Atlantic Road & Traffic Management

Traffic Engineering Specialists

Draft Report
Traffic Impact Study

Superstore, Wal-Mart, and Kent Development
Yarmouth, Nova Scotia

Prepared for

The Plaza Group
Dartmouth, Nova Scotia

September 2004

0439

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1.0 Introduction

Background

The Plaza Group is proposing a major retail development at the existing Superstore and Kent site on Starrs Road, Yarmouth (Figure 1). The Phase 1 concept plan for 2004 includes an 81,000 square foot Superstore, a 10,000 square foot Liquor Store, an 85,000 square foot Wal-Mart Department Store, a 40,000 square foot Kent Building Supplies store, a 21,000 square foot Commercial Retail Unit (CRU) store, and the existing Shell Gas station.

Phase 2 development, expected by horizon year 2010, will include enlarging the Superstore to 115,000 square feet, and the Wal-Mart Department Store to 125,000 square feet.

Because of the magnitude of additional site generated traffic expected from the added development, a Traffic Impact Study is needed to evaluate site access needs. *The Plaza Group* has retained *Atlantic Road & Traffic Management* to complete a Traffic Impact Study (TIS) for the proposed development.

A Traffic Impact Study Usually Considers Four Questions

A TIS usually consists of four steps to answer the following questions:

1. **What are the existing traffic situations** on roads adjacent to the study site? How have traffic volumes increased historically? How many collisions have occurred during the past five years?
2. **What traffic changes are expected** at Study Area intersections? How many vehicle trips will be generated by the proposed development during peak hours, as well as for a 24 hour weekday? How will the traffic be distributed at Site entrances and exits, and to Study Area roads and intersections?
3. **What traffic impacts will occur** on Study Area roads and intersections? How will level of service at intersections be affected?
4. **What road or intersection improvements are required** to mitigate project impacts on Study Area traffic movements?

Study Objectives

The objectives of this study are:

1. To determine the number of trips generated by the existing site development;
2. To estimate the number of additional trips that will be generated by the planned 2004/05 and 2010 developments and to distribute generated trips to the Study Area;
3. To evaluate the impacts of site generated traffic on capacity and level of service of the existing site entrances;
4. To evaluate the need for a traffic signals at the Starrs Road entrance; and
5. To evaluate impacts on the existing Highway 101 / Starrs Road signalized intersection.

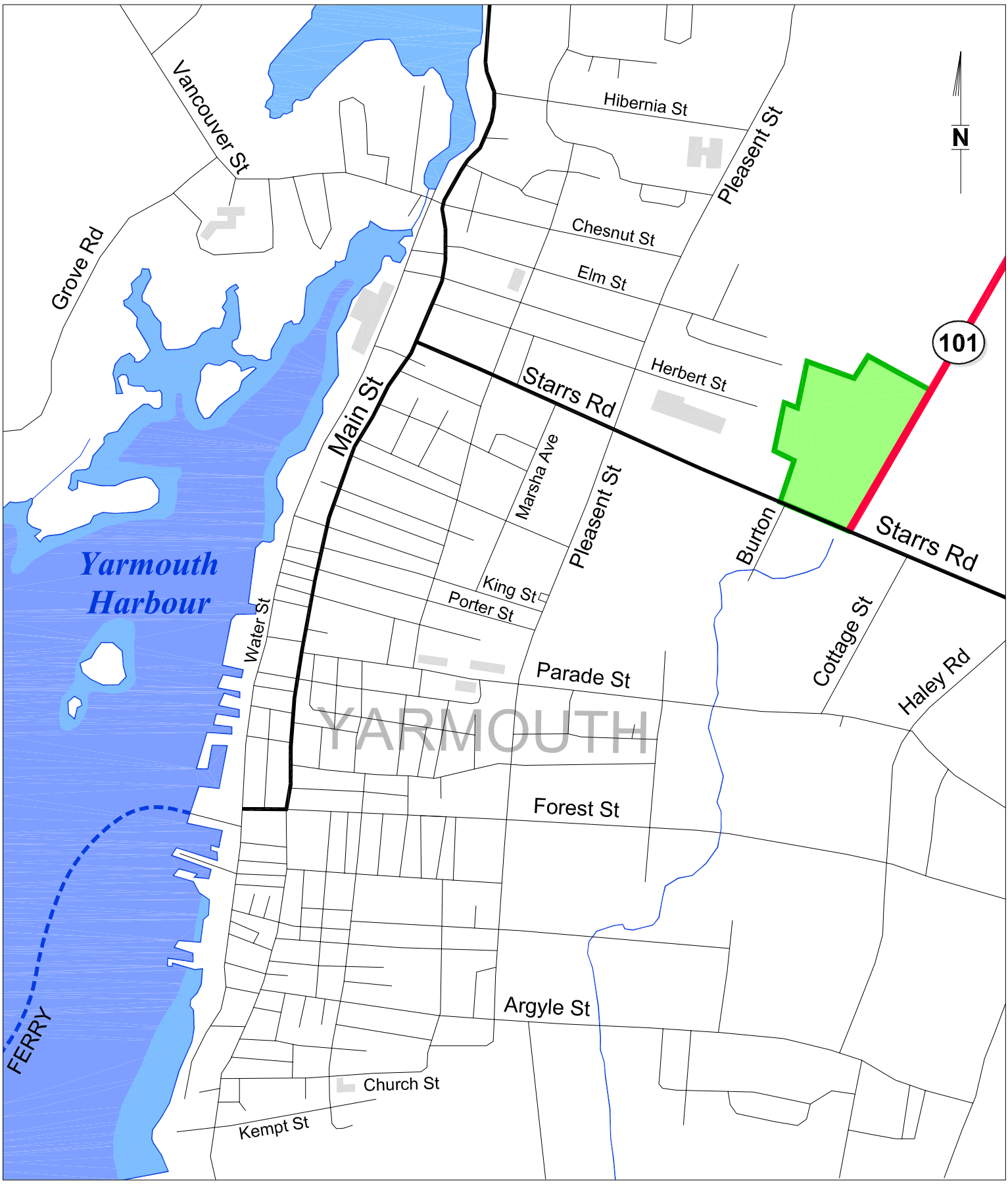
Vancouver St
Hibernia St
Pleasent St
N
Grove Rd
Chesnut St
Elm St
101
Herbert St
Starrs Rd
Main St
Marsha Ave
Pleasent St
Burton
Starrs Rd
Yarmouth Harbour
King St
Porter St
Water St
Parade St
Cottage St
Haley Rd
YARMOUTH
Forest St
Argyle St
FERRY
Church St
Kempt St

FIGURE 1

2.0 Site Descriptions

2.1 Existing Site and Street Descriptions

Existing Site Development

The development site is on the north side of Starrs Road immediately west of Highway 101 (Figure 1). The existing site is occupied by a 46,000 square foot Superstore and a 25,000 square foot Kent Building Supplies Store. The existing Kent store and part of the existing Superstore are shown on Figure 2. There is a Shell Service Station at the southwest corner that shares an entrance with Superstore.

Description of Study Area Streets and Intersections

The Study Area (Figure 2) consists of the section of Starrs Road (Trunk 3) between Highway 101 and Brooklyn Street. The existing driveway and street intersections in the Study Area are listed in Table 1. Distances in metres from the centerline of Highway 101, as well as the distances from the centerline of Brooklyn Street, to the centerline of each driveway or street, are also included in Table 1.

The Highway 101 intersection is controlled by fully actuated traffic signals and all other intersections are controlled by STOP signs or assumed stop conditions expected where a driveway meets an arterial street.

Starrs Road (Photos 1 to 4, Appendix A) is a two lane urban arterial street with curb and gutter and a concrete sidewalk on the north side and gravel shoulder and open ditch on the south side. The posted speed limit is 50 km/h. There is a two-way left turn lane throughout the section (Photos 2 and 3) with dedicated eastbound left turn lanes for Brooklyn Street (Photo 1) and Highway 101 (Photo 4).

Table 1 - Existing Driveway and Street Intersections in the Study Area

Driveway / Street	Distance from the Centerline of Highway 101 (metres)	Distance from the Centerline of Brooklyn Street (metres)
Highway 101	0	308
Kent Driveway	108	200
Superstore East Driveway	136	172
Superstore West Driveway and Shell East Driveway	187	121
Burton Avenue [1]	213	95
Shell West Driveway	228	80
Comfort Inn Driveway	248	60
Brooklyn Street [2]	308	0

NOTE:
1. Burton Avenue, a dirt street with low volumes, intersects the south side of Starrs Road at a T-intersection on, while all other intersections are T-intersections to the north side of Starrs Road.
2. Brooklyn Street is currently a gravel surfaced dead end street with very low volumes that serves as the back driveway to Comfort Inn.

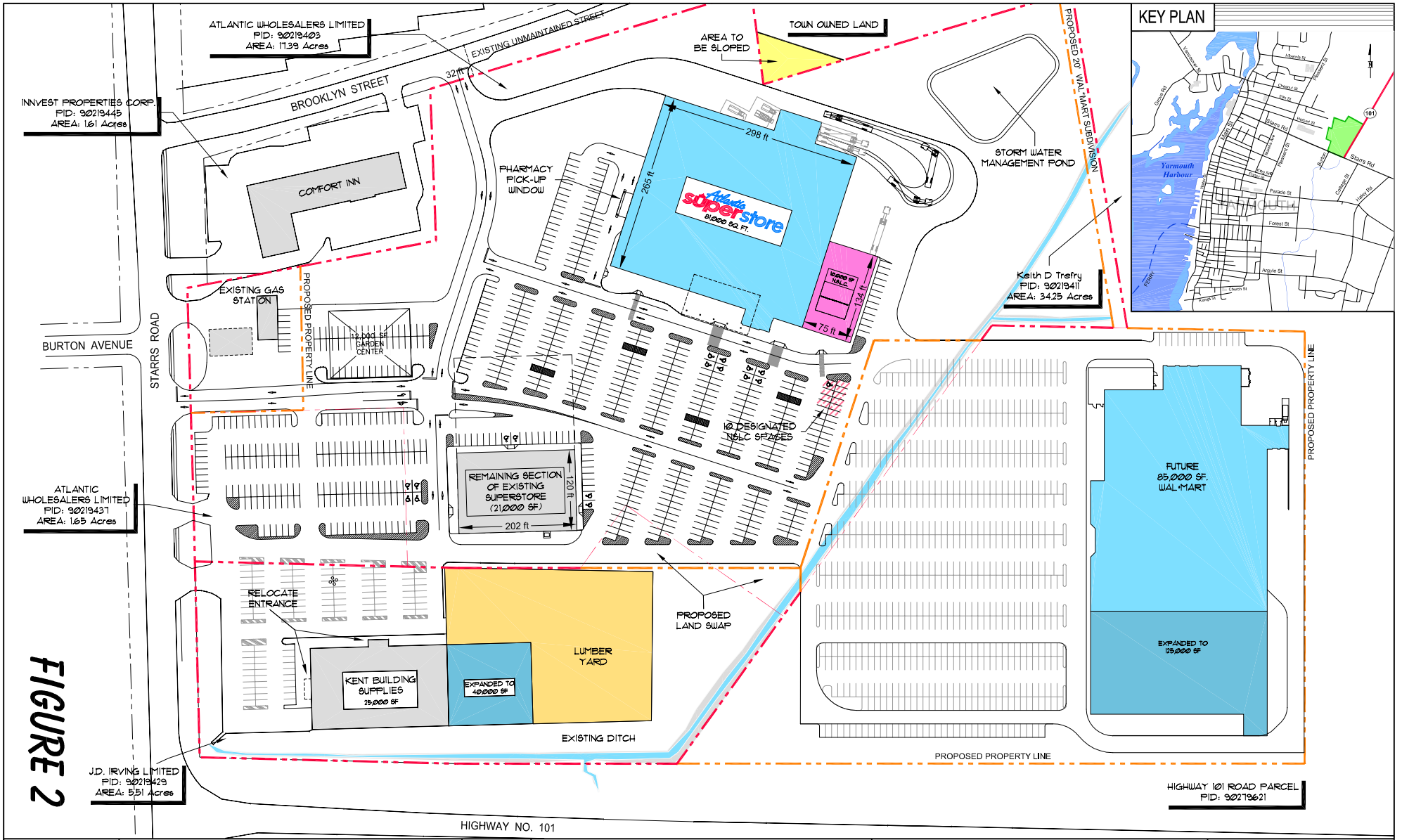

FIGURE 2

SITE ANALYSIS

	BUILDING AREA	PARKING SPACES	PARKING RATIO
SUPERSTORE (Blk) W N.S.L.C (10K)	91,000 sf	498	5.5
REMAINING SECTION OF SUPERSTORE	21,000 SF	203	9.7
WAL*MART EXPANDED TO 125k	125,000 sf	697	5.6
KENT EXPANDED To 40k	40,000 sf	117	3.0
EXISTING GAS STATION	2,000 SF	7	3.5
TOTAL	279,000 sf	1522	6.0
TOTAL ON LPL PROPERTIES	112,000 sf	701	6.3

NOTES:

- Updated as per APM site plan "238-SP1-11" dated 18/08/04

PROPOSED LOT AREAS:

SUPERSTORE	11.42 Acres
GAS BAR LOT	0.77 Acres
WAL-MART	11.29 Acres
KENT BUILDING SUPPLIES	5.41 Acres
TOTAL	34.89 Acres

100 75 50 25 0 100 200 300 400

1" = 200'

YARMOUTH, NOVA SCOTIA

SITE PLAN

PROPOSED POWER CENTRE.

DATE:

AUGUST 26th, 2004

DRAWING NO:

W02323123\8v94

VERSION 9.4

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Review of Collision History

Collision abstracts for 1999 to 2003 for the Study Section of Starrs Road between Highway 101 and Brooklyn Street, obtained from the Department of Transportation and Public Works (TPW), are summarized in Table 2. There were 14 reported collisions in the area during the five year period, including the following:

- six at the Highway 101 traffic signals;
- two at Comfort Inn involving entering or exiting vehicles;
- two at Superstore involving entering or exiting vehicles;
- four rear end collisions on Starrs Road (two at Kent; one at Superstore; one at Burton)

The collision data, summarized in Table 2, do not indicate any significant safety problem on Starrs Road in the Study Area.

Table 2 - 1999 - 2003 Collision History - Starrs Road Study Area

Year	Month	Severity	Configuration	Notes
1999	Jan	PDO	Rear End	On Starrs Road at Kent Driveway
	Mar	PDO	Right Angle	A vehicle turning left to enter the Superstore driveway was stuck by a vehicle turning left from Superstore to Starrs Road
	Apr	PDO	Rear End	At Highway 101 traffic signals; unspecified Starrs Road approach
2000	Jan	Injury	Left Turn Right Angle	A vehicle turning left to Comfort Inn during a snow storm (white-out conditions) was struck by a westbound vehicle
	Sep	PDO	Rear End	At Superstore; unspecified Starrs Road approach
	Dec	Injury	Rear End	At Highway 101 traffic signals; westbound Starrs Road approach
2001	Aug	PDO	Rear End	At Highway 101 traffic signals; unspecified Starrs Road approach
	Nov	PDO	Passing; Right Turn	At Comfort Inn: possibly involved a vehicle turning left from Comfort Inn to Starrs Road eastbound
	Nov	PDO	Left Turn Right Angle	At Highway 101 traffic signals; left turning vehicle failed to yield
2002	Jan	PDO	Right Angle	At Highway 101 traffic signals; westbound vehicle on Starrs Road failed to stop for red light
	Feb	Injury	Rear End	At Highway 101 traffic signals; westbound approach
	Sep	PDO	Rear End	Near Kent; involved two westbound vehicles
2003	Jan	PDO	Left Turn Sideswipe	At Superstore; during a snow storm; vehicle exiting left from Superstore was struck by an eastbound vehicle
	Sep	PDO	Rear End	At Burton Avenue; unspecified Starrs Road approach

NOTE: PDO indicates Property Damage Only

Machine Traffic Counts

Machine traffic counts were obtained by TPW on Starrs Road during September 2003. Counts were obtained 'just west of Highway 101' and 'just east of Pleasant Street'. Tabulated hourly volumes for the two counts are included in Tables A-1 and A-2, Appendix A. The 2003 Annual Average Daily Traffic (AADT) volume on Starrs Road in the

Study Area just west of Highway 101 was estimated to be 16,300 vehicles per day (vpd) and the average weekday volume was 19,700 vpd. The average weekday hourly volumes for the two count locations are shown graphically in Figure A-1, Appendix A. Comparison of Friday and Saturday hourly volumes on Starrs Road in the Study Area, shown graphically in Figure A-2, indicates the Friday hourly volumes are generally higher than Saturday volumes.

Manual Turning Movement Counts

Manual turning movement counts were obtained at seven Study Area Starrs Road intersections (Table 3) on Wednesday to Friday, July 21 to 23, 2004. Counts were obtained in 15 minute increments from 7:00 AM to 9:00 AM, 11:30 AM to 1:30 PM; and 3:30 PM to 5:30 PM, and are tabulated in Tables A-3 to A-6, Appendix A. AM, Noon, and PM peak hour counts are indicated by shaded areas on these tables. The counts obtained on a Friday in July indicated Starrs Road two-way volumes of about 1270 vehicles per hour (vph) in the Study Area, and Highway 101 volumes of about 335 vph, during the PM peak hour.

Table 3 - Manual Turning Movements Counts in the Study Area

Driveway / Street	Date Counted	Data Table
Highway 101	Friday, July 23	A-3
Kent Driveway	Thursday, July 22	A-4
Superstore East Driveway	Thursday, July 22	A-4
Superstore West Driveway and Shell East Driveway	Thursday, July 22	A-5
Shell West Driveway	Thursday, July 22	A-5
Comfort Inn Driveway	Wednesday, July 21	A-6
Brooklyn Street [2]	Wednesday, July 21	A-6

Estimated 2004 Design Hourly Volumes (DHVs)

Since AM or Noon peak hour traffic is rarely a concern at retail sites, and since machine counts indicate that Friday hourly volumes on Starrs Road are generally higher than Saturday volumes, this Study will consider only weekday PM peak hours. Machine count data (Tables A-1 and A-2) indicates that Friday volumes, which are the highest volumes of any day of the week, are about 10% higher than Thursday volumes. Since the counts at the Superstore / Kent site entrances were obtained on a busy Summer Thursday, the counted PM peak hourly volumes entering and exiting the site have been increased by 10% to provide an estimation of the 2004 design hourly volume (DHV).

Estimated DHVs for intersections that serve the existing Superstore and Kent site have been tabulated in Table 4. During the 2004 DHV, the three driveways serving Superstore and Kent have a combined two-way volume of 580 vehicles per hour (vph), with 285 vph entering and 295 vph exiting the Site. Review of the turning volumes indicates that 44% of trips are to/from the east and 56% of trips are to/from the west.

The traffic impact study will include evaluation of four locations on Starrs Road in the Study Area:

1. Highway 101intersection;
2. A site entrance that combines the two existing east driveways to Kent and Superstore;
3. The existing Superstore / Shell entrance; and
4. Brooklyn Street intersection.

The 2004 DHVs for the four intersections, without site development changes, are shown on Figure B-1, Box A, in Appendix A.

Calculation of 2010 Design Hourly Volumes

Since experience with other traffic studies indicates that traffic volumes generally increase by about 2% per year, an annual growth rate of 2% has been assumed for projection of horizon year background traffic volumes. The 2004 DHVs for through volumes on Starrs Road and Highway 101 for the Study Area intersections (Figure A-7, Box A) have been increased by 12% (2% per year) to provide projected 2010 DHVs shown in Figure B-1, Box B. Volumes shown in Figure B-1 do not include any traffic or street changes from the proposed developments.

Table 4 - Trips Generated by the Existing Superstore / Kent Site during the 2004 Design Hour

Vehicles Entering / Exiting Superstore / Kent Site during the PM Design Hourly Volume (DHV)

Time	Entering Traffic (Vehicles/Hour)									Exiting Traffic (Vehicles/Hour)								
	Kent		Superstore		Superstore Shell		Shell		Total	Kent		Superstore		Superstore Shell		Shell		Total
	RT	LT	RT	LT	RT	LT	RT	LT		LT	RT	LT	RT	LT	RT	LT	RT	
Movement Totals	65	25	25	30	45	95	5	15	305	50	30	40	50	30	95	10	25	330
From / To East	65		25		45		5		140	50		40		30		10		130
From / To West	25		30		95		15		165	30		50		95		25		200
Total In or Out	90		55		140		20		305	80		90		125		35		330
% Total In or Out	30		18		46		7		100	24		27		38		11		100

PM Peak Hour Two-Way Volumes Using the Three Driveways

Vehicles	170	145	265	-	580
%	29	25	46	-	100

PM Peak Hour Trip Distribution - East and West of Site

PM Peak Hour Trip Distribution East and West of Site	East	West	Total
Entering Vehicles	135	150	285
Exiting Vehicles	120	175	295
Total Two-Way Vehicles	255	325	580
Percent of Trips	44	56	100

NOTES

1. The counted driveway volumes (Tables A-4 and A-5), obtained during the PM peak hour on a busy Summer Thursday afternoon, have been increased by 10% and rounded to the nearest 5 vehicles per hour (vph) to provide an estimate of the 2004 PM design hourly volume (DHV).
2. For this Study it has been assumed that volumes using the western Shell driveway will not be affected by the proposed development changes.
3. During the 2004 weekday PM design hourly volume (DHV), the three driveways serving Superstore and Kent have a two-way DHV of 580 vph, with 285 vph entering and 295 vph exiting the Site.
3. **44%** of trips are to/from the **east**
4. **56%** of trips are to/from the **west**

2.2 Descriptions of the Proposed Development

Proposed Development

The Phase 1 concept plan (Figure 2) for 2004 includes an 81,000 square foot Superstore, a 10,000 square foot Liquor Store, an 85,000 square foot Wal-Mart Department Store, a 40,000 square foot Kent Building Supplies store, a 21,000 square foot Commercial Retail Unit (CRU), and the existing Shell Gas station.

Phase 2 development, expected by horizon year 2010, will include enlarging the Superstore to 115,000 square feet, and the Wal-Mart Department Store to 125,000 square feet. Other site changes are not expected during Phase 2.

Proposed Site Accesses

The Site will be served by three accesses:

1. Kent Entrance (secondary site entrance from combination of two existing east driveways to Kent and Superstore);
2. Primary Site Entrance (existing Superstore / Shell entrance); and
3. Brooklyn Street Entrance (secondary site entrance and Truck entrance for Superstore and Wal-Mart.

Design of Driveway Entrances

The design of site driveways will include details of number of lanes, lane widths, and traffic signal design. The Primary Entrance will be four lanes wide, with two exiting and two entering lanes.

The *Geometric Design Guide for Canadian Roads* (Transportation Association of Canada, 1999), indicates the desirability of providing a 'no conflict' or storage zone on major driveways. The suggested minimum length for this zone, commonly referred to as the 'clear throat', is 40 metres for arterial road entrance to a large supermarket (Table 3.2.9.3 and Figure 3.2.5.2). The design of the Primary Entrance driveway will include consideration of the required clear throat.

Potential Brooklyn Street Extension

The Town of Yarmouth is considering extension of Brooklyn Street north to connect with Herbert Street or Elm Street. If this connection is completed at some time in the future, it will provide an alternate access for traffic from areas north of Starrs Road, and reduce some of the traffic demands on the Starrs Road site entrances.

Potential Burton Avenue Relocation

Burton Avenue intersects with the south side of Starrs Road at T-intersection about 26 metres west of the centerline of the Primary Entrance to the Site. It is understood that the Town of Yarmouth has considered the possibility of realigning Burton Avenue so that it meets Stars Road opposite the Primary Entrance so as to create a four-way intersection. A decision should be made concerning this re-alignment before the final intersection design plans are prepared for the Primary Entrance intersection.

3.0 Trip Generation, Distribution and Assignment

Trip Generation, Distribution, and Assignment Process

The Trip Generation, Distribution and Assignment processes for this Study include the following steps:

1. Prepare trip generation estimates - How many new trips will the Site generate during Phase 1 and Phase 2 development in addition to trips generated by the existing 46,000 square foot Superstore and the 25,000 square foot Kent store? How many trips will be generated by each of the individual land uses on the site during the two proposed development phases?
2. Estimate new external trips generated by the Site - How many trips generated by the individual land uses involve on-site cross-shopping trips?
3. Calculate external trips by trip types - How many external trips are pass-by or primary trips?
4. Estimate trip distribution - How will external trips be distributed to the trade area for the development?
5. Assign trips to intersections - How will site trips travel through the proposed site entrance intersections and adjacent street intersections?

Phase 1 (2004) Trip Generation Estimates are Based on Gross Floor Area

Trip Generation, 7th Edition (Institute of Transportation Engineers (ITE), Washington, 2003) contains trip generation rates for various land uses which are usually recorded as 'trips per 1000 square feet of Gross Floor Area (GFA)'. Since AM peak hour traffic is rarely a concern at retail sites, this evaluation will consider only weekday PM peak hours.

Phase 1 (2004) trip generation estimates for individual land uses proposed for the development have been calculated using trip generation rates from *Trip Generation, 7th Edition.* Land use descriptions, ITE codes, unit sizes, trip generation rates, and trip generation estimates for a weekday PM peak hour, for individual land uses are included in Table 5.

The first phase of the proposed Superstore store will have a gross floor area (GFA) of 81,000 square feet, consisting of 50,000 square feet of Supermarket and 31,000 square feet of general merchandise. Since trips generated by the existing 46,000 square foot Superstore are included in the existing turning movement volumes at the Starr's Road entrances, this Study will consider trip generation for the Phase 1 Superstore for an additional 4,000 square feet of supermarket and 31,000 square feet of general merchandise similar to the Free-Standing Discount Store described in *Trip Generation* Land Use Code 815.

Since trips generated by the existing 25,000 square foot Kent store are included in the existing turning movement volumes at the Starr's Road entrances, this Study will consider trip generation for the additional planned 15,000 square foot expansion.

Table 5 - Trip Generation Estimates for Individual Land Uses for Phase 1

Land Use	ITE Land Use [1]	Size [4]	Trip Generation Rates [1]			T, Trips Generated		
			Trips/Hour per 1000 GFA [5]			Peak Hour [6]		
			2-Way	In	Out	2-Way	In	Out
Supermarket [2]	850	4	10.45	5.33	5.12	42	21	20
Discount Store [3]	815	31	5.06	2.53	2.53	157	78	78
Liquor Store [7]	-	10	25	12.5	12.5	250	125	125
CRU [8]	867	21	3.4	1.8	1.6	71	38	34
Home Improvement [9]	862	15	2.45	1.15	1.3	37	17	20
Discount Store [10]	815	85	5.06	2.53	2.53	430	215	215
Total Trips for Individual New Land Uses for Phase 1						987	494	492
Trips Generated by the Existing Site Development (Table 4)						580	285	295
Total Existing + New Trips for Individual Land Uses Phase 1						1567	779	787

NOTES:
1. Trip generation rates were extracted from *Trip Generation, 7th Edition* (Institute of Transportation Engineers, 2003).
2. Trip generation rates for Land Use 850 are based on Supermarkets that generally average 56,000 GFA. Phase 1 of the proposed store will consist of 50,000 square feet of supermarket space, with residual space being used for general merchandise. Since trips generated by the existing 46,000 square foot Superstore are included in the existing site access counts, this Study will include trips generated by an additional 4,000 square feet of supermarket space.
3. Trip estimates for Superstore for GFA beyond 50,000 square feet have been calculated using rates for Free-Standing Discount Store (Land Use 815) to simulate general retail usage. This part of the Supermarket building will account for 31,000 square feet of the 81,000 square foot building in Phase 1.
4. The size of the land use is indicated as number of '1000 square feet Gross Floor Area (GFA)'
5. Rates indicate 'trips per 1000 square feet GFA' for a weekday PM peak hour between 4:00 and 6:00 PM.
6. The directional splits for Entering and Exiting traffic are from *Trip Generation*.
7. Trip generation rates for Liquor Store were developed by *ARTM* from counts taken for other studies
8. This is a Commercial Retail Unit (CRU) which will occupy part of the existing Superstore building.
9. Since trips generated by the existing 25,000 square foot Kent store are included in the existing site access counts, this Study will include only additional trips generated by the proposed 15,000 square foot addition.
10. This is a Wal-Mart Department Store.

Phase 1 (2004) Trip Estimates are Reduced to Adjust for Cross-Shopping Trips

Trips generated by a mixed use development are usually affected by *cross-shopping* or 'on-site synergy' which represents internal site trips. Since there will be four 'big box' land uses, a liquor store and a gas station on the site, cross shopping will account for a significant number of the trips generated by the individual land uses. Estimates of trips generated by the 'big boxes' , Liquor Store and existing site generated trips will be reduced by 20%, to account for cross shopping between businesses throughout the site.

Estimates of the 'Adjusted Trips Generated' for Phase 1 are recorded in Table 6. These are the additional external trips that will be generated by the initial phase of the development.

Table 6 - Phase 1 Trips Adjusted for Cross - Shopping and On-Site Synergies

Land Use	Cross Shopping Adjustment Percent [1]	Gross Trips Generated [2]		Adjusted Trips Generated [3]	
		PM Peak Hour		PM Peak Hour	
		In	Out	In	Out
Total Trips for Individual New Land Uses for Phase 1 (Table 5)	25	494	492	371	369
Existing Development [4]	25	285	295	214	221
Phase 1 Existing + New Trips Adjusted for Cross-Shopping				585	590
Less Existing External Trips Generated by the Site (Table 4)				285	295
Additional External Trips Generated by the Site in Phase 1 [5]				300	295

NOTES:
1. Due to the size and diversity of this multi-use development, many trips will originate and end within the site without impacting traffic volumes on site entrances. Trips generated by individual land uses have been reduced to account for cross-shopping and on-site synergies.
2. Total trips generated by individual land uses (Table 5).
3. Estimated 'external' site generated trips after adjustment for cross-shopping and on-site synergies.
4. While the existing site development offers few opportunities for cross-shopping, the redeveloped site will promote cross-shopping for both the existing and new trips attracted to the site.
5. This is an estimate of the number of additional trips that will enter and exit the site after completion of Phase 1 development.

Types of External Trips Generated by the Site for Phase 1 (2004)

Two types of external trips are included in traffic generated by the proposed development - *Pass-by* and *Primary Trips*.

Pass-by trips are those which are made as 'intervening opportunity' stops by vehicles already passing by the site on an adjacent street. Although these trips will be included in the driveway volumes to the site, they will not increase the overall traffic volumes on Study Area streets. While pass-by traffic generally represents a significant component of trips attracted to retail land uses, future traffic volumes on adjacent streets and land use types must be considered when determining appropriate pass-by percentages to use for each Study Area.

Trip Generation Handbook (Institute of Transportation Engineers, 2001) contains records of pass-by percentages for different land uses. Average typical pass-by percentages for PM peak hours include Discount Store (17%), Shopping Center (34%), Gas Bar (56%); Supermarket (36%); and Home Improvement Store (48%). A pass-by rate of 30% has been assumed for all new external trips attracted to the Site.

Primary trips are trips made specifically to shop at the businesses in the development. Numbers of external trips (pass-by and primary) entering and exiting each land use for the PM peak hour are shown in Table 7.

Table 7 - External Trips (Pass-By and Primary) for Phase 1

Usage	% Pass-By Trips [1]	Adjusted New Trips Generated [2]		Pass-By Trips [3]		Primary Trips	
		In	Out	In	Out	In	Out
New External Trips (Table 6)	30	300	295	90	90	210	205

NOTES: 1. Estimated percentages for Pass-By Trips from Starrs Road.
2. Estimated new 'external' site generated trips after adjustment for cross-shopping and on-site synergies (Table 6).
3. Pass-By Trips have been adjusted so that exiting trips equal entering trips.

Phase 2 (2010) Trip Generation Estimates

Trip generation estimates have been prepared for Phase 2 development with expansion of both Superstore and Wal-Mart considered to be completed by 2010. Wal-Mart will be enlarged from 88,000 square feet to 125,000 square feet, and the Phase 2 Superstore will have a GFA of 115,000 square feet, consisting of 60,000 square feet of Supermarket and 55,000 square feet of general merchandise. Since trips generated by the existing 46,000 square foot Superstore are included in the existing turning movement volumes at the Starrs Road entrances, this Study will consider trip generation for the Phase 2 Superstore for an additional 14,000 square feet of supermarket and 55,000 square feet of general merchandise similar to the Free-Standing Discount Store described in *Trip Generation* Land Use Code 815. Cumulative trip generation estimates for individual land uses for Phase 2 development are included in Table 8.

Adjustments for Cross-Shopping Trips and Calculation of Pass-By and Primary Trips for Phase 2 (2010)

Phase 2 adjustments for cross-shopping have used the same percentage reductions for individual land uses as were used in Phase 1 (Table 6). Phase 2 adjusted trips, the external trips that will be generated by the development, are included in Table 9. The same pass-by percentages used in Phase 1 (Table 7) have been used to calculate pass-by and primary trips for Phase 2 (Table10).

Trip Distribution

Review of existing traffic volumes at the site entrance intersections on Starrs Road (Table 4) indicates that the existing traffic distribution is 44% to the east and 56% to the west. With the development of significantly increased retail space, and a greater mix of land uses, it is expected that the directional split for both Phase 1 and Phase 2 developments will be 50% to the east and 50% to the west.

Intersections Included in Traffic Evaluation for the Redeveloped Site

Four Starrs Road intersections are included in the traffic evaluation for the redeveloped site:

1. Highway 101
2. Secondary Site Entrance (combination of two existing east driveways to Kent and Superstore);
3. Primary Site Entrance (existing Superstore / Shell entrance);
4. Brooklyn Street (secondary site entrance and Truck entrance for Superstore and Wal-Mart.

Table 8 - Cumulative Trip Generation Estimates for Individual Land Uses for Phase 2

Land Use	ITE Land Use [1]	Size [4]	Trip Generation Rates [1]			T, Trips Generated		
			Trips/Hour per 1000 GFA [5]			Peak Hour [6]		
			2-Way	In	Out	2-Way	In	Out
Supermarket [2]	850	14	10.45	5.33	5.12	146	75	72
Discount Store [3]	815	55	5.06	2.53	2.53	278	139	139
Liquor Store [7]	-	10	25	12.5	12.5	250	125	125
CRU [8]	867	21	3.4	1.8	1.6	71	38	34
Home Improvement [9]	862	15	2.45	1.15	1.3	37	17	20
Discount Store [10]	815	125	5.06	2.53	2.53	633	316	316
Total Trips for Individual New Land Uses for Phase 2						1415	710	706
Trips Generated by the Existing Site Development (Table 4)						580	285	295
Total Existing + New Trips for Individual Land Uses Phase 2						1995	995	1001

NOTES:
1. Trip generation rates were extracted from *Trip Generation, 7th Edition* (Institute of Transportation Engineers, 2003).
2. Trip generation rates for Land Use 850 are based on Supermarkets that generally average 56,000 GFA. Phase 2 of the proposed store will consist of 60,000 square feet of supermarket space, with residual space being used for general merchandise. Since trips generated by the existing 46,000 square foot Superstore are included in the existing site access counts, this Study will include trips generated by an additional 14,000 square feet of supermarket space.
3. Trip estimates for Superstore for GFA beyond 60,000 square feet have been calculated using rates for Free-Standing Discount Store (Land Use 815) to simulate general retail usage. This part of the Supermarket building will account for 55,000 square feet of the 81,000 square foot building in Phase 2.
4. The size of the land use is indicated as number of '1000 square feet Gross Floor Area (GFA)'
5. Rates indicate 'trips per 1000 square feet GFA' for a weekday PM peak hour between 4:00 and 6:00 PM.
6. The directional splits for Entering and Exiting traffic are from *Trip Generation*.
7. Trip generation rates for Liquor Store were developed by *ARTM* from counts taken for other studies
8. This is a Commercial Retail Unit (CRU) which will occupy part of the existing Superstore building.
9. Since trips generated by the existing 25,000 square foot Kent store are included in the existing site access counts, this Study will include only additional trips generated by the proposed 15,000 square foot addition.
10. This is a Wal-Mart Department Store.

Trip Assignment 2004 and 2010

External site generated trips for Phase 1 (Table 7) and Phase 2 (Table 10) have been distributed with 50% to the west, 40% to the east and 10% to Highway 101. Trips have been assigned to the three site entrances in relation to direction of travel and site layout:

- *WB entering trips* - 50% Kent; 50% Primary; 0% Brooklyn;
- *EB exiting trips* - 20% Kent; 80% Primary; 0% Brooklyn;
- *EB entering trips* - 30% Brooklyn; 60% Primary; 10% Kent;
- *WB exiting trips* - 30% Brooklyn; 60% Primary; 10% Kent.

Phase 1 traffic volume changes at Study Area intersections are illustrated diagrammatically in Figure B-2, Box A, Appendix B. They include redistribution of existing site generated trips (Figure B-1, Box A) caused by both access and site layout changes, as well as the assignment of Phase 1 generated pass-by and new primary trips (Table 7). Phase 1 volume changes have been added to existing 2004 DHVs (Figure B-1, Box A) to produce estimated 2004 intersection volumes (Figure B-3, Box A) that include Phase 1 generated trips.

Phase 2 traffic volume changes at Study Area intersections are illustrated diagrammatically in Figure B-2, Box B, Appendix B. They include redistribution of existing site generated trips (Figure B-1, Box B) caused by both access and site layout changes, as well as the assignment of Phase 2 generated pass-by and new primary trips (Table 10). Phase 2 volume changes have been added to projected 2010 DHVs (Figure B-1, Box B) to produce projected 2010 intersection volumes (Figure B-3, Box B) that include Phase 2 generated trips .

Table 9 - Phase 2 (2010) Trips Adjusted for Cross - Shopping and On-Site Synergies

Land Use	Cross Shopping Adjustment Percent [1]	Gross Trips Generated [2]		Adjusted Trips Generated [3]	
		PM Peak Hour		PM Peak Hour	
		In	Out	In	Out
Total Trips for Individual New Land Uses for Phase 2 (Table 8)	25	710	706	533	530
Existing Development [4]	25	285	295	214	221
Phase 1 Existing + New Trips Adjusted for Cross-Shopping				747	751
Less Existing External Trips Generated by the Site				285	295
Additional External Trips Generated by the Site in Phase 1 [5]				462	456

NOTES:
1. Due to the size and diversity of this multi-use development, many trips will originate and end within the site without impacting traffic volumes on site entrances. Trips generated by individual land uses have been reduced to account for cross-shopping and on-site synergies.
2. Total trips generated by individual land uses (Table 8).
3. Estimated 'external' site generated trips after adjustment for cross-shopping and on-site synergies.
4. While the existing site development offers few opportunities for cross-shopping, the redeveloped site will promote cross-shopping for both the existing and new trips attracted to the site.
5. This is an estimate of the number of additional trips that will enter and exit the site after completion of Phase 1 development.

Table 10 - External Trips (Pass-By and Primary) for Phase 2

Usage	% Pass-By Trips [1]	Adjusted New Trips Generated [2]		Pass-By Trips [3]		Primary Trips	
		In	Out	In	Out	In	Out
New External Trips (Table 6)	30	462	456	139	139	323	317

NOTES:
1. Estimated percentages for Pass-By Trips from Starrs Road.
2. Estimated new 'external' site generated trips after adjustment for cross-shopping and on-site synergies (Table 9).
3. Pass-By Trips have been adjusted so that exiting trips equal entering trips.

4.0 Signal Warrant Analysis

Traffic Signal Warrant Principles

A signal warrant analysis is completed to determine if the installation of traffic signals at an intersection will provide a positive impact on total intersection operation. That is, the benefits in time saved and improved safety that will accrue to vehicles entering from a side street will exceed the negative impact that signals will have in time lost and potential additional collisions for vehicles approaching the intersection on the main street.

The *Canadian Traffic Signal Warrant Procedure* (*Transportation Association of Canada (TAC)* considers 100 warrant points as an indication that traffic signals will provide a positive impact. The signal warrant analysis uses six peak hours of vehicular and pedestrian volumes, and intersection, roadway and study area characteristics to calculate a warrant point value.

2004 and 2010 Volumes Without Additional Development

Volumes without additional development - Six hours of volume data without additional site generated trips were estimated for the Primary Site Entrance intersection (Superstore / Shell) for 2004 and 2010. The 2004 volumes were calculated using the manual count data (Tables A-3 to A-6) and 2010 volumes were estimated by projecting 2004 volumes using 2% annual growth rate for Starrs Road through traffic. Signal warrant analyses work sheets for 2004 and 2010 'without' volumes are included in Tables C-1 and C-2, Appendix C.

2004 and 2010 Volumes for Primary Site Entrance and Brooklyn Street Intersections with Additional Development

Volumes with additional development - Additional 2004 and 2010 PM peak hour pass-by and new primary trips intersection by additional development, included in Table 7 (2004) and Table 10 (2010), were used to estimate pass-by and primary trips for other hours as a percentage of the PM peak hour values. The six hour manual counts obtained during this Study indicate the following relationship for site generated trips during hours of the day relative to the PM peak hour:

- Hour 1 (7:00 AM to 8:00 AM) 20% PM peak hour
- Hour 2 (8:00 AM to 9:00 AM) 40% PM peak hour
- Hour 3 (11:30 AM to 12:30 PM) 85% PM peak hour
- Hour 4 (12:30 PM to 1:30 PM) 80% PM peak hour
- Hour 5 (3:30 PM to 4:30 PM) 85% PM peak hour
- Hour 6 (4:30 PM to 5:30 PM) 100% PM peak hour.

Intersection hourly volumes required for signal warrant analyses were calculated by assigning the pass-by and primary trips calculated for each hour to appropriate intersection turning movements, and then adding existing hourly site generated trips that have been redistributed to account for changes in both access and site layout.

Signal warrant analyses work sheets for 2004 and 2010 'with' volumes are included in Tables C-3 and C-3 (Primary Entrance) and Tables C-5 and C-6 (Brooklyn Street) Starrs Road intersections. Analyses results are summarized in Table 11.

Table 11 - Summary of Signal Warrant Analyses for Starrs Road Intersections

Year	Primary Entrance			Brooklyn Street		
	Table	Points	Warrant Met ?	Table	Points	Warrant Met ?
Analyses for 2004 and 2010 Without Addition of Site Development Traffic						
2004	C-1	32	No	-	-	-
2010	C-2	57	No	-	-	-
Analyses for 2004 and 2010 With Addition of Site Development Traffic						
2004	C-3	129	Yes	C-5	24	No
2010	C-4	202	Yes	C-6	35	No

Summary of Signal Warrant Analysis Results

Signal warrant analyses indicate the following:

1. With normal traffic growth, and without additional site generated trips, traffic signals will not be warranted at the Primary Entrance during 2004 or 2010.
2. With additional site generated trips form Phase 1 development, traffic signals will be warranted at the Primary Entrance during 2004.
3. Traffic signals will not be warranted at Brooklyn Street intersection during either 2004 or 2010.

5.0 Intersection Performance

Intersection Level of Service Analysis

The level or quality of performance of an intersection in terms of traffic movement is determined by a level of service (LOS) analysis. LOS for intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and increased travel time.

Table 12 - Level of Service (LOS) Criteria for Intersections

LOS	Signalized Intersections Control Delay (seconds per vehicle)	LOS Description	Two Way Stop Controlled (TWSC) Intersections Control Delay (seconds per vehicle)
A	less than 10.0	Very low delay; most vehicles do not stop **(Excellent)**	less than 10.0
B	between 10.0 and 20.0	Higher delay; more vehicles stop **(Very Good)**	between 10.0 and 15.0
C	between 20.0 and 35.0	Higher level of congestion; number of vehicles stopping is significant, although many still pass through intersection without stopping **(Good)**	between 15.0 and 25.0
D	between 35.0 and 55.0	Congestion becomes noticeable; vehicles must sometimes wait through more than one red light; many vehicles stop **(Satisfactory)**	between 25.0 and 35.0
E	between 55.0 and 80.0	Vehicles must often wait through more than one red light; considered by many agencies to be the limit of **acceptable** delay	between 35.0 and 50.0
F	greater than 80.0	This level is considered to be unacceptable to most drivers; occurs when arrival flow rates exceed the capacity of the intersection **(Unacceptable)**	greater than 50.0

LOS Criteria

LOS criteria (Table 12) are stated in terms of average control delay per vehicle which includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. LOS 'A' describes an intersection approach with a very low control delay of up to ten seconds per vehicle. On the other hand, LOS 'F' describes an intersection with control delay greater than 80 seconds for signalized intersections (50 seconds for unsignalized), considered unacceptable by most drivers.

LOS Analyses - 2004 to 2010

Since commercial sites that contain large box retail stores, such as Superstore and Wal-Mart, do not generate significant volumes during the AM peak hour, PM peak hour volume projections have been used as the Design Hourly Volumes (DHV's) for all level of service (LOS) evaluations in this Study. LOS analyses have been completed using *Synchro 6.0 / SimTraffic 6.0* software.

Level of service (LOS) analyses have been completed for 2004 and 2010 both 'without' and 'with' additional site generated traffic for the following Starrs Road intersections:

1. Highway 101 signalized intersection;
2. Kent Entrance (secondary site entrance; combination of two existing east driveways to Kent and Superstore);
3. Primary Entrance (reconstructed Superstore / Shell entrance);
4. Brooklyn Street Entrance (secondary site entrance and Truck entrance for Superstore and Wal-Mart.

Analyses Include Traffic Signals at the Primary Site Entrance

LOS analyses for scenarios that include additional site generated traffic have been completed for traffic signal control with a separate left turn phase for the eastbound approach and a right turn lane for the westbound approach at the Primary Entrance. Brooklyn Street and the secondary entrances have been analyzed with STOP sign control. For 2010 analyses, a separate left turn phase has been added at Highway 101. Also, analyses have been completed with an additional westbound through lane on Starrs Road at Highway 101 and the Kent entrance. LOS analysis sheets are included in Appendix C and results are summarized in Tables 13, 14, 15 and 16.

Table 13 - Summary Level of Service Analyses Results - Highway 101 Intersection

Year Scenario Page Number	LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement						Intersection LOS
		EB-L	EB-T	WB-T	WB-R	SB-L	SB-R	
2004 Without Development Page C-7	Delay	7.9	4	5.3	1.4	18.8	6.7	5.4
	LOS	A	A	A	A	B	A	A
	v/c	0.4	0.33	0.5	0.08	0.21	0.26	-
	Queue	15.7	29.1	52.6	4.1	13.9	9.4	-
2004 With Development Page C-11	Delay	8.3	4	5.4	1.4	23.7	7.4	5.6
	LOS	A	A	A	A	C	A	A
	v/c	0.46	0.38	0.55	0.08	0.22	0.33	-
	Queue	19.6	36.2	64	4.2	17.3	12.4	-
2010 Without Development C-15	Delay	6.9	3.6	14.4	4.8	30.9	8.9	10.0
	LOS	A	A	A	A	C	A	B
	v/c	0.39	0.35	0.66	0.11	0.26	0.31	-
	Queue	13.9	35.1	129.3	10.6	19.8	12.1	-
2010 With Development C-19	Delay	19.6	4.3	18.9	1.4	34.1	8.3	13.1
	LOS	B	A	B	A	C	A	B
	v/c	0.56	0.43	0.78	0.09	0.28	0.41	-
	Queue	32.8	48.9	186.9	4.9	19.8	14.2	-
2010 With Development & WB Lane C-23	Delay	5	5	11.5	0.9	21.9	6.3	8.3
	LOS	A	A	B	A	C	A	A
	v/c	0.36	0.47	0.48	0.09	0.21	0.34	-
	Queue	11.1	48.7	55.8	3.4	15.4	11.8	-

Table 14 - Summary Level of Service Analyses Results - Combined Kent East Intersections

Year Scenario Page Number	LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m)						Intersection LOS
		EB-L	EB-T	WB-T	WB-R	SB-L	SB-R	
2004 Without Development Page C-8	Delay	10.5	0	0		125.7	17.6	9.5
	LOS	B	A	A		F	C	A
	v/c	0.08	0.29	0.46		0.88	0.23	-
	Queue	2.1	0	0		40	6.8	-
2004 With Development Page C-12	Delay	11.3	0	0		69.9	18	3.0
	LOS	B	A	A		F	C	A
	v/c	0.05	0.38	0.53		0.53	0.12	-
	Queue	1.3	0	0		18.5	3.1	-
2010 Without Development C-16	Delay	11.3	0	0		286.3	20.9	18.0
	LOS	B	A	A		F	C	C
	v/c	0.1	0.34	0.51		1.27	0.28	-
	Queue	2.4	0	0		56.9	8.4	-
2010 With Development C-20	Delay	16.6	0	0		679.6	31.2	26.4
	LOS	C	A	A		F	D	D
	v/c	0.11	0.45	0.62		1.96	0.26	-
	Queue	2.9	0	0		60.8	7.5	-
2010 With Development & WB Lane C-24	Delay	10.9	0	0	0	109.1	11	4.6
	LOS	B	A	A	A	F	B	A
	v/c	0.06	0.45	0.33	0.29	0.75	0.07	-
	Queue	1.5	0	0	0	29.9	1.8	-

Table 15 - Summary Level of Service Analyses Results - Primary Entrance Intersection

Year Scenario Page Number	LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m)						Intersection LOS
		EB-L	EB-T	WB-T	WB-R	SB-L	SB-R	
2004 Without Development Without Signals Page C-9	Delay	10.5	0	0		63.1	18.1	3.3
	LOS	B	A	A		F	C	A
	v/c	0.14	0.31	0.45		0.35	0.27	-
	Queue	3.6	0	0		10.4	8.3	-
2004 With Development With Signals Page C-13	Delay	7.5	6.5	18.1	4.3	37.4	6.3	13.9
	LOS	A	A	B	A	D	A	B
	v/c	0.41	0.34	0.59	0.16	0.64	0.47	-
	Queue	20.8	52.5	120	13.3	59.4	17.5	-
2010 Without Development With Signals C-17	Delay	11.5	0	0		112.5	21.8	4.2
	LOS	B	A	A		F	C	A
	v/c	0.16	0.35	0.51		0.52	0.33	-
	Queue	4.2	0	0		15.9	10.5	-
2010 With Development Without Signals C-21	Delay	12.9	8.1	22.3	5.7	32.4	5.7	15.7
	LOS	B	A	C	A	C	A	B
	v/c	0.6	0.43	0.82	0.25	0.68	0.48	-
	Queue	31.9	61.4	142	17.6	77.9	19	-

Table 16 - Summary Level of Service Analyses Results - Brooklyn Street Intersection

Year Scenario Page Number	LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement					Intersection LOS
		EB-L	EB-T	WB-TR	SB-L	SB-R	
2004 Without Development Page C-10	Delay	9.7	0	0	32.5	15.2	0.1
	LOS	A	A	A	D	C	A
	v/c	0	0.37	0.49	0.01	0.02	-
	Queue	0	0	0	0.2	0.3	-
2004 With Development Page C-14	Delay	11.8	0	0	80.2	22.7	1.9
	LOS	B	A	A	F	C	A
	v/c	0.15	0.38	0.5	0.02	0.31	-
	Queue	4.1	0	0	0.5	9.6	-
2010 Without Development C-18	Delay	10.4	0	0	45.5	17.3	0.1
	LOS	B	A	A	E	C	A
	v/c	0	0.42	0.54	0.01	0.02	-
	Queue	0	0	0	0.3	0.4	-
2010 With Development C-22	Delay	15.4	0	0	254.3	44.6	3.7
	LOS	C	A	A	F	E	A
	v/c	0.26	0.45	0.58	0.07	0.58	-
	Queue	7.9	0	0	1.5	23.9	-

Summary of LOS Analyses Results

1. 'Without' development the four intersections operate with excellent LOS 'A' for 2004 volumes. The SB-L at the STOP controlled intersections have reduced levels of service as would be expected at a busy arterial street, however, the Kent driveway results are probably distorted by analysis of combined intersections, and queues at the other intersections are short.
2. 'With' Phase 1 development and installation of traffic signals at the Primary Entrance, the Primary Entrance intersection will operate at very good LOS 'B' and the other three intersections will continue to operate at LOS 'A'.
3. 'Without' development during 2010, but with a separate left turn phase for eastbound traffic provided at the Highway 101 traffic signals to accommodate normal traffic growth during the next six years, the Highway 101 intersection will operate at LOS 'B' and the other three intersections will operate at LOS 'A'.
4. 'With' Phase 2 development, and existing lane configurations at the Highway 101 intersection, *Synchro 6.0* analysis indicated that the intersection would operate at LOS 'B', however, WB-T queues are in excess of 187 m (see Table 13 and Page C-19) and *SimTraffic 6.0* analysis indicated severe queue build-up for the WB-T approach to the intersection.
5. 'With' Phase 2 development, and construction of an additional westbound through lane from Highway 101 to the Kent Entrance, the Primary Entrance intersection will operate at very good LOS 'B' and the other three intersections will operate at LOS 'A'.

5.0 Summary and Conclusions

Proposed Development

1. *The Plaza Group* is proposing re-development of the existing Superstore and Kent site on Starrs Road, Yarmouth. includes an 81,000 square foot Superstore, a 10,000 square foot Liquor Store, an 85,000 square foot Wal-Mart Department Store, a 40,000 square foot Kent Building Supplies store, a 21,000 square foot Commercial Retail Unit (CRU), and the existing Shell Gas station. Phase 2 development, expected by horizon year 2010, will include enlarging the Superstore to 115,000 square feet, and the Wal-Mart Department Store to 125,000 square feet.

Proposed Site Accesses

2. The Site will be served by three accesses to Starrs Road:
   - Kent Entrance (secondary site entrance from combination of two existing east driveways to Kent and Superstore);
   - Primary Site Entrance (existing Superstore / Shell entrance);
   - Brooklyn Street Entrance (secondary site entrance and Truck entrance for Superstore and Wal-Mart.

Description of the Study Area Section of Starrs Road

3. The Study Area consists of the section of Starrs Road (Trunk 3) between Highway 101 and Brooklyn Street. The Highway 101 intersection is controlled by fully actuated traffic signals and all other intersections are controlled by STOP signs or assumed stop conditions expected where a driveway meets an arterial street.

   Starrs Road is a two lane arterial street with curb, gutter and a concrete sidewalk on the north side and gravel shoulder and open ditch on the south side. The posted speed limit is 50 km/h. There is a two-way left turn lane throughout the section with dedicated eastbound left turn lanes for Brooklyn Street and Highway 101.

What are the Existing Safety and Traffic Volume Conditions at Study Area Intersections?

4. **Safety** - Review of 1999 to 2003 collision abstracts indicated 14 reported collisions in the area, including the following:
   - six at the Highway 101 traffic signals;
   - two at Comfort Inn involving entering or exiting vehicles;
   - two at Superstore involving entering or exiting vehicles;
   - four rear end collisions on Starrs Road (two at Kent; one at Superstore; one at Burton).

   The collision data, summarized in Table 2, do not indicate any significant safety problem on Starrs Road in the Study Area.

   Traffic Volumes - The 2003 Annual Average Daily Traffic (AADT) volume on Starrs Road in the Study Area was estimated to be 16,300 vehicles per day (vpd) and the average weekday volume was 19,700 vpd. Manual counts obtained at the Highway 101 / Starrs Road intersection on a Friday in July 2004 indicated Starrs Road two-way volumes of about 1270 vehicles per hour (vph) in the Study Area, and Highway 101 volumes of about 335 vph, during the PM peak hour.

Trip Generation

5. The existing 46,000 square foot Superstore and 25,000 square foot Kent Building Supplies Store generate a combined two-way volume of 580 vehicles per hour (vph), with 285 vph entering and 295 vph exiting the Site, during the 2004 DHV. Review of turning volumes indicates that 44% of trips are to/from the east and 56% of trips are to/from the west. Trip generation estimates for additional square footage of retail space have been completed using rates published in *Trip Generation, 7th Edition* (Institute of Transportation Engineers, Washington, 2003).

   Trips to a mixed use development are usually affected by *cross-shopping* or 'on-site synergy' which includes internal site trips. Since this development will contain several different businesses, cross shopping between these businesses will be common. After adjustments for cross-shopping, it is estimated that the Phase 1 of the development will generated about 1175 vph trips, and the fully developed Site with Phase 1 plus Phase 2 will generate about 1500 vph trips, during the PM peak hour of an average weekday.

Pass-by Trips

6. **Pass-by trips** are those which are made as 'intervening opportunity' stops by vehicles already passing by the site on an adjacent street. *Trip Generation Handbook* (Institute of Transportation Engineers, 2001) contains records of pass-by percentages for different land uses. Average typical pass-by percentages for PM peak hours include Discount Store (17%), Shopping Center (34%), Gas Bar (56%); Supermarket (36%); and Home Improvement Store (48%). A pass-by rate of 30% has been assumed for all new external trips attracted to the Site.

Trip Distribution and Assignment

7. External site generated trips for Phases 1 and Phase 2 have been distributed with 50% to the west, 40% to the east and 10% to Highway 101. Trips have been assigned to the three site entrances in relation to direction of travel and site layout:
   - *WB entering trips* - 50% Kent; 50% Primary; 0% Brooklyn;
   - *EB exiting trips* - 20% Kent; 80% Primary; 0% Brooklyn;
   - *EB entering trips* - 30% Brooklyn; 60% Primary; 10% Kent;
   - *WB exiting trips* - 30% Brooklyn; 60% Primary; 10% Kent.

Signal Warrant Analysis

8. Signal warrant analyses completed using the *Canadian Traffic Signal Warrant Procedure* (*Transportation Association of Canada (TAC)* indicate the following:
   - With normal traffic growth, and without additional site generated trips, traffic signals will not be warranted at the Primary Entrance during 2004 or 2010.
   - With additional site generated trips form Phase 1 development, traffic signals will be warranted at the Primary Entrance during 2004.
   - Traffic signals will not be warranted at Brooklyn Street intersection during either 2004 or 2010.

Level of Service Analyses Include Traffic Signals at the Primary Site Entrance

9. Level of service (LOS) analyses have been completed using *Synchro 6.0 / SimTraffic 6.0* software. LOS analyses for scenarios that include additional site generated traffic have been completed for traffic signal control with a separate left turn phase for the eastbound approach and a right turn lane for the westbound approach at the Primary Entrance. Brooklyn Street and the secondary entrances have been analyzed with STOP sign control. For 2010 analyses, a separate left turn phase has been added at Highway 101. Also, analyses have been completed with an additional westbound through lane on Starrs Road at Highway 101 and the Kent entrance.

Summary of Level of Service Analyses Results

10. The LOS analyses revealed the following:
    - 'Without' development the Study Area intersections operate with excellent LOS 'A' for 2004 volumes.
    - 'With' Phase 1 development and installation of traffic signals at the Primary Entrance, the Primary Entrance intersection will operate at very good LOS 'B' and other intersections will continue to operate at LOS 'A'.
    - 'Without' development during 2010, but with a separate left turn phase for eastbound traffic provided at the Highway 101 traffic signals to accommodate normal traffic growth during the next six years, the Highway 101 intersection will operate at LOS 'B' and other intersections will operate at LOS 'A'.
    - 'With' Phase 2 development, and construction of an additional westbound through lane from Highway 101 to the Kent Entrance, the Primary Entrance intersection will operate at very good LOS 'B' and the other three intersections will operate at LOS 'A'.

Other Site Access Considerations

11. Additional items to be considered during site access design include:
    - ***Design of Driveway Entrances*** -The design of site driveways will include details of number of lanes, lane widths, and traffic signal design. The Primary Entrance will be four lanes wide, with two exiting and two entering lanes. The design of the driveway entrance will also include consideration of the required clear throat distances.
    - ***Potential Brooklyn Street Extension*** - The Town of Yarmouth is considering extension of Brooklyn Street north to connect with Herbert Street or Elm Street. If this connection is completed, it will provide an alternate access for traffic from areas north of Starrs Road, and reduce some of the traffic demands on the Starrs Road site entrances.
    - ***Potential Burton Avenue Relocation*** - Burton Avenue intersects with the south side of Starrs Road at T-intersection about 26 metres west of the centerline of the Primary Entrance to the Site. It is understood that the Town of Yarmouth has considered the possibility of realigning Burton Avenue so that it meets Stars Road opposite the Primary Entrance so as to

create a four-way intersection. A decision should be made concerning this re-alignment before the final intersection design plans are prepared for the Primary Entrance intersection.

Recommended Actions for Phase 1 Development

12. The following actions are recommended for Phase 1 development:
    - Re-construct the Primary Entrance to include four travel lanes and appropriate clear throat distances, as well as a right turn lane on the Starrs Road westbound approach;
    - Install traffic signals on Starrs Road at the Primary Entrance, complete with a separate eastbound left turn phase;
    - Re-construct the two east site entrance to provide a combined Kent entrance, complete with appropriate clear throat distances; and
    - Re-mark the left turn lane markings on Starrs Road to provide dedicated left turn lanes for both the Primary and Kent entrances.

Recommended Actions for Phase 2 Development

13. The following actions are recommended when construction of Phase 2 development is planned:
    - Count site entrance volumes and re-evaluate trip generation and distribution values;
    - Complete planned widening of Starrs Road to include an additional westbound through lane from east of Highway 101 intersection to meet the Primary Entrance right turn lane; and
    - Install a separate left turn phase for eastbound traffic at the Highway 101 traffic signals.

Conclusions

14. Analyses indicate that with completion of the recommended actions, the Primary Entrance intersection will operate at level of service ‘B’ and the other Study Area intersections will operate at LOS ‘A’, with the completion of Phase 2 development in 2010.

Appendix A

Study Area Photos & Traffic Volume Data

Photo 1 - Looking east on Starrs Road from Brooklyn Street

Photo 2 - Looking east on Starrs Road from Superstore / Shell Driveway

Photo 3 - Looking west on Starrs Road from Superstore / Shell Driveway

Photo 4 - Looking west on Starrs Road from Highway 101

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Table A-1 - Hourly Volumes Starrs Road just West of Highway 101
September 3 to 10, 2003

Hour	Days of the Week							Hourly Averages	
	Mon-08	Tue-09	Wed-11/03	Thu-04	Fri-05	Sat-06	Sun-07	Week	Weekday
0									
1	63	32	41	48	29	68	105	55	43
2	47	23	45	42	33	60	100	50	38
3	63	32	75	64	42	66	32	53	55
4	86	71	80	88	65	51	34	68	78
5	141	109	148	115	125	94	44	111	128
6	388	402	419	444	384	227	79	335	407
7	1086	1034	1094	1036	944	528	317	863	1039
8	1406	1382	1367	1348	1333	789	390	1145	1367
9	1139	1114	1157	1230	1145	1149	570	1072	1157
10	1238	1153	1257	1323	1315	1416	702	1201	1257
11	1229	1217	1282	1284	1396	1506	784	1243	1282
12	1417	1281	1441	1440	1511	1519	849	1351	1418
13	1364	1288	1531	1368	1488	1554	920	1359	1408
14	1280	1301	1418	1335	1431	1392	922	1297	1353
15	1326	1363	1368	1349	1546	1400	857	1316	1390
16	1470	1472	1507	1466	1574	1472	750	1387	1498
17	1322	1234	1384	1335	1514	1197	804	1256	1358
18	1123	1093	1213	1189	1433	1175	722	1135	1210
19	1076	992	1145	1072	1436	1065	875	1094	1144
20	838	960	1045	882	1168	1118	637	950	979
21	504	556	557	513	808	662	425	575	588
22	252	219	276	253	502	388	207	300	300
23	116	173	154	153	247	281	129	179	169
24	57	60	83	84	94	211	54	92	76
TOTALS	19031	18561	20087	19461	21563	19388	11308	18486	19741

Estimated 2003 AADT 16300; Average Weekday Volume September 2003 - 19,700

Table A-2 - Hourly Volumes Starrs Road just East of Pleasant Street
September 9 to 15, 2003

Hour	Days of the Week							Hourly Averages	
	Mon-15	Tue-09	Wed-10	Thu-11	Fri-12	Sat-13	Sun-14	Week	Weekday
0									
1	39	39	64	43	72	89	134	69	51
2	51	19	88	62	62	98	144	75	56
3	45	47	74	72	81	52	48	60	64
4	85	62	67	99	96	54	38	72	82
5	174	124	199	211	201	163	73	164	182
6	379	365	382	421	380	223	140	327	385
7	1019	923	1028	994	1003	570	310	835	993
8	1288	1309	1364	1354	1337	807	398	1122	1330
9	1192	1120	1227	1136	1158	1169	558	1080	1167
10	1222	1153	1187	1241	1210	1407	733	1165	1203
11	1281	1302	1340	1426	1386	1536	682	1279	1347
12	1452	1417	1535	1416	1571	1504	895	1399	1478
13	1413	1356	1386	1357	1514	1413	892	1333	1405
14	1329	1363	1343	1319	1441	1342	855	1285	1359
15	1404	1377	1475	1422	1587	1378	902	1364	1453
16	1605	1566	1542	1561	1668	1462	803	1458	1588
17	1277	1289	1383	1436	1486	1309	851	1290	1374
18	1110	1142	1269	1221	1393	1277	820	1176	1227
19	1161	1104	1215	1334	1456	1181	797	1178	1254
20	887	1003	922	1117	1272	1071	628	986	1040
21	493	621	633	694	749	759	429	625	638
22	282	273	349	356	457	545	223	355	343
23	152	204	179	199	301	456	114	229	207
24	86	96	79	84	163	221	60	113	102
TOTALS	19426	19274	20330	20575	22044	20086	11527	19037	20330

Estimated 2003 AADT 17900; Average Weekday Volume September 2003 - 20,300

Figure A-1 - Starrs Road - Trunk 3 - Yarmouth
Average Weekday Hourly Volumes - September 2003

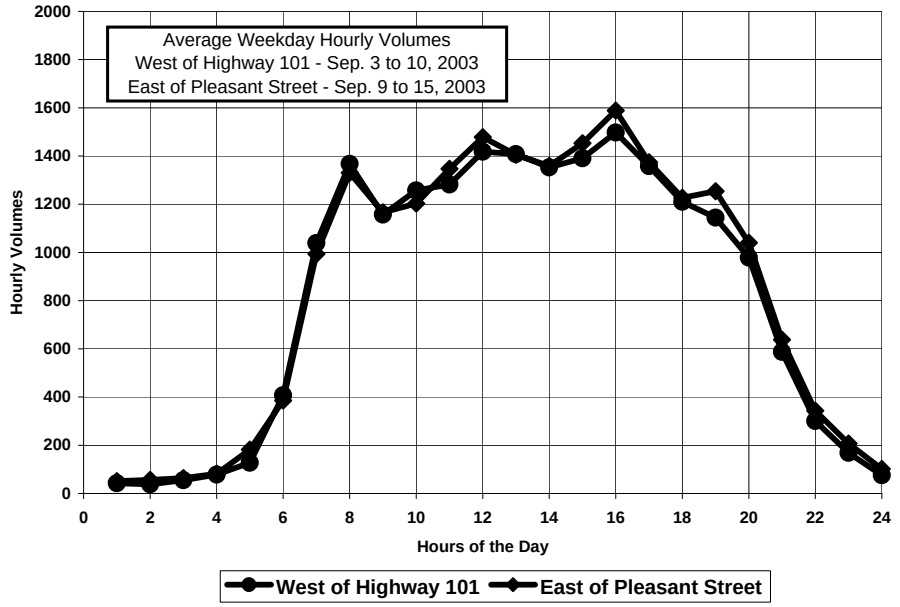


Figure A-2 - Starrs Road - Trunk 3 - Yarmouth
Friday and Saturday Hourly Volumes - September 2003

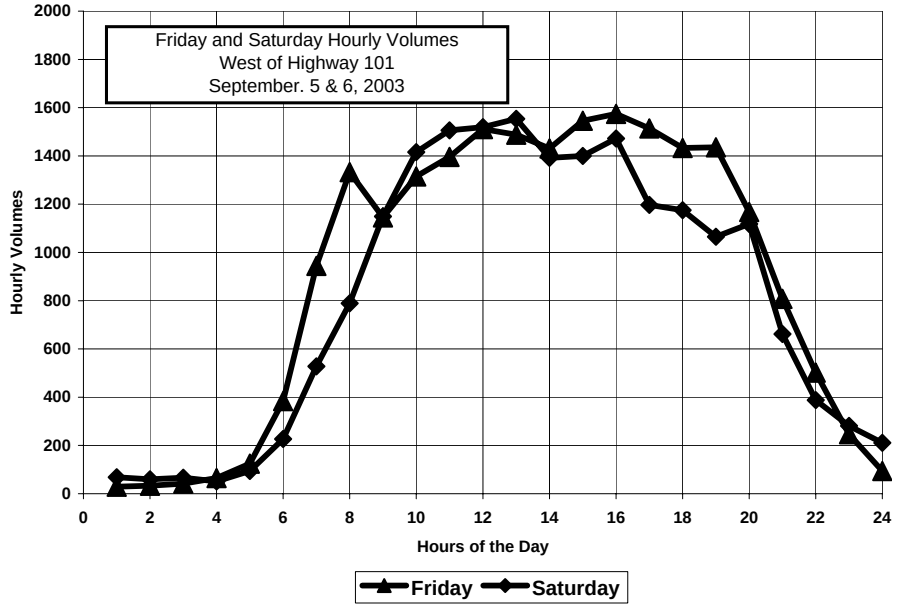
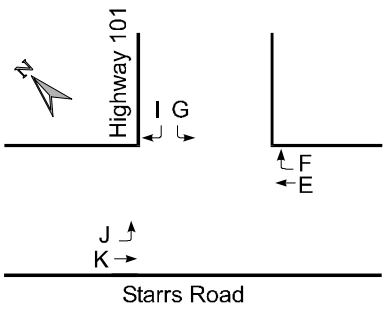


Table A-3

Highway 101
@
Starrs Road

Yarmouth, NS



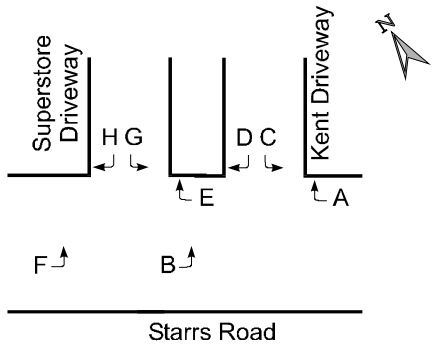
Friday, July 23, 2004

Time	Starrs Road Westbound Approach		Highway 101 Southbound Approach		Starrs Road Eastbound Approach		Total Vehicles
	E	F	G	I	J	K	
07:00-07:15	61	5	4	14	12	46	142
07:15-07:30	90	7	9	27	15	72	220
07:30-07:45	112	10	14	26	14	90	266
07:45-08:00	122	2	21	33	10	108	296
08:00-08:15	103	7	9	23	9	88	239
08:15-08:30	104	7	5	37	9	100	262
08:30-08:45	110	3	14	28	13	90	258
08:45-09:00	109	5	12	16	10	82	234
Weekday AM Peak	441	26	49	119	42	386	1063
11:30-11:45	171	11	11	15	21	147	376
11:45-12:00	163	11	11	29	11	154	379
12:00-12:15	153	8	7	23	12	159	362
12:15-12:30	154	13	8	22	15	144	356
12:30-12:45	159	16	6	14	11	169	375
12:45-13:00	154	10	12	24	18	124	342
13:00-13:15	169	14	7	17	24	115	346
13:15-13:30	147	19	16	17	17	98	314
Weekday Noon Peak	629	48	32	88	49	626	1472
15:30-15:45	152	11	11	24	37	104	339
15:45-16:00	160	16	12	9	18	97	312
16:00-16:15	179	14	12	25	38	90	358
16:15-16:30	155	28	13	26	28	99	349
16:30-16:45	167	21	12	15	34	105	354
16:45-17:00	161	17	8	16	27	85	314
17:00-17:15	165	28	16	13	32	142	396
17:15-17:30	142	17	8	9	47	126	349
Weekday PM Peak	648	94	49	70	121	431	1413

Table A-4

Starrs Road
@
Kent and Superstore Driveways

Yarmouth, NS



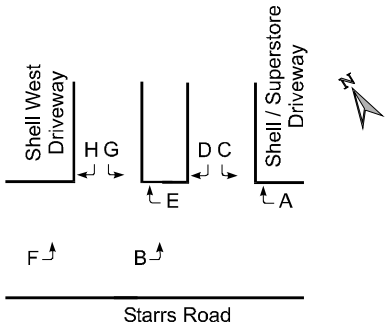
Thursday, July 22, 2004

Time	Kent Driveway				Superstore Driveway			
	Right In	Left In	Left Out	Right Out	Right In	Left In	Left Out	Right Out
	A	B	C	D	E	F	G	H
07:00-07:15	0	3	1	0	0	1	1	0
07:15-07:30	1	4	0	0	0	0	0	0
07:30-07:45	4	3	1	0	0	2	0	0
07:45-08:00	3	3	3	2	0	2	1	0
08:00-08:15	6	0	5	2	2	1	0	3
08:15-08:30	8	8	5	3	3	3	1	5
08:30-08:45	8	2	3	2	3	4	11	3
08:45-09:00	8	1	1	1	1	1	2	3
Weekday AM Peak	21	14	14	7	5	8	2	8
11:30-11:45	16	5	7	8	10	9	3	14
11:45-12:00	17	3	5	8	3	6	7	15
12:00-12:15	15	1	6	10	9	5	8	9
12:15-12:30	12	2	6	3	4	10	9	7
12:30-12:45	11	10	10	6	2	4	5	9
12:45-13:00	18	1	4	7	4	7	3	9
13:00-13:15	23	3	13	7	8	8	7	11
13:15-13:30	15	5	5	6	4	5	4	11
Weekday Noon Peak	55	16	27	27	18	25	29	40
15:30-15:45	14	1	10	4	4	3	12	12
15:45-16:00	13	4	12	5	5	5	12	9
16:00-16:15	20	7	4	7	6	12	6	7
16:15-16:30	17	7	13	6	8	6	6	10
16:30-16:45	16	8	10	7	5	5	13	12
16:45-17:00	11	5	14	5	2	8	3	12
17:00-17:15	14	6	9	7	9	7	13	13
17:15-17:30	15	2	11	3	2	6	8	12
Weekday PM Peak	58	26	46	25	24	26	35	47

Table A-5

Starrs Road
@
Shell Driveways / Superstore Driveway

Yarmouth, NS



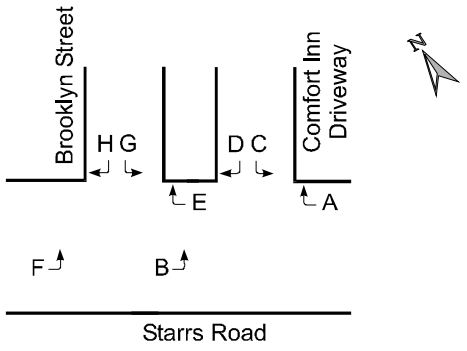
Thursday, July 22, 2004

Time	Shell / Superstore Driveway				Shell West Driveway			
	Right In	Left In	Left Out	Right Out	Right In	Left In	Left Out	Right Out
	A	B	C	D	E	F	G	H
07:00-07:15	4	3	4	5	0	5	1	3
07:15-07:30	5	2	1	4	1	4	2	2
07:30-07:45	5	9	4	3	0	1	0	4
07:45-08:00	13	5	2	4	1	3	0	4
8:00-08:15	7	3	2	3	0	1	1	2
08:15-08:30	8	9	4	10	0	4	1	2
08:30-08:45	9	3	5	11	0	2	1	4
08:45-09:00	7	8	2	8	0	2	1	1
Weekday AM Peak	33	26	12	20	1	9	2	12
11:30-11:45	11	12	6	28	0	2	0	5
11:45-12:00	6	14	4	17	0	3	0	4
12:00-12:15	5	20	7	18	0	8	4	5
12:15-12:30	3	16	4	20	0	6	3	2
12:30-12:45	8	18	7	15	0	2	1	4
12:45-13:00	11	14	4	19	0	3	1	3
13:00-13:15	6	15	2	20	0	2	1	4
13:15-13:30	8	18	5	14	1	4	3	4
Weekday Noon Peak	22	68	22	70	0	19	8	15
15:30-15:45	5	21	5	11	0	4	0	1
15:45-16:00	6	13	4	17	1	3	2	2
16:00-16:15	10	11	7	19	1	5	1	7
16:15-16:30	7	24	3	20	1	3	1	8
16:30-16:45	13	22	6	24	1	6	2	5
16:45-17:00	9	19	11	29	4	1	4	5
17:00-17:15	10	23	9	15	0	3	1	5
17:15-17:30	4	15	8	17	0	7	1	1
Weekday PM Peak	39	88	29	88	6	13	8	23

Table A-6

Starrs Road
@
Confort Inn and Brooklyn Street

Yarmouth, NS



Wednesday, July 21, 2004

Time	Comfort Inn Driveway				Brooklyn Street			
	Right In	Left In	Left Out	Right Out	Right In	Left In	Left Out	Right Out
	A	B	C	D	E	F	G	H
07:00-07:15	0	1	0	3	0	0	0	0
07:15-07:30	1	3	2	3	0	0	0	2
07:30-07:45	0	1	1	0	0	0	0	1
07:45-08:00	0	2	0	1	0	1	0	2
08:00-08:15	0	1	2	2	0	0	0	1
08:15-08:30	0	1	1	6	0	0	0	1
08:30-08:45	0	2	1	6	0	0	1	3
08:45-09:00	3	0	3	1	0	0	0	1
Weekday AM Peak	0	5	4	9	0	1	0	5
11:30-11:45	0	0	0	1	0	0	0	0
11:45-12:00	1	0	0	2	0	0	0	1
12:00-12:15	0	1	0	1	0	0	0	0
12:15-12:30	1	0	0	0	1	0	1	0
12:30-12:45	0	1	1	0	0	0	0	1
12:45-13:00	1	1	0	0	0	0	0	2
13:00-13:15	0	0	0	1	0	0	0	0
13:15-13:30	1	0	0	2	0	0	0	0
Weekday Noon Peak	2	2	1	3	1	0	1	2
15:30-15:45	0	0	0	0	0	0	0	0
15:45-16:00	0	4	0	2	0	0	0	0
16:00-16:15	2	1	0	3	0	0	0	0
16:15-16:30	1	2	0	0	0	0	1	1
16:30-16:45	1	1	0	1	0	0	0	0
16:45-17:00	4	2	1	1	0	0	0	1
17:00-17:15	0	0	0	0	0	1	0	1
17:15-17:30	2	2	0	0	1	1	1	1
Weekday PM Peak	6	5	1	2	0	1	1	3

Appendix B

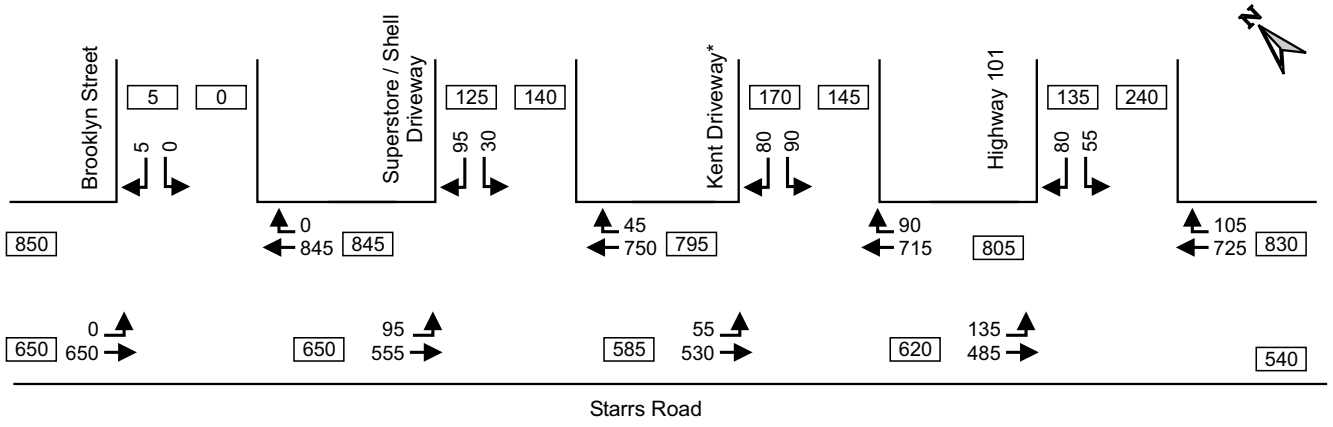
Traffic Volume Diagrams

A 2004 PM PEAK HOUR BACKGROUND VOLUME

*Driveway Volumes at Superstore East Driveway and Kent Driveway are combined

NOT TO SCALE

B 2010 PM PEAK HOUR BACKGROUND VOLUME

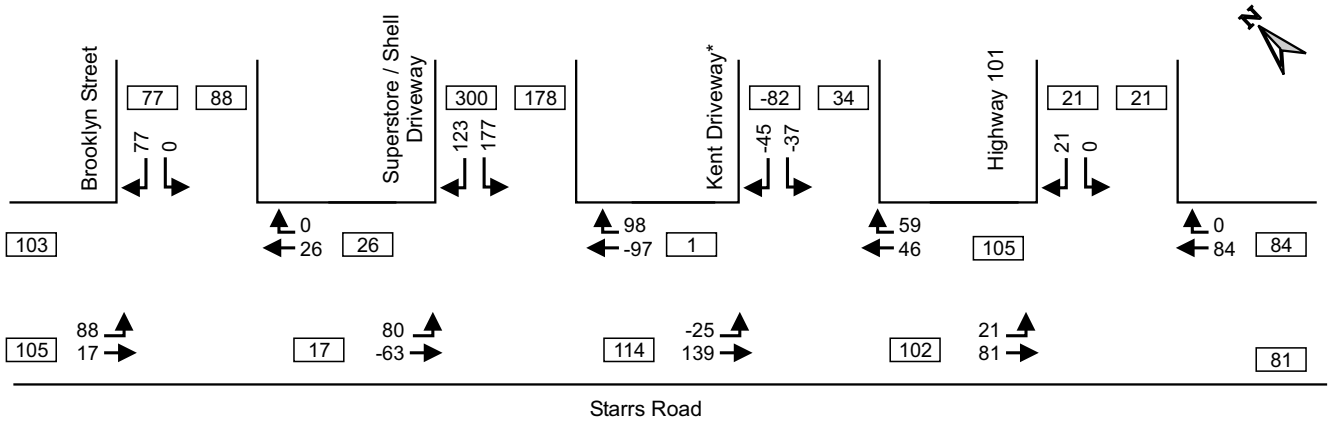


*Driveway Volumes at Superstore East Driveway and Kent Driveway are combined

NOT TO SCALE

Atlantic Road & Traffic Management *Traffic Engineering Specialists*	**TIS - Superstore, Kent, and Wal-Mart Development Starrs Road, Yarmouth, Nova Scotia**	**Figure B-1**
	Turning Movement Volumes without Site Development	**September 2004**

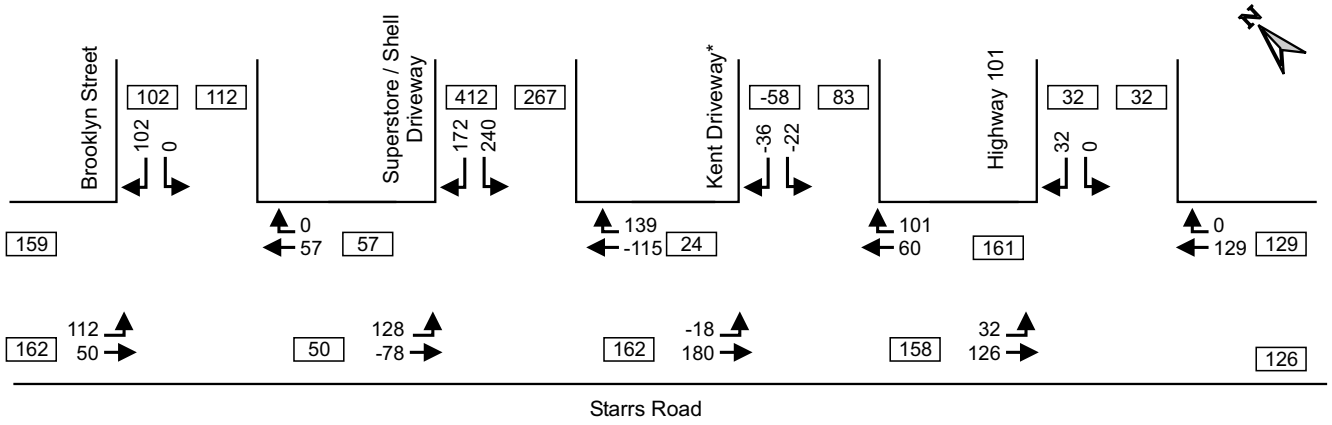
A PHASE 1 DEVELOPMENT



*Driveway Volumes at Superstore East Driveway and Kent Driveway are combined

NOT TO SCALE

B PHASE 1 AND 2 DEVELOPMENT

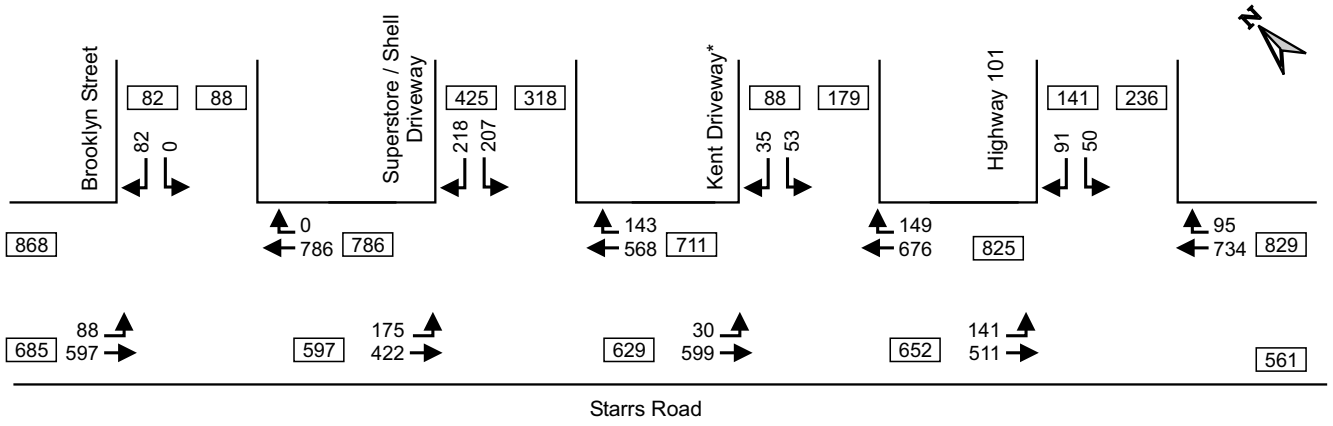


*Driveway Volumes at Superstore East Driveway and Kent Driveway are combined

NOT TO SCALE

Atlantic Road & Traffic Management *Traffic Engineering Specialists*	**TIS - Superstore, Kent, and Wal-Mart Development Starrs Road, Yarmouth, Nova Scotia**	**Figure B-2**
	Weekday Peak Hour Site Generated and Redistributed Volume	**September 2004**

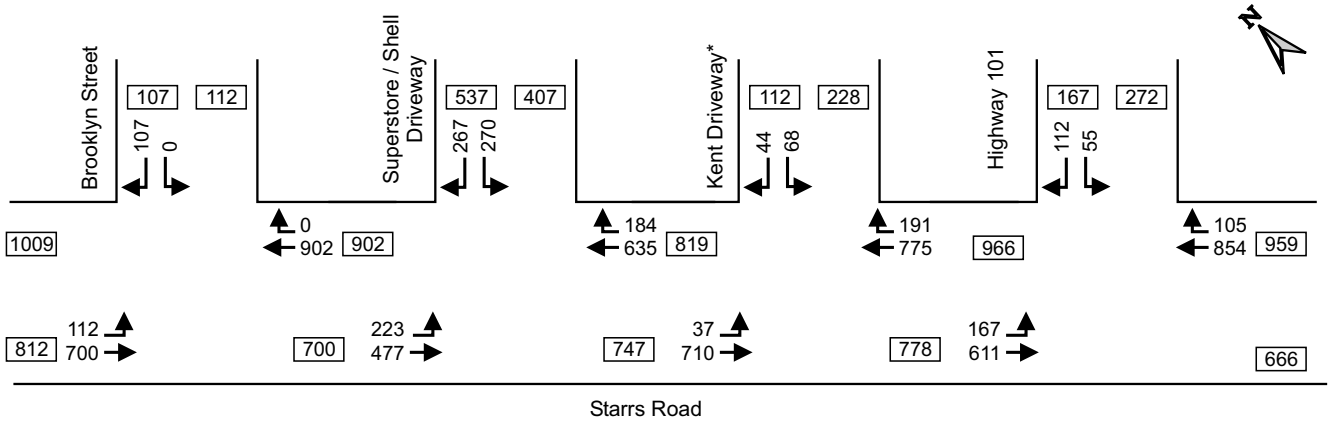
A 2004 PM PEAK HOUR WITH PHASE 1 DEVELOPMENT



*Driveway Volumes at Superstore East Driveway and Kent Driveway are combined

NOT TO SCALE

B 2010 PM PEAK HOUR WITH PHASE 1 AND 2 DEVELOPMENT



*Driveway Volumes at Superstore East Driveway and Kent Driveway are combined

NOT TO SCALE

Atlantic Road & Traffic Management *Traffic Engineering Specialists*	**TIS - Superstore, Kent, and Wal-Mart Development Starrs Road, Yarmouth, Nova Scotia**	**Figure B-3**
	Turning Movement Volumes with Site Development	**September 2004**

Appendix C

Signal Warrant & Level of Service Analyses

Atlantic Road & Traffic Management
Traffic Engineering Specialists

Canadian Traffic Signal Warrant Analysis

Table C-1 - Starrs Road at Superstore - 2004 Traffic Volumes without Site Generated Traffic

Date: September 13, 2004

City: Yarmouth

Main Street	**Starrs Road**
Side Street	**Superstore Primary Entrance**

MainStreet1Lanes	(#)	1	Distance to next signal	(m)	187
MainStreet2Lanes	(#)	1	Elementary School	(y/n)	n
MainStreet LT Lanes	(#)	1	Senior's Complex	(y/n)	n
SideStreet1Lanes	(#)	0	Pathway to School	(y/n)	n
SideStreet2Lanes	(#)	2	Metro Area Population	(#)	7,500
MainStreetSpeedLimit	(km/h)	50	Side Street Bus Route	(y/n)	n
MainStreetTrucks/Buses	(%)	5.0%	Side Street Trucks	(%)	5.0%
Refuge Width on Median	(m)	0.0	T or 1-Way Intersection	(y/n)	y
			Central Business District	(y/n)	n

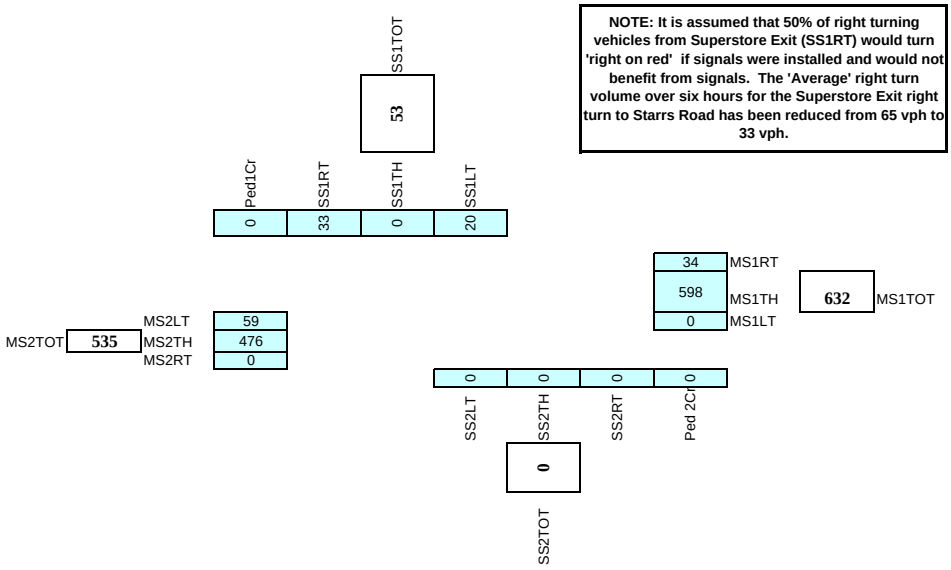
Vm =	**1,167** (MainSt Vol Total)	Cs =	**0.900** (Int SpacingFactor)
Vs =	**53** (SideSt Vol Highest)	Cmt =	**1.000** (MainStTruckFactor)
Pc =	**0** Peds Crossing Main	Cv =	**1.000** (SpeedFactor)
K1 =	**1,400** veh/veh const	Cp =	**1.200** (PopDemoFactor)
K2 =	**5,000** veh/ped const	Csb =	**1.000** (SideStBusFactor)
L =	**3.0** TotalMainStLanes	Cst =	**1.000** (SideStTruckFactor)
F =	**1.000** (PedDemoFactor)	Vmx =	**632** (MainStHighest)
Vm1 =	**1,167** (MainStVeh-Veh#)	Vm2 =	**1,167** (MainStVeh-Ped#)
Cvp =	**1.080** (product of Cs,Cmt,Cv,Cp)	Cbt =	**1.000** (maximum of Csb,Cst)
Ct1 =	**0.667** T Int / one way Factor		

***** Enter the hourly turning movement counts averaged over the peak six hours of a typical week day**

***** Enter the peak pedestrian volume crossing the main street averaged over the same hours**

	Starrs Road WB			Starrs Road EB			Superstore Exit						PW	PE
	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	0	445	30	20	365	0	10	0	20	0	0	0	0	0
8:00 - 9:00	0	475	35	25	375	0	15	0	35	0	0	0	0	0
11:00 - 12:00	0	685	30	70	630	0	25	0	90	0	0	0	0	0
12:00 - 13:00	0	645	35	70	545	0	20	0	75	0	0	0	0	0
16:00 - 17:00	0	670	30	75	455	0	20	0	75	0	0	0	0	0
17:00 - 18:00	0	665	45	95	485	0	30	0	95	0	0	0	0	0
Average	0	598	34	59	476	0	20	0	33	0	0	0	0	0

NOTE: It is assumed that 50% of right turning vehicles from Superstore Exit (SS1RT) would turn 'right on red' if signals were installed and would not benefit from signals. The 'Average' right turn volume over six hours for the Superstore Exit right turn to Starrs Road has been reduced from 65 vph to 33 vph.



W = [Ct1xCbt(Vm1 x Vs)/K1 + (F(Vm2 x Pc)L)/K2] x Cvp

W = 32 **32** **0**

Not Warranted - Vs<75 ***Veh*** ***Ped***

Atlantic Road & Traffic Management
Traffic Engineering Specialists

Canadian Traffic Signal Warrant Analysis

Table C-2 - Starrs Road at Superstore - 2010 Traffic Volumes without Site Generated Traffic

Date: September 13, 2004
City: Yarmouth

Main Street	**Starrs Road**
Side Street	**Superstore Primary Entrance**

MainStreet1Lanes	(#)	1	Distance to next signal	(m)	187
MainStreet2Lanes	(#)	1	Elementary School	(y/n)	n
MainStreet LT Lanes	(#)	1	Senior's Complex	(y/n)	n
SideStreet1Lanes	(#)	0	Pathway to School	(y/n)	n
SideStreet2Lanes	(#)	2	Metro Area Population	(#)	7,500
MainStreetSpeedLimit	(km/h)	50	Side Street Bus Route	(y/n)	n
MainStreetTrucks/Buses	(%)	5.0%	Side Street Trucks	(%)	5.0%
Refuge Width on Median	(m)	0.0	T or 1-Way Intersection	(y/n)	y
			Central Business District	(y/n)	n

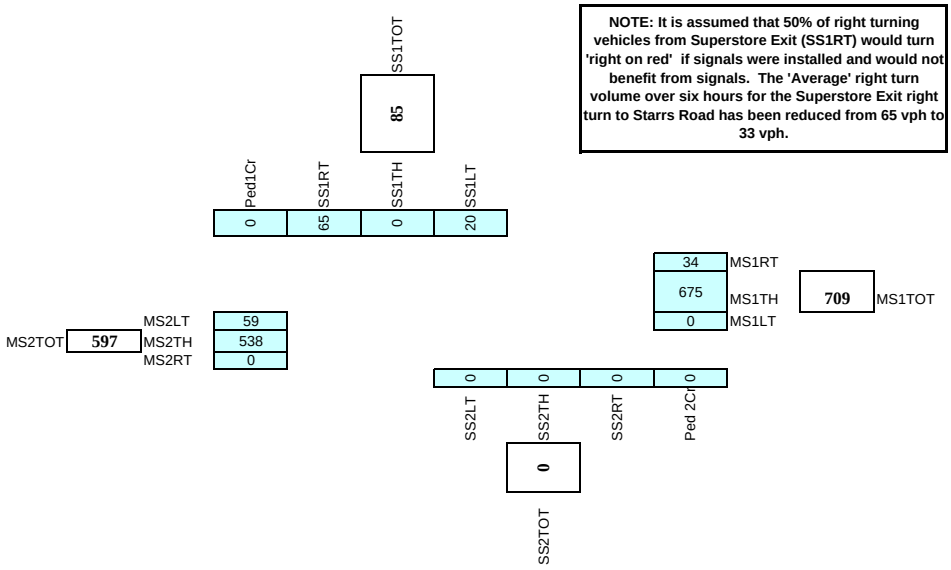
Vm =	**1,306** (MainSt Vol Total)	Cs =	**0.900** (Int SpacingFactor)
Vs =	**85** (SideSt Vol Highest)	Cmt =	**1.000** (MainStTruckFactor)
Pc =	**0** Peds Crossing Main	Cv =	**1.000** (SpeedFactor)
K1 =	**1,400** veh/veh const	Cp =	**1.200** (PopDemoFactor)
K2 =	**5,000** veh/ped const	Csb =	**1.000** (SideStBusFactor)
L =	**3.0** TotalMainStLanes	Cst =	**1.000** (SideStTruckFactor)
F =	**1.000** (PedDemoFactor)	Vmx =	**709** (MainStHighest)
Vm1 =	**1,306** (MainStVeh-Veh#)	Vm2 =	**1,306** (MainStVeh-Ped#)
Cvp =	**1.080** (product of Cs,Cmt,Cv,Cp)	Cbt =	**1.000** (maximum of Csb,Cst)
Ct1 =	**0.667** T Int / one way Factor		

***** Enter the hourly turning movement counts averaged over the peak six hours of a typical week day**

***** Enter the peak pedestrian volume crossing the main street averaged over the same hours**

	Starrs Road WB			Starrs Road EB			Superstore Exit						PW	PE
	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	0	500	30	20	410	0	10	0	20	0	0	0	0	0
8:00 - 9:00	0	535	35	25	425	0	15	0	35	0	0	0	0	0
11:00 - 12:00	0	775	30	70	705	0	25	0	90	0	0	0	0	0
12:00 - 13:00	0	730	35	70	615	0	20	0	75	0	0	0	0	0
16:00 - 17:00	0	760	30	75	515	0	20	0	75	0	0	0	0	0
17:00 - 18:00	0	750	45	95	555	0	30	0	95	0	0	0	0	0
Average	0	675	34	59	538	0	20	0	65	0	0	0	0	0

NOTE: It is assumed that 50% of right turning vehicles from Superstore Exit (SS1RT) would turn 'right on red' if signals were installed and would not benefit from signals. The 'Average' right turn volume over six hours for the Superstore Exit right turn to Starrs Road has been reduced from 65 vph to 33 vph.



W = [Ct1xCbt(Vm1 x Vs)/K1 + (F(Vm2 x Pc)L)/K2] x Cvp

W = 57 **57** **0**

NOT Warranted ***Veh*** ***Ped***

Atlantic Road & Traffic Management
Traffic Engineering Specialists

Canadian Traffic Signal Warrant Analysis

Table C-3 - Starrs Road at Superstore - 2004 Traffic Volumes with Site Generated Traffic

Date: September 13, 2004

City: Yarmouth

Main Street	**Starrs Road**
Side Street	**Superstore Primary Entrance**

MainStreet1Lanes	(#)	1	Distance to next signal	(m)	187
MainStreet2Lanes	(#)	1	Elementary School	(y/n)	n
MainStreet LT Lanes	(#)	1	Senior's Complex	(y/n)	n
SideStreet1Lanes	(#)	0	Pathway to School	(y/n)	n
SideStreet2Lanes	(#)	2	Metro Area Population	(#)	7,500
MainStreetSpeedLimit	(km/h)	50	Side Street Bus Route	(y/n)	n
MainStreetTrucks/Buses	(%)	5.0%	Side Street Trucks	(%)	5.0%
Refuge Width on Median	(m)	0.0	T or 1-Way Intersection	(y/n)	y
			Central Business District	(y/n)	n

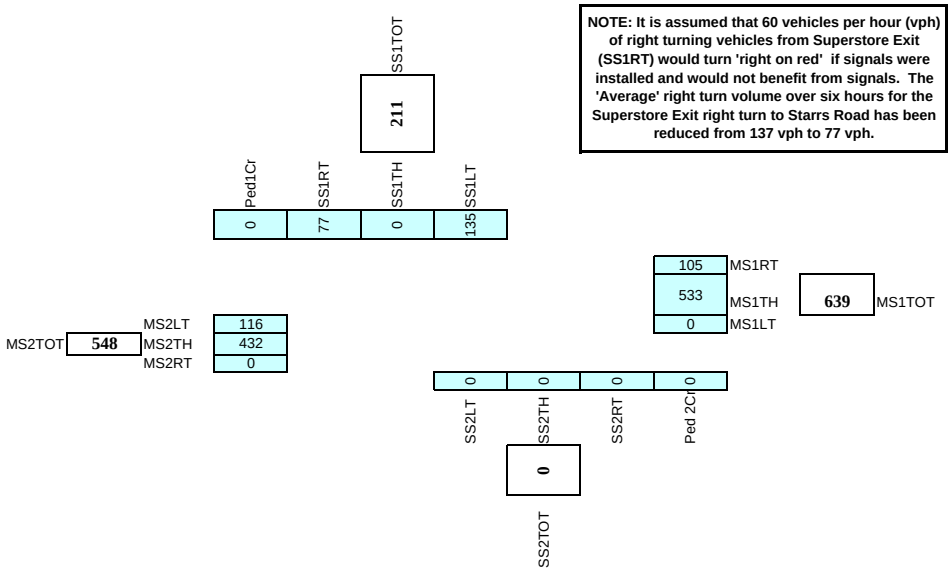
Vm =	**1,187** (MainSt Vol Total)	Cs =	**0.900** (Int SpacingFactor)
Vs =	**211** (SideSt Vol Highest)	Cmt =	**1.000** (MainStTruckFactor)
Pc =	**0** Peds Crossing Main	Cv =	**1.000** (SpeedFactor)
K1 =	**1,400** veh/veh const	Cp =	**1.200** (PopDemoFactor)
K2 =	**5,000** veh/ped const	Csb =	**1.000** (SideStBusFactor)
L =	**3.0** TotalMainStLanes	Cst =	**1.000** (SideStTruckFactor)
F =	**1.000** (PedDemoFactor)	Vmx =	**639** (MainStHighest)
Vm1 =	**1,187** (MainStVeh-Veh#)	Vm2 =	**1,187** (MainStVeh-Ped#)
Cvp =	**1.080** (product of Cs,Cmt,Cv,Cp)	Cbt =	**1.000** (maximum of Csb,Cst)
Ct1 =	**0.667** T Int / one way Factor		

***** Enter the hourly turning movement counts averaged over the peak six hours of a typical week day**

***** Enter the peak pedestrian volume crossing the main street averaged over the same hours**

	Starrs Road WB			Starrs Road EB			Superstore Exit						PW	PE
	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	0	442	40	44	350	0	30	0	27	0	0	0	0	0
8:00 - 9:00	0	446	71	59	350	0	80	0	72	0	0	0	0	0
11:00 - 12:00	0	598	124	141	576	0	165	0	176	0	0	0	0	0
12:00 - 13:00	0	558	126	136	493	0	152	0	162	0	0	0	0	0
16:00 - 17:00	0	588	127	143	401	0	175	0	164	0	0	0	0	0
17:00 - 18:00	0	568	143	175	422	0	207	0	218	0	0	0	0	0
Average	0	533	105	116	432	0	135	0	77	0	0	0	0	0

NOTE: It is assumed that 60 vehicles per hour (vph) of right turning vehicles from Superstore Exit (SS1RT) would turn 'right on red' if signals were installed and would not benefit from signals. The 'Average' right turn volume over six hours for the Superstore Exit right turn to Starrs Road has been reduced from 137 vph to 77 vph.



W = [Ct1xCbt(Vm1 x Vs)/K1 + (F(Vm2 x Pc)L)/K2] x Cvp

W = **129** **129** **0**

Warranted ***Veh*** ***Ped***

Atlantic Road & Traffic Management
Traffic Engineering Specialists

Canadian Traffic Signal Warrant Analysis

Table C-4 - Starrs Road at Superstore - 2010 Traffic Volumes with Site Generated Traffic

Date: September 13, 2004
City: Yarmouth

Main Street	**Starrs Road**
Side Street	**Superstore Primary Entrance**

MainStreet1Lanes	(#)	1	Distance to next signal	(m)	187
MainStreet2Lanes	(#)	1	Elementary School	(y/n)	n
MainStreet LT Lanes	(#)	1	Senior's Complex	(y/n)	n
SideStreet1Lanes	(#)	0	Pathway to School	(y/n)	n
SideStreet2Lanes	(#)	2	Metro Area Population	(#)	7,500
MainStreetSpeedLimit	(km/h)	50	Side Street Bus Route	(y/n)	n
MainStreetTrucks/Buses	(%)	5.0%	Side Street Trucks	(%)	5.0%
Refuge Width on Median	(m)	0.0	T or 1-Way Intersection	(y/n)	y
			Central Business District	(y/n)	n

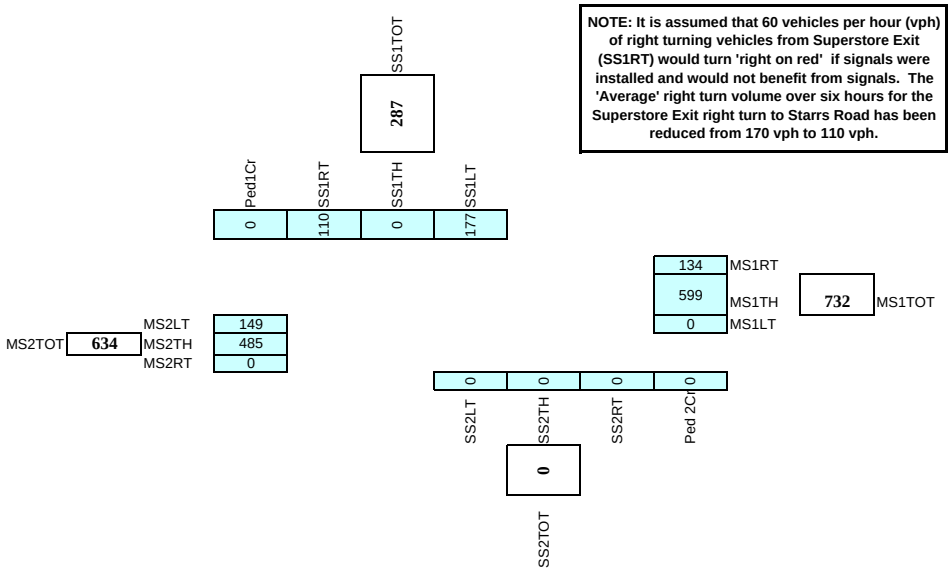
Vm =	**1,366** (MainSt Vol Total)	Cs =	**0.900** (Int SpacingFactor)
Vs =	**287** (SideSt Vol Highest)	Cmt =	**1.000** (MainStTruckFactor)
Pc =	**0** Peds Crossing Main	Cv =	**1.000** (SpeedFactor)
K1 =	**1,400** veh/veh const	Cp =	**1.200** (PopDemoFactor)
K2 =	**5,000** veh/ped const	Csb =	**1.000** (SideStBusFactor)
L =	**3.0** TotalMainStLanes	Cst =	**1.000** (SideStTruckFactor)
F =	**1.000** (PedDemoFactor)	Vmx =	**732** (MainStHighest)
Vm1 =	**1,366** (MainStVeh-Veh#)	Vm2 =	**1,366** (MainStVeh-Ped#)
Cvp =	**1.080** (product of Cs,Cmt,Cv,Cp)	Cbt =	**1.000** (maximum of Csb,Cst)
Ct1 =	**0.667** T Int / one way Factor		

***** Enter the hourly turning movement counts averaged over the peak six hours of a typical week day**

***** Enter the peak pedestrian volume crossing the main street averaged over the same hours**

	Starrs Road WB			Starrs Road EB			Superstore Exit						PW	PE
	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	0	495	50	56	395	0	38	0	35	0	0	0	0	0
8:00 - 9:00	0	498	86	79	394	0	105	0	92	0	0	0	0	0
11:00 - 12:00	0	674	158	182	638	0	219	0	217	0	0	0	0	0
12:00 - 13:00	0	629	159	174	552	0	203	0	202	0	0	0	0	0
16:00 - 17:00	0	660	164	181	452	0	226	0	208	0	0	0	0	0
17:00 - 18:00	0	635	184	223	477	0	270	0	267	0	0	0	0	0
Average	0	599	134	149	485	0	177	0	110	0	0	0	0	0

NOTE: It is assumed that 60 vehicles per hour (vph) of right turning vehicles from Superstore Exit (SS1RT) would turn 'right on red' if signals were installed and would not benefit from signals. The 'Average' right turn volume over six hours for the Superstore Exit right turn to Starrs Road has been reduced from 170 vph to 110 vph.



W = [Ct1xCbt(Vm1 x Vs)/K1 + (F(Vm2 x Pc)L)/K2] x Cvp

W = **202** **202** **0**

Warranted ***Veh*** ***Ped***

Atlantic Road & Traffic Management
Traffic Engineering Specialists

Canadian Traffic Signal Warrant Analysis

Table C-5 - Starrs Road at Brooklyn Street - 2004 Traffic Volumes with Site Generated Traffic

Date: September 13, 2004

City: Yarmouth

Main Street	**Starrs Road**
Side Street	**Brooklyn Street**

MainStreet1Lanes	(#)	1	Distance to next signal	(m)	121
MainStreet2Lanes	(#)	1	Elementary School	(y/n)	n
MainStreet LT Lanes	(#)	1	Senior's Complex	(y/n)	n
SideStreet1Lanes	(#)	0	Pathway to School	(y/n)	n
SideStreet2Lanes	(#)	1	Metro Area Population	(#)	7,500
MainStreetSpeedLimit	(km/h)	50	Side Street Bus Route	(y/n)	n
MainStreetTrucks/Buses	(%)	5.0%	Side Street Trucks	(%)	5.0%
Refuge Width on Median	(m)	0.0	T or 1-Way Intersection	(y/n)	y
			Central Business District	(y/n)	n

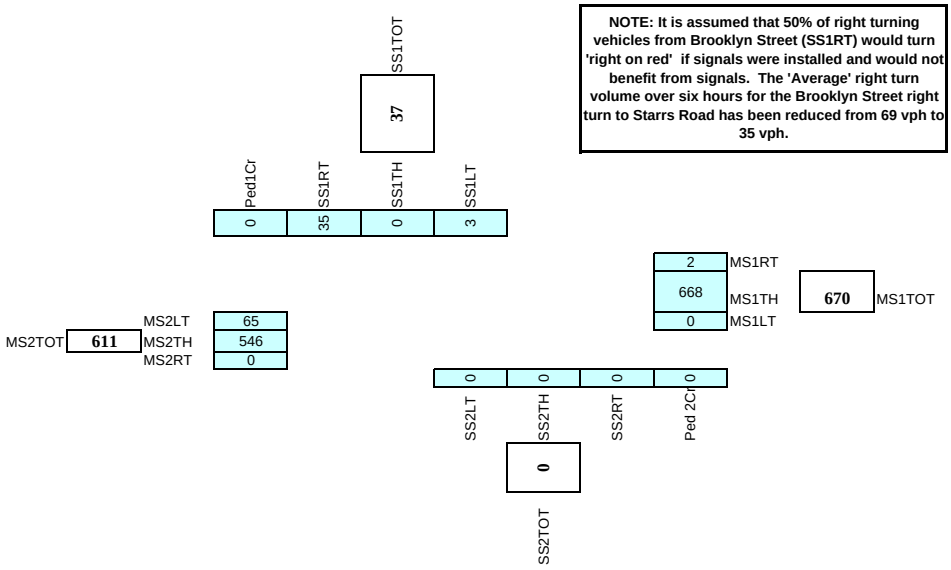
Vm =	**1,281** (MainSt Vol Total)	Cs =	**0.900** (Int SpacingFactor)
Vs =	**37** (SideSt Vol Highest)	Cmt =	**1.000** (MainStTruckFactor)
Pc =	**0** Peds Crossing Main	Cv =	**1.000** (SpeedFactor)
K1 =	**1,400** veh/veh const	Cp =	**1.200** (PopDemoFactor)
K2 =	**5,000** veh/ped const	Csb =	**1.000** (SideStBusFactor)
L =	**3.0** TotalMainStLanes	Cst =	**1.000** (SideStTruckFactor)
F =	**1.000** (PedDemoFactor)	Vmx =	**670** (MainStHighest)
Vm1 =	**1,281** (MainStVeh-Veh#)	Vm2 =	**1,281** (MainStVeh-Ped#)
Cvp =	**1.080** (product of Cs,Cmt,Cv,Cp)	Cbt =	**1.000** (maximum of Csb,Cst)
Ct1 =	**0.667** T Int / one way Factor		

***** Enter the hourly turning movement counts averaged over the peak six hours of a typical week day**

***** Enter the peak pedestrian volume crossing the main street averaged over the same hours**

	Starrs Road WB			Starrs Road EB			Brooklyn Street						PW	PE
	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	0	469	0	37	389	0	5	0	21	0	0	0	0	0
8:00 - 9:00	0	513	5	38	399	0	10	0	48	0	0	0	0	0
11:00 - 12:00	0	774	0	73	717	0	0	0	93	0	0	0	0	0
12:00 - 13:00	0	720	0	70	629	0	0	0	87	0	0	0	0	0
16:00 - 17:00	0	747	5	86	544	0	0	0	85	0	0	0	0	0
17:00 - 18:00	0	786	0	88	597	0	0	0	82	0	0	0	0	0
Average	0	668	2	65	546	0	3	0	35	0	0	0	0	0

NOTE: It is assumed that 50% of right turning vehicles from Brooklyn Street (SS1RT) would turn 'right on red' if signals were installed and would not benefit from signals. The 'Average' right turn volume over six hours for the Brooklyn Street right turn to Starrs Road has been reduced from 69 vph to 35 vph.



W = [Ct1xCbt(Vm1 x Vs)/K1 + (F(Vm2 x Pc)L)/K2] x Cvp

W = **24** **24** **0**

Not Warranted - Vs<75 ***Veh*** ***Ped***

Atlantic Road & Traffic Management
Traffic Engineering Specialists

Canadian Traffic Signal Warrant Analysis

Table C-6 - Starrs Road at Brooklyn Street - 2010 Traffic Volumes with Site Generated Traffic

Date: September 13, 2004
City: Yarmouth

Main Street	**Starrs Road**
Side Street	**Brooklyn Street**

MainStreet1Lanes	(#)	1	Distance to next signal	(m)	121
MainStreet2Lanes	(#)	1	Elementary School	(y/n)	n
MainStreet LT Lanes	(#)	1	Senior's Complex	(y/n)	n
SideStreet1Lanes	(#)	0	Pathway to School	(y/n)	n
SideStreet2Lanes	(#)	1	Metro Area Population	(#)	7,500
MainStreetSpeedLimit	(km/h)	50	Side Street Bus Route	(y/n)	n
MainStreetTrucks/Buses	(%)	5.0%	Side Street Trucks	(%)	5.0%
Refuge Width on Median	(m)	0.0	T or 1-Way Intersection	(y/n)	y
			Central Business District	(y/n)	n

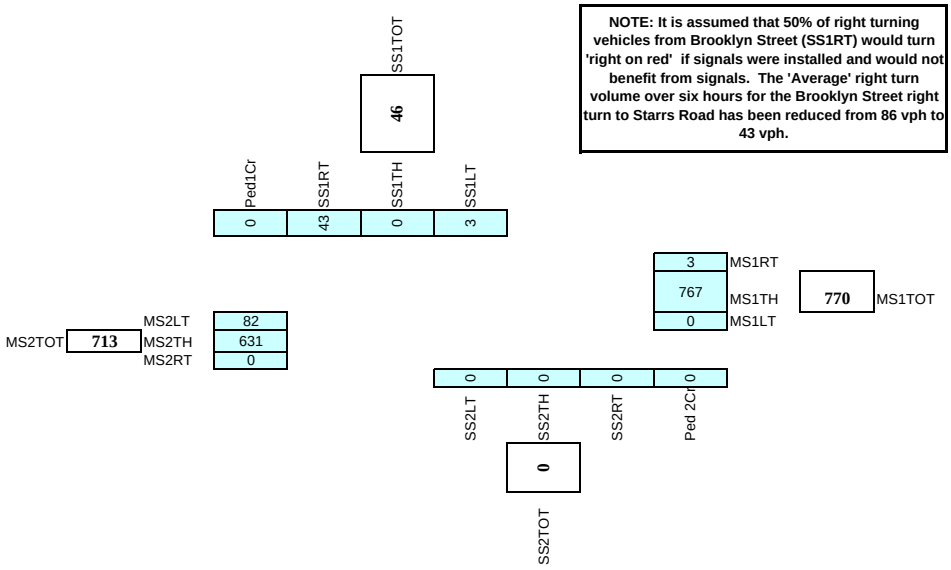
Vm =	**1,482** (MainSt Vol Total)	Cs =	**0.900** (Int SpacingFactor)
Vs =	**46** (SideSt Vol Highest)	Cmt =	**1.000** (MainStTruckFactor)
Pc =	**0** Peds Crossing Main	Cv =	**1.000** (SpeedFactor)
K1 =	**1,400** veh/veh const	Cp =	**1.200** (PopDemoFactor)
K2 =	**5,000** veh/ped const	Csb =	**1.000** (SideStBusFactor)
L =	**3.0** TotalMainStLanes	Cst =	**1.000** (SideStTruckFactor)
F =	**1.000** (PedDemoFactor)	Vmx =	**770** (MainStHighest)
Vm1 =	**1,482** (MainStVeh-Veh#)	Vm2 =	**1,482** (MainStVeh-Ped#)
Cvp =	**1.080** (product of Cs,Cmt,Cv,Cp)	Cbt =	**1.000** (maximum of Csb,Cst)
Ct1 =	**0.667** T Int / one way Factor		

***** Enter the hourly turning movement counts averaged over the peak six hours of a typical week day**

***** Enter the peak pedestrian volume crossing the main street averaged over the same hours**

	Starrs Road WB			Starrs Road EB			Brooklyn Street						PW	PE
	MS1LT	MS1TH	MS1RT	MS2LT	MS2TH	MS2RT	SS1LT	SS1TH	SS1RT	SS2LT	SS2TH	SS2RT	PedC1	PedC2
7:00 - 8:00	0	530	5	43	446	0	5	0	24	0	0	0	0	0
8:00 - 9:00	0	585	5	47	463	0	10	0	58	0	0	0	0	0
11:00 - 12:00	0	891	0	93	820	0	0	0	114	0	0	0	0	0
12:00 - 13:00	0	831	0	89	726	0	0	0	106	0	0	0	0	0
16:00 - 17:00	0	863	5	105	633	0	0	0	107	0	0	0	0	0
17:00 - 18:00	0	902	0	112	700	0	0	0	107	0	0	0	0	0
Average	0	767	3	82	631	0	3	0	43	0	0	0	0	0

NOTE: It is assumed that 50% of right turning vehicles from Brooklyn Street (SS1RT) would turn 'right on red' if signals were installed and would not benefit from signals. The 'Average' right turn volume over six hours for the Brooklyn Street right turn to Starrs Road has been reduced from 86 vph to 43 vph.



W = [Ct1xCbt(Vm1 x Vs)/K1 + (F(Vm2 x Pc)L)/K2] x Cvp

W = **35** **35** **0**

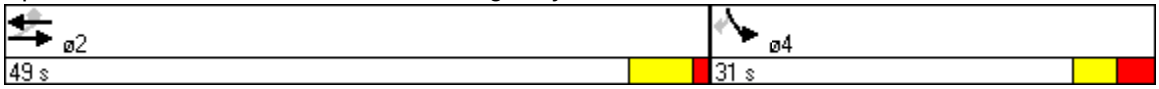
Not Warranted - Vs<75 ***Veh*** ***Ped***

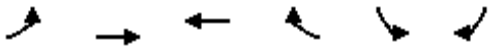
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1789	1883	1883	1601	1789	1601
Flt Permitted	0.232				0.950	
Satd. Flow (perm)	437	1883	1883	1601	1789	1601
Satd. Flow (RTOR)				74		76
Volume (vph)	120	430	650	95	50	70
Lane Group Flow (vph)	130	467	707	103	54	76
Turn Type	Perm			Perm		Perm
Protected Phases		2	2		4	
Permitted Phases	2			2		4
Total Split (s)	49.0	49.0	49.0	49.0	31.0	31.0
Act Effct Green (s)	52.6	52.6	52.6	52.6	10.4	10.4
Actuated g/C Ratio	0.75	0.75	0.75	0.75	0.14	0.14
v/c Ratio	0.40	0.33	0.50	0.08	0.21	0.26
Control Delay	7.9	4.0	5.3	1.4	18.8	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.9	4.0	5.3	1.4	18.8	6.7
LOS	A	A	A	A	B	A
Approach Delay		4.8	4.8		11.7	
Approach LOS		A	A		B	
Queue Length 50th (m)	4.2	14.1	25.7	0.7	4.1	0.0
Queue Length 95th (m)	15.7	29.1	52.6	4.1	13.9	9.4
Internal Link Dist (m)		97.2	192.3		185.9	
Turn Bay Length (m)	60.0			30.0		50.0
Base Capacity (vph)	340	1466	1466	1263	584	574
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.32	0.48	0.08	0.09	0.13

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 69.8
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.50
Intersection Signal Delay: 5.4 Intersection LOS: A
Intersection Capacity Utilization 54.2% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 1: Starrs Road & Highway 101





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	55	460	630	90	90	80
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	500	685	98	98	87
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)		69	121			
pX, platoon unblocked	0.82				0.82	0.82
vC, conflicting volume	783				1353	734
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	735				1430	676
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				12	77
cM capacity (veh/h)	715				112	372

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	60	500	783	98	87
Volume Left	60	0	0	98	0
Volume Right	0	0	98	0	87
cSH	715	1700	1700	112	372
Volume to Capacity	0.08	0.29	0.46	0.88	0.23
Queue Length 95th (m)	2.1	0.0	0.0	40.0	6.8
Control Delay (s)	10.5	0.0	0.0	125.7	17.6
Lane LOS	B			F	C
Approach Delay (s)	1.1		0.0	74.8	
Approach LOS				F	

Intersection Summary			
Average Delay	9.5		
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	95	485	665	45	30	95
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	527	723	49	33	103
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)			191			
pX, platoon unblocked	0.87				0.87	0.87
vC, conflicting volume	772				1481	747
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	737				1554	709
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	86				65	73
cM capacity (veh/h)	754				93	377

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	103	527	772	33	103
Volume Left	103	0	0	33	0
Volume Right	0	0	49	0	103
cSH	754	1700	1700	93	377
Volume to Capacity	0.14	0.31	0.45	0.35	0.27
Queue Length 95th (m)	3.6	0.0	0.0	10.4	8.3
Control Delay (s)	10.5	0.0	0.0	63.1	18.1
Lane LOS	B			F	C
Approach Delay (s)	1.7		0.0	28.9	
Approach LOS				D	

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	1	580	760	1	1	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	630	826	1	1	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)			304			
pX, platoon unblocked	0.96				0.96	0.96
vC, conflicting volume	827				1459	827
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	819				1480	819
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	98
cM capacity (veh/h)	774				132	359

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	1	630	827	1	5
Volume Left	1	0	0	1	0
Volume Right	0	0	1	0	5
cSH	774	1700	1700	132	359
Volume to Capacity	0.00	0.37	0.49	0.01	0.02
Queue Length 95th (m)	0.0	0.0	0.0	0.2	0.3
Control Delay (s)	9.7	0.0	0.0	32.5	15.2
Lane LOS	A			D	C
Approach Delay (s)	0.0		0.0	18.1	
Approach LOS				C	

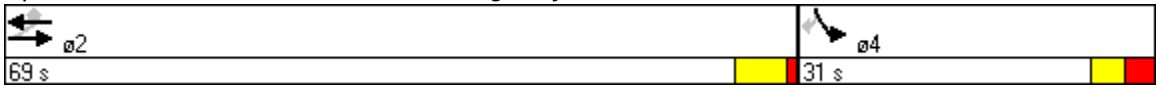
Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1789	1883	1883	1601	1789	1601
Flt Permitted	0.230				0.950	
Satd. Flow (perm)	433	1883	1883	1601	1789	1601
Satd. Flow (RTOR)				66		99
Volume (vph)	141	511	734	95	50	91
Lane Group Flow (vph)	153	555	798	103	54	99
Turn Type	Perm			Perm		Perm
Protected Phases		2	2		4	
Permitted Phases	2			2		4
Total Split (s)	69.0	69.0	69.0	69.0	31.0	31.0
Act Effct Green (s)	56.6	56.6	56.6	56.6	10.4	10.4
Actuated g/C Ratio	0.77	0.77	0.77	0.77	0.14	0.14
v/c Ratio	0.46	0.38	0.55	0.08	0.22	0.33
Control Delay	8.3	4.0	5.4	1.4	23.7	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.3	4.0	5.4	1.4	23.7	7.4
LOS	A	A	A	A	C	A
Approach Delay		4.9	4.9		13.2	
Approach LOS		A	A		B	
Queue Length 50th (m)	5.4	17.9	31.4	0.9	4.4	0.0
Queue Length 95th (m)	19.6	36.2	64.0	4.2	17.3	12.4
Internal Link Dist (m)		96.2	192.3		185.9	
Turn Bay Length (m)	60.0			30.0		50.0
Base Capacity (vph)	359	1561	1561	1339	557	567
Starvation Cap Reductn	0	97	0	0	0	0
Spillback Cap Reductn	0	0	3	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.38	0.51	0.08	0.10	0.17

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 73.7
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.55
Intersection Signal Delay: 5.6 Intersection LOS: A
Intersection Capacity Utilization 59.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Starrs Road & Highway 101



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	30	599	676	149	53	35
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	651	735	162	58	38
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)		70	120			
pX, platoon unblocked	0.78				0.83	0.78
vC, conflicting volume	897				1532	816
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	868				1475	765
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				47	88
cM capacity (veh/h)	608				109	316

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	33	651	897	58	38
Volume Left	33	0	0	58	0
Volume Right	0	0	162	0	38
cSH	608	1700	1700	109	316
Volume to Capacity	0.05	0.38	0.53	0.53	0.12
Queue Length 95th (m)	1.3	0.0	0.0	18.5	3.1
Control Delay (s)	11.3	0.0	0.0	69.9	18.0
Lane LOS	B			F	C
Approach Delay (s)	0.5		0.0	49.2	
Approach LOS				E	

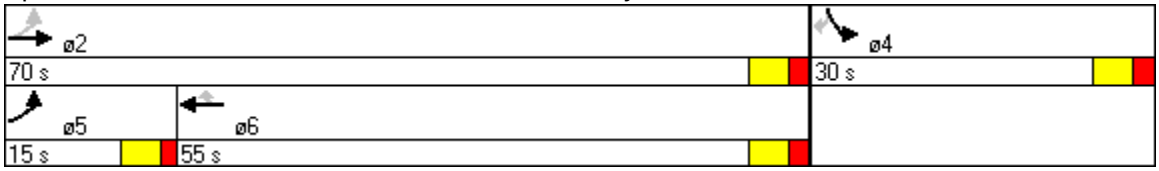
Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1789	1883	1883	1601	1789	1601
Flt Permitted	0.231				0.950	
Satd. Flow (perm)	435	1883	1883	1601	1789	1601
Satd. Flow (RTOR)				116		237
Volume (vph)	175	422	568	143	207	218
Lane Group Flow (vph)	190	459	617	155	225	237
Turn Type	pm+pt			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Total Split (s)	15.0	70.0	55.0	55.0	30.0	30.0
Act Effct Green (s)	66.0	66.0	51.2	51.2	18.2	18.2
Actuated g/C Ratio	0.72	0.72	0.56	0.56	0.20	0.20
v/c Ratio	0.41	0.34	0.59	0.16	0.64	0.47
Control Delay	7.5	6.5	17.5	4.3	37.4	6.3
Queue Delay	0.0	0.0	0.5	0.0	0.0	0.0
Total Delay	7.5	6.5	18.1	4.3	37.4	6.3
LOS	A	A	B	A	D	A
Approach Delay		6.8	15.3		21.4	
Approach LOS		A	B		C	
Queue Length 50th (m)	9.1	25.9	68.2	3.0	37.0	0.0
Queue Length 95th (m)	20.8	52.5	120.0	13.3	59.4	17.5
Internal Link Dist (m)		89.6	46.3		84.3	
Turn Bay Length (m)	40.0			40.0		
Base Capacity (vph)	472	1349	1046	940	466	593
Starvation Cap Reductn	0	0	139	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.34	0.68	0.16	0.48	0.40

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 92.2
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 13.9 Intersection LOS: B
Intersection Capacity Utilization 61.1% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 3: Starrs Road & Main Driveway



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	88	597	786	1	1	82
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	96	649	854	1	1	89
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)			114			
pX, platoon unblocked	0.77				0.77	0.77
vC, conflicting volume	855				1695	855
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	812				1906	811
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				98	69
cM capacity (veh/h)	625				49	291

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	96	649	855	1	89
Volume Left	96	0	0	1	0
Volume Right	0	0	1	0	89
cSH	625	1700	1700	49	291
Volume to Capacity	0.15	0.38	0.50	0.02	0.31
Queue Length 95th (m)	4.1	0.0	0.0	0.5	9.6
Control Delay (s)	11.8	0.0	0.0	80.2	22.7
Lane LOS	B			F	C
Approach Delay (s)	1.5		0.0	23.4	
Approach LOS				C	

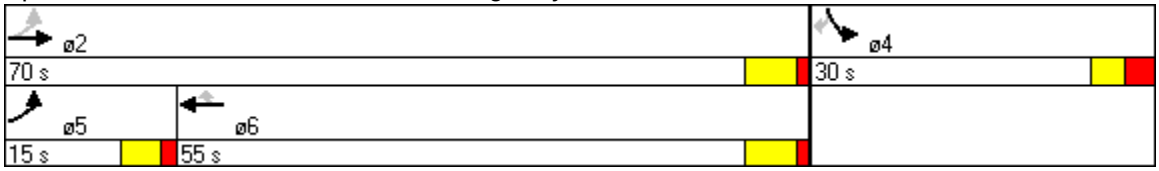
Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1789	1883	1883	1601	1789	1601
Flt Permitted	0.113				0.950	
Satd. Flow (perm)	213	1883	1883	1601	1789	1601
Satd. Flow (RTOR)				53		87
Volume (vph)	135	485	725	105	55	80
Lane Group Flow (vph)	147	527	788	114	60	87
Turn Type	pm+pt			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Total Split (s)	15.0	70.0	55.0	55.0	30.0	30.0
Act Effct Green (s)	58.2	59.0	47.0	47.0	9.9	9.9
Actuated g/C Ratio	0.76	0.80	0.64	0.64	0.13	0.13
v/c Ratio	0.39	0.35	0.66	0.11	0.26	0.31
Control Delay	6.9	3.6	14.1	4.8	30.9	8.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.9	3.6	14.1	4.8	30.9	8.9
LOS	A	A	B	A	C	A
Approach Delay		4.3	13.0		17.9	
Approach LOS		A	B		B	
Queue Length 50th (m)	3.9	17.9	76.0	3.6	7.1	0.0
Queue Length 95th (m)	13.9	35.1	129.2	10.6	19.8	12.1
Internal Link Dist (m)		97.2	192.3		185.9	
Turn Bay Length (m)	60.0			30.0		50.0
Base Capacity (vph)	390	1555	1293	1116	511	520
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.34	0.61	0.10	0.12	0.17

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 74
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 10.0 Intersection LOS: B
Intersection Capacity Utilization 59.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Starrs Road & Highway 101



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	55	530	715	90	90	80
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	576	777	98	98	87
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)		69	121			
pX, platoon unblocked	0.79				0.79	0.79
vC, conflicting volume	875				1522	826
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	842				1658	781
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	90				0	72
cM capacity (veh/h)	629				77	313

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	60	576	875	98	87
Volume Left	60	0	0	98	0
Volume Right	0	0	98	0	87
cSH	629	1700	1700	77	313
Volume to Capacity	0.10	0.34	0.51	1.27	0.28
Queue Length 95th (m)	2.4	0.0	0.0	56.9	8.4
Control Delay (s)	11.3	0.0	0.0	286.3	20.9
Lane LOS	B			F	C
Approach Delay (s)	1.1		0.0	161.4	
Approach LOS				F	

Intersection Summary			
Average Delay	18.0		
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	95	555	750	45	30	95
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	603	815	49	33	103
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)			191			
pX, platoon unblocked	0.83				0.83	0.83
vC, conflicting volume	864				1649	840
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	836				1784	807
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	84				48	67
cM capacity (veh/h)	661				63	316

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	103	603	864	33	103
Volume Left	103	0	0	33	0
Volume Right	0	0	49	0	103
cSH	661	1700	1700	63	316
Volume to Capacity	0.16	0.35	0.51	0.52	0.33
Queue Length 95th (m)	4.2	0.0	0.0	15.9	10.5
Control Delay (s)	11.5	0.0	0.0	112.5	21.8
Lane LOS	B			F	C
Approach Delay (s)	1.7		0.0	43.6	
Approach LOS				E	

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	1	650	845	1	1	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	707	918	1	1	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)			304			
pX, platoon unblocked	0.89				0.89	0.89
vC, conflicting volume	920				1628	919
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	910				1703	909
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	98
cM capacity (veh/h)	668				90	297

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	1	707	920	1	5
Volume Left	1	0	0	1	0
Volume Right	0	0	1	0	5
cSH	668	1700	1700	90	297
Volume to Capacity	0.00	0.42	0.54	0.01	0.02
Queue Length 95th (m)	0.0	0.0	0.0	0.3	0.4
Control Delay (s)	10.4	0.0	0.0	45.5	17.3
Lane LOS	B			E	C
Approach Delay (s)	0.0		0.0	22.0	
Approach LOS				C	

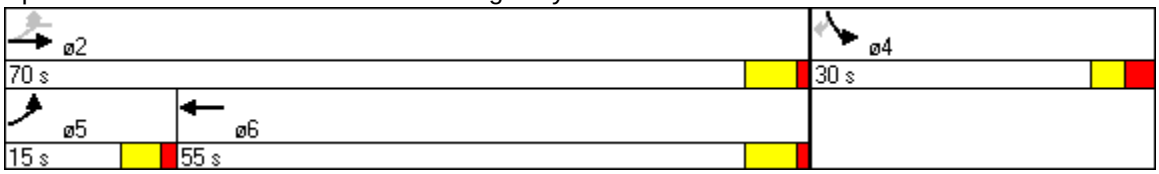
Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1789	1883	1883	1601	1789	1601
Flt Permitted	0.073				0.950	
Satd. Flow (perm)	137	1883	1883	1601	1789	1601
Satd. Flow (RTOR)				64		122
Volume (vph)	167	611	854	105	55	112
Lane Group Flow (vph)	182	664	928	114	60	122
Turn Type	pm+pt			custom		Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			2		4
Total Split (s)	15.0	70.0	55.0	70.0	30.0	30.0
Act Effct Green (s)	65.1	66.0	50.6	66.0	10.0	10.0
Actuated g/C Ratio	0.81	0.82	0.63	0.82	0.12	0.12
v/c Ratio	0.56	0.43	0.78	0.09	0.28	0.41
Control Delay	19.6	4.0	18.8	1.4	34.1	8.2
Queue Delay	0.0	0.3	0.1	0.0	0.0	0.1
Total Delay	19.6	4.3	18.9	1.4	34.1	8.3
LOS	B	A	B	A	C	A
Approach Delay		7.6	17.0		16.8	
Approach LOS		A	B		B	
Queue Length 50th (m)	10.9	26.2	104.3	1.3	8.9	0.0
Queue Length 95th (m)	32.8	48.9	#186.9	4.9	19.8	14.2
Internal Link Dist (m)		95.8	246.9		185.9	
Turn Bay Length (m)	60.0			30.0		50.0
Base Capacity (vph)	336	1550	1192	1330	472	512
Starvation Cap Reductn	0	350	0	0	0	0
Spillback Cap Reductn	0	0	16	0	0	32
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.55	0.79	0.09	0.13	0.25

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 80.4
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 13.1 Intersection LOS: B
Intersection Capacity Utilization 67.5% ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Starrs Road & Highway 101



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	37	710	775	191	68	44
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	40	772	842	208	74	48
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)		71	120			
pX, platoon unblocked	0.55				0.62	0.55
vC, conflicting volume	1050				1798	946
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1091				1966	902
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				0	74
cM capacity (veh/h)	350				38	184

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	40	772	1050	74	48
Volume Left	40	0	0	74	0
Volume Right	0	0	208	0	48
cSH	350	1700	1700	38	184
Volume to Capacity	0.11	0.45	0.62	1.96	0.26
Queue Length 95th (m)	2.9	0.0	0.0	60.8	7.5
Control Delay (s)	16.6	0.0	0.0	679.6	31.2
Lane LOS	C			F	D
Approach Delay (s)	0.8		0.0	424.9	
Approach LOS				F	

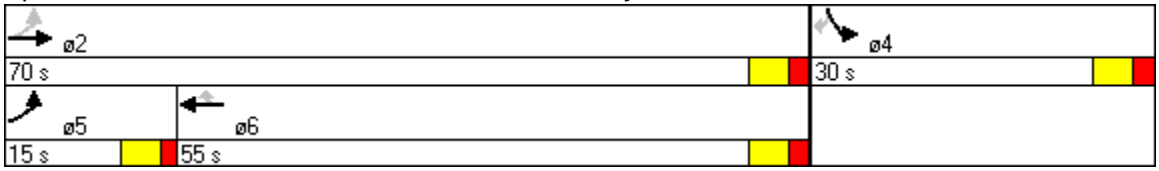
Intersection Summary			
Average Delay	26.4		
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		

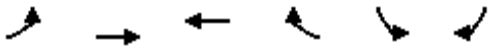
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1789	1883	1883	1601	1789	1601
Flt Permitted	0.180				0.950	
Satd. Flow (perm)	339	1883	1883	1601	1789	1601
Satd. Flow (RTOR)				133		290
Volume (vph)	233	477	635	184	270	267
Lane Group Flow (vph)	253	518	690	200	293	290
Turn Type	pm+pt			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			6		4
Total Split (s)	15.0	70.0	55.0	55.0	30.0	30.0
Act Effct Green (s)	49.5	49.5	34.2	34.2	18.6	18.6
Actuated g/C Ratio	0.65	0.65	0.45	0.45	0.24	0.24
v/c Ratio	0.60	0.43	0.82	0.25	0.68	0.48
Control Delay	12.9	8.1	22.2	5.7	32.4	5.7
Queue Delay	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	12.9	8.1	22.3	5.7	32.4	5.7
LOS	B	A	C	A	C	A
Approach Delay		9.7	18.6		19.1	
Approach LOS		A	B		B	
Queue Length 50th (m)	13.2	32.2	83.5	5.4	39.1	0.0
Queue Length 95th (m)	31.9	61.4	142.0	17.6	77.9	19.0
Internal Link Dist (m)		89.6	46.7		84.3	
Turn Bay Length (m)	40.0			40.0		
Base Capacity (vph)	438	1343	1046	949	573	709
Starvation Cap Reductn	0	0	36	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.39	0.68	0.21	0.51	0.41

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 76.7
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 15.7 Intersection LOS: B
Intersection Capacity Utilization 71.3% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 3: Starrs Road & Main Driveway





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	112	700	902	1	1	107
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	122	761	980	1	1	116
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)			114			
pX, platoon unblocked	0.66				0.66	0.66
vC, conflicting volume	982				1985	981
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	972				2497	971
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	74				93	42
cM capacity (veh/h)	467				15	202

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	122	761	982	1	116
Volume Left	122	0	0	1	0
Volume Right	0	0	1	0	116
cSH	467	1700	1700	15	202
Volume to Capacity	0.26	0.45	0.58	0.07	0.58
Queue Length 95th (m)	7.9	0.0	0.0	1.5	23.9
Control Delay (s)	15.4	0.0	0.0	254.3	44.6
Lane LOS	C			F	E
Approach Delay (s)	2.1		0.0	46.6	
Approach LOS				E	

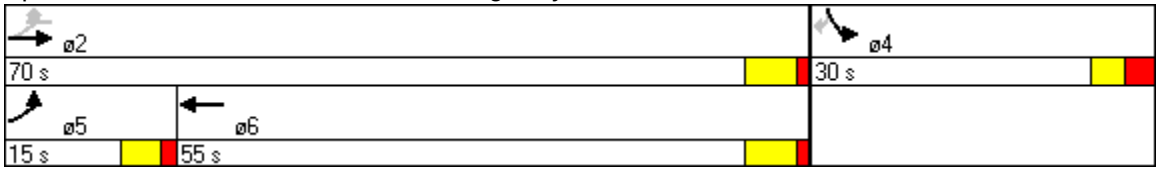
Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1789	1883	3579	1601	1789	1601
Flt Permitted	0.206				0.950	
Satd. Flow (perm)	388	1883	3579	1601	1789	1601
Satd. Flow (RTOR)				114		122
Volume (vph)	167	611	854	105	55	112
Lane Group Flow (vph)	182	664	928	114	60	122
Turn Type	pm+pt			custom		Perm
Protected Phases	5	2	6		4	
Permitted Phases	2			2		4
Total Split (s)	15.0	70.0	55.0	70.0	30.0	30.0
Act Effct Green (s)	41.5	42.3	30.7	42.3	9.4	9.4
Actuated g/C Ratio	0.70	0.74	0.54	0.74	0.16	0.16
v/c Ratio	0.36	0.47	0.48	0.09	0.21	0.34
Control Delay	5.0	5.0	11.5	0.9	21.9	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.0	5.0	11.5	0.9	21.9	6.3
LOS	A	A	B	A	C	A
Approach Delay		5.0	10.4		11.5	
Approach LOS		A	B		B	
Queue Length 50th (m)	4.7	23.8	35.1	0.0	5.0	0.0
Queue Length 95th (m)	11.1	48.7	55.8	3.4	15.4	11.8
Internal Link Dist (m)		95.8	110.7		185.9	
Turn Bay Length (m)	60.0			30.0		50.0
Base Capacity (vph)	527	1565	2478	1350	622	636
Starvation Cap Reductn	0	31	0	0	0	0
Spillback Cap Reductn	0	0	8	0	0	1
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.43	0.38	0.08	0.10	0.19

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 56.8
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.48
Intersection Signal Delay: 8.3 Intersection LOS: A
Intersection Capacity Utilization 46.2% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 1: Starrs Road & Highway 101



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	37	710	775	191	68	44
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	40	772	842	208	74	48
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)		71	120			
pX, platoon unblocked	0.83				0.90	0.83
vC, conflicting volume	1050				1798	525
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	853				1472	219
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				25	93
cM capacity (veh/h)	648				99	650

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	40	772	562	488	74	48
Volume Left	40	0	0	0	74	0
Volume Right	0	0	0	208	0	48
cSH	648	1700	1700	1700	99	650
Volume to Capacity	0.06	0.45	0.33	0.29	0.75	0.07
Queue Length 95th (m)	1.5	0.0	0.0	0.0	29.9	1.8
Control Delay (s)	10.9	0.0	0.0	0.0	109.1	11.0
Lane LOS	B				F	B
Approach Delay (s)	0.5		0.0		70.6	
Approach LOS					F	

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	47.8%	ICU Level of Service	A
Analysis Period (min)	15		