		2.25	0.00	0.29
95% queue length	0.84	0.00		0.06		149.72	0.00	1.20
Control Delay	9.9	7.7		40.3		2290	20.7	11.3
LOS	A	A		E		F	C	B
Approach Delay				40.3			1599	
Approach LOS				E			F	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.78	1.00
v(il), Volume for stream 2 or 5		226
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		1.00
d(M,LT), Delay for stream 1 or 4	9.9	7.7
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.0

rr11&tr410_2033
HCS+: Unsignalized Intersections Release 5.21

TWO-WAY STOP CONTROL SUMMARY

Analyst: Kevin Paul, E.I.T.
Agency/Co.: A. D. Williams Engineering Inc
Date Performed: 16/03/2008
Analysis Time Period: Peak Hour
Intersection: Rge Rd 1-1 & Town. Road 41-0
Jurisdiction: Lacombe County
Units: U. S. Customary
Analysis Year:
Project ID: i15451.00
East/West Street: Range Road 1-1
North/South Street: Township Road 41-0
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	7	0	653	0	372	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR	7	0	653	0	372	0
Percent Heavy Vehicles	10	--	--	10	--	--
Median Type/Storage	Undivided /					
RT Channelized?			No			
Lanes	0	1	1	0	1	0
Configuration		LT	R		LTR	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	372	0	0	0	0	14
Peak Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR	372	0	0	0	0	14
Percent Heavy Vehicles	10	10	10	10	10	10
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			No /
Lanes	1	1	0	0	1	0
Configuration		L	TR		LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT	LTR	L		TR		LTR	
v (vph)	7	0	372		0		14	
C(m) (vph)	1144	897	538				656	
v/c	0.01	0.00	0.69				0.02	
95% queue length	0.02	0.00	6.25				0.07	
Control Delay	8.2	9.0	26.3				10.6	
LOS	A	A	D				B	
Approach Delay							10.6	
Approach LOS							B	

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Kevin Paul, E.I.T.
Agency/Co.: A. D. Williams Engineering Inc
Date Performed: 16/03/2008
Analysis Time Period: Peak Hour
Intersection: Rge Rd 1-1 & Town. Road 41-0
Jurisdiction: Lacombe County
Units: U. S. Customary
Analysis Year:
Project ID: i15451.00
East/West Street: Range Road 1-1
North/South Street: Township Road 41-0
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	7	0	653	0	372	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Peak-15 Minute Volume	2	0	163	0	93	0
Hourly Flow Rate, HFR	7	0	653	0	372	0
Percent Heavy Vehicles	10	--	--	10	--	--
Median Type/Storage	Undivided /					
RT Channelized?			No			
Lanes	0	1	1	0	1	0
Configuration	LT		R	LTR		
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	372	0	0	0	0	14
Peak Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Peak-15 Minute Volume	93	0	0	0	0	4
Hourly Flow Rate, HFR	372	0	0	0	0	14
Percent Heavy Vehicles	10	10	10	10	10	10
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			No /
RT Channelized?						
Lanes	1	1	0	0	1	0
Configuration	L		TR		LTR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	0	372
Shared ln volume, major rt vehicles:	0	0
Sat flow rate, major th vehicles:	1700	1700
Sat flow rate, major rt vehicles:	1700	1700
Number of major street through lanes:	1	1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	10	10	10	10	10	10	10	10
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Grade/100			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage	4.2	4.2	7.2	6.6	6.3	7.2	6.6	6.3
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20	2.20	3.50	4.00	3.30	3.50	4.00	3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	10	10	10	10	10	10	10	10
t(f)	2.3	2.3	3.6	4.1	3.4	3.6	4.1	3.4

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				
Total Saturation Flow Rate, s (vph)				
Arrival Type				
Effective Green, g (sec)				
Cycle Length, C (sec)				
Rp (from Exhibit 16-11)				
Proportion vehicles arriving on green P				

g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x	372	653	393	386	0	712	1039	372
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process	7		8		10		11	
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s	1500		1500		1500		1500	
P(x)								
V(c,u,x)								
C(r,x)								

C(plat,x)

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	0	372
Potential Capacity	1062	656
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1062	656
Probability of Queue free St.	1.00	0.98
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	653	372
Potential Capacity	897	1144
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	897	1144
Probability of Queue free St.	1.00	0.99
Maj L-Shared Prob Q free St.	1.00	0.99
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	386	1039
Potential Capacity	536	223
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	533	222
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	393	712
Potential Capacity	552	337
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	0.99
Maj. L, Min T Adj. Imp Factor.	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.97	1.00
Movement Capacity	538	335

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	386	1039

Potential Capacity	536	223
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity	533	222

Result for 2 stage process:		
a		
y		
C t	533	222
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	393	712
Potential Capacity	552	337
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	0.99
Maj. L, Min T Adj. Imp Factor.	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.97	1.00
Movement Capacity	538	335

Results for Two-stage process:		
a		
y		
C t	538	335

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	372	0	0	0	0	14
Movement Capacity (vph)	538	533	1062	335	222	656
Shared Lane Capacity (vph)					656	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	538	533	1062	335	222	656
Volume	372	0	0	0	0	14
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						

n max								
C sh							656	
SUM C sep								
n								
C act								

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT	LTR	L		TR		LTR	
v (vph)	7	0	372		0		14	
C(m) (vph)	1144	897	538				656	
v/c	0.01	0.00	0.69				0.02	
95% queue length	0.02	0.00	6.25				0.07	
Control Delay	8.2	9.0	26.3				10.6	
LOS	A	A	D				B	
Approach Delay							10.6	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.99	1.00
v(il), Volume for stream 2 or 5	0	372
v(i2), Volume for stream 3 or 6	0	0
s(il), Saturation flow rate for stream 2 or 5	1700	1700
s(i2), Saturation flow rate for stream 3 or 6	1700	1700
P*(oj)	0.99	1.00
d(M,LT), Delay for stream 1 or 4	8.2	9.0
N, Number of major street through lanes	1	1
d(rank,1) Delay for stream 2 or 5	0.0	0.0

rr11&tr411_2033
HCS+: Unsignalized Intersections Release 5.21

TWO-WAY STOP CONTROL SUMMARY

Analyst: Kevin Paul, E.I.T.
Agency/Co.: A. D. Williams Engineering Inc
Date Performed: 16/03/2008
Analysis Time Period: Peak Hour
Intersection: Rge Rd 1-1 & Town. Road 41-1
Jurisdiction: Lacombe County
Units: U. S. Customary
Analysis Year:
Project ID: i15451.00
East/West Street: Range Road 1-1
North/South Street: Township Road 41-1
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	0	14	372	0	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR	0	0	14	372	0	0
Percent Heavy Vehicles	10	--	--	10	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	7	0	0	0	0	0
Peak Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR	7	0	0	0	0	0
Percent Heavy Vehicles	10	10	10	10	10	10
Percent Grade (%)		0			2	
Flared Approach: Exists?/Storage		No /			No /	
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR			LTR	
v (vph)	0	372		7			0	
C(m) (vph)	1572	1553		258				
v/c	0.00	0.24		0.03				
95% queue length	0.00	0.94		0.08				
Control Delay	7.3	8.0		19.3				
LOS	A	A		C				
Approach Delay				19.3				
Approach LOS				C				

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: Kevin Paul, E.I.T.
Agency/Co.: A. D. Williams Engineering Inc
Date Performed: 16/03/2008
Analysis Time Period: Peak Hour
Intersection: Rge Rd 1-1 & Town. Road 41-1
Jurisdiction: Lacombe County
Units: U. S. Customary
Analysis Year:
Project ID: i15451.00
East/West Street: Range Road 1-1
North/South Street: Township Road 41-1
Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	0	0	14	372	0	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Peak-15 Minute Volume	0	0	4	93	0	0
Hourly Flow Rate, HFR	0	0	14	372	0	0
Percent Heavy Vehicles	10	--	--	10	--	--
Median Type/Storage	Undivided /					
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	7	0	0	0	0	0
Peak Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Peak-15 Minute Volume	2	0	0	0	0	0
Hourly Flow Rate, HFR	7	0	0	0	0	0
Percent Heavy Vehicles	10	10	10	10	10	10
Percent Grade (%)		0			2	
Flared Approach: Exists?/Storage		No /			No /	
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0
Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	0	0
Shared ln volume, major rt vehicles:	14	0
Sat flow rate, major th vehicles:	1700	1700
Sat flow rate, major rt vehicles:	1700	1700
Number of major street through lanes:	1	1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1	4.1	7.1	6.5	6.2	7.1	6.5	6.2
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	10	10	10	10	10	10	10	10
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Grade/100			0.00	0.00	0.00	0.02	0.02	0.02
t(3,lt)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage	4.2	4.2	7.2	6.6	6.3	7.2	6.6	6.3
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20	2.20	3.50	4.00	3.30	3.50	4.00	3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	10	10	10	10	10	10	10	10
t(f)	2.3	2.3	3.6	4.1	3.4	3.6	4.1	3.4

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				
Total Saturation Flow Rate, s (vph)				
Arrival Type				
Effective Green, g (sec)				
Cycle Length, C (sec)				
Rp (from Exhibit 16-11)				
Proportion vehicles arriving on green P				

g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	0	14	751	751	7	751	758	0
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process	7		8		10		11	
	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s	1500		1500		1500		1500	
P(x)								
V(c,u,x)								
C(r,x)								

C(plat,x)

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	7	0
Potential Capacity	1052	1062
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1052	1062
Probability of Queue free St.	1.00	1.00
Step 2: LT from Major St.	**4**	**1**
Conflicting Flows	14	0
Potential Capacity	1553	1572
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1553	1572
Probability of Queue free St.	0.76	1.00
Maj L-Shared Prob Q free St.	0.76	1.00
Step 3: TH from Minor St.	**8**	**11**
Conflicting Flows	751	758
Potential Capacity	330	327
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.76	0.76
Movement Capacity	251	249
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	**7**	**10**
Conflicting Flows	751	751
Potential Capacity	317	317
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.76	0.76
Maj. L, Min T Adj. Imp Factor.	0.82	0.82
Cap. Adj. factor due to Impeding mvmnt	0.82	0.82
Movement Capacity	258	258

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	751	758

Potential Capacity	330	327
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.76	0.76
Movement Capacity	251	249
Result for 2 stage process:		
a		
y		
C t	251	249
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	751	751
Potential Capacity	317	317
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.76	0.76
Maj. L, Min T Adj. Imp Factor.	0.82	0.82
Cap. Adj. factor due to Impeding mvmnt	0.82	0.82
Movement Capacity	258	258
Results for Two-stage process:		
a		
y		
C t	258	258

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	7	0	0	0	0	0
Movement Capacity (vph)	258	251	1052	258	249	1062
Shared Lane Capacity (vph)		258				

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	258	251	1052	258	249	1062
Volume	7	0	0	0	0	0
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						

n max	
C sh	258
SUM C sep	
n	
C act	

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR			LTR	
v (vph)	0	372		7			0	
C(m) (vph)	1572	1553		258				
v/c	0.00	0.24		0.03				
95% queue length	0.00	0.94		0.08				
Control Delay	7.3	8.0		19.3				
LOS	A	A		C				
Approach Delay				19.3				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.76
v(il), Volume for stream 2 or 5	0	0
v(i2), Volume for stream 3 or 6	14	0
s(il), Saturation flow rate for stream 2 or 5	1700	1700
s(i2), Saturation flow rate for stream 3 or 6	1700	1700
P*(oj)	1.00	0.76
d(M,LT), Delay for stream 1 or 4	7.3	8.0
N, Number of major street through lanes	1	1
d(rank,1) Delay for stream 2 or 5	0.0	1.9