NOVA SCOTIA DEPARTMENT OF
TRANSPORTATION & PUBLIC WORKS

HIGHWAY 102- ROUTE 214
INTERCHANGE AREA TRANSPORTATION STUDY

January, 2003
1199-1

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NOVA SCOTIA DEPARTMENT OF TRANSPORTATION & PUBLIC WORKS

HIGHWAY 102 - ROUTE 214
INTERCHANGE AREA TRANSPORTATION STUDY

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1.0 INTRODUCTION

The Nova Scotia Department of Transportation & Public Works (TPW) commissioned O'Halloran Campbell Consultants (O'HCC) to carry out this study concerning the implications for the Route 214 road network in the vicinity of the Highway 102 interchange as a result of proposed expansions of existing developments and ongoing growth of the surrounding area. The study was based on TPW's Terms of Reference dated May 13, 2002 (see **Appendix A**). This report provides the results of the study.

1.1 OBJECTIVE

The objectives of this transportation study are:

- Assess Route 214 in the interchange area with existing traffic volumes (2002).
- Assess Route 214 in the interchange area with 20 year horizon traffic volumes (2022).
- Identify potential infrastructure improvements including phasing.
- Identify access management measures.
- Conduct a functional design and cost estimate of the preferred improvement options.

The overall intent of the study is to identify the requirements to provide a safe and efficient transportation network that will facilitate future residential, commercial and industrial growth and development.

1.2 BACKGROUND

Elmsdale has experienced significant growth in recent years due in part to population growth and various developments. The Municipality of East Hants has experienced the highest percentage growth of all the municipalities in Nova Scotia over the last decade. The study area is shown in Figure 1.1 on the following page. The Elmsdale Shopping Centre and the Atlantic Superstore are within the study area and both developments have plans for future expansion. Further commercial developments are expected to take place in the East Hants Business Park and in the area of the interchange. The Municipality has zoned the land as commercial, fronting Route 214, east of the

HIGHWAY 102/ROUTE 214 INTERCHANGE AREA TRANSPORTATION STUDY

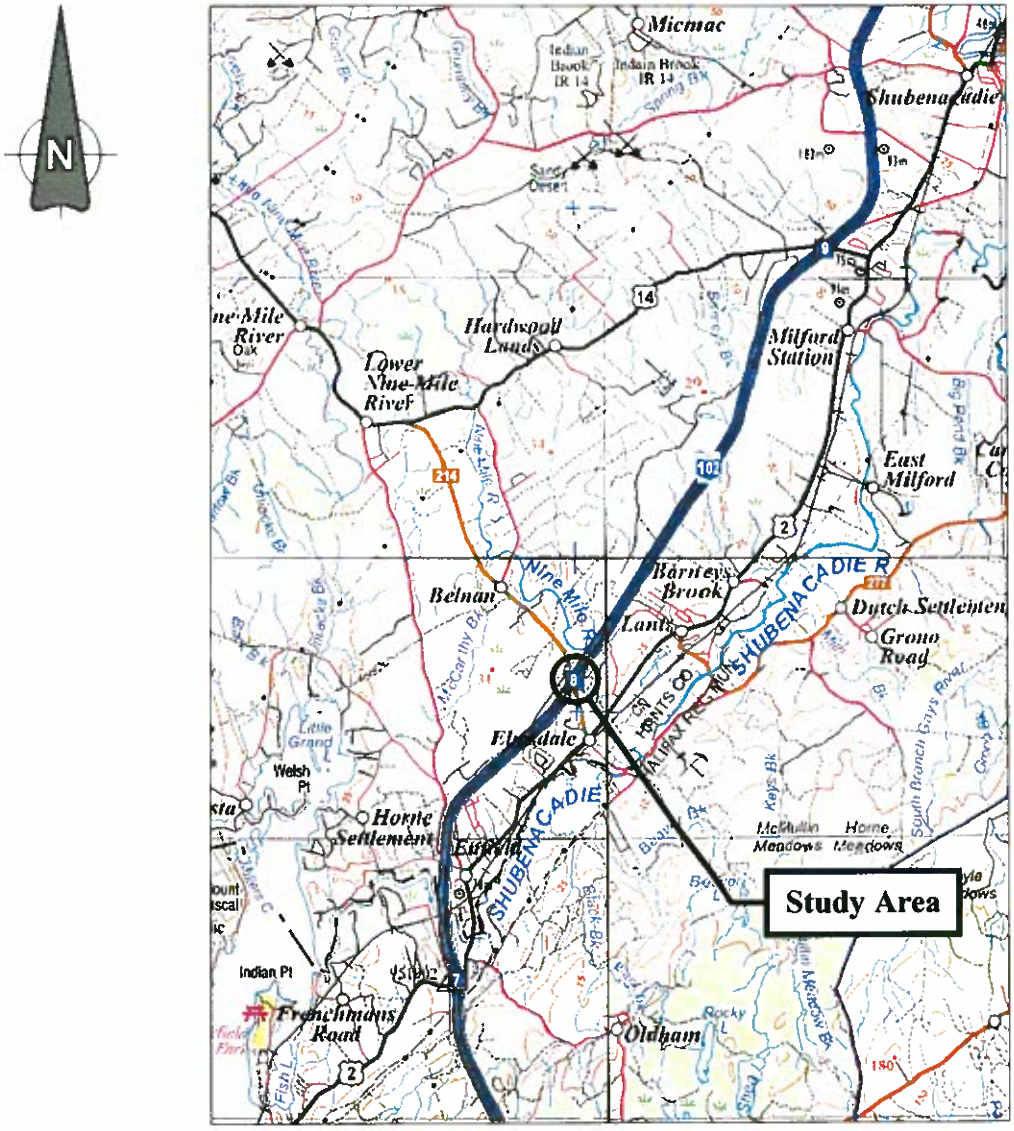

FIGURE 1.1

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JANUARY, 2003
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study area. The rapid growth and commercialization of the area is placing increasing stress on the roadway infrastructure system.

TPW called for proposals for a study to assess the long term transportation needs in the Highway 102/Route 214 interchange area. The study components are to include traffic analyses using collected data, functional designs of area improvements and an appropriate access management plan required to ensure safe and efficient interchange area operations with future growth and development. The existing and the proposed configurations are to be assessed over a 20 year horizon period. O'Halloran Campbell was retained to conduct the study.

1.3 PREVIOUS STUDIES

Some of the previous studies conducted for the Highway 102/Route 214 (Elmsdale) Interchange area include the following:

- Elmsdale Shopping Centre: Traffic Impact Analysis, Delphi Systems Incorporated, March 2002.
- The Final Report, Traffic Impact Study, Elmsdale Superstore Site Development, Elmsdale, Nova Scotia, Atlantic Road and Traffic Management, April 2002.
- Municipality of East Hants, Route 214 Corridor Study, Streetwise Traffic Engineering, April 1998.
- Municipality of East Hants, Socio-Economic Study, August 1999.

Only the Introduction chapter and data were provided for the Elmsdale Shopping Centre and the Elmsdale Superstore reports. The full report was provided for the Route 214 Corridor Study and the Socio-Economic Study.

The Elmsdale Shopping Centre report, conducted for Atlantic Shopping Centres, details the impacts on the Elmsdale Shopping Centre signalized intersection and the Route 214/Northbound Highway 102 Ramp terminus intersection by the proposed 100,000 sq. ft. expansion of the Elmsdale Shopping Centre. The main recommendation was to signalize the Route 214/Northbound Highway 102 Ramp terminus intersection and coordinate it with the Elmsdale Shopping Centre intersection signals.

The Elmsdale Superstore report, conducted for Loblaws Properties Limited, assesses the impact on the Superstore / Park Road / Route 214 intersection from the proposed 153,000 sq. ft. expansion of the Superstore. The improvements identified in the report include a right-in only entrance to the Superstore on Route 214 approximately 80 m west of the Southbound Ramp terminal and the signalization and additional left turn lanes at the Superstore/Park Rd./Route 214 intersection. It is understood that the right-in only entrance is proceeding in the near term.

The Route 214 Corridor Study, conducted for the Municipality of East Hants, is a regional assessment of Route 214. The objective of the study was to assess the existing configuration with increased traffic volumes anticipated from the new commercially zoned area and identify geometric improvements to manage the estimated additional volumes. Level of Service (LOS) analyses were conducted for traffic along Route 214 at the signalized intersection at Trunk 2 and the Elmsdale Shopping Centre, and for a typical unsignalized commercial driveway intersection. The traffic flow was simulated using a QRS model. Recommendations for a short term plan included widening Route 214 to accommodate a centre two-way left turn lane with curb and sidewalks on both sides in areas along Route 214 where any commercial redevelopment occurred. Recommendations for a long term plan included diversion of additional traffic outside the interchange area. The potential solutions for this included a North Lantz interchange, a South Lantz interchange, a south collector (south of Route 214 and east of Highway 102) and a north collector (north of Route 214 and east of Highway 102). It is understood that TPW favoured the South Lantz Interchange solution (beyond the scope of this study).

The Socio-Economic Study involved the assessment of population growth rates between 1991 and 1996, based on Census statistics for all of East Hants, including Elmsdale and surrounding areas. A projection of population growth for the horizon year of 2021 was estimated. Other statistics were reviewed in the study including marital status, languages, aboriginal population, education, income levels, housing, and labour force. The average annual population growth rate over twenty five years (1996 to 2021), for the regional services area of Enfield, Elmsdale and Lantz, was estimated to be 3.2% per year. This is discussed further in Section 2.2.

2.0 STUDY AREA

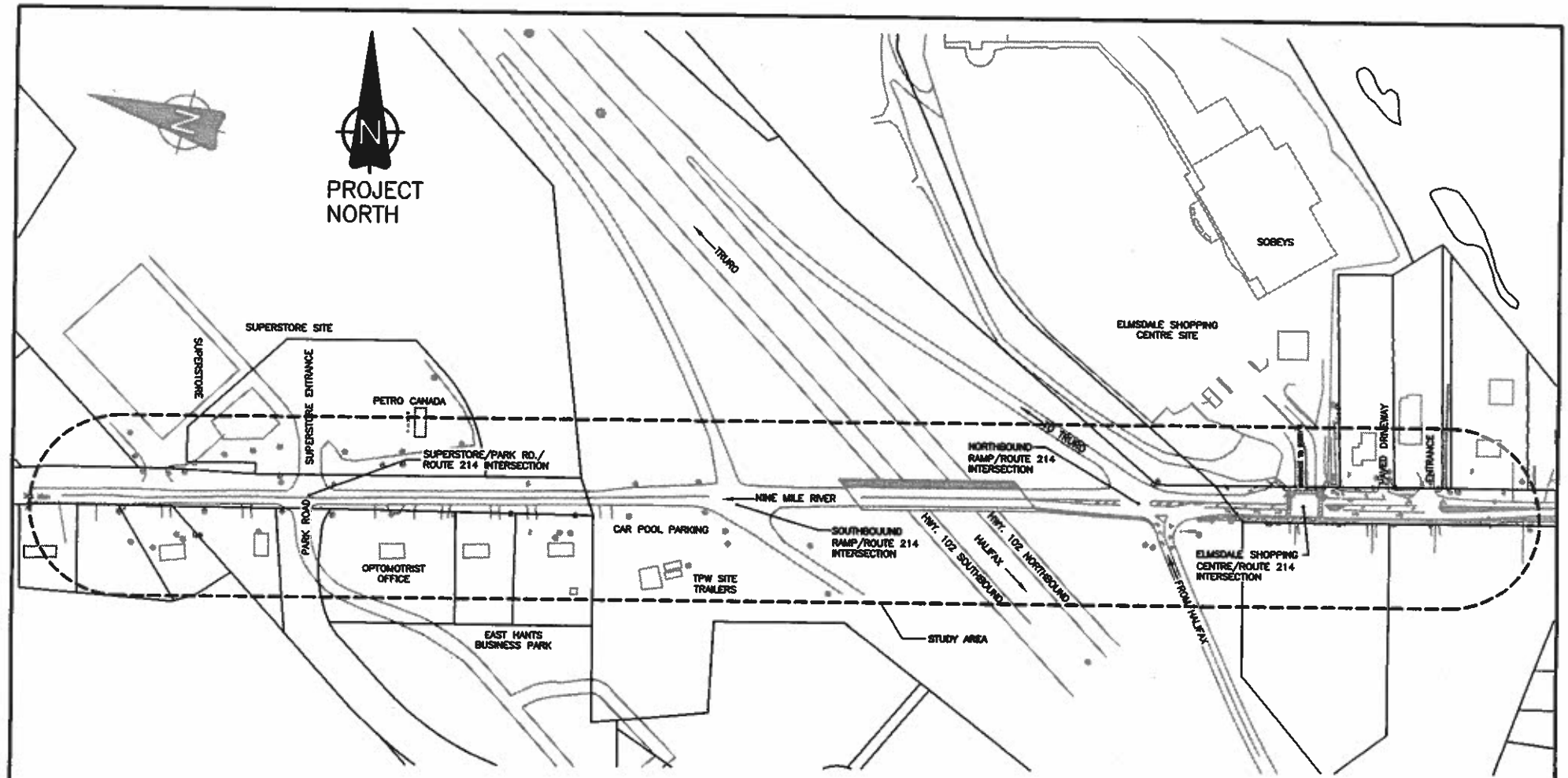
2.1 PHYSICAL DESCRIPTION

The study area includes Route 214 from the Superstore/East Hants Business Park (Park Road) to the Elmsdale Shopping Centre (approximately 550 m). Route 214 is a two-lane collector highway that crosses over Highway 102, spanning between Trunk No. 14 and Trunk No. 2. The study area includes the Superstore/Park Road intersection, the terminus of the Southbound and Northbound Highway 102 Ramps, and the signalized intersection at the Elmsdale Shopping Centre. The study area includes several residential driveways and one commercial driveway between the Superstore and Highway 102. The driveways and the intersections are in close proximity to one another. (See Figure 2.1)

Along Route 214, west of the Superstore, there are many farms and a few commercial/residential developments sparsely distributed. There are no signalized intersections near the study area, west of the Superstore.

The Superstore site includes businesses such as Superstore grocery store, NS liquor store (NSLC) and a Petro Canada gas bar with a convenience store. The site is approximately 33 acres of land with almost 60,000 sq. ft. of occupied commercial space and it is owned by Loblaws Properties Limited. The site is not fully developed. Access to the site is via an unsignalized intersection on Route 214 opposite Park Road and is located approximately 220 m west of the Highway 102 Southbound Ramp intersection. There is a service vehicle driveway further west than the main Superstore driveway. The Superstore driveway has a left-turn lane and a shared through right-turn lane for traffic exiting and one receiving lane for traffic entering the Superstore site. The clear throat distance on the Superstore driveway is approximately 25 m.

The East Hants Business Park has 24 businesses including automotive repair shops, metal shops, equipment rentals, recycling plant, manufacturing facilities, etc. The site is approximately 35 acres with 28 acres of it fully developed. The land is owned and managed by the Municipality of East Hants. Access to the site is via the unsignalized intersection with Route 214 described above for the



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HWY. 102/RTE. 214 INTERCHANGE AREA TRANSPORTATION STUDY

STUDY AREA

FIGURE 2.1 | JAN. 2003

E:\1199-1\FIGURES\FIGURE2.1.dwg

Superstore, with one lane in each direction. There is a 3 km long two lane loop road through the park.

The Highway 102 overpass has one lane in each direction with a narrow sidewalk on the south side of the bridge. On the west side of the Highway 102 interchange, Route 214 has two lanes with gravel shoulders and some residential/commercial driveways along the south side. There is a reduced speed limit of 50 km/h approximately 100 m west of the interchange. The westbound speed limit is increased from 50 km/h to 70 km/h at the same location.

In the vicinity of the Elmsdale Shopping Centre, Route 214 has three lanes with curb and sidewalk on each side. Route 214 is three lanes wide from about 75 m east of the Elmsdale Shopping Centre to about 50 m west of the Highway 102 Northbound Ramps. In each case there is an eastbound and a westbound through lane and the third lane is designated as follows:

- east of study area - shared left-turn lane
- east limit of study area to Elmsdale Shopping Centre - shared left-turn lane
- Elmsdale Shopping Centre to 50 m west of the Northbound Ramps - eastbound left turn storage lane

The Elmsdale Shopping Centre is owned by Sobeys and it includes businesses such as Sobeys, Subway, Pharmasave, Radio Shack, Scotia Bank, Tim Horton's, Wilson's Fuels, etc. The shopping centre is 103,000 sq. ft. on 16 acres of land, with 30 additional acres for potential development. Access to the shopping centre is via one signalized intersection on Route 214 approximately 80 m east of the Highway 102 Northbound Ramp intersection. The shopping centre intersection is a tee with both a right and left turn lane for traffic exiting and two receiving lanes for traffic entering the shopping centre site. The clear throat distance is approximately 35 m.

Some of the businesses found east of the Elmsdale Shopping Centre include McDonald's, an Irving service station, a bank, a flower shop, auto parts shops, travel agency, church, video store, etc. The next signalized intersection, along Route 214, is approximately 1 km east (at Trunk 2) of the shopping centre, with an active rail crossing just beyond Trunk 2.

2.2 *GROWTH & DEVELOPMENT SCENARIOS*

A traffic growth of 2% compounded annually was assumed, based on TPW's experience. From the East Hants Socio-Economic study, it was found that there were 4,483 people in the serviced areas of Elmsdale, Enfield and Lantz in 1996 and that 10,150 people are projected for 2021 (see **Appendix B**). Using trip generation for "Single Family Detached Housing"during the p.m. peak hour, it was found that this would equate to about 934 trip ends per hour in 1996 and 1,880 trip ends per hour in 2021 or about 2.8% traffic growth compounded annually. This is a broad approximation of possible growth and it is considered supportive of the 2% traffic growth used.

The 2% growth rate per year over 20 years (or 49%) was applied to the background traffic volumes, i.e. traffic unrelated to the Superstore site, the Business Park site or the Elmsdale Shopping Centre site, to develop the 20 year horizon traffic excluding development. This includes east and westbound traffic not turning into any of the developments and all traffic movements at both the north and southbound ramp terminals.

The Elmsdale Shopping Centre is planning a 100,000 sq ft commercial retail expansion including a building supply store and other commercial type outlets. This would almost double the size of the current Elmsdale Shopping Centre from 103,000 sq ft to 203,000 sq ft.

The Superstore is planning a 153,000 sq ft expansion, in addition to the existing 55,500 sq ft, over the next 20 years. Some of the expansions to the Superstore will include a Liquor Store expansion, home improvement store, and general expansion to the Superstore facilitating various specialty retail shops.

ITE Trip Generation 6th Edition was used to estimate the additional traffic volumes generated by the Superstore site expansions and for the Elmsdale Shopping Centre site expansions. These developments were treated as "Shopping Centre". The generated trips were reduced by 25% for passby and then added to the background traffic volumes and distributed on the basis of the existing volumes. The following table (Table 2.1) summarizes the development expansions and the resulting ITE trip generation results:

TABLE 2.1 - ITE TRIP GENERATION RESULTS

ITE Trip Generation - Estimated Additional Traffic before Pass-by Reduction				
Development	*Expansion (sq. ft.)*	*ITE Type*	*Trip Ends In (veh/hr)*	*Trip Ends Out (veh/hr)*
Superstore	153,000	Shopping Centre, p.m. peak	400	433
Elmsdale Shopping Centre	100,000	Shopping Centre, p.m. peak	301	327

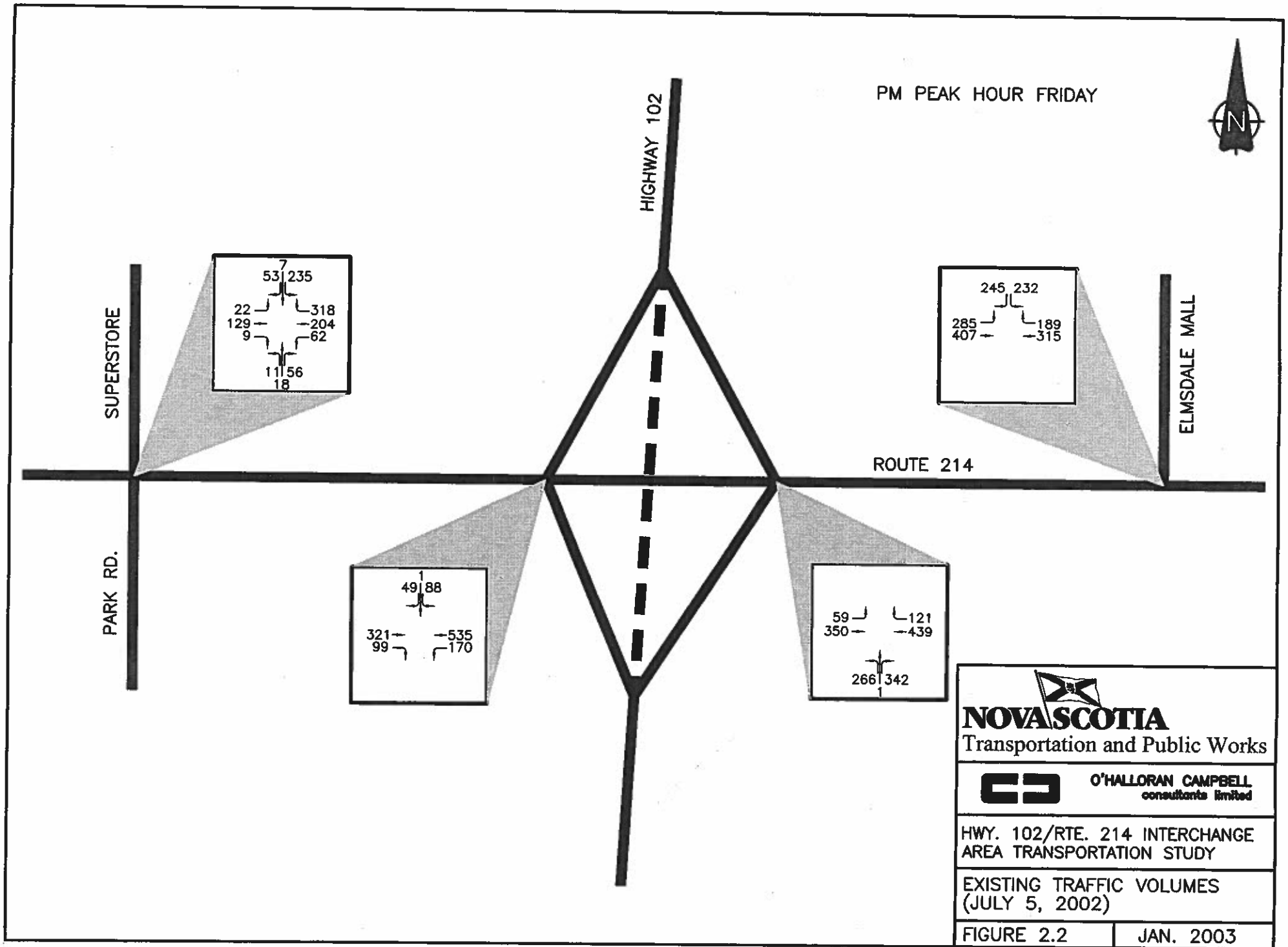
The Business Park is projected to increase from approximately 28 to 192 acres (700%) over the next 20 years. The turning movement counts of July 5, 2002 conducted for this study, were used as a representation of the currently developed 28 acres, although the existing volumes are only about 54% of the volumes predicted by the ITE Trip Generation. On this basis, the existing traffic volumes were multiplied by 7 to obtain the developed growth for the East Hants Business Park over the next 20 years, which is 14% less than the volume predicted using ITE Trip Generation.

2.3 EXISTING AND HORIZON TRAFFIC

Manual traffic counts were conducted on Friday, July 5, 2002 from 3:30 pm to 5:30 pm for the following intersections:

- Route 214/Superstore/Park Rd.
- Route 214/Southbound Ramp
- Route 214/Northbound Ramp
- Route 214/Elmsdale Shopping Centre

The count summaries can be found in **Appendix C**. The traffic volumes were not factored using Average Annual Weekday Traffic (AAWT), which is considered to be somewhat conservative. The existing traffic count data (year 2002) was balanced (i.e. adjusted to account for inconsistencies in counts between adjacent intersections) and the adjusted volumes are shown in Figure 2.2, the estimated 20 year horizon traffic volumes excluding additional development in the study area (year 2022) are shown in Figure 2.3 and the estimated 20 year horizon traffic volumes including additional development in the study area (year 2022) are shown in Figure 2.4. The 20 year horizon figures have been prepared on the basis that the right-in driveway to the Superstore will be in place. It was


PM PEAK HOUR FRIDAY
N
HIGHWAY 102
SUPERSTORE
PARK RD.
ELMSDALE MALL
ROUTE 214
7
53 235
22 318
129 204
9 62
11 56
18
245 232
285 189
407 315
1
49 88
321 535
99 170
59 121
350 439
266 342
1
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EXISTING TRAFFIC VOLUMES
(JULY 5, 2002)
FIGURE 2.2
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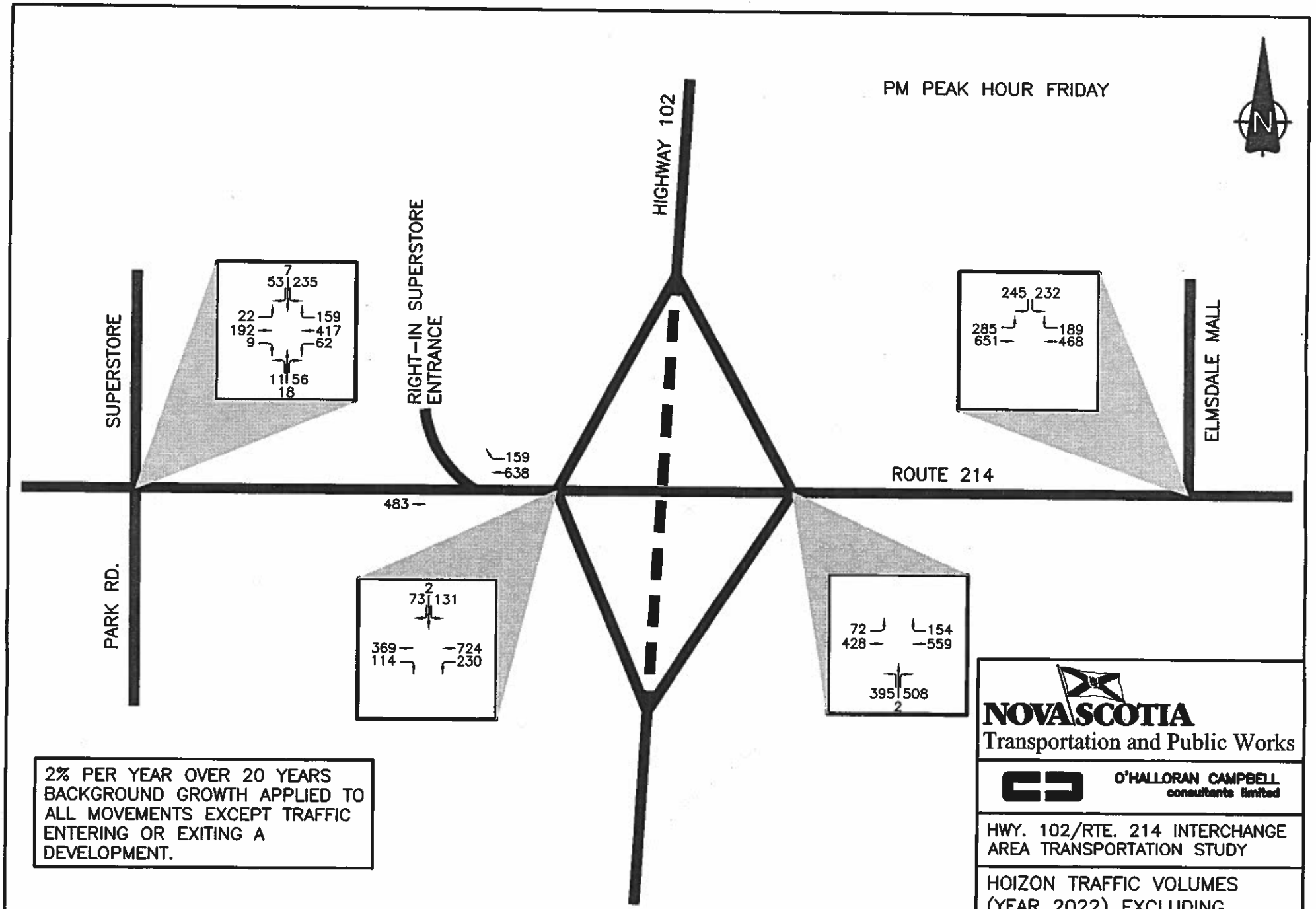
E:\1198-1\TRAFFIC COUNTS\FIGURE1.dwg


PM PEAK HOUR FRIDAY
N
HIGHWAY 102
SUPERSTORE
RIGHT-IN SUPERSTORE ENTRANCE
ELMSDALE MALL
ROUTE 214
PARK RD.
7
53 235
22 159
192 417
9 62
11 56
18
245 232
285 189
651 468
159
638
483
2
73 131
369 724
114 230
72 154
428 559
395 508
2
2% PER YEAR OVER 20 YEARS BACKGROUND GROWTH APPLIED TO ALL MOVEMENTS EXCEPT TRAFFIC ENTERING OR EXITING A DEVELOPMENT.
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HOIZON TRAFFIC VOLUMES (YEAR 2022) EXCLUDING DEVELOPMENT
FIGURE 2.3
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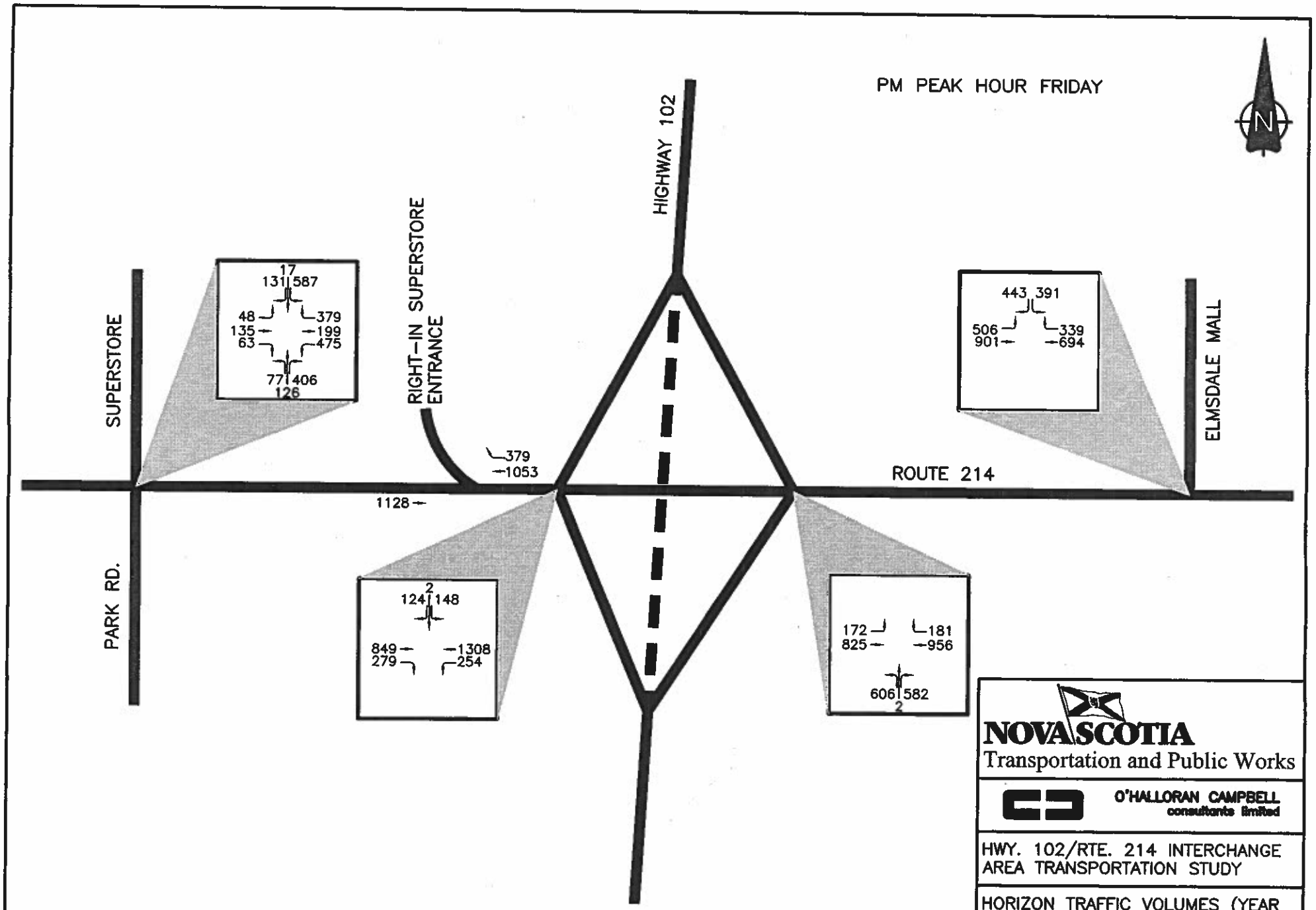
E:\1199-1\TRAFFIC COUNTS\FIGURE2.dwg



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HORIZON TRAFFIC VOLUMES (YEAR 2022) INCLUDING DEVELOPMENT

FIGURE 2.4	JAN. 2003

E:\1199-1\TRAFFIC COUNTS\FIGURE3.dwg

assumed that 50% of the westbound right turns will use the Route 214/Superstore/Park Rd. intersection and 50% will use the right-in Superstore entrance.

In order to estimate 20 year horizon traffic volumes excluding and including development (2022), the growth and development scenarios of Section 2.2 were applied.

3.0 TRAFFIC MODELLING

3.1 SIGNAL WARRANT ANALYSES

Signal warrant analyses were performed for the three unsignalized intersections in the study area during the p.m. peak, with the following scenarios considered:

- ***Scenario 1*** - Elmsdale Shopping Centre signalized
- ***Scenario 2*** - Elmsdale Shopping Centre and the Northbound Ramp terminal signalized
- ***Scenario 3*** - Elmsdale Shopping Centre, Northbound Ramp terminal and Superstore/Park Rd. signalized

The results are summarized in Table 3.1 and the worksheets are provided in **Appendix D**. Priority points of 100 or more are considered to warrant traffic signals.

TABLE 3.1 - PM PEAK SIGNAL WARRANT ANALYSIS RESULTS

Signalization Priority Points			
Intersection with Rte 214	***Existing Traffic (2002)***	***20 Year Horizon (2022) Excluding Development***	***20 Year Horizon (2022) Including Development***
Superstore/Park Rd. - Scenario 1	42.7	56.2	***289.5***
- Scenario 2	39.9	52.8	***282.6***
Southbound Ramp - Scenario 1	42.2	71.4	***146.8***
- Scenario 2	35.3	57.5	***122.3***
- Scenario 3	17.6	18.0	43.3
Northbound Ramp - Scenario 1	***109.5***	***167.1***	***341.5***

The total priority points for the Northbound Ramp intersection exceeds 100 points and it is considered to warrant signals for the existing and future scenarios.

The total priority points at the Route 214/Superstore/Park Rd. intersection are high for the 20 year horizon including development, at 289.5. With the addition of the proposed expansion, signals would be warranted.

At the Route 214/Southbound Ramp intersection, signals would not be warranted if the Superstore/Park Rd. and Northbound Ramp intersection are signalized.

3.2 LEVEL OF SERVICE ANALYSES

The Highway Capacity Manual defines Level of Service (LOS) as being a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. Some of the factors considered when measuring the LOS of a traffic movement include speed and travel time, freedom to manoeuver, traffic interruptions, comfort and convenience, and safety. The six levels of service are A to F, A representing free flow conditions and F representing forced or breakdown flow.

The LOS analyses were carried out for the four study intersections along Route 214 using the Highway Capacity Software (HCS) 2000. The analyses were conducted for the existing 2002 traffic volumes and for the estimated 20 year horizon 2022 traffic volumes, excluding and including developments. The intersections were initially analysed for the existing conditions, i.e. Superstore, Southbound Ramp and Northbound Ramp as unsignalized, and the results are summarized in Table 3.2. The detailed results are provided in **Appendix E**. The acronyms used in the table are defined as follows:

Acronym	Definition
NB	Northbound
SB	Southbound
EB	Eastbound
WB	Westbound
L	Left
T	Through
R	Right

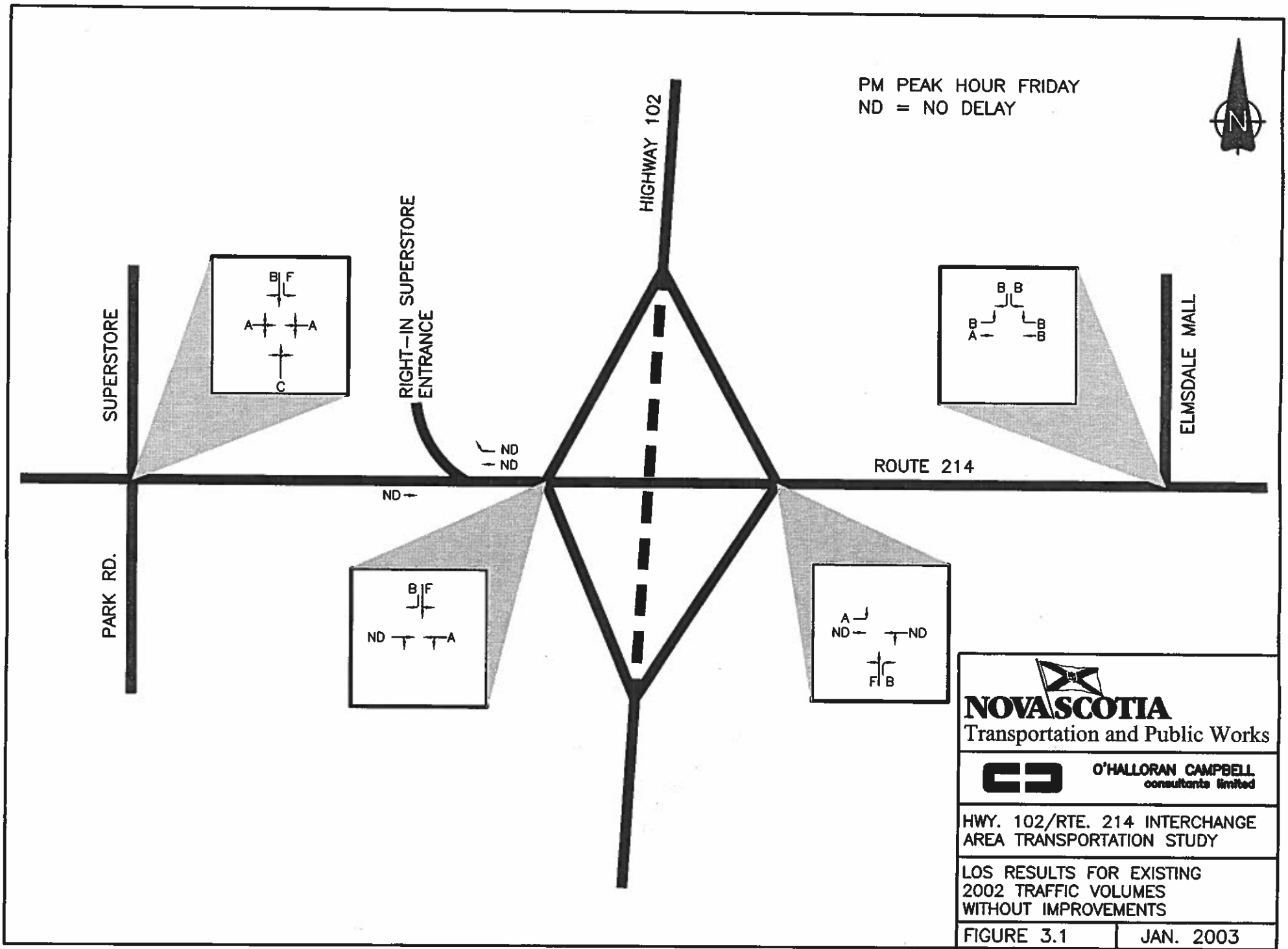
The Southbound Ramp was modelled as two lanes because the ramp flares out at Route 214 permitting vehicles to use it as though there was a short auxiliary lane for right turns.

The existing signal timing and phasing was used for the Elmsdale Shopping Centre (see **Appendix F**).

TABLE 3.2 - HCS LOS RESULTS WITHOUT IMPROVEMENTS

Movement	Existing (2002)				20 Year Horizon Excluding Developments (2022)				20 Year Horizon Including Developments (2022)			
	V/C	Queue Length (# vehs)	Delay (s)	LOS	V/C	Queue Length (# vehs)	Delay (s)	LOS	V/C	Queue Length (# vehs)	Delay (s)	LOS
Route 214Superstore/Park Rd. Unsignalized PM Peak												
EBLTR	0.03	0.09	8.8	A	0.03	0.09	9.0	A	0.06	0.21	9.2	A
WBLTR	0.06	0.18	7.7	A	0.06	0.19	7.9	A	0.47	2.63	10.5	B
NBLTR	0.27	1.09	16.7	C	0.34	1.48	21.3	C	Err	Err	Err	F
SBL	1.08	10.76	128.6	F	1.58	16.72	344.1	F	Err	Err	Err	F
SBTR	0.12	0.41	12.1	B	0.15	0.52	14.1	B	1.55	12.83	356.6	F
Route 214/Southbound Ramp Unsignalized PM Peak												
EBTR	ND				ND				ND			
WBLT	0.17	0.61	9.0	A	0.25	0.97	9.7	A	0.51	2.89	18.5	C
SBLT	0.90	5.80	122.6	F	2.64	16.88	881.1	F	Err	Err	Err	F
SBR	0.13	0.43	13.8	B	0.25	0.96	18.3	C	1.10	8.45	170.7	F
Route 214/Northbound Ramp Unsignalized PM Peak												
EBL	0.07	0.23	9.2	A	0.10	0.34	10.0	A	0.37	1.72	15.9	C
EBT	ND				ND				ND			
WBTR	ND				ND				ND			
NBLT	1.13	13.80	130.1	F	2.35	40.13	656.2	F	19.5	93.06	Err	F
NBR	0.49	2.74	14.3	B	0.79	7.91	26.7	D	1.36	29.04	199.7	F
Route 214/Elmsdale Shopping Centre Signalized PM Peak												
EBL	0.68	6.7	11.3	B	0.71	7.1	13.5	B	1.27	37.8	147.2	F
EBT	0.45	8.2	6.5	A	0.72	16.5	10.3	B	0.99	36.9	37.3	D
WBT	0.56	9.0	16.0	B	0.83	15.7	25.8	C	1.23	49.2	136.0	F
WBR	0.21	2.4	13.4	B	0.21	2.4	13.4	B	0.43	5.2	14.8	B
SBL	0.55	8.0	17.3	B	0.55	8.0	17.3	B	0.93	18.1	41.7	D
SBR	0.28	3.4	15.1	B	0.28	3.4	15.1	B	0.50	6.4	16.6	B
Intersection			12.4	B			16.0	B			77.6	E

The LOS results are summarized in Figures 3.1, 3.2 and 3.3 on the following three pages. Error results (Err) were obtained for many of the 20 year horizon traffic movements. Where 'Err' is indicated in the table, the HCS reports show blank result fields to indicate that delays are in excess of 999.9 seconds, i.e. out of the software range. This indicates that queue lengths may become infinitely large and the volume infinitely exceeds the capacity, i.e. V/C (volume over capacity)


PM PEAK HOUR FRIDAY
ND = NO DELAY
N
HIGHWAY 102
RIGHT-IN SUPERSTORE ENTRANCE
SUPERSTORE
PARK RD.
ELMSDALE MALL
ROUTE 214
B F
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C
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A
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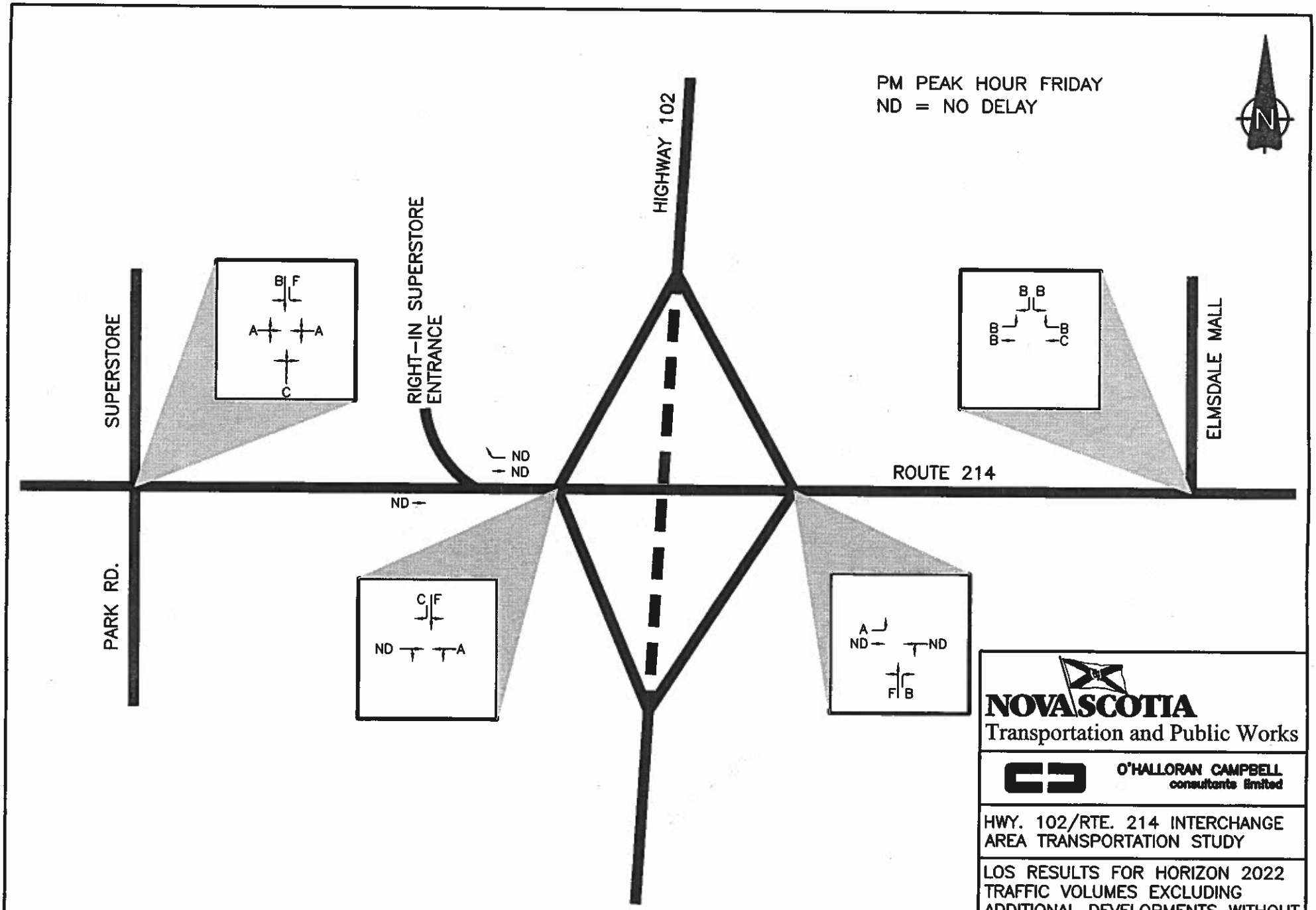
AREA TRANSPORTATION STUDY
LOS RESULTS FOR EXISTING
2002 TRAFFIC VOLUMES
WITHOUT IMPROVEMENTS
FIGURE 3.1
JAN. 2003
E:\1199-1\FIGURES\FIGURE3.1.dwg



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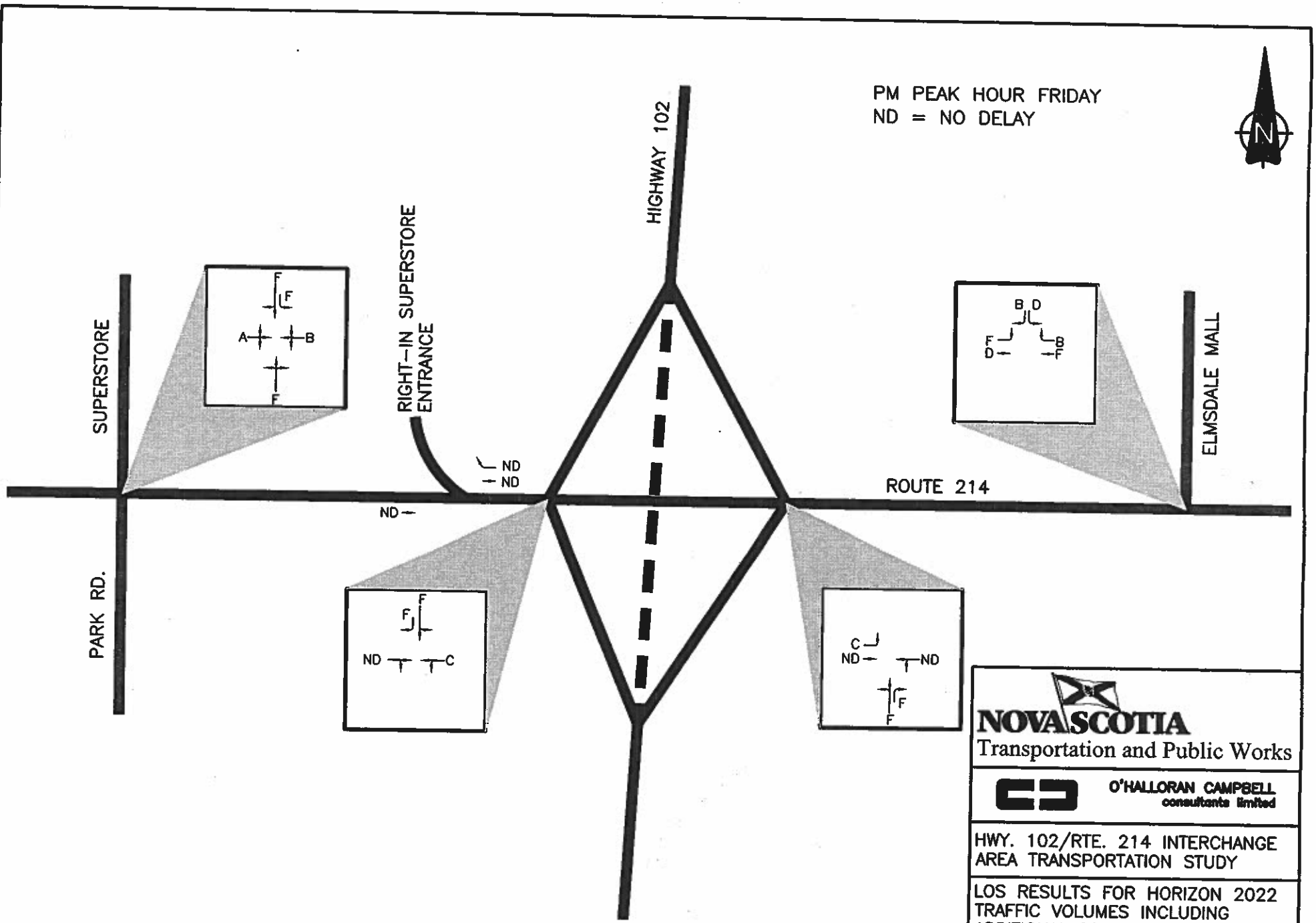
LOS RESULTS FOR HORIZON 2022 TRAFFIC VOLUMES EXCLUDING ADDITIONAL DEVELOPMENTS WITHOUT IMPROVEMENTS

FIGURE 3.2 | JAN. 2003

E:\1199-1\FIGURES\FIGURE3.2.dwg



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LOS RESULTS FOR HORIZON 2022 TRAFFIC VOLUMES INCLUDING ADDITIONAL DEVELOPMENTS WITHOUT IMPROVEMENTS

FIGURE 3.3 | JAN. 2003

E:\1199-1\FIGURES\FIGURE3.3.dwg

becomes undefined. This result occurs for movements with traffic conflicts such as left turns. The performance of an unsignalized intersection is considered unacceptable in these cases.

In other instances, a blank result field in HCS also represents a traffic movement which experiences no delays therefore a result is not required, i.e. volume is infinitely small compared to the capacity therefore V/C infinitely approaches zero. This result is indicated by 'ND' in the table. This result occurs for movements with no traffic conflicts such as through and right turns.

Route 214/Superstore/Park Rd. with existing 2002 traffic has a LOS F for the southbound left turn exiting the Superstore site, with more than a 2 minute delay and an 11 vehicle queue. Improvements are considered to be warranted, which might include signals. The V/C ratios for the 20 year horizon with development becomes undefined due to excessive volumes and inadequate capacity. Significant improvements are warranted for the Superstore driveway and Park Road by 2022.

Route 214/Southbound Ramp with existing 2002 traffic has a LOS F for traffic exiting Highway 102 southbound onto Route 214 eastbound (southbound shared through-left), with more than a 2 minute delay and a 6 vehicle queue. For the 20 year horizon, it is estimated that southbound traffic will experience excessive queues, potentially backing up down the ramp. The Southbound Ramp warrants improvements for the southbound left turn at the time of signalization and for the intersection by 2022.

Route 214/Northbound Ramp with existing 2002 traffic has a LOS F for the northbound left, with delays over 2 minutes and a 14 vehicle queue. For the 20 year horizon, it is estimated that northbound traffic will experience excessive queues, potentially backing up onto Highway 102. Improvements are warranted for the northbound left in the near term and for the intersection by 2022.

Route 214/The Elmsdale Shopping Centre intersection with existing 2002 traffic volumes is at LOS B or better and is considered acceptable. With background traffic growth to 2022 the LOS remains at LOS B. The 20 year horizon traffic volumes with development reduces the LOS from LOS B to LOS E and an overall delay degradation of 65 seconds. Improvements are considered to be warranted by 2022 with the development and this is discussed further in Section 3.3.

The signal warrant analyses indicated that signals are warranted at Route 214/Northbound Ramp for the existing and at the Route 214/Superstore/Park Rd. when further development takes place. The LOS analyses in Table 3.2 indicate that signals may be warranted at Route 214/Southbound Ramp for the existing. An LOS analysis was carried out assuming the three unsignalized intersections are signalized as of 2002. The results are summarized in Table 3.3.

TABLE 3.3 - HCS LOS RESULTS WITH SIGNALS

Movement	Existing (2002)				20 Year Horizon Excluding Developments (2022)				20 Year Horizon Including Developments (2022)			
	V/C	Queue Length (# vehs)	Delay (s)	LOS	V/C	Queue Length (# vehs)	Delay (s)	LOS	V/C	Queue Length (# vehs)	Delay (s)	LOS
Route 214/Superstore/Park Rd. Signalized PM Peak												
EBLTR	0.67	10.5	40.8	D	0.81	16.4	51.5	D	1.58	45.0	323.9	F
WBLTR	0.84	19.2	16.4	B	0.96	27.8	19.9	B	2.32	227.1	620.6	F
NBLTR	0.18	4.9	20.3	C	0.21	5.8	27.4	C	2.36	134.1	659.1	F
SBL	0.36	7.4	17.1	B	0.43	9.2	24.6	C	1.27	49.0	172.9	F
SBTR	0.09	2.1	12.9	B	0.10	2.6	18.2	B	0.23	6.2	16.4	B
Intersection			20.6	C			26.7	C			494.6	D
Route 214/Southbound Ramp Signalized PM Peak												
EBTR	0.94	26.1	55.6	E	1.19	45.2	138.1	F	2.19	182.7	570.1	F
WBLT	0.83	10.0	6.6	A	1.07	45.9	53.0	D	2.09	210.1	501.7	F
SBLT	0.28	5.8	31.7	C	0.54	9.8	45.3	D	0.58	Err	45.3	D
SBR	0.19	3.2	30.7	C	0.37	5.5	41.7	D	0.59	10.9	47.6	D
Intersection			25.4	C			76.1	E			481.5	F
Route 214/Northbound Ramp Signalized PM Peak												
EBL	0.14	0.4	1.2	A	0.22	3.1	15.2	B	0.54	8.8	25.1	C
EBT	0.32	1.9	1.3	A	0.41	2.4	1.5	A	0.72	7.8	1.9	A
WBTR	0.78	22.3	16.2	B	0.98	46.2	39.3	D	1.54	140.9	266.3	F
NBLT	0.53	14.0	27.9	C	0.72	23.4	33.8	C	1.28	72.3	173.0	F
NBR	0.66	16.5	32.0	C	0.89	30.8	47.0	D	1.18	54.0	134.7	F
Intersection			18.0	B			32.0	C			151.3	F
Route 214/Elmsdale Shopping Centre Signalized PM Peak												
EBL	0.68	6.7	11.3	B	0.71	7.1	13.5	B	1.27	37.8	147.2	F
EBT	0.45	8.2	6.5	A	0.72	16.5	10.3	B	0.99	36.9	37.3	D
WBT	0.56	9.0	16.0	B	0.83	15.7	25.8	C	1.23	49.2	136.0	F
WBR	0.21	2.4	13.4	B	0.21	2.4	13.4	B	0.43	5.2	14.8	B
SBL	0.55	8.0	17.3	B	0.55	8.0	17.3	B	0.93	18.1	41.7	D
SBR	0.28	3.4	15.1	B	0.28	3.4	15.1	B	0.50	6.4	16.6	B
Intersection			12.4	B			16.0	B			77.6	E

The LOS results are summarized in Figures 3.4, 3.5 and 3.6 on the following three pages.

Signalizing the four study intersections should improve the LOS of each intersection to an acceptable level, i.e. LOS D or better, for existing traffic volumes (2002), without physical improvements, with the exception of the Southbound Ramp. Physical improvements may be warranted at this location with existing (2002) traffic volumes..

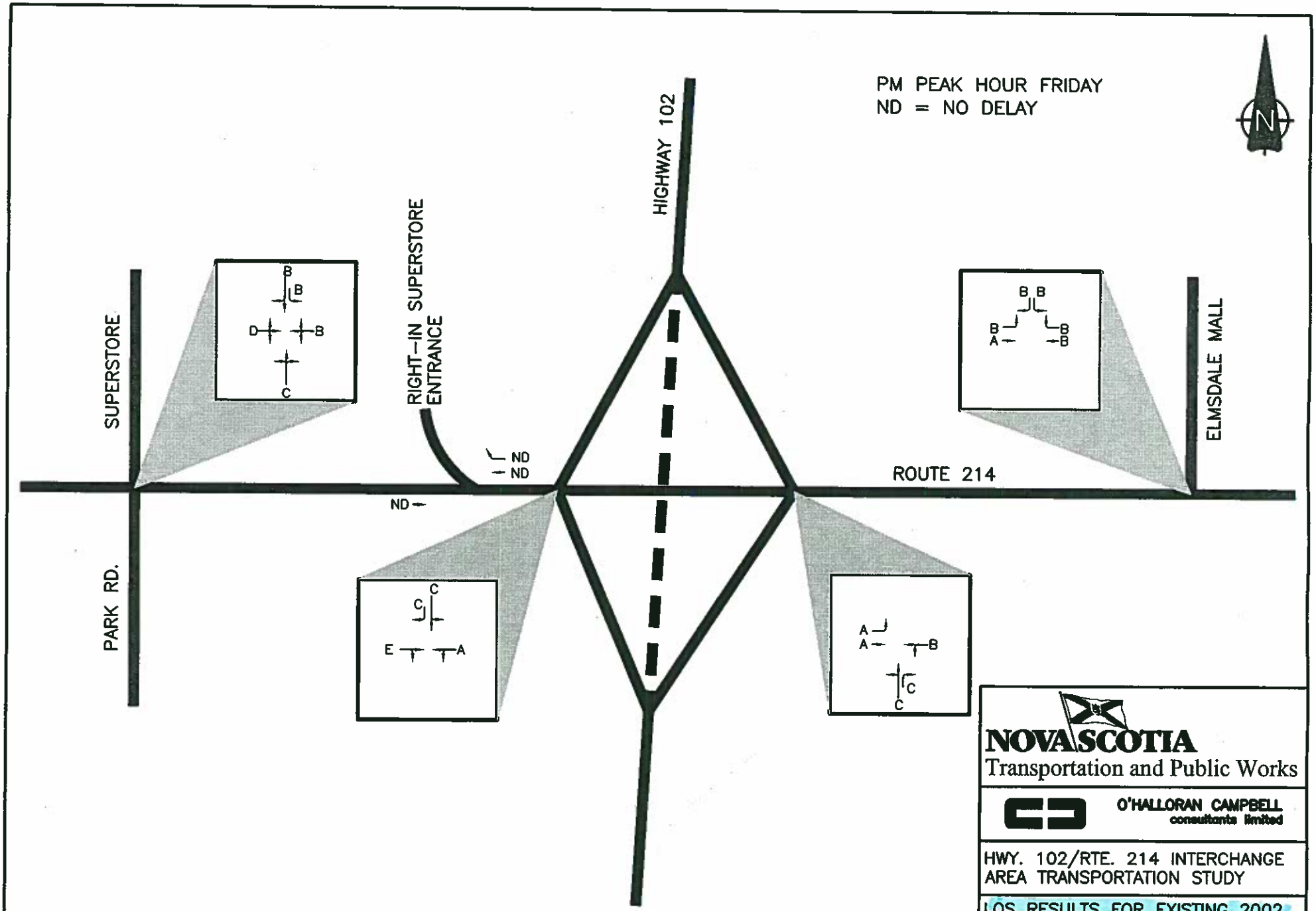
With 20 year horizon traffic volumes excluding developments (2022), the Route 214/Superstore/Park Rd., the Route 214/Elmsdale Shopping Centre and the Route 214/Northbound Ramp intersections operate at an acceptable level (i.e. LOS D) with signals and no physical changes. Again, the Route 214/Southbound Ramp intersection would be at LOS E and it should have physical improvements at the time of signalization.

With 20 year horizon traffic volumes including developments (2022), all four intersections operate at an undesirable level (i.e. LOS E or worse) with signalization only. This demonstrates that after development, physical changes will be warranted.

3.3 Potential Improvements and Areas of Concern

In order to improve the Highway 102/Route 214 interchange area traffic network, the following improvement options were considered and analysed to assess the effect of the change. The options were applied to horizon 2022 traffic volumes with additional developments. The LOS results are summarized in the table following the option descriptions and the detailed results are found in **Appendix G**. New signals would be coordinated with the adjacent signals. A protected signal phase signifies a flashing green light for left turn traffic movements and a permitted signal phase signifies a solid green light in which left turning traffic must yield to on-coming through traffic.

Note - the optimal signal phasing was selected as being westbound traffic initially protected followed by east/westbound traffic permitted, then southbound traffic protected, followed by north/southbound traffic permitted, unless noted otherwise.



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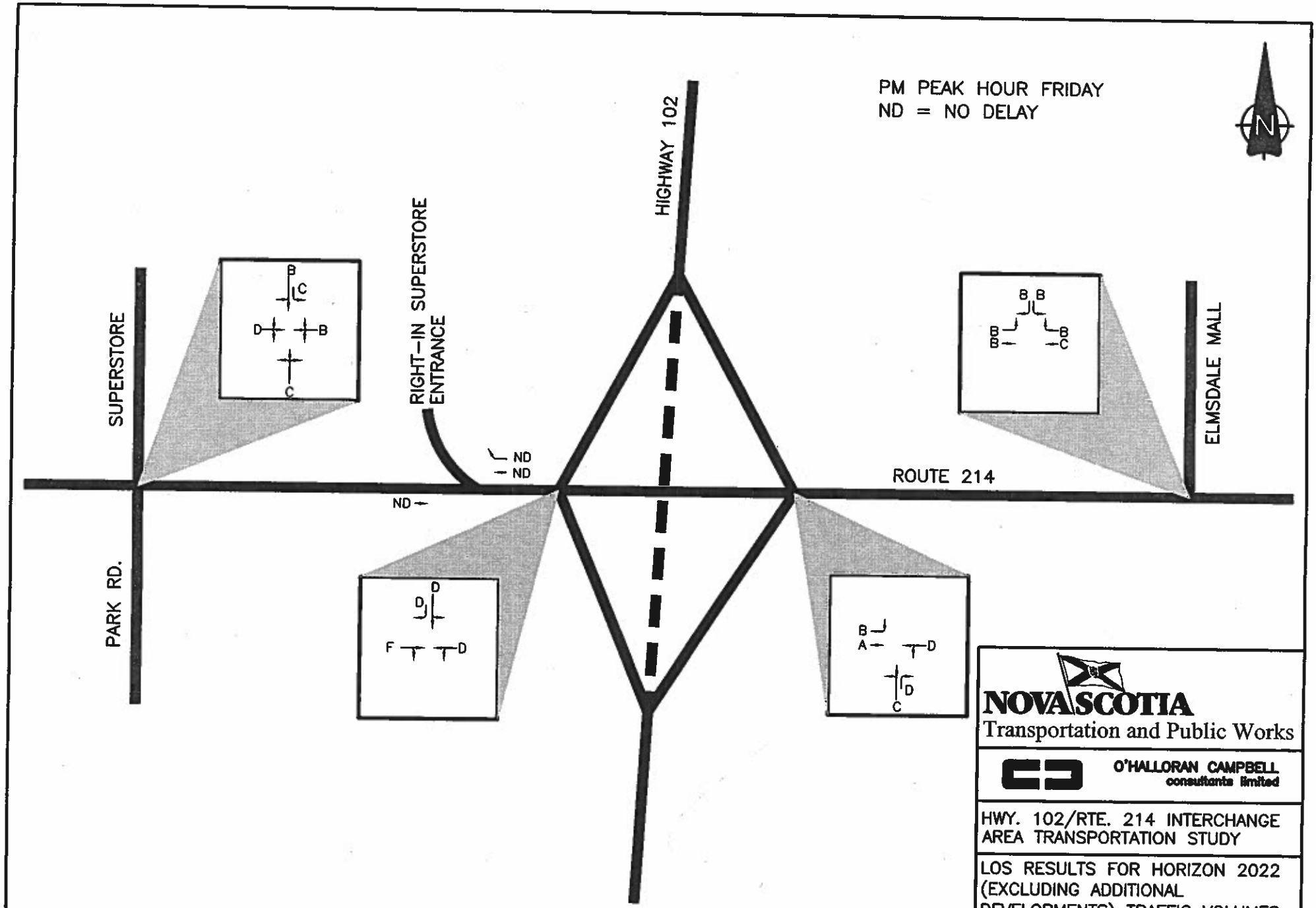
LOS RESULTS FOR EXISTING 2002
TRAFFIC VOLUMES WITH SIGNALS

FIGURE 3.4 | JAN. 2003

E:\1199-1\FIGURES\FIGURE3.4.dwg



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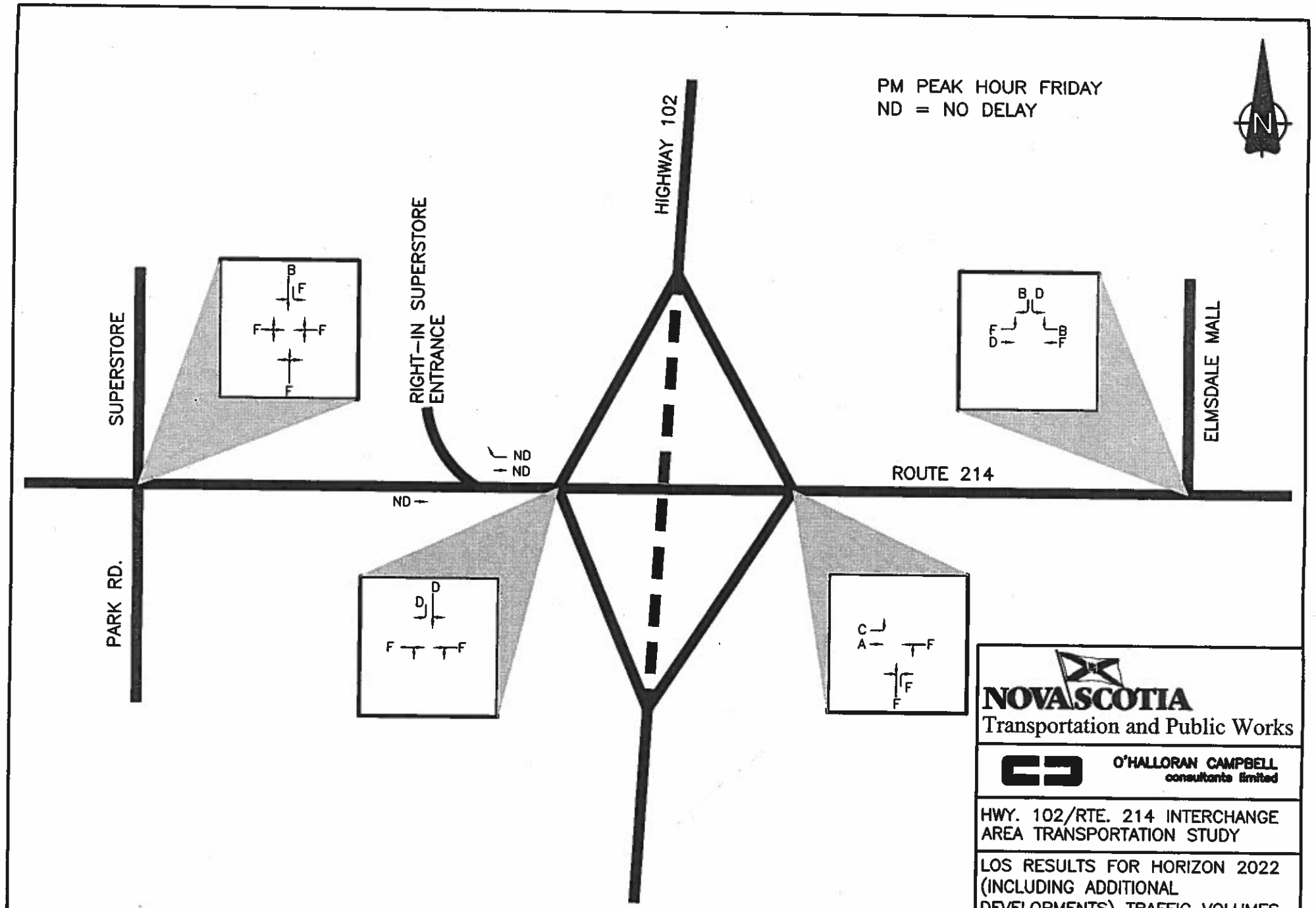
LOS RESULTS FOR HORIZON 2022 (EXCLUDING ADDITIONAL DEVELOPMENTS) TRAFFIC VOLUMES WITH SIGNALS

FIGURE 3.5 | JAN. 2003

E:\1199-1\FIGURES\FIGURE3.5.dwg



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LOS RESULTS FOR HORIZON 2022 (INCLUDING ADDITIONAL DEVELOPMENTS) TRAFFIC VOLUMES WITH SIGNALS

FIGURE 3.6 | JAN. 2003

E:\1199-1\FIGURES\FIGURE3.6.dwg

Option 1 - Signalize the Route 214/Northbound Ramp intersection.

Option 2 - Signalize the Route 214/Northbound Ramp and the Route 214/Superstore/Park Rd. intersections.

Option 3 - Signalize three intersections (Option 2) and widen Route 214 to four lanes with dual left and right turn lanes exiting the developments.

Option 4 - Signalize three intersections (Option 2) and widen Route 214 to three lanes, with two lanes westbound.

Option 5 - Signalize three intersections (Option 2) and widen Route 214 to three lanes, with two lanes eastbound.

Option 6 - Signalize the four study intersections (Option 2) and widen Route 214 to three lanes, with two lanes westbound.

Option 7 - Option 6 but with the centre lane serving as a shared left turn lane.

Option 8 - Signalize the four study intersections and widen Route 214 to four lanes, with dual right and left turn lanes for traffic exiting the developments.

Option 9 to 13 - Same as Option 8 with variations to the signal phasing at each intersection, as follows:

- Protected west, then permitted east/west, and permitted north/south
- Protected east/west left, then permitted east/west, protected north/south left and permitted north/south
- East/west and north/south all permitted
- Protected east, then permitted east/west, protected north and permitted north/south
- Protected east, west, north and south

Option 14 - Same as Option 8 but omitting dual right turns exiting from the developments.

Option 1 Movement	LOS	Option 2 Movement	LOS	Option 3 Movement	LOS	Option 4 Movement	LOS	Option 5 Movement	LOS	Option 6 Movement	LOS	Option 7 Movement	LOS	Option 8 Movement	LOS	Option 9 Movement	LOS	Option 10 Movement	LOS	Option 11 Movement	LOS	Option 12 Movement	LOS	Option 13 Movement	LOS	Option 14 Movement	LOS
Route 214/Superstore/Park Road																											
EBLTR	A	EBLTR	F	EBLT	C	EBL	F					EBL	D	EBLTTR	C	EBLTTR	D	EBLTTR	B	EBLTTR	B	EBLTTR	B	EBLTTR	C	EBLTTR	C
				EBTR		EBTR	D	EBLT	D	EBL	F	EBTR	D															WBLTTR	C
				WBLT	B	WBLT	C	EBTR	ND	EBTR	D																
WBLTR	B	WBLTR	F	WBTR	ND	WBTR	ND	WBL	F			WBL	F	WBLTTR	B	WBLTTR	C	WBLTTR	E	WBLTTR	E	WBLTTR	F	WBLTTR	F		
								WTR	B	WBLT	B	WBT	A														
				NBL	C	NBL	D			WBTR		WBR	A														
NBLTR	F	NBLTR	F	NBLT	C	NBLT		NBL	F	NBL	D			NBL	C	NBL	E	NBL	C	NBL	B	NBL	B	NBL	D	NBL	C
				NBRR	A	NBR	A	NBTR	C	NBLT	D	NBL	D	NBLT	C	NBT	D	NBT	D	NBT	B	NBT	A	NBT	D	NBLT	D
SBL	F	SBL	F	SBLL	C	SBL	E	NBR	A	NBR	A	NBT	D	NBRR	A	NBR	A	NBR	A	NBR	A	NBR	A	NBR	A	NBR	C
				SBTR	A	SBTR	A	SBL	D	SBL	E	NBR	A														
SBTR	F	SBTR	A	SBR	A	SBR	A	SBLT	D	SBTR	A			SBLL	C	SBL	E	SBL	F	SBL	F	SBL	F	SBL	F	SBLL	D
Intersection		F		B		C		D		C		SBL	F	SBTR	A	SBTR	A	SBTR	B	SBTR	A	SBTR	A	SBTR	A	SBTR	C
												SBTR	A	SBR	A												
		F		B		C		D		C		D		B		C		D		D		F		F		G	
Route 214/Southbound Ramp																											
				EBTT	ND	EBT	ND	EBTT	ND	EBT	D	EBT	D	EBTT	C	EBTTR	C	EBTTR	D	EBTTR	C	EBTTR	B	EBTTR	B	EBTTR	C
EBTR	ND	EBTR	ND	EBR	ND	EBR	ND	EBR	ND	EBR	B	EBR	A	EBR	B												
				WBLT	C	WBLT	C	WBL	C	WBLT	C					WBLTT	B	WBLTT	C	WBLTT	B	WBLTT	B	WBLTT	B	WBL	A
WBLT	F	WBLT	F	WBT	ND	WBT	ND	WBT	ND	WBT		WBL	B	WBLTT	B											WBT	B
				SBL	F	SBL	F	SBL	F	SBL	D	WBT	B			SBL	D	SBL	C	SBL	D	SBL	D	SBL	D	SBL	D
SBLTR	F	SBLTR	F	SBLTR	F	SBLR	C	SBL	F	SBLR	A			SBLT	D	SBLTR	C	SBR	B	SBR	B	SBR	B	SBR	B	SBR	D
Intersection				SBR	C	SBR		SBR		SBR	A	SBLT	D	SBR	C	SBR	B										
										C		SBR	C														
												B		C		B		C		B		B		B		C	
Route 214/Northbound Ramp																											
EBL	D	EBL	C	EBLT	B	EBL	B	EBLT	B			EBL	C	EBLTT	A	EBLTT	B	EBLTT	C	EBLTT	B	EBLTT	B	EBLTT	B	EBL	D
EBT	B	EBT	A	EBT	B	EBT	C	EBT				EBT	C													EBT	A
										EBT	A																
WBTR	F	WBTR	F	WBT	B	WBT	D	WBTR	F			WBT	F	WBTT	B	WBTT	D	WBTT	E	WBTT	D	WBTT	D	WBTT	D		
				WBT		WBTR				WBTT	C	WBR	A	WBR	A	WBR	B	WBR	C	WBR	B	WBR	B	WBR	B	WBTT	C
NBLT	F	NBLT	F	WBR	A					WBR	A															WBR	C
NBR	D	NBR	E	NBL	C	NBL	E	NBL	F	NBLL	C	NBL	F	NBL	C	NBL	D	NBL	D	NBL	D	NBL	D	NBL	D		
				NBLTR	C	NBLTR	E	NBTR	B	NBTR	C	NBTR	D	NBLTR	C	NBR	B	NBR	C	NBR	B	NBR	C	NBR	B	NBLL	C
Intersection	F			NBR	B			NBR	B					NBR	B											NBR	D
		F		B		D		F		B		F		B		C		D		C		C		C		C	
Route 214/Elmsdale Shopping Centre																											
EBL	E	EBL	E	EBLT	B	EBL	D	EBL	F	EBL	C	EBT	A	EBLTT	B	EBLTT	B	EBLTT	B	EBLTT	B	EBLTT	B	EBLTT	B	EBL	D
EBT	B	ET	B	EBT		EBT	B	EBTT	A	EBT	B	EBL	E													EBT	A
												WBT	E	WBTT	D	WBTTR	D	WBTTR	D	WBTTR	D	WBTTR	D	WBTT	C		
WBT	E	WBT	E	WBTT	C	WBT	D			WBTT	D	WBR	B	WBR	C											WBR	D
WBR	B	WBR	B	WBR	B	WBTR		WBTR	F	WBR	C																
SBL	E	SBL	E	SBLL	C	SBL	D	SBLL	E	SBL	D	SBL	E	SBLL	C	SBLL	C	SBLL	C	SBLL	C	SBLL	C	SBLL	C	SBLL	D
SBR	A	SBR	A	SBRR	A	SBRR	A	SBR	A	SBRR	A	SBR	A	SBRR	A	SBR	A	SBR	A	SBR	A	SBR	A	SBR	A	SBR	B
Intersection	D		D		C		C		E		C		D		B		C		C		C		C		C		C

Notes:

- Options applied to 20 year horizon traffic volumes (2022) including additonal developments.

- PM Peak hour

The main area of concern in the study area is the limited distance between the Northbound Ramp terminal and the Elmsdale Shopping Centre intersections (approximately 80 m). The approximately 80 m distance does not provide adequate storage for vehicles, resulting in traffic queuing on the Northbound Ramp, on the Highway 102 overpass structure and on the east side of the Elmsdale Shopping Centre intersection. This limited distance will be the key factor in the selection of the appropriate signal timing, phasing and coordination.

In conjunction with the improvements, it is considered desirable to reduce the maximum posted speed limit from 50/70 km/h to 50 km/h throughout the study area. The 50 km/h speed zone would extend approximately 300 m west of the Superstore entrance. This reduction in speed would reduce the sight distance requirements and improve traffic safety in the area.

4.0 ACCESS MANAGEMENT PLAN

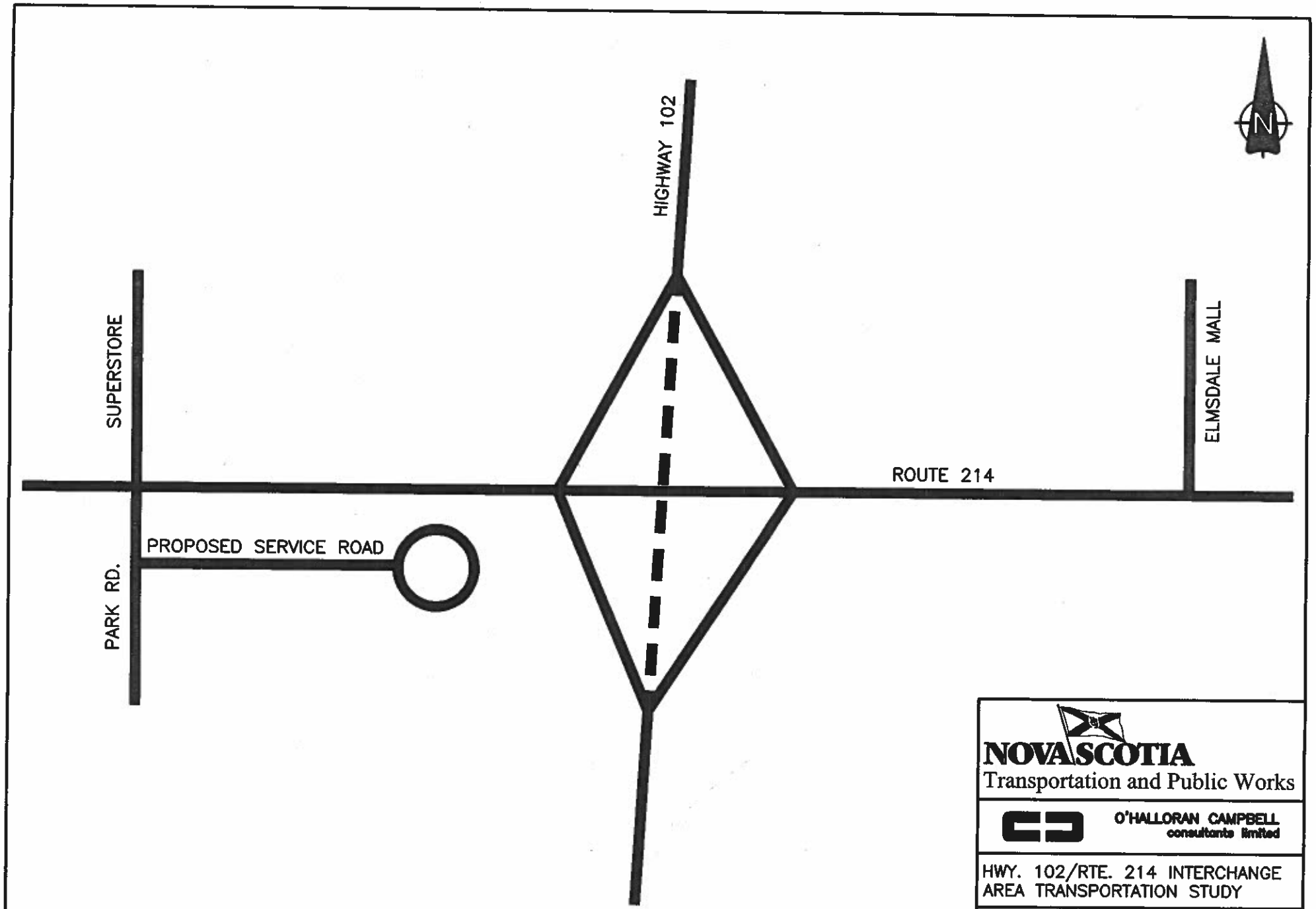
TAC provides the following general guidelines regarding access to an urban collector, which is the classification for Route 214 in the study area (outside the study area, Route 214 is considered rural):

- if a development is bordered by two roads of different classification, access should be to the lower classification (i.e. optometrist office at the corner of Route 214 and Park Rd. should have access via Park Rd.)
- the minimum clear distance between a major intersection and an access is 55 m
- based on an average running speed of 55 km/h, a cycle length of 80 s, and having ideal traffic progression the recommended signalized intersection spacing is 600 m
- attempts should be made to remove all redundant driveways and entrances.

Route 214 throughout the study area is quite congested, with closely spaced intersections and significant turning movement volumes. This could lead to safety concerns. It is highly desirable that access be restricted on Route 214 between the Elmsdale Shopping Centre Driveway and the Superstore/Park Road driveways. It is considered that this area should be designated as controlled access.

For the driveways (one commercial, three residential, and one car pool lot) on the south side of Route 214 west of Highway 102 to Park Road, it is recommended that a service road be considered to provide access to these properties. The service road would be parallel and south of Route 214 with a connection to Park Road (See Figure 4.1). Switching the access to Park Road should be encouraged, perhaps by making it a condition of providing municipal water and sewer services and/or a change in property use. Otherwise the properties should be zoned as residential to minimize the traffic volumes at the driveways. Access should not be provided to Route 214 and the service road. The access to the car pool parking lot should be relocated to the service road.

No new access driveways or intersections should be permitted between the Elmsdale Shopping Centre and the Superstore/Park Road Intersection. Where possible, existing driveways should be consolidated. No driveways should be permitted within 30 m of a signalized intersection. Driveways for commercial developments should have a minimum clear throat distance of 8 m. The



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PROPOSED SERVICE ROAD

FIGURE 4.1 | JAN. 2003

E:\1199-1\TRAFFIC COUNTS\FIGURE4.1.dwg

intent would be to implement the TAC Guidelines as opportunities arise and to restrict further congestion along Route 214.

A substantial portion of Route 214 in the study area and further west has gravel shoulders and ditches for drainage. It is recommended that Route 214 in the study area be upgraded to a higher classification, with curbs and sidewalks. This would discourage roadside vendors, parking on the shoulder of the road or other obstructions and u-turns. Until development warrants sidewalks on both sides, the sidewalk could be placed on one side only.

Driveways with direct access to Route 214 should be required to have a minimum 160 m sight distance for a design speed along Route 214 of 60 km/h (i.e. posted speed limit of 50 km/h).

Dedicated turning lanes should be provided on Route 214 for access to side streets and driveways as warranted by new development.

Developments should be planned to provide controlled pedestrian access and direct pedestrians to intended crossing locations. Sidewalks should be considered on development sides of Route 214, i.e. along the north side of Route 214 in the short term (already developed) and on the south side of Route 214 if development occurs.

For the property between McDonald's and the Elmsdale Shopping Centre, the access should be provided via one of the adjacent properties if this can be imposed. Alternatively the zoning and use of this property should be restricted to residential so that the driveway volume remains low.

The access management plan should be implemented as opportunities arise, possibly through servicing requests, zone change requests, development agreement applications, etc. TPW and the Municipality should coordinate implementation of the plan.

5.0 FUNCTIONAL DESIGN

5.1 PREFERRED IMPROVEMENTS

Based on the LOS results shown in Section 3.3, after 20 years of background growth and the full proposed development (see Section 2.2), it appears that improvement Option 14 is the only option that provides an acceptable LOS (i.e. LOS D or better) for all movements in the study area.

Option 14 includes the following (see SK-1199-1-1 Functional Plan):

- signalization of the three unsignalized intersections, all coordinated,
- signal phasing: westbound and southbound left-turn protected and the remainder permitted,
- widening of Route 214 to four lanes (two in each direction) including widening of the overpass structure, and
- widening/improvements to the Superstore driveway, the Elmsdale Shopping Centre driveway, the Business Park entrance and both ramp terminals.

Other suggested improvements include the following:

- Curb on both sides of Route 214 through the study area.
- Sidewalk on both sides of Route 214. It may be practical to construct one sidewalk on the north side and defer construction of the south sidewalk until pedestrian traffic warrants it.
- Extension of the 50 km/h maximum posted speed limit to approximately 300 m west of the Route 214/Superstore/Park Rd. intersection.

The improvements have been analysed in an effort to correlate them with background traffic growth and the phasing of the developments in the upgrading strategy plan. This is discussed further in Section 5.2.

5.2 *Upgrading Strategy (Phasing and Timing)*

The following summarizes the upgrading strategy with the timing of each item and the estimated associated cost including 15% contingency and HST (Section 6.0 has a further breakdown of costs):

Year 2003:

- Signalize three additional intersections (four study intersections would be signalized) and coordinate signal timing and phasing. The signals should be installed with a provision for widening Route 214 in the future.
- Add channelized right-turn lane at the top of the Southbound Ramp with a raised median island.
- Add a 30 m right turn storage lane for eastbound Route 214 traffic at the Southbound Ramp.
- Extend maximum posted speed limit of 50 km/h approximately 300 m west of the Superstore driveway.
- Approximate order of magnitude cost is $700,000.

Year 2007:

- Assuming proposed additional development is more than 25% but less than 50 % underway (i.e. 40 to 85 acre business park development, 35,000 to 75,000 sq. ft. Superstore expansion, and 25,000 to 50,000 sq.ft. Elmsdale Shopping Centre expansion), Route 214 should be widened to four lanes with two lanes in each direction. All widening should take place towards the north.
- The existing overpass structure should be adjusted to accommodate three lanes at this time with 3.2 m lanes, 0.5 m offsets and a 1.5 m sidewalk.
- Install curbs on both sides of Route 214.
- Install Sidewalk on the north side of Route 214.
- Install storm drainage system prior to widening Route 214 (i.e. catchbasins, manholes and leads).
- Approximate order of magnitude cost is $800,000.

Year 2012:

- Assuming the proposed additional development exceeds 50% (see above), the overpass structure will require another adjacent one-lane structure with a sidewalk, all on the north side of the existing overpass (See SK-1199-1-1).
- Widen the Superstore Driveway to accommodate two left-turn lanes.

- Widen Park Road to accommodate two left-turn lanes (with one shared through lane) and a channelized right-turn slip lane separated by a new raised median island.
- Widen the Northbound Ramp to accommodate two left-turn lanes and add a raised concrete median island.
- Widen the Elmsdale Shopping Centre driveway to accommodate two left-turn lanes and separate slip lanes with raised concrete median islands.
- Add right-turn slip lane between Elmsdale Shopping Centre driveway and the Northbound on-ramp for westbound Route 214 traffic.
- Signal timing and phasing should be reviewed and appropriate adjustments may be required to accommodate additional traffic volumes.
- Approximate order of magnitude cost is $1,700,000.

Year 2017:

- Assuming development has taken place on the south side of Route 214, sidewalks should be considered along the length of the study area.
- Approximate order of magnitude cost is $100,000.

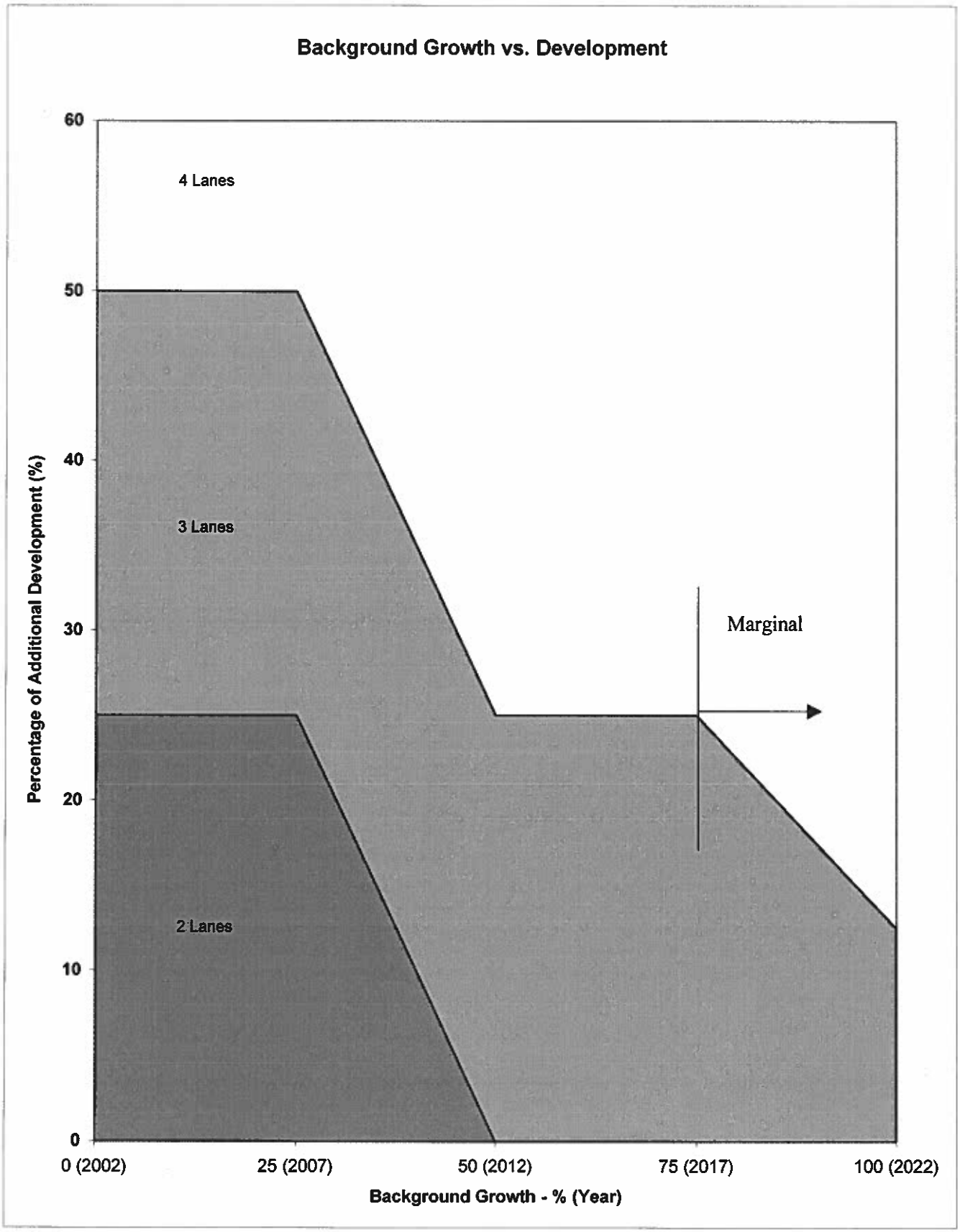
Year 2022:

- Signal timing and phasing should be reviewed and appropriate adjustments may be required to accommodate additional traffic volumes.
- Approximate order of magnitude cost is $20,000.

The figure on the following page illustrates the correlation between Background growth and Development growth, with the study intersections signalized. The lines indicate the points at which two and three lanes would no longer function to serve the traffic volumes at the corresponding levels of growth and development.

The required number of lanes along Route 214 throughout the study area is highly dependent on the proportion of the proposed additional development that has taken place. The above upgrading strategy plan phasing may have to be altered accordingly, depending on the status of the additional developments at that time. The Piercey's Building Supply Store, currently being added to the Elmsdale Shopping Centre accounts for just under 10% of the proposed additional developments.

FIGURE 5.1 - ROUTE 214 LANE REQUIREMENTS



5.3 *FUNCTIONAL PLAN CRITERIA*

The following criteria (Table 5.1) was taken from the TAC Geometric Design Guide for Canadian Roads and was used as the basis for the functional design:

TABLE 5.1 - FUNCTIONAL DESIGN CRITERIA

Item	TAC Guidelines	Functional Design Criteria
Border with Sidewalk	0.3 m - 1.0 m	0.3 m
Border without Sidewalk	0.3 m - 3.0 m	n/a
Sidewalk with Boulevard	1.5 m - 1.8 m	1.5 m
Sidewalk without Boulevard	2.0 m - 3.0 m	n/a
Boulevard	1.5 m - 3.0 m	1.2 m
Lane Widths	3.5 m - 3.7 m	3.5 m
Maximum Lane Width Reduction	0.2 m	n/a
Left-turn Lanes	3.3 m	3.3 m
Two-way Service Road Lane Width	3.3 m per direction	not shown on plan
Shoulder Width (if no curb & gutter)	2.5 m	n/a
Minimum Offset	0.3 m	0.5 m

The Functional design is generally based on the minimum TAC guidelines in order to maximize the use of the existing right-of-way, hence minimizing the need for additional land acquisition. The Functional Plan (SK-1199-1-1) illustrates the magnitude of required land acquisition with the superimposition of the required right-of-way over the existing right-of-way. The widening was assumed to take place to the north (Truro side) of Route 214 due to limiting constraints found on the south side (i.e. cemetery and more properties).

Streetscaping, such as landscaping, signage, lighting, landscaped medians and boulevards, etc. is becoming a trend in community development and establishing town identity. These items improve aesthetics of the area, making it a more pedestrian-vehicle friendly environment. One of the main constraints involved with this in the Route 214/Highway 102 interchange area would be the available right-of-way space. The proposed cross-sections shown on the Functional Plan (SK-1199-1-1) would have to be increased between three and five metres in order to facilitate medians and boulevards large enough to accommodate landscaping. Streetscaping was not incorporated into the functional design.

6.0 COST ESTIMATE

An order of magnitude cost estimate was prepared for the preferred option, Improvement Option 14 as described in Section 5.1 and as shown on the Functional Plan (see SK-1199-1-1). The cost estimate was divided into three sections as follows:

- ***Area 1*** - 50 m west of Superstore/Park Rd. to Southbound Ramp Terminal
- ***Area 2*** - Southbound Ramp Terminal to Northbound Ramp Terminal
- ***Area 3*** - Northbound Ramp Terminal to 50 m east of Elmsdale Shopping Centre Driveway

The cost estimates are on the basis of a road structure of 150 mm of asphalt and 650 mm of gravel. An allowance of 0.3 m behind the back of the sidewalk has been included for slopes to existing grade and landscaping with topsoil and sod. It includes modifications to the existing signals and provision of three new sets of signals. The cost estimate excludes land acquisition and water, sanitary and other underground services. The cost estimate also excludes any allowance for streetscaping. An allowance has been included in Areas 1, 2 and 3 for a storm sewer system, which includes a 450 mm diameter main, manholes at 300 m and catchbasins at 150 m.

The order of magnitude cost estimate to improve Area 1 includes removals, gravels and asphalt, curb, gutter and sidewalk on both sides of Route 214, stormwater drainage system including manholes and catchbasins, topsoil and sod, pavement markings and new traffic signals at the Superstore/Park Rd. intersection.

The cost estimate for Area 2 includes a proposed one lane structure plus sidewalk north of the existing structure.

The order of magnitude cost estimate is summarized in the following Table 6.1:

TABLE 6.1 - ORDER OF MAGNITUDE COST ESTIMATE

Item	Price		
	Area 1	Area 2	Area 3
Excavation/Removals	$30,000	$30,000	$10,000
Stormwater Drainage System	$40,000	$30,000	$30,000
Gravel	$60,000	$30,000	$20,000
Asphalt	$80,000	$40,000	$20,000
Curb & Gutter	$60,000	$25,000	$30,000
Sidewalk	$70,000	$50,000	$30,000
Traffic Signals	$140,000	$280,000	n/a
Traffic Signal Modifications	n/a	n/a	$50,000
Topsoil & Sod	$15,000	$10,000	$5,000
Overpass Structure	n/a	$1,300,000	n/a
Pavement Markings & Signage	$5,000	$5,000	$5,000
Sub-total 1	$500,000	$1,800,000	$200,000
Contingency (± 15%)	$80,000	$270,000	$30,000
Sub-total 2	$580,000	$2,070,000	$230,000
Subtotal (Area 1, 2 and 3)			$2,880,000
15% HST			$440,000
Total			$3,320,000

7.0 CONCLUSIONS

The following conclusions are based on trip generation, horizon year projection of traffic volumes, signal warrant analyses, and LOS analyses:

1. Background traffic growth is expected to take place at a rate of about 2% per annum over the next 20 years, i.e. a 50% increase.

2. An estimated 2,500 additional trip ends (excluding reduction for pass-by trips) would be generated during the weekday afternoon peak hour by the expansion of the Superstore (55,000 to 208,000 sq. ft.), East Hants Business Park (28 to 195 acres), and the Elmsdale Shopping Centre expansion (100,000 to 203,000 sq. ft.). These expansions are planned to take place over the next 20 years, but tentative dates have not been provided.

3. The right-turn entrance only to the Superstore has been accepted and is planned to be built in the next year by the developer. It has been included for the analyses, beyond 2002 or with the introduction of further development.

4. From the signal warrant analyses it was found that:

    - Traffic signals are warranted at the Northbound Ramp with existing (2002) traffic volumes.

    - Traffic signals will be warranted at the three study intersections after 20 years of background traffic growth (2022) with the proposed additional development.

    - Traffic signals would not be warranted at the Southbound Ramp intersection after 20 years of background traffic growth (2022) with the proposed additional development if the Superstore/Park Rd. and the Northbound Ramp intersections are signalized.

5. From the LOS analyses results, for the existing configuration with no additional signalization of intersections, it was found that:

- Left turn movements exiting the Superstore, the Southbound Ramp and the Northbound Ramp have an LOS F with existing (2002) traffic volumes. Improvements should be implemented for the left turn movements.

- Queue lengths increase for the left turns after 20 years of background traffic growth (2022) without any additional developments.

- Most of the LOS results will experience degradation to D and F, with delays and queue lengths increasing to an unacceptable level (i.e. extreme congestion) after 20 years of background traffic growth (2022) with additional developments. Significant improvements will be required.

6. Signalization of the four study intersections will improve the LOS of all four intersections to an acceptable level for the existing 2002 traffic volumes. Physical improvements are also considered to be warranted at the Southbound Ramp at the time of signalization. These improvements include channelized right-turn lane at the top of the ramp with a raised median island and a 30 m right-turn storage lane for Route 214 eastbound traffic. All intersections in the study area, with the exception of the Southbound Ramp terminal, operate at an acceptable LOS with horizon (2022) traffic volumes excluding additional developments, with signalization only.

7. The LOS for most of the traffic movements at the four study intersections is deteriorated to an unacceptable level in 20 years with additional development, even with signalization of the four intersections. Physical improvements are required.

8. As soon as 25% of the proposed additional developments are reached, Route 214 should be upgraded to four lanes, with the overpass structure adjusted to three lanes, sidewalks introduced on the north side and curbs on both sides of Route 214. When 50% of the proposed additional development is accomplished, the overpass structure should be widened to four lanes with sidewalks on each side. Depending on developments along the south side of Route 214, it may be feasible to add sidewalks to both sides of the road. Traffic signal timing and phasing should be reviewed and adjusted accordingly during times that traffic volumes increase.

9. Improvement Option 14 (four lanes on Route 214 plus signalization of intersections and additional turning lanes) results in acceptable LOS (LOS D or better) for all traffic movements with horizon (2022) traffic volumes including additional development.

10. The intersections are closely spaced resulting in a high volume of turn movements in a relatively short length, and a lack of length for provision of turning movement storage. The intersection spacing is restrictive and it would have been preferable for the distance between intersections to be greater, i.e. 200 m or more.

11. Commercial and residential driveways are close to the Highway 102 Ramps and this is contributing to the issues identified in Item 8 above. Access control should be implemented to restrict driveways or intersections within the study area. Access for properties along the south side of Route 214 could be provided via a new service road, parallel to Route 214 on the south side, intersecting with Park Road. Relocation of the access should be encouraged. Access should not be permitted to Route 214 and the service road.

12. Route 214 is curbed at the east end of the study area and has gravel shoulders and ditches from the Elmsdale Shopping Centre west, i.e. more rural type road. As the area has become more commercialized there has been significant traffic growth and turning movements. It is considered highly desirable to provide more visual queues and guidance for drivers by provision of curbs. This will also restrict the potential for vehicles using the shoulders of Route 214.

13. The 50 km/h maximum posted speed limit zone should be extended to approximately 300 m west of the Route 214/Superstore/Park Rd. intersection.

14. The ramp alignments at Route 214 results in a wide intersection, which is not desirable for pedestrian crossings. It would be preferable for the ramps to intersect Route 214 at 90 degrees.

15. Further development will increase traffic volumes and congestion on Route 214 to an undesirable level. Developments should be closely monitored and regulated and corresponding road network improvements should be implemented at the appropriate time.

16. Streetscaping may be considered as a part of the improvements, however the limiting factor is the available right-of-way width along Route 214. Streetscaping will require from 3 to 5 additional meters of land acquisition and potentially a wider new overpass structure.

8.0 RECOMMENDATIONS

The following recommendations are provided based on the study. See Section 5.2 for the suggested timing and phasing of the improvements.

1. Traffic signals should be installed for the three unsignalized intersections in the study area in 2003. They should be done at the same time or in the following sequence:
    - Route 214/Northbound Ramp
    - Route 214/Superstore/Park Rd.
    - Route 214/Southbound Ramp

    The phasing and timing of the existing traffic signals at the Elmsdale Shopping Centre should be adjusted to be coordinated with new traffic signals in the study area. Signal timing and phasing should be reviewed and adjusted accordingly at times when there is a significant traffic pattern changes, i.e. new developments. Priority should be given to ensure that traffic does not congest on the north and southbound ramps back onto Highway 102 and that the flow of the Route 214 traffic takes precedence over the flow of traffic entering and exiting developments in the study area.

2. The following physical changes should be implemented at the Route 214/Southbound Ramp intersection in 2003:
    - Introduce designated turn lanes for southbound movements at Route 214 (separate right and left turn lanes).
    - Install a right turn storage lane, 30 m long for eastbound traffic turning right onto the Southbound Ramp.

3. Extend maximum posted speed limit of 50 km/h (i.e. reduce posted speed from 70 km/h) to approximately 300 m west of the Superstore driveway in 2003. The speed limit reduction would

decrease the turning sight distance requirements by approximately 90 m and should improve safety.

4. Route 214 should be widened to four lanes with a three lane overpass (i.e. modified existing structure). This should be carried out after the business park develops by 40 acres, the Superstore undergoes 35,000 sq.ft. of expansion and the Elmsdale Shopping Centre undergoes 25,000 sq.ft. of expansion (i.e. 600 additional trip ends).

5. Sidewalks along the north side of Route 214 should be installed throughout the study area at the same time as Route 214 widening to four lanes. Sidewalks on the south side of Route 214 should be constructed if pedestrian traffic volumes warrant it.

6. Curb and gutter with a piped stormwater drainage system should be installed along Route 214 throughout the study area at the time of widening to four lanes. This will assist in regulating traffic speeds, u-turning, and side-of-the-road activity.

7. Route 214 overpass structure should be upgraded to four lanes (see Dwg. No. SK-1199-1-1, Functional Plan) after the business park develops approximately 85 acres, the Superstore expands by 75,000 sq. ft. and the Elmsdale Shopping Centre expands by 50,000 sq.ft. (i.e. 1200 additional trip ends). The existing overpass structure should be sufficient to accommodate a sidewalk and three lanes and the new structure should accommodate the fourth lane and a sidewalk.

8. Park Road, the Superstore driveway, the Northbound Ramp terminal and the Elmsdale Shopping Centre driveway should be widened at the same time as the structure is widened to four lanes to accommodate two left-turn lanes and channelized right-turn lanes with raised concrete channelization islands (see Dwg. No. SK-1199-1-1).

9. Add a westbound right-turn slip lane for the Northbound Highway 102 on-ramp.

10. Install a sidewalk along the south side of Route 214 as pedestrian traffic warrants it.

11. Traffic signal timing and phasing at all intersections in the study area should be reviewed and adjusted accordingly to accommodate any increase in traffic volumes.

12. A service road is recommended, beginning at Park Road and extending east, parallel to Route 214 to provide access to properties along the south side of Route 214 between the Southbound Ramp and the Superstore Entrance. Route 214 between the Southbound Ramp and the Superstore entrance should be designated controlled access.

13. When widening Route 214 to four lanes, land acquisition will be required on the north side of Route 214 from the Southbound Ramp to just west of the Superstore Entrance, from the Northbound Ramp to just east of the Elmsdale Shopping Centre Entrance. Additional land acquisition will also e required on the east side of Park Road for the widening of the entrance to the East Hants Business Park. This should be considered in the short term to avoid any potential delays when planning the Route 214 upgrade.

APPENDIX A

TPW REQUEST FOR PROPOSALS
HIGHWAY 102 - ROUTE 214 INTERCHANGE AREA
TRANSPORTATION STUDY

NOVA SCOTIA

Transportation and
Public Works
Highway Engineering Services
Highway Planning and Design

Request For proposals
for
Highway 102 - Route 214 Interchange Area Transportation Study

Traffic Engineering Services Standing Offer Tender # 60101568

1.0 BACKGROUND

Highway 102 is a primary provincial highway connecting Halifax and Truro. Route 214 is a collector highway extending from Trunk 2 in Elmsdale westerly to Trunk 14. Connection between the two is by means of a typical diamond interchange.

The area surrounding the interchange is the suburban community of Elmsdale which has seen significant residential and commercial growth over the last two decades. This growth has resulted in traffic pressures on the interchange and Route 214 from the interchange to Trunk 2. In 1998, in response to existing and anticipated future traffic challenges, the Municipality of East Hants commissioned a study to determine the required geometric improvements and access management principles necessary to safely and efficiently accommodate traffic on Route 214 between Trunk 2 and Highway 102.

Development is continuing and expanding on Route 214 west of the interchange. Presently there are two large commercial developments on each side of the interchange, both with expansion plans, and an industrial park on the west side of Highway 102 which has moderate to high growth potential. Although the developers have undertaken traffic impact studies to determine the effects of each development individually, the Department recognizes the necessity of performing an area wide study to understand the cumulative impacts of all developments in the study area and to identify the necessary future infrastructure improvements and access management measures that will enable development and protect the safe and efficient operation of the interchange and Route 214.

2.0 OBJECTIVES

The primary objectives of this study are to:

- **Using traffic data obtained from the individual site traffic impact studies for the area, augmented with additional data collection as required, perform analysis as required to evaluate the traffic impacts to the interchange area as a whole, through the study horizon.**

- **Identify functional requirements and infrastructure improvements required to accommodate the projected traffic demands including cost estimates and functional plans where applicable. Determine the triggers for infrastructure upgrades and prepare a phasing plan that corresponds to traffic volumes and time horizons.**

- **Determine an appropriate access management plan for the section of Route 214 within the study area. This plan will identify the access measures that will accommodate existing access and facilitate future development while identifying the necessary limits required to ensure safe and efficient interchange operation through the study horizon.**

3.0 STUDY AREA

The study is to be focussed on the Highway 102/Route 214 interchange area as shown on the attached figure. It will assess the interchange configuration, including the Route 214 approaches (Elmsdale Shopping Centre entrance to the Park Road/Superstore entrance), for safety and capacity through a twenty year time horizon.

4.0 DUTIES OF THE CONSULTANT

- Meet with the project management team as per the schedule specified in Section 7.0 (Meetings and Reports).
- Familiarization with the study area including, but not necessarily limited to, existing highway infrastructure, existing development, zoning, land ownership, approved and proposed developments, terrain and soil conditions.
- Review all past transportation, traffic impact and land use studies within the study area.
- Collect supplementary data as required to perform the required analysis and to develop growth projections and estimates of future traffic volumes for the 20 year horizon.
- Assuming no improvements to the existing highway network within the study area, identify existing and estimated future levels of service and safety on the existing roadway network. Areas with moderate to severe deficiencies, existing or projected, should be highlighted.
- Identify cost effective road network upgrades (geometric improvements, new alignments, traffic control measures, etc.) to eliminate existing and predicted future deficiencies within the study area.
- Prepare an access management plan for the study area.
- Develope a recommended upgrading strategy for providing acceptable levels of service within the study area. The upgrading strategy shall include phasing and time frames for implementation and shall be presented to the project management team for approval.
- After acceptance of the upgrading strategy by the project management team, prepare functional designs where applicable and finalize cost estimates for the proposed improvements. The functional designs will adhere to TPW design standards and specs.
- Prepare a draft final report summarizing all work completed and present to the project management team.

- Finalize Report

5.0 DUTIES OF TPW

- Meet with the Consultant on an arranged schedule.
- Provide the Consultant with any available documentation (reports, studies, plans, etc.) required to complete the project.

6.0 GUIDANCE

A project management team will administer the technical and analytical work of the Consultant. The team will consist of representatives from TPW and possibly the Municipality of East Hants. The Consultant will report to the project management team chair, who will be responsible for overall administration of the study.

Acceptance and approval of the work will take place after the project management team has been satisfied that the requirements, as specified in the contract, have been met.

7.0 MEETINGS AND REPORTS

The Consultant shall meet with the project management team for the project initiation, the presentation of upgrading strategies, and other meetings as required during the duration of the project. All meetings will be held in Halifax, Nova Scotia. The Consultant shall meet with the project management team within one week of notification of award of contract. The initial meeting with the Consultant will be to finalize the study requirements, data requirements and the methodologies to be used.

The following reports shall be required.

Five (5) copies of a draft final report for the Study must be submitted for comment and possible amendments before the final version is submitted. The Consultant must be prepared to submit a second draft if requested.

Twenty (20) bound copies and one unbound copy of the final report. The Consultant shall also have a copy on hand should additional copies be required at short notice. The Consultant shall provide one electronic copy of the final report on CD compatible with WordPerfect 6.1 including all plans (compatible with AutoCad 2000), tables, diagrams, figures and pictures. All copies of the draft and final report shall be on letter size paper and appropriately titled. The final report shall include an executive summary and a list of references. All reports shall contain copies of supporting plans and figures. The Terms of Reference shall be attached as an appendix to the final report.

8.0 STUDY SCHEDULE

The Consultant shall meet with the project management team within one week of notification of award of contract. The study shall be completed and the required copies of the final report presented within **2 Months** of award of contract.

9.0 PROPOSAL REQUIREMENTS

Failure to provide information outlined in this section may result in disqualification.

Three (3) copies of your proposal (fax copies are not acceptable) are to be delivered by 10:00 am local time, ***Wednesday, May 29, 2002*** to the 4th floor receptionist at Purdy's Wharf Tower II, 1969 Upper Water Street.

Proposals and their envelopes should be clearly marked with the name and address of the proponent and the project or program title. Late proposals will not be accepted and will be returned to the proponent. Proponents are solely responsible for their own expenses in preparing, delivering or presenting a proposal.

To facilitate efficient review of the proposals, proponents are requested to use the following format. The proposal shall be organized into four chapters and such chapters limited where indicated.

1. **Introduction**

   This chapter shall include, but not necessarily be limited to, background information, a description of the study area, and understanding of the project and its objectives, including potential key issues.

2. **Qualifications**

   This chapter shall include, but not necessarily be limited to:

   - A summary of relevant company experience within the past 10 years including dates projects were worked on. This shall be a maximum of three pages.

   - A summary of project team member experience in areas related to these terms of reference. This summary shall be a maximum of one page per team member, focusing on the team member's relevant experience. The role of each team member in the study shall be clearly explained.

3. Methodology

This chapter shall include, but not necessarily be limited to:

- A list of all information and data sources available to the Consultant and expected to be used in the Study.
- A detailed work plan, identifying planned field work, and including intended approach, methodology and schedule for the study.
- A draft table of contents for the report.
- A concordance table (or similar) linking proposal to this RFP.

4. Project Management

This chapter shall include, but not necessarily be limited to:

- A discussion of quality assurance/quality control, cost control, scheduling, insurance, and safety certification. Copies of certificates are not required as part of the proposal, but shall be provided by the successful Consultant upon award of the contract.
- Number of person-days for each team member by task assigned to the project. For consistency, the basis of remuneration will be per **8 hour day** for all team members.

One copy of the cost proposal shall be provided, **to be separately sealed in an envelope,** including labour costs, related expenses, printing costs and professional services obtained outside of the firm. Prices quoted are to be in Canadian dollars and **exclusive of federal and provincial taxes**. Expenses shall not exceed the Nova Scotia provincial rates ($0.34/km, breakfast $6.00, lunch $7.00, supper $13.50, incidentals $4.00 per night)

By submitting a proposal, the proponent warrants that all components required to deliver the services requested have been identified in the proposal or will be provided by the Consultant at no additional charge. The technical proposal must be signed by the person(s) authorized to sign on behalf of the proponent and to bind the proponent to statements made in response to this Request for Proposal.

10.0 LIABILITY FOR ERRORS

While considerable effort to ensure the accuracy of the information in this Request for Proposal has been made, the information contained in this Request for Proposal is supplied solely as a guideline to Proponents. The information is not guaranteed or warranted, nor is it necessarily comprehensive or exhaustive.

11.0 REQUEST FOR PROPOSAL AMENDMENTS

All proponents will be notified regarding any changes made to the Request for Proposal or any appendices or any change in the closing date or time. It is the responsibility of the proponent to ensure they have received all amendments. When these changes occur within five government business days of the close of the proposal, the proposal closing date will be extended to allow for a suitable number of bid preparation days between the issuance of the change and the closing date. All amendments must accompany each proposal. Proposals that do not contain all the amendments may be immediately returned and the proponent eliminated from further consideration.

12.0 PAYMENT SCHEDULE

Payments for professional services rendered will be made monthly in arrears upon receipt of invoices detailing progress work completed, and subject to the following conditions;

(a) Monthly payments will be issued for up to 90 % of the amount invoiced. The remaining amount will be paid upon completion of and acceptance of the work, as indicated in (b), and;

(b) Receipts shall be provided for all expenses if requested.

13.0 EVALUATION OF PROPOSALS

Proposals shall be evaluated based on the "Government Procurement Process: Architects and Professional Services" (June 15, 1998).

All proposals will be initially assessed based on the experience and expertise of the project team. Any proposals not meeting minimum qualifications will not be evaluated further.

The criteria for evaluating proposals, based on technical and managerial merit, will be the following;

- Experience and expertise of the consulting firm on similar projects. 5 points
- Qualification and experience of team members on similar projects. 20 points
- Understanding of project and objectives. 20 points
- Proposed methodology and approach. 20 points
- Quality of the proposal. 15 points

- Local knowledge and content. 5 points

After meeting initial qualifications, proposals will be evaluated on the basis of their technical and managerial merit and then on the basis of price. The technical submission shall be rated as shown above, out of 85 points, and the remaining 15 points shall be allotted based on price. Only those proposals achieving an aggregate score of 68/85 (80%) or greater will have their sealed cost envelopes opened. The lowest price shall be awarded 15 points (all prices within 5% will receive the same price points). The next lowest price (beyond 5%) will receive 12 points. Points for other submissions will be assigned with 3 fewer points for each successively higher priced price proposal. But again, each time the same score will be awarded if successive prices are within 5% of the last highest price. The proposal with the highest total points will be awarded the contract. Proposals not meeting the required 68/85 will have their unopened cost envelopes returned.

Notwithstanding the technical/managerial and price scores, TPW reserves the right to reject any proposal where prices are deemed unreasonable relative to other prices bid, typically a 25% variance from the average qualified bid (excluding the bid in question).

The Department reserves the right to negotiate any or all conditions of the Consultant's proposed work plan and reject all submitted proposals. Unsuccessful proponents may request a debriefing meeting following execution of a contract with the successful proponent.

14.0 CONTRACT PROCEDURES

Notice in writing to a proponent of the acceptance of its proposal by the Province and the subsequent full execution of a written contract will constitute a contract for the goods or services, and no proponent will acquire any legal or equitable rights or privileges relative to the goods or services until the occurrence of both such events.

If a written contract cannot be negotiated within thirty (30) days of notification of the successful proponent, the Province may, at its sole discretion at any time thereafter, terminate negotiations with that proponent and either negotiate a contract with the next qualified proponent or choose to terminate the Request for Proposal process and not enter into a contract with any of the proponents.

15.0 INQUIRIES

All enquiries related to this Request for Proposal are to be directed to the following person. Information obtained from any other source is not official and may be inaccurate. Enquiries and responses may be recorded and may be distributed to all proponents at the Province's option.

Department Contact:
Michael Croft, P.Eng. (Project Management Team Chair)

Infrastructure Planning Engineer
Telephone: 902-424-3548
Fax: 902-424-0571
Email: croftmi@gov.ns.ca

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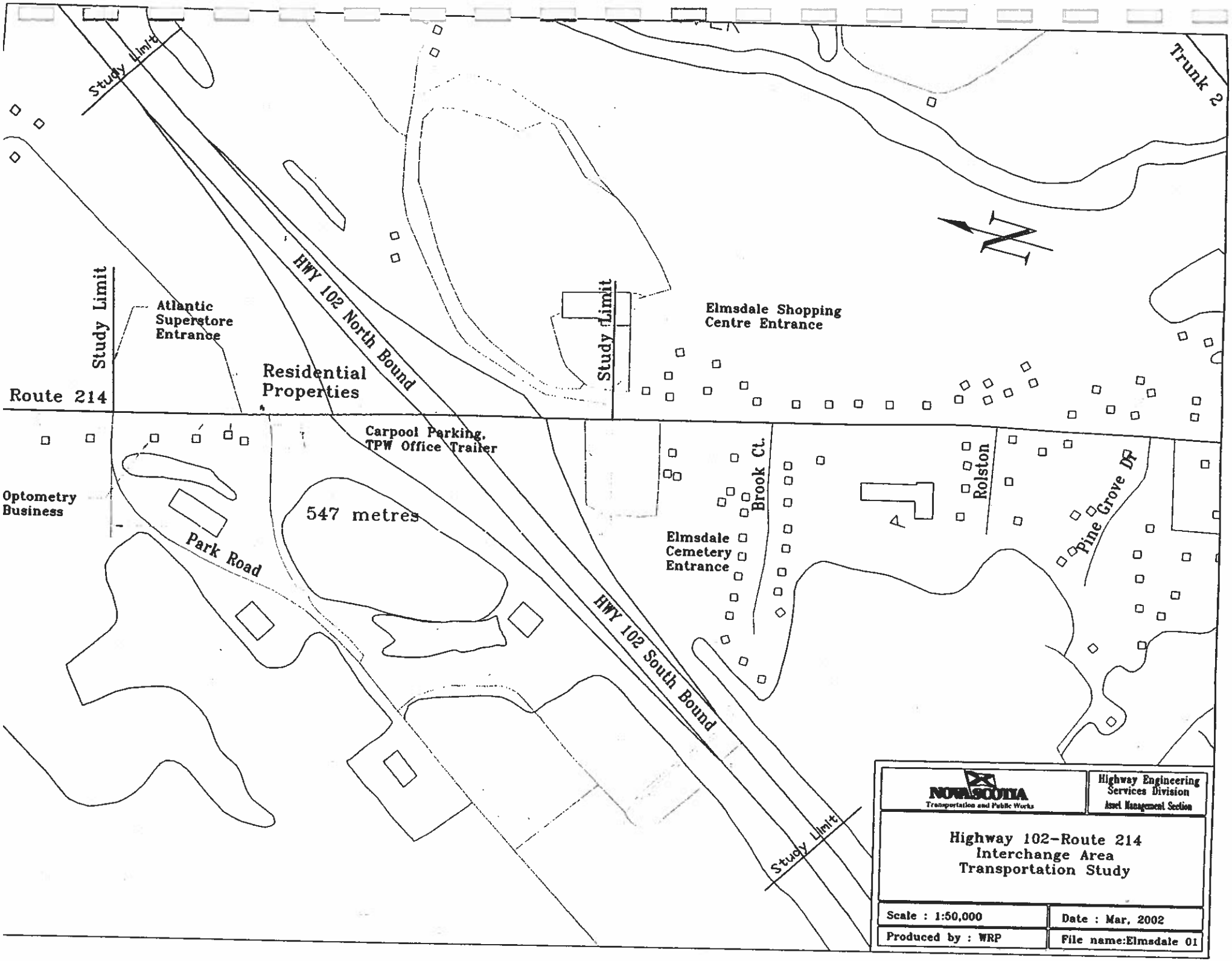

Study Limit
Trunk 2
HWY 102 North Bound
Study Limit
Atlantic Superstore Entrance
Elmsdale Shopping Centre Entrance
Residential Properties
Route 214
Carpool Parking, TPW Office Trailer
Brook Ct.
Rolston
Pine Grove Dr
Optometry Business
547 metres
Park Road
Elmsdale Cemetery Entrance
HWY 102 South Bound
Study Limit
NOVA SCOTIA
Transportation and Public Works
Highway Engineering Services Division
Asset Management Section
Highway 102–Route 214
Interchange Area
Transportation Study
Scale : 1:50,000
Date : Mar. 2002
Produced by : WRP
File name:Elmsdale 01

APPENDIX B

POPULATION GROWTH STATISTICS & PAST TRAFFIC COUNTS

6 FUTURE POPULATION CHANGE (RSB)

The Regional Serviceable Boundary (RSB) is generally the area between Highway 102 and the Shubenacadie River within the Districts of Enfield, Elmsdale, and Lantz. This area is broken out from the Municipal and District statistical profiles, as decisions on infrastructure improvements in this area are based on expected population change which is not necessarily captured by the District totals. For example, over the last census period the population in the Districts of Enfield, Elmsdale and Lantz grew by 9.8% while the population in the RSB grew by 25%. Given that municipal water and sewer services are available in this area, it is also the most urbanized area of the Municipality and the majority of residential population growth is found here.

In fact, during the last census period, population growth in the RSB accounted for 70% of all population growth in the Municipality.

Future RSB Population Change - Number of Residents							
	1996	2001	2006	2011	2016	2021	
Porter Dillon Forecast	4483	6617	8754	10428	12090	13759	High Growth
Average of all Projections	4483	5820	7090	8148	9170	10150	Moderate Growth
Change Based on Historic Trend	4483	5376	6269	7162	8055	8948	
RSB Growth as a % of HRM Growth	4483	5466	6246	6854	7364	7743	Low Growth

Future RSB Population Change - Percentage Change From Previous Census Year (actual increase)							
	1996	2001	2006	2011	2016	2021	
Porter Dillon Forecast	24.9% (893)	47.6% (2134)	32.3% (2137)	19.1% (1674)	15.9% (1662)	13.8% (1669)	High Growth
Average of all Projections	24.9% (893)	29.8% (1337)	21.8% (1270)	14.9% (1058)	12.5% (1022)	10.7% (980)	Moderate Growth
Change Based on Historic Trend	24.9% (893)	19.9% (893)	16.6% (893)	14.2% (893)	12.4% (893)	11.1% (893)	
RSB Growth as a % of HRM Growth	24.9% (893)	21.9% (983)	14.3% (780)	9.7% (608)	7.4% (510)	5.1% (379)	Low Growth

As with the forecasts for East Hants as a whole, different methods were used to provide a high, moderate and low growth scenario. As can be seen in the tables above, a fairly significant difference between the forecasts is evident, with a spread of over 6000 people by the year 2021 between the low and high growth scenarios. Again despite the difference in actual numbers, all projections show a slowing rate of population growth in the future as evidenced in the declining rates seen in the preceding tables. This is a national trend and is primarily due to a general aging of the population.

6.1 Change Based on Historic Trend

This method is quite simply an extension of historic growth in the Corridor into the future. In this case, growth from 1991 to 1996 was used to project future growth. For East Hants as a whole two census periods were used as opposed to data only being available for one period here, meaning that this trend line is somewhat less reliable, but nonetheless a valuable forecast based on recent population growth. This projection falls between Porter Dillon's forecast and the HRM based growth forecast and is close to the average (moderate growth scenario).

6.2 Change as a Percentage of HRM's Growth (Low Growth Scenario)

As mentioned previously, East Hants population change appears to track closely to change in Halifax Regional Municipality (HRM). Growth in the RSB is similarly linked to HRM growth. This is understandable as the RSB acts as a bedroom community to HRM. The RSB is, in effect, part of suburban Halifax and captures a fairly constant percentage of suburban Halifax growth. As growth changes in HRM, then so will growth change in the RSB.

Again, there are pitfalls with this method. Essentially this is a projection based on a another projection, possibly amplifying any errors contained within the first. Because this projection shows the lowest growth rate and although this forecast was based on a moderate growth scenario for HRM, the assumptions in that study seem conservative and as a result, this projection will be treated as the low growth scenario.

6.3 Porter Dillon's Forecast (High Growth Scenario)

This forecast was taken from the *East Hants Infrastructure Capacity Study* (*Porter Dillon, 1998*). This forecast is 'conservatively optimistic' because it was developed to anticipate municipal infrastructure needed to service a growing population. The study authors deliberately made high growth assumptions to ensure that the Municipality would not reach a situation where there were inadequate services to support the population in the RSB. Indeed, many of the assumptions seem quite optimistic. For example, the authors assumed 3.35 persons per household in all future development, whereas the latest census indicates that in East Hants there are 3.0 people per household. As a result of such assumptions, this forecast will be considered the high growth scenario.

6.4 Average of All Forecasts (Moderate Growth Scenario)

Averaging all three forecasts provides results close to the historic trend line. As such this forecast will be treated as a moderate growth scenario which provides the most probable outcome. In this case, the RSB population will continue to grow, albeit at a declining rate.

By 2021, in this scenario, we can expect a population of 10,150. This would be an increase of 5,667 people, or double the current population, over this 25 year period or an increase of about 227 people per year.

MUNICIPALITY OF EAST HANTS
P.O. Box 190, Shubenacadie, N.S. B0N 2H0

Grant Bain, Dp., B.E.S.
Director of Planning & Development

Telephone: (902) 758-2715
Facsimile: (902) 758-3497

gbain@municipality.easthants.ns.ca

		nge/Year	% Growth
			5.6
		.4	5.3
			5.1
			4.8
			4.6
2001	5820		4.2
2002	6074	254	4.0
2003	6328		3.9
2004	6582		3.7
2005	6836		3.6
2006	7090		2.9
2007	7302	211.6	2.8
2008	7513		2.7
2009	7725		2.7
2010	7936		2.6
2011	8148		2.4
2012	8352	204.4	2.4
2013	8557		2.3
2014	8761		2.3
2015	8966		2.2
2016	9170		2.1
2017	9366	196	2.0
2018	9562		2.0
2019	9758		2.0
2020	9954		1.9
2021	10150		
2022			
2023			
2024			
2025			
2026			
2027			
2028			
2029			
2030			
2031			

30 AUG 2002

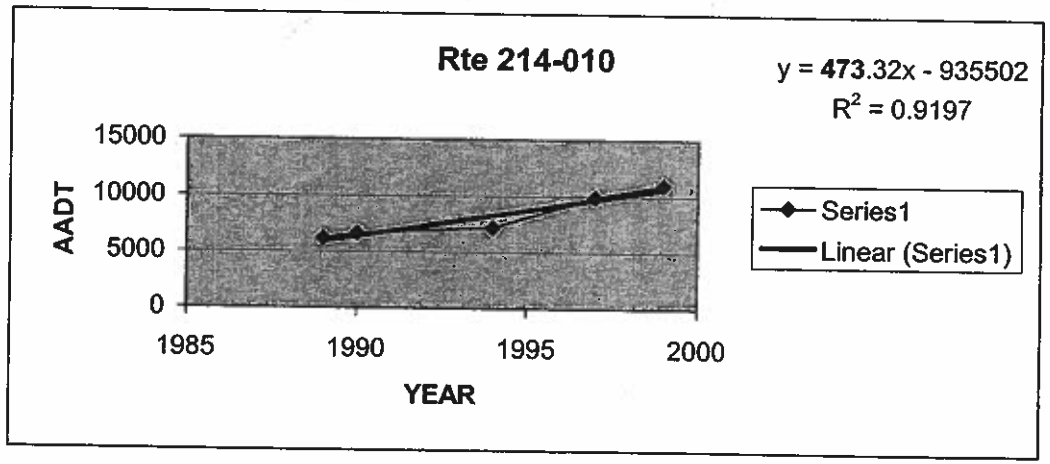
STACY - OUR SOCIO-ECONOMIC STUDY IS ATTACHED. PART 6 OF THE STUDY IS THE RELEVANT PART IN RELATION TO GROWTH RATES AFFECTING TRAFFIC ON ROUTE 214. BASED ON GROWTH RATES OUTLINED IN OUR STUDY, THE ABOVE SHOWS THE ANTICIPATED ANNUAL % GROWTH FOR THE REGIONAL SERVICED AREA OF ENFIELD, ELMSDALE & LANTZ. THE AVERAGE ANNUAL GROWTH OVER THIS PERIOD IS AROUND 3.2%. I WOULD SUGGEST USING THIS FIGURE IF YOU WANT TO TAKE A CAUTIOUS APPROACH TO POPULATION PROJECTION - THIS WILL LIKELY PUT YOU AT THE HIGH END OF THE WINDOW.

CALL IF YOU WISH TO DISCUSS.

- GRANT.

Rte 214-Section 010 - Tk.2 (Elmsdale) to Hwy 102 Inter/c

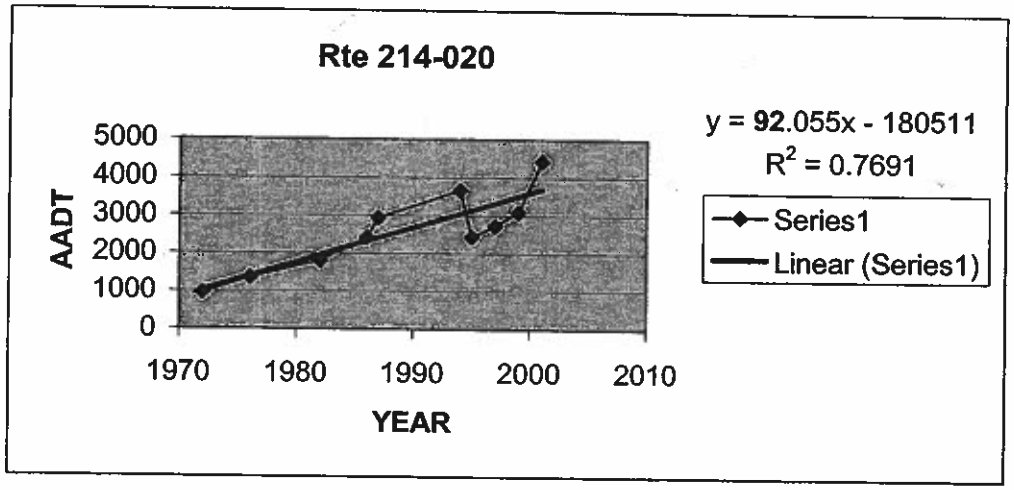
1989	6190
1990	6650
1994	7210
1997	9920
1999	11000



Growth is 473 Vehicles per year.

Rte 214-Section 020 - Hwy 102 Inter/c to Tk. 14

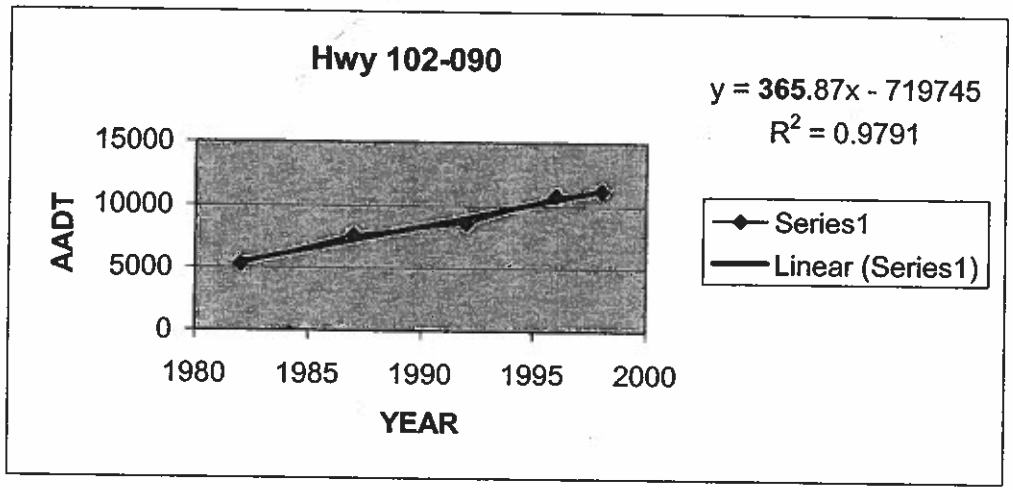
1972	950
1976	1350
1982	1800
1986	2410
1987	2940
1994	3660
1995	2430
1997	2730
1999	3090
2001	4420



Growth is 92 Vehicles per year.

Hwy 102-Section 090 - Enfield to Elmsdale (Northbound)

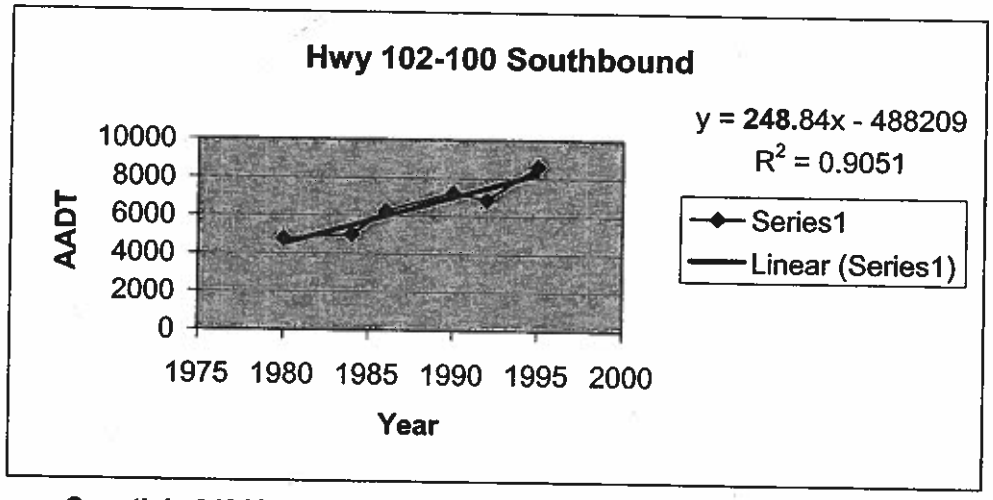
1982	5270
1987	7660
1992	8600
1996	10800
1998	11200



Growth is 365 Vehicles per year.

Hwy 102-Section 100 - Elmsdale to Milford (Southbound)

1980	4760
1984	5000
1986	6260
1990	7220
1992	6850
1995	8620



Growth is 248 Vehicles per year.

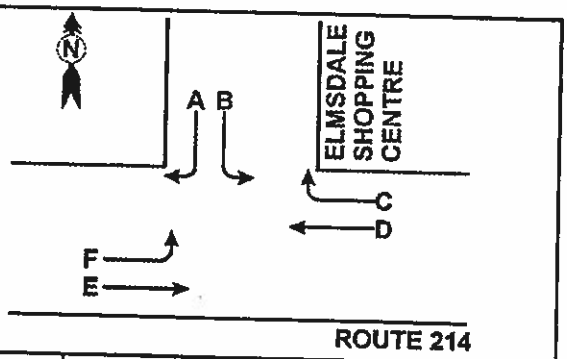
APPENDIX C

JULY 5, 2002 TRAFFIC COUNTS

Route 214
@
Elmsdale Shopping Centre

Existing Traffic Count Data

Friday, July 5, 2002

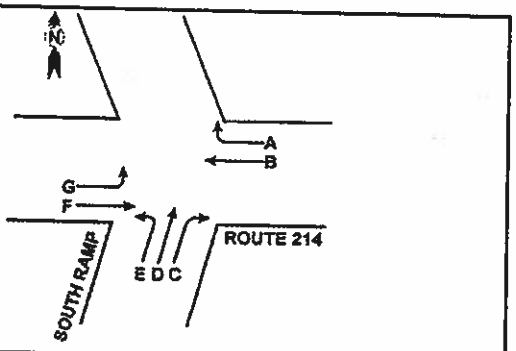


Time	A	B	C	D	E	F	Total
3:30	60	53	66	74	87	56	396
3:45	53	39	48	59	95	58	352
4:00	71	69	45	88	95	84	442
4:15	74	47	45	104	116	58	444
4:30	68	51	52	81	102	57	411
4:45	80	75	47	104	94	86	486
5:00	58	66	48	76	92	65	405
5:15	76	53	46	81	116	62	434
Peak	293	232	189	377	407	285	1783
Peak Hour Factor	0.92	0.78	0.91	0.91	0.88	0.83	
Pedestrian	0	0	1	1	0	0	
% Trucks	1	0.5	1	5	6	2	

Route 214
@
South Ramp Terminal

Existing Traffic Count Data

Friday, July 5, 2002

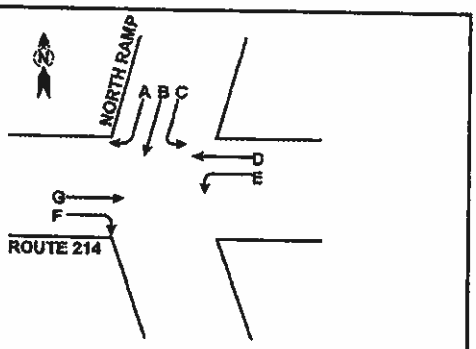


Time	A	B	C	D	E	F	G	Total
3:30	21	102	58	0	52	77	17	327
3:45	22	101	66	0	45	101	15	350
4:00	22	97	94	1	44	103	12	373
4:15	31	126	94	0	72	97	14	434
4:30	33	109	103	0	66	93	16	420
4:45	35	107	88	0	84	95	17	426
5:00	29	126	77	0	58	86	17	393
5:15	29	121	90	0	71	100	10	421
Peak	121	439	379	1	266	388	59	1653
Peak Hour Factor	0.87	0.88	0.92	1	0.8	0.95	0.87	
Pedestrians	0	0	0	0	0	0	0	
% Trucks	9	3	6	0	4	4	0	

Route 214
@
North Ramp Terminal

Existing Traffic Count Data

Friday, July 5, 2002

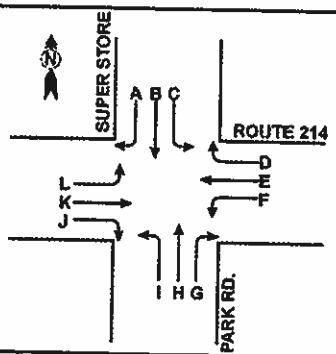


Time	A	B	C	D	E	F	G	Total
3:30	13	0	17	119	34	21	84	288
3:45	15	0	27	96	26	24	87	275
4:00	11	0	21	106	38	32	101	309
4:15	9	1	25	134	39	19	88	315
4:30	14	0	33	116	44	19	92	318
4:45	15	0	23	149	40	29	93	349
5:00	11	0	19	131	30	24	92	307
5:15	14	0	27	136	36	25	93	331
Peak	49	1	102	505	161	99	374	1291
Peak Hour Factor	0.82	1	0.78	0.85	0.92	0.78	0.93	
Pedestrians	0	0	0	0	0	0	0	
% Trucks	7	0	4	3	5	3	5	

Route 214
@
Superstore Entrance/Park Rd.

Existing Traffic Count Data

Friday July 5, 2002



Time	A	B	C	D	E	F	G	H	I	J	K	L	Total
3:30	14	6	62	73	42	15	15	0	2	3	24	12	268
3:45	11	2	71	57	34	12	11	1	1	1	33	7	241
4:00	12	3	66	78	45	18	19	5	1	1	44	6	298
4:15	14	2	69	74	56	20	11	2	5	5	25	7	290
4:30	11	1	69	81	55	10	13	7	3	2	35	6	293
4:45	16	1	63	87	50	16	19	4	2	1	38	3	300
5:00	9	3	65	76	61	13	21	1	2	1	29	3	284
5:15	14	0	68	77	64	5	20	3	4	1	37	3	296
Peak	53	7	264	320	206	64	62	18	11	9	145	22	1181
Peak Hour Factor	0.83	1	0.96	0.92	0.92	0.8	0.82	0.65	0.55	0.45	0.83	0.79	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	
% Trucks	2	0	1	2	3	18	5	0	0	0	8	0	

APPENDIX D

SIGNAL WARRANT ANALYSES

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Superstore Entrance/Park Rd./Route 214 PM Peak Hour - Existing			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**-25.0**	**42.7**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**30.5**	
	N. Leg (2.0 x 7.28 x 1.0) S. Leg (2.0 x 1.82 x 1.0) E. Leg (0.25 x 11.30 x 1.0) W. Leg (2.0 x 4.75 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**37.2**	
	(8.15 + 0.1) x (4.41 + 0.1) x 1.0		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Superstore Entrance/Park Rd./Route 214 PM Peak Hour - 20 Year Horizon Excluding Development			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**-25.0**	**56.2**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**35.7**	
	N. Leg (2.0 x 6.95 x 1.0) S. Leg (2.0 x 1.73 x 1.0) E. Leg (0.25 x 13.62 x 1.0) W. Leg (2.0 x 7.49 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**45.5**	
	(10.88 + 0.1) x (4.04 + 0.1) x 1.0		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Superstore Entrance/Park Rd./Route 214 PM Peak Hour - 20 Year Horizon Including Development			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**-25.0**	**289.5**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**78.5**	
	N. Leg (2.0 x 17.73 x 1.0) S. Leg (2.0 x 12.39 x 1.0) E. Leg (0.25 x 27.24 x 1.0) W. Leg (2.0 x 5.69 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**236.0**	
	(17.86 + 0.1) x (13.04 + 0.1) x 1.0		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Superstore Entrance/Park Rd./Route 214 PM Peak Hour - Existing with Signals at Northbound Ramp			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**-25.0**	**39.9**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**27.7**	
	N. Leg (2.0 x 7.3 x 1.0) S. Leg (2.0 x 1.82 x 1.0) E. Leg (0.0 x 11.30 x 1.0) W. Leg (2.0 x 4.75 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**37.2**	
	(8.15 + 0.1) x (4.41 + 0.1) x 1.0		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Superstore Entrance/Park Rd./Route 214 PM Peak Hour - 20 Year Horizon Excluding Dev. with Signals at Northbound Ramp			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**-25.0**	**52.8**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**32.3**	
	N. Leg (2.0 x 6.95 x 1.0) S. Leg (2.0 x 1.73 x 1.0) E. Leg (0.0 x 13.62 x 1.0) W. Leg (2.0 x 7.49 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**45.5**	
	(10.88 + 0.1) x (4.04 + 0.1) x 1.0		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Superstore Entrance/Park Rd./Route 214 PM Peak Hour - 20 Year Horizon Including Dev. With Signals at Northbound Ramp			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**-25.0**	**282.6**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**71.6**	
	N. Leg (2.0 x 17.73 x 1.0) S. Leg (2.0 x 12.39 x 1.0) E. Leg (0.0 x 27.24 x 1.0) W. Leg (2.0 x 5.69 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**236.0**	
	(17.86 + 0.1) x (13.04 + 0.1) x 1.0		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Southbound Ramp/Route 214 PM Peak Hour - Existing			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**42.2**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**16.3**	
	N. Leg (2.5 x 1.62 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (0.0 x 7.60 x 1.0) W. Leg (2.0 x 6.12 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**18.9**	
	(12.12 + 0.1) x (1.62 + 0.1) x 1.0		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Southbound Ramp/Route 214 PM Peak Hour - 20 Year Horizon Excluding Development			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**71.4**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**32.7**	
	N. Leg (2.5 x 2.19 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (0.0 x 15.47 x 1.0) W. Leg (2.0 x 13.62 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**31.7**	
	(15.29 + 0.1) x (2.19 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Southbound Ramp/Route 214 PM Peak Hour - 20 Year Horizon Including Development			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**146.8**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**61.8**	
	N. Leg (2.5 x 2.92 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (0.0 x 27.22 x 1.0) W. Leg (2.0 x 27.24 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**78.0**	
	(28.62 + 0.1) x (2.92 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET
Uniform Traffic Control Devices for Canada - Chapter B
Intersection: Southbound Ramp/Route 214
PM Peak Hour - Existing with Signals at Northbound Ramp

Part	Calculation	SubTotal	Priority Points
I Accident Rating	From Figure B2-1	**7.0**	**35.3**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**9.4**	
	N. Leg (2.5 x 1.62 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (-0.9 x 7.60 x 1.0) W. Leg (2.0 x 6.12 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**18.9**	
	(12.12 + 0.1) x (1.62 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Southbound Ramp/Route 214 PM Peak Hour - 20 Year Horizon Excluding Dev. with Signals at Northbound Ramp			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**57.5**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$ N. Leg (2.5 x 2.19 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (-0.9 x 15.47 x 1.0) W. Leg (2.0 x 13.62 x 1.0)	**18.8**	
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$ (15.29 + 0.1) x (2.19 + 0.1) x 0.9	**31.7**	

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Southbound Ramp/Route 214 PM Peak Hour - 20 Year Horizon Including Dev. With Signals at Northbound Ramp			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**122.3**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**37.3**	
	N. Leg (2.5 x 2.92 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (-0.9 x 27.22 x 1.0) W. Leg (2.0 x 27.24 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**78.0**	
	(28.62 + 0.1) x (2.92 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Southbound Ramp/Route 214 PM Peak Hour - Existing with Signals at Superstore and Northbound Ramp			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**17.6**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**-8.3**	
	N. Leg (2.5 x 1.62 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (-0.9 x 7.60 x 1.0) W. Leg (-0.9 x 6.12 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**18.9**	
	(12.12 + 0.1) x (1.62 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Southbound Ramp/Route 214 PM Peak Hour - 20 Year Horizon Excluding Dev. With Signals at Supertore and Northbound Ramp			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**18.0**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**-20.7**	
	N. Leg (2.5 x 2.19 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (-0.9 x 15.47 x 1.0) W. Leg (-0.9 x 13.62 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**31.7**	
	(15.29 + 0.1) x (2.19 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET
Uniform Traffic Control Devices for Canada - Chapter B

Intersection: Southbound Ramp/Route 214
PM Peak Hour - 20 Year Horizon Including Dev. With Signals at Supertore and Northbound Ramp

Part	Calculation	SubTotal	Priority Points
I Accident Rating	From Figure B2-1	**7.0**	**43.3**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**-41.7**	
	N. Leg (2.5 x 2.92 x 1.0) S. Leg (2.5 x 0.0 x 1.0) E. Leg (-0.9 x 27.22 x 1.0) W. Leg (-0.9 x 27.24 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**78.0**	
	(28.62 + 0.1) x (2.92 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Northbound Ramp/Route 214 PM Peak Hour - Existing			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**109.5**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**34.6**	
	N. Leg (2.5 x 0.0 x 1.0) S. Leg (2.5 x 6.87 x 1.0) E. Leg (-0.5 x 14.12 x 1.0) W. Leg (2.0 x 12.26 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**67.9**	
	(10.72 + 0.1) x (6.87 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B Intersection: Northbound Ramp/Route 214 PM Peak Hour - 20 Year Horizon Excluding Development			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**167.1**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$ N. Leg (2.5 x 0.0 x 1.0) S. Leg (2.5 x 9.63 x 1.0) E. Leg (-0.5 x 17.54 x 1.0) W. Leg (2.0 x 15.47 x 1.0)	**46.2**	
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$ (12.91 + 0.1) x (9.63 + 0.1) x 0.9	**113.9**	

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

SIGNALIZATION PRIORITY POINT WORKSHEET Uniform Traffic Control Devices for Canada - Chapter B			
Intersection: Northbound Ramp/Route 214 **PM Peak Hour - 20 Year Horizon Including Development**			
Part	**Calculation**	**SubTotal**	**Priority Points**
I Accident Rating	From Figure B2-1	**7.0**	**341.5**
II Delays and Vehicular Stops	$P_2 \times V_t \times F_e$	**72.6**	
	N. Leg (2.5 x 0.0 x 1.0) S. Leg (2.5 x 12.66 x 1.0) E. Leg (-0.5 x 27.06 x 1.0) W. Leg (2.0 x 27.22 x 1.0)		
III Intersecting Volumes and Pedestrian Volumes	$(V_a + P) \times (Va + P) \times F_{ow}$	**261.9**	
	(22.70 + 0.1) x (12.66 + 0.1) x 0.9		

P_2 = Qualitative index expressing effect traffic signal would have upon availability of crossing gaps, Progression of vehicles, delay to vehicles, and the number of stops to which vehicles are subjected to.

V_t = total annual average daily traffic volume on each individual leg, divided by 1000.

F_e = expansion factor accounting for increase in vehicular volume occurring within one year due to installation of traffic control signal.

V_a = total annual average daily traffic volume approaching intersection, divided by 1000.

P = total annual average daily pedestrian volume crossing intersection, divided by 1000.

F_{ow} = factor expressing increased safety, capacity and facility of movement at intersection of one-way streets due to smaller number of conflict points compared with two-way streets.

APPENDIX E

EXISTING AND HORIZON LOS RESULTS WITHOUT IMPROVEMENTS

HCS2000: Unsignalized Intersections Release 4.1a

TWO-WAY STOP CONTROL SUMMARY

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 8/13/2002
Analysis Time Period: PM Peak (4:00 to 5:00 PM)
Intersection: Superstore/Park Rd./Route 214
Jurisdiction: NSTPW
Units: U. S. Customary
Analysis Year: 2002 - Existing
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Superstore/Park Rd.
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	22	129	9	62	204	318
Peak-Hour Factor, PHF	0.79	0.83	0.45	0.80	0.92	0.92
Hourly Flow Rate, HFR	27	155	20	77	221	345
Percent Heavy Vehicles	7	--	--	3	--	--
Median Type	Undivided					
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	11	18	56	235	7	53
Peak Hour Factor, PHF	0.55	0.65	0.82	0.96	1.00	0.83
Hourly Flow Rate, HFR	19	27	68	244	7	63
Percent Heavy Vehicles	0	0	5	1	0	2
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?		No			No	
Storage						
RT Channelized?						
Lanes	0	1	0	1	1	0
Configuration		LTR		L		TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR		L		TR
v (vph)	27	77		114		244		70
C(m) (vph)	978	1391		420		226		578
v/c	0.03	0.06		0.27		1.08		0.12
95% queue length	0.09	0.18		1.09		10.76		0.41
Control Delay	8.8	7.7		16.7		128.6		12.1
LOS	A	A		C		F		B
Approach Delay				16.7			102.6	
Approach LOS				C			F	

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Stacy D. Muise
O'Halloran Campbell Consultants Ltd.
1657 Bedford Row
P.O. Box 1028, Halifax Nova Scotia
B3J 2X1

HCS2000: Unsignalized Intersections Release 4.1c

TWO-WAY STOP CONTROL SUMMARY

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 8/13/2002
Analysis Time Period: PM Peak (4:00 to 5:00 PM)
Intersection: Superstore/Park Rd./Route 214
Jurisdiction: NSTPW
Units: U. S. Customary
Analysis Year: 2022 - Horizon Excluding Devs.
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Superstore/Park Rd.
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	22	192	9	62	417	159
Peak-Hour Factor, PHF	0.79	0.83	0.45	0.80	0.92	0.92
Hourly Flow Rate, HFR	27	231	20	77	453	172
Percent Heavy Vehicles	7	--	--	3	--	--
Median Type	Undivided					
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	11	18	56	235	7	53
Peak Hour Factor, PHF	0.55	0.65	0.82	0.96	1.00	0.83
Hourly Flow Rate, HFR	19	27	68	244	7	63
Percent Heavy Vehicles	0	0	5	1	0	2
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?		No			No	
Storage						
RT Channelized?						
Lanes	0	1	0	1	1	0
Configuration		LTR		L		TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR		L		TR
v (vph)	27	77		114		244		70
C(m) (vph)	929	1304		334		154		467
v/c	0.03	0.06		0.34		1.58		0.15
95% queue length	0.09	0.19		1.48		16.72		0.52
Control Delay	9.0	7.9		21.3		344.1		14.1
LOS	A	A		C		F		B
Approach Delay				21.3			270.6	
Approach LOS				C			F	

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Stacy D. Muise
O'Halloran Campbell Consultants Ltd.
1657 Bedford Row
PO Box 1028, Halifax Nova Scotia
B3J 2X1

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TWO-WAY STOP CONTROL SUMMARY

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 8/13/2002
Analysis Time Period: PM Peak (4:00 to 5:00 PM)
Intersection: Superstore/Park Rd./Route 214
Jurisdiction: NSTPW
Units: U. S. Customary
Analysis Year: 2022 - Horizon Including Devs.
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Superstore/Park Rd.
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	48	135	63	475	199	379
Peak-Hour Factor, PHF	0.79	0.83	0.45	0.80	0.92	0.92
Hourly Flow Rate, HFR	60	162	140	593	216	411
Percent Heavy Vehicles	7	--	--	3	--	--
Median Type	Undivided					
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	77	126	406	587	17	131
Peak Hour Factor, PHF	0.55	0.65	0.82	0.96	1.00	0.83
Hourly Flow Rate, HFR	139	193	495	611	17	157
Percent Heavy Vehicles	0	0	5	1	0	2
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?		No			No	
Storage						
RT Channelized?						
Lanes	0	1	0	1	1	0
Configuration		LTR		L		TR

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR		LTR		L		TR
v (vph)	60	593		827		611		174
C(m) (vph)	927	1249		0		0		112
v/c	0.06	0.47						1.55
95% queue length	0.21	2.63						12.83
Control Delay	9.2	10.5						356.6
LOS	A	B		F		F		F
Approach Delay								
Approach LOS								

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Stacy D. Muise
O'Halloran Campbell Consultants Ltd.
1657 Bedford Row
PO Box 1028, Halifax Nova Scotia
B3J 2X1

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TWO-WAY STOP CONTROL SUMMARY

Analyst:	Stacy D. Muise
Agency/Co.:	O'Halloran Campbell Consultant
Date Performed:	8/13/2002
Analysis Time Period:	PM Peak (4:00 to 5:00 PM)
Intersection:	Southbound Ramp/Route 214
Jurisdiction:	NSTPW
Units: U. S. Customary	
Analysis Year:	2002 - Existing
Project ID:	Highway 102/Route 214 Interchange Area Transportation Study
East/West Street:	Route 214
North/South Street:	Southbound Ramp
Intersection Orientation:	EW
Study period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		321	99	170	535	
Peak-Hour Factor, PHF		0.93	0.78	0.92	0.85	
Hourly Flow Rate, HFR		345	126	184	629	
Percent Heavy Vehicles		--	--	4	--	--
Median Type	Undivided					
RT Channelized?						
Lanes		1 0		0 1		
Configuration		TR		LT		
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				88	1	49
Peak Hour Factor, PHF				0.78	1.00	0.82
Hourly Flow Rate, HFR				112	1	59
Percent Heavy Vehicles				4	0	7
Percent Grade (%)		0			1	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?						Yes
Lanes				0 1		1
Configuration				LT		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT				LT		R
v (vph)		184				113		59
C(m) (vph)		1077				125		469
v/c		0.17				0.90		0.13
95% queue length		0.61				5.80		0.43
Control Delay		9.0				122.6		13.8
LOS		A				F		B
Approach Delay							85.3	
Approach LOS							F	

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Stacy D. Muise
O'Halloran Campbell Consultants Ltd.
1657 Bedford Row
PO Box 1028, Halifax Nova Scotia
B3J 2X1

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TWO-WAY STOP CONTROL SUMMARY

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 8/13/2002
Analysis Time Period: PM Peak (4:00 to 5:00 PM)
Intersection: Southbound Ramp/Route 214
Jurisdiction: NSTPW
Units: U. S. Customary
Analysis Year: 2022 - Horizon Excluding Devs.
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Southbound Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		369	114	230	724	
Peak-Hour Factor, PHF		0.93	0.78	0.92	0.85	
Hourly Flow Rate, HFR		396	146	249	851	
Percent Heavy Vehicles		--	--	4	--	--
Median Type	Undivided					
RT Channelized?						
Lanes		1 0		0 1		
Configuration		TR		LT		
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				131	2	73
Peak Hour Factor, PHF				0.78	1.00	0.82
Hourly Flow Rate, HFR				167	2	89
Percent Heavy Vehicles				0	0	0
Percent Grade (%)		1			1	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?						Yes
Lanes				0 1		1
Configuration				LT		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT				LT		R
v (vph)		249				169		89
C(m) (vph)		1013				64		359
v/c		0.25				2.64		0.25
95% queue length		0.97				16.88		0.96
Control Delay		9.7				881.1		18.3
LOS		A				F		C
Approach Delay							583.4	
Approach LOS							F	

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Stacy D. Muise
O'Halloran Campbell Consultants Ltd.
1657 Bedford Row
PO Box 1028, Halifax Nova Scotia
B3J 2X1

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TWO-WAY STOP CONTROL SUMMARY

Analyst:	Stacy D. Muise
Agency/Co.:	O'Halloran Campbell Consultant
Date Performed:	8/13/2002
Analysis Time Period:	PM Peak (4:00 to 5:00 PM)
Intersection:	Southbound Ramp/Route 214
Jurisdiction:	NSTPW
Units: U. S. Customary	
Analysis Year:	2022 - Horizon Including Devs.
Project ID:	Highway 102/Route 214 Interchange Area Transportation Study
East/West Street:	Route 214
North/South Street:	Southbound Ramp
Intersection Orientation:	EW
Study period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		849	279	254	1308	
Peak-Hour Factor, PHF		0.93	0.78	0.92	0.85	
Hourly Flow Rate, HFR		912	357	276	1538	
Percent Heavy Vehicles		--	--	4	--	--
Median Type	Undivided					
RT Channelized?						
Lanes		1 0		0 1		
Configuration		TR		LT		
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				148	2	124
Peak Hour Factor, PHF				0.78	1.00	0.82
Hourly Flow Rate, HFR				189	2	151
Percent Heavy Vehicles				4	0	7
Percent Grade (%)		1			1	
Median Storage						
Flared Approach: Exists?						Yes
Storage				0	1	1
RT Channelized?						
Lanes				0	1	1
Configuration				LT		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT				LT		R
v (vph)		276				191		151
C(m) (vph)		539				0		137
v/c		0.51						1.10
95% queue length		2.89						8.45
Control Delay		18.5						170.7
LOS		C				F		F
Approach Delay								
Approach LOS								

HCS2000: Unsignalized Intersections Release 4.1c

Stacy D. Muise
O'Halloran Campbell Consultants Ltd.
1657 Bedford Row
PO Box 1028, Halifax Nova Scotia
B3J 2X1

HCS2000: Unsignalized Intersections Release 4.1c

TWO-WAY STOP CONTROL SUMMARY

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 8/13/2002
Analysis Time Period: PM Peak (4:00 to 5:00 PM)
Intersection: Northbound Ramp/Route 214
Jurisdiction: NSTPW
Units: U. S. Customary
Analysis Year: 2002 - Existing
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Northbound Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	59	350			439	121
Peak-Hour Factor, PHF	0.87	0.95			0.88	0.87
Hourly Flow Rate, HFR	67	368			498	139
Percent Heavy Vehicles	4	--	--		--	--
Median Type	Undivided					
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	266	1	342			
Peak Hour Factor, PHF	0.80	1.00	0.92			
Hourly Flow Rate, HFR	332	1	371			
Percent Heavy Vehicles	4	0	6			
Percent Grade (%)		1			0	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?			No			
Lanes	0	1	1			
Configuration	LT		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L		LT		R			
v (vph)	67		333		371			
C(m) (vph)	933		295		755			
v/c	0.07		1.13		0.49			
95% queue length	0.23		13.80		2.74			
Control Delay	9.2		130.1		14.3			
LOS	A		F		B			
Approach Delay			69.1					
Approach LOS			F					

HCS2000: Unsignalized Intersections Release 4.1c

Stacy D. Muise
O'Halloran Campbell Consultants Ltd.
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B3J 2X1

HCS2000: Unsignalized Intersections Release 4.1c

TWO-WAY STOP CONTROL SUMMARY

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 8/13/2002
Analysis Time Period: PM Peak (4:00 to 5:00 PM)
Intersection: Northbound Ramp/Route 214
Jurisdiction: NSTPW
Units: U. S. Customary
Analysis Year: 2022 - Horizon Excluding Devs.
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Northbound Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	72	428			559	154
Peak-Hour Factor, PHF	0.87	0.95			0.88	0.87
Hourly Flow Rate, HFR	82	450			635	177
Percent Heavy Vehicles	4	--	--		--	--
Median Type	Undivided					
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	395	2	508			
Peak Hour Factor, PHF	0.80	1.00	0.92			
Hourly Flow Rate, HFR	493	2	552			
Percent Heavy Vehicles	4	0	6			
Percent Grade (%)		1			0	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?			No			
Lanes	0	1	1			
Configuration	LT		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L		LT		R			
v (vph)	82		495		552			
c(m) (vph)	802		211		698			
v/c	0.10		2.35		0.79			
95% queue length	0.34		40.13		7.91			
Control Delay	10.0-		656.2		26.7			
LOS	A		F		D			
Approach Delay				324.3				
Approach LOS				F				

HCS2000: Unsignalized Intersections Release 4.1c

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O'Halloran Campbell Consultants Ltd.
1657 Bedford Row
PO Box 1028, Halifax Nova Scotia
B3J 2X1

HCS2000: Unsignalized Intersections Release 4.1c

TWO-WAY STOP CONTROL SUMMARY

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 8/13/2002
Analysis Time Period: PM Peak (4:00 to 5:00 PM)
Intersection: Northbound Ramp/Route 214
Jurisdiction: NSTPW
Units: U. S. Customary
Analysis Year: 2022 - Horizon Including Devs.
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Northbound Ramp
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	172	825			956	181
Peak-Hour Factor, PHF	0.87	0.95			0.88	0.87
Hourly Flow Rate, HFR	197	868			1086	208
Percent Heavy Vehicles	4	--	--		--	--
Median Type	Undivided					
RT Channelized?						
Lanes	1	1			1	0
Configuration	L	T				TR
Upstream Signal?		Yes			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	606	2	582			
Peak Hour Factor, PHF	0.80	1.00	0.92			
Hourly Flow Rate, HFR	757	2	632			
Percent Heavy Vehicles	4	0	6			
Percent Grade (%)		1			0	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?			No			
Lanes	0	1	1			
Configuration	LT		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L		LT		R			
v (vph)	197		759		632			
C(m) (vph)	527		39		465			
v/c	0.37		19.46		1.36			
95% queue length	1.72		93.06		29.04			
Control Delay	15.9				199.7			
LOS	C		F		F			
Approach Delay								
Approach LOS				F				

HCS2000: Unsignalized Intersections Release 4.1c

Stacy D. Muise
O'Halloran Campbell Consultants Ltd.
1657 Bedford Row
PO Box 1028, Halifax Nova Scotia
B3J 2X1

Analyst: Stacy D. Muise
Agency: O'Halloran Campbell Consultant
Date: 07/05/2002
Period: PM Peak (4:00 to 5:00 PM)
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
E/W St: Rte 214

Inter.: Elmsdale S. C./Route 214
Area Type: All other areas
Jurisd: NSTPW
Year : 2002 - Existing
N/S St: Elmsdale Shopping Centre

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	0	1	1	0	0	0	1	0	1
LGConfig	L	T			T	R				L		R
Volume	285	407			315	189				232		245
Lane Width	12.1	12.1			15.7	12.1				15.7		15.7
RTOR Vol						95						120

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A	A			NB Left				
Thru	A	A			Thru				
Right					Right				
Peds	X	X			Peds				
WB Left					SB Left	A			
Thru		A			Thru				
Right		A			Right	A			
Peds		X			Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	7.8	13.7				12.8			
Yellow	4.5	4.5				3.0			
All Red	1.4	1.4				1.9			

Cycle Length: 51.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	504	1767	0.68	0.57	11.3	B		
T	1030	1792	0.45	0.57	6.5	A	8.6	A
Westbound								
T	619	2025	0.56	0.31	16.0	B	15.4	B
R	481	1573	0.21	0.31	13.4	B		
Northbound								
Southbound								
L	537	2000	0.55	0.27	17.3	B		
							16.6	B
R	481	1790	0.28	0.27	15.1	B		

Intersection Delay = 12.4 (sec/veh) Intersection LOS = B

HCS2000: Signalized Intersections Release 4.1c

Stacy D. Muise
Route 214 from Soeys to Superstore
Baseline

Phone:
E-Mail:
Fax:

OPERATIONAL ANALYSIS

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 07/05/2002

Analyst: Stacy D. Muise
Agency: O'Halloran Campbell Consultant
Date: 07/05/2002
Period: PM Peak (4:00 to 5:00 PM)
Project ID: Highway 102/Route 214 Interchange Area Traffic Impact Study
E/W St: Rte 214

Inter.: Elmsdale S. C./Route 214
Area Type: All other areas
Jurisd: NSTPW
Year : 2022 - Horizon Excluding Devs.
N/S St: Elmsdale Shopping Centre

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	0	1	1	0	0	0	1	0	1
LGConfig	L	T			T	R				L		R
Volume	285	651			468	189				232		245
Lane Width	12.1	12.1			15.7	12.1				15.7		15.7
RTOR Vol						95						120

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A	A			NB Left			
Thru	A	A			Thru			
Right					Right			
Peds	X	X			Peds			
NB Left					SB Left	A		
Thru		A			Thru			
Right		A			Right	A		
Peds		X			Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	7.8	13.7				12.8		
Yellow	4.5	4.5				3.0		
All Red	1.4	1.4				1.9		

Cycle Length: 51.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
	482	1768	0.71	0.57	13.5	B		
	1030	1792	0.72	0.57	10.3	B	11.3	B
Westbound								
	619	2025	0.83	0.31	25.8	C	23.7	C
	481	1573	0.21	0.31	13.4	B		
Northbound								
Southbound								
L	537	2000	0.55	0.27	17.3	B		
							16.6	B
	481	1790	0.28	0.27	15.1	B		

Intersection Delay = 16.0 (sec/veh) Intersection LOS = B

HCS2000: Signalized Intersections Release 4.1c

Stacy D. Muise
oute 214 from Soeys to Superstore
aseline

hone:
-Mail:

Fax:

OPERATIONAL ANALYSIS

nalyst: Stacy D. Muise
gency/Co.: O'Halloran Campbell Consultant
ate Performed: 07/05/2002

Analyst: Stacy D. Muise
Agency: O'Halloran Campbell Consultant
Date: 07/05/2002
Period: PM Peak (4:00 to 5:00 PM)
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
E/W St: Rte 214

Inter.: Elmsdale S. C./Route 214
Area Type: All other areas
Jurisd: NSTPW
Year : 2022 - Horizon Including Devs.
N/S St: Elmsdale Shopping Centre

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	0	1	1	0	0	0	1	0	1
LGConfig	L	T			T	R				L		R
Volume	506	901			694	339				391		443
Lane Width	12.1	12.1			15.7	12.1				15.7		15.7
RTOR Vol						150						220

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A	A			NB Left			
Thru	A	A			Thru			
Right					Right			
Peds	X	X			Peds			
WB Left					SB Left	A		
Thru		A			Thru			
Right		A			Right	A		
Peds		X			Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	7.8	13.7				12.8		
Yellow	4.5	4.5				3.0		
All Red	1.4	1.4				1.9		

Cycle Length: 51.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
	482	1768	1.27	0.57	147.2	F		
	1030	1792	0.99	0.57	37.3	D	78.3	E
Westbound								
	619	2025	1.23	0.31	136.0	F	110.0	F
	481	1573	0.43	0.31	14.8	B		
Northbound								
Southbound								
	537	2000	0.93	0.27	41.7	D		
							33.5	C
	481	1790	0.50	0.27	16.6	B		

Intersection Delay = 77.6 (sec/veh) Intersection LOS = E

HCS2000: Signalized Intersections Release 4.1c

Stacy D. Muise
Route 214 from Soeys to Superstore
Baseline

Phone:
E-Mail:

Fax:

OPERATIONAL ANALYSIS

Analyst: Stacy D. Muise
Agency/Co.: O'Halloran Campbell Consultant
Date Performed: 07/05/2002

APPENDIX F

SIGNAL SETTINGS

TRACONEX TMP390 DATA BASE REPORTER FILE C:\TNETJ\DATAB\ELMSOBEY.I02

EM # 2 CENTRAL Drop Name: ELMSDALE-SOBEYS Drop # 4
This report printed: 13:27:20 08-10-2000

(1)TOD CURRENT CALENDAR AND CLOCK

MNEM		DATA
R	CURRENT CALENDAR YEAR	96
ON	CURRENT CALENDAR MONTH	10
DOM	CURRENT DAY OF MONTH	29
R	CURRENT HOUR OF DAY	23
IN	CURRENT MINUTE	7
RTC	REAL TIME CLK RTC ON = 1 DST ON = 2	21
SEC	CURRENT SECOND	9
OW	DAY OF WEEK 1=SUNDAY	3
V	RESERVED - DO NOT EDIT	0
CON	39=TMP390 DO NOT EDIT	39
DV	REVISION 1=A 2=B ETC DO NOT EDIT	22
R	VERSION DISPLAY ONLY - DO NOT EDIT	4
IDH	CONTROLLER I.D. HIGH BYTE	0
IDL	CONTROLLER I.D. LOW BYTE	0

(2)390 MODE. PAGE 0. PHASE 0 - OPTION SELECTION

MNEM		DATA
USE	PHASES IN USE	..6.4.21
	PEDESTRIAN - ENABLE CONCURRENT PED MOVE	....4.2
K	FLASHING WALK	.....
ARW	ACTUATED REST IN WALK	.....
WC	WALK CLEARANCE PROTECT	.....
	DENSITY - ENABLES DENSITY OPERATION	.....
L	LAST CAR PASSAGE	.....
VN1	VEHICLE TO NON-ACTUATED NO. 1	.....
P	PEDESTRIAN TO NON-ACTUATED NO. 1	.....
V	VEHICLE TO NON-ACTUATED NO. 2	.....
PN2	PEDESTRIAN TO NON-ACTUATED NO. 2	.....
FGN	CANADA FAST FLASH GREEN	1
L	SELECT LEFT TURN AMBER BLANK	.....
A	SELECT ANTI-BACKUP PHASES	1

(3)390 MODE. PAGE 0. PHASES 1 TO 8 - PHASE TIMING

		PH 1	PH 2	PH 3	PH 4	PH 5	PH 6	PH 7	PH 8
N	MINIMUM GREEN INTERVAL	7	7	0	7	0	15	0	0
LK	WALK INTERVAL	0	7	0	7	0	0	0	0
C	PEDESTRIAN CLEARANCE	0	6	0	6	0	0	0	0
S	PASSAGE TIME (PRESET GAP)	0.5	0.5	0.0	0.5	0.0	0.5	0.0	0.0
X1	MAXIMUN GREEN NO. 1	20	40	0	30	0	40	0	0
X2	MAXIMUM GREEN NO. 2	40	40	0	40	0	40	0	0
E	YELLOW CLEARANCE	4.5	4.5	3.0	3.0	3.0	4.5	3.0	3.0
E	ALL RED CLEARANCE	1.4	1.4	0.0	1.9	0.0	1.4	0.0	0.0
RT	RED REVERT MIN TIME	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
B	ACTUATIONS BEFORE ADDED INITIAL	0	0	0	0	0	0	0	0
I	SECS PER ACTUATION ADDED INITIAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C	MAXIMUM ADDED INITIAL TIME	0	0	0	0	0	0	0	0
R	TIME BEFORE REDUCTION	0	0	0	0	0	0	0	0
T	TIME TO REDUCE TO MINIMUM GAP	1	1	1	1	1	1	1	1
	MINIMUM GAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CONDITIONAL MINIMUM	0	0	0	0	0	0	0	0

TRACONEX TMP390 DATA BASE REPORTER FILE C:\TNETJ\DATAB\ELMSOBEY.I02

EM # 2 CENTRAL Drop Name: ELMSDALE-SOBEYS Drop # 4

This report printed: 13:27:20 08-10-2000

(1)TOD CURRENT CALENDAR AND CLOCK

MNEM		DATA
YR	CURRENT CALENDAR YEAR	96
MON	CURRENT CALENDAR MONTH	10
DOM	CURRENT DAY OF MONTH	29
HR	CURRENT HOUR OF DAY	23
MIN	CURRENT MINUTE	7
RTC	REAL TIME CLK RTC ON = 1 DST ON = 2	21
SEC	CURRENT SECOND	9
DOW	DAY OF WEEK 1=SUNDAY	3
RSV	RESERVED - DO NOT EDIT	0
CON	39=TMP390 DO NOT EDIT	39
REV	REVISION 1=A 2=B ETC DO NOT EDIT	22
VER	VERSION DISPLAY ONLY - DO NOT EDIT	4
IDH	CONTROLLER I.E. HIGH BYTE	0
IDL	CONTROLLER I.D. LOW BYTE	0

(2)390 MODE, PAGE 0, PHASE 0 - OPTION SELECTION

MNEM		DATA
USE	PHASES IN USE	..6.4.21
PED	PEDESTRIAN - ENABLE CONCURRENT PED MOVE	....4.2.
FWK	FLASHING WALK	....
ARW	ACTUATED REST IN WALK	....
WCP	WALK CLEARANCE PROTECT	.....

MNEM		DATA
USE	PHASES IN USE	..6.4.21
PED	PEDESTRIAN - ENABLE CONCURRENT PED MOVE	....4.2.
FNK	FLASHING WALK	.....
ARW	ACTUATED REST IN WALK	.....
WCP	WALK CLEARANCE PROTECT	.....
	DENSITY - ENABLES DENSITY OPERATION	.....
LCP	LAST CAR PASSAGE	.....
VN1	VEHICLE TO NON-ACTUATED NO. 1	.....
PN1	PEDESTRIAN TO NON-ACTUATED NO. 1	.....
VN2	VEHICLE TO NON-ACTUATED NO. 2	.....
PN2	PEDESTRIAN TO NON-ACTUATED NO. 2	.....
FGN	CANADA FAST FLASH GREEN	1
LAB	SELECT LEFT TURN AMBER BLANK	.....
ABU	SELECT ANTI-BACKUP PHASES	1

Fully Actuated

PROTECTED LEFT TURN ARROW 214 EAST BOUND

PERMISSIVE GREEN BALL 214 WEST BOUND

MALL EXIT

PERMISSIVE GREEN BALL 214 EASTBOUND

(3)390 MODE, PAGE 0, PHASES 1 TO 8 - PHASE TIMING

MNEM		PH 1	PH 2	PH 3	PH 4	PH 5	PH 6	PH 7	PH 8
MIN	MINIMUM GREEN INTERVAL	7	7	0	7	0	15	0	0
WLK	WALK INTERVAL	0	7	0	7	0	0	0	0
WCL	PEDESTRIAN CLEARANCE	0	6	0	6	0	0	0	0
PSG	PASSAGE TIME (PRESET GAP)	0.5	0.5	0.0	0.5	0.0	0.5	0.0	0.0
MX1	MAXIMUM GREEN NO. 1	20	40	0	30	0	40	0	0
MX2	MAXIMUM GREEN NO. 2 (NOT USED)	40	40	0	40	0	40	0	0
YEL	YELLOW CLEARANCE	4.5	4.5	3.0	3.0	3.0	4.5	3.0	3.0
RED	ALL RED CLEARANCE	1.4	1.4	0.0	1.9	0.0	1.4	0.0	0.0
RRT	RED REVERT MIN TIME	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ABA	ACTUATIONS BEFORE ADDED INITIAL	0	0	0	0	0	0	0	0
S/A	SECS PER ACTUATION ADDED INITIAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MXI	MAXIMUM ADDED INITIAL TIME	0	0	0	0	0	0	0	0
TBR	TIME BEFORE REDUCTION	0	0	0	0	0	0	0	0
TTR	TIME TO REDUCE TO MINIMUM GAP	1	1	1	1	1	1	1	1
MNG	MINIMUM GAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CONDITIONAL MINIMUM	0	0	0	0	0	0	0	0

APPENDIX G

LOS ANALYSES RESULTS WITH IMPROVEMENTS

Analyst: Stacy D. Muise
Agency: O'Halloran Campbell Consultant
Date: 07/05/2002
Period: PM Peak (4:00 to 5:00 pm)
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
E/W St: Route 214

Inter.: Superstore/Park Rd/Route 214
Area Type: All other areas
Jurisd: NSTPW
Year : 2022 - Option No. 14
N/S St: Superstore DW?Park Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	2	0	0	2	0	1	1	1	2	1	0
LGConfig		LTR		DefL	TR		L	T	R	L	TR	
Volume	48	135	63	475	199	379	77	126	406	587	17	131
Lane Width		15.7		12.1	15.7		12.1	15.7	12.1	12.1	13.1	
RTOR Vol			15			140			155			35

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left	P				NB Left	A	P	
	Thru	P				Thru	A		
	Right	P				Right	A		
	Peds	X				Peds	X		
WB	Left	P	A			SB Left	A	A	
	Thru	P	A			Thru	A	A	
	Right		A			Right	A	A	
	Peds	X	X			Peds	X	X	
NB	Right		P			EB Right			
SB	Right					WB Right		P	
Green		34.7	29.4				13.6	20.3	
Yellow		3.5	3.5				3.5	3.5	
All Red		0.5	0.5				0.5	0.5	

Cycle Length: 114.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	894	2936	0.30	0.30	31.2	C	31.2	C
Westbound								
DefL	716	1537	0.78	0.29	26.7	C		
TR	1100	1919	0.45	0.60	12.8	B	20.2	C
Northbound								
L	409	1229	0.22	0.33	27.7	C		
T	255	2137	0.55	0.12	49.8	D	32.0	C
R	637	1545	0.44	0.41	24.5	C		
Southbound								
L	955	3483	0.72	0.33	39.9	D		
TR	563	1693	0.23	0.33	27.7	C	38.0	D

Intersection Delay = 29.0 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1c

Stacy D. Muise
oute 214 from Soeys to Superstore
aseline

hone:
-Mail: Fax:

OPERATIONAL ANALYSIS

alyst: Stacy D. Muise
ency/Co.: O'Halloran Campbell Consultant
Date Performed: 07/05/2002

Intersection: Superstore/Park Rd/Route 214
Area Type: All other areas
Jurisdiction: NSTPW
Analysis Year: 2022 - Option No. 14
Project ID: Highway 102/Route 214 Interchange Area Transportation Study

East/West Street: Route 214
North/South Street: Superstore DW?Park Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	48	135	63	475	199	379	77	126	406	587	17	131
% Heavy Veh	0	8	0	18	3	2	0	0	5	1	0	2
PHF	0.85	0.85	0.90	0.85	0.85	0.90	0.85	0.90	0.90	0.85	0.85	0.90
PK 15 Vol	14	40	18	140	59	105	23	35	113	173	5	36
Hi Ln Vol												
Grade		0			0			0			0	
Ideal Sat		1900		1900	1900		1900	1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	2	0	0	2	0	1	1	1	2	1	0
LGConfig		LTR			DefL TR		L	T	R	L	TR	
Lane Width		15.7		12.1	15.7		12.1	15.7	12.1	12.1	13.1	
RTOR Vol			15			140			155			35
Adj Flow		268		559	500		91	140	279	691	127	
%InSharedLn												
Prop LTs		0.209		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs		0.198			0.532			0.000	1.000		0.843	
Peds Bikes	0		0		0	0		0			0	0
Buses		0		0	0		0	0	0	0	0	
%InProtPhase					0.0	0.0			0.0		0.0	
Duration	0.25			Area Type: All other areas								

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Arriv. Type		3		2	3		3	3	3	3	3	
Unit Ext.		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
I Factor		1.000			0.484			1.000			1.000	
Lost Time		2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Ext of g		2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Ped Min g												

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	A	P	
Thru	P				Thru	A		
Right	P				Right	A		
Peds	X				Peds	X		
WB Left	P	A			SB Left	A	A	
Thru	P	A			Thru	A	A	
Right		A			Right	A	A	
Peds	X	X			Peds	X	X	
NB Right		P			EB Right			
SB Right					WB Right		P	
Green	34.7	29.4				13.6	20.3	
Yellow	3.5	3.5				3.5	3.5	
All Red	0.5	0.5				0.5	0.5	

Cycle Length: 114.0 secs

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	48	135	63	475	199	379	77	126	406	587	17	131
PHF	0.85	0.85	0.90	0.85	0.85	0.90	0.85	0.90	0.90	0.85	0.85	0.90
Adj flow	56	159	53	559	234	266	91	140	279	691	20	107
No. Lanes	0	2	0	0	2	0	1	1	1	2	1	0
Lane group		LTR		DefL	TR		L	T	R	L	TR	
Adj flow		268		559	500		91	140	279	691	127	
Prop LTs		0.209		1.000	0.000		1.000	0.000		1.000	0.000	
Prop RTs		0.198			0.532			0.000	1.000		0.843	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound		Westbound			Northbound			Southbound		
LG	LTR		DefL	TR		L	T	R	L	TR	
So	1900		1900	1900		1900	1900	1900	1900	1900	
Lanes	2	0	0	2	0	1	1	1	2	1	0
fW	1.125		1.005	1.125		1.005	1.125	1.005	1.005	1.037	
fHV	0.955		0.847	0.976		1.000	1.000	0.952	0.990	0.983	
fG	1.000		1.000	1.000		1.000	1.000	1.000	1.000	1.000	
fP	1.000		1.000	1.000		1.000	1.000	1.000	1.000	1.000	
fBB	1.000		1.000	1.000		1.000	1.000	1.000	1.000	1.000	
fA	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
fLU	0.95		1.00	1.00		1.00	1.00	1.00	0.97	1.00	
fRT	0.970			0.920			1.000	0.850		0.874	
fLT	0.781		0.950	1.000		0.644	1.000		0.950	1.000	
Sec.			0.540						0.488		
fLpb	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
fRpb	1.000			1.000			1.000	1.000		1.000	
S	2936		1537	1919		1229	2137	1545	3483	1693	
Sec.			874						1788		

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	LTR	268	2936	0.09	0.30	894	0.30
Right							
Westbound							
Prot		293	1537	0.19	0.293	450	0.65
Perm		266	874	0.30	0.304	266	1.00
Left	DefL	559			0.29	716	0.78
Prot							
Perm							
Thru	TR	500	1919	0.00	0.60	1100	0.45
Right							
Northbound							
Prot							
Perm							
Left	L	91	1229	0.07	0.33	409	0.22
Prot							
Perm							
Thru	T	140	2137	0.07	0.12	255	0.55
Right	R	279	1545	0.18	0.41	637	0.44
Southbound							
Prot		478	3483	0.14	0.213	742	0.64
Perm		213	1788	0.12	0.119	213	1.00
Left	L	691			0.33	955	0.72
Prot							
Perm							
Thru	TR	127	1693		0.33	563	0.23
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.00

Total lost time per cycle, L = 0.00 sec

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Incremental Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
LTR	0.30	0.30	30.4	1.000	894	0.50	0.9	0.0	31.2	C	31.2	C
Westbound												
DefL	0.78	0.29	22.6	1.058	716	0.33	2.8	0.0	26.7	C		
TR	0.45	0.60	12.7	1.000	1100	0.11	0.1	0.0	12.8	B	20.2	C
Northbound												
L	0.22	0.33	27.4	1.000	409	0.11	0.3	0.0	27.7	C		
T	0.55	0.12	47.3	1.000	255	0.15	2.5	0.0	49.8	D	32.0	C
R	0.44	0.41	24.0	1.000	637	0.11	0.5	0.0	24.5	C		
Southbound												
L	0.72	0.33	37.1	1.000	955	0.28	2.7	0.0	39.9	D		
TR	0.23	0.33	27.5	1.000	563	0.11	0.2	0.0	27.7	C	38.0	D

Intersection delay = 29.0 (sec/veh) Intersection LOS = C

Errors exist. See bottom of text report.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input

		EB	WB	NB	SB
Cycle length, C	114.0 sec				
Total actual green time for LT lane group, G (s)			68.1	37.9	37.9
Effective permitted green time for LT lane group, g(s)			34.7	37.9	13.6
Opposing effective green time, go (s)			34.7	37.9	13.6
Number of lanes in LT lane group, N			1	1	2
Number of lanes in opposing approach, No			2	1	1
Adjusted LT flow rate, VLT (veh/h)			559	91	691
Proportion of LT in LT lane group, PLT			1.000	1.000	1.000
Proportion of LT in opposing flow, PLTo			0.21	0.00	0.00
Adjusted opposing flow rate, Vo (veh/h)			268	127	140
Lost time for LT lane group, tL			4.00	4.00	4.00
Computation					
LT volume per cycle, LTC=VLTC/3600			17.70	2.88	21.88
Opposing lane util. factor, fLUo		1.00	0.95	1.00	1.00
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)			4.47	4.02	4.43
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g			0.0	0.0	0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)			1.00	1.00	1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]			0.70	0.67	0.88
gq, (see Exhibit C16-4,5,6,7,8)			2.74	1.78	4.47
gu=g-gq if gq>=gf, or = g-gf if gq<gf			31.96	36.12	9.13
gf=Max(gq-gf)/2,0)			1.37	0.89	2.23
PTHo=1-PLTo			0.79	1.00	1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]			1.00	1.00	2.32
EL1 (refer to Exhibit C16-3)			1.70	1.48	1.50
EL2=Max((1-Ptho**n)/Plto, 1.0)			1.32		
fmin=2(1+PL)/g or fmin=2(1+Pl)/g			0.12	0.11	0.49
gdiff=max(gq-gf,0)			2.74	0.00	0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)			0.54	0.64	0.49
Plt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)], (fmin<=fm<=1.00)					
or flt=[fm+0.91(N-1)]/N**					
Left-turn adjustment, fLT			0.540	0.644	0.488

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

		EB	WB	NB	SB
Cycle length, C	114.0 sec				
Total actual green time for LT lane group, G (s)		34.7			
Effective permitted green time for LT lane group, g(s)		34.7			
Opposing effective green time, go (s)		68.1			
Number of lanes in LT lane group, N		2			
Number of lanes in opposing approach, No		2			
Adjusted LT flow rate, VLT (veh/h)		56			
Proportion of LT in LT lane group, PLT		0.209	0.000	0.000	0.000
Proportion of LT in opposing flow, PLTo		0.00			
Adjusted opposing flow rate, Vo (veh/h)		500			
Lost time for LT lane group, tL		4.00			
Computation					
LT volume per cycle, LTC=VLTC/3600		1.77			
Opposing lane util. factor, fLUo		1.00	0.95	1.00	1.00
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)		7.92			
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g		5.2			
Opposing platoon ratio, Rpo (refer Exhibit 16-11)		1.00			
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]		0.40			
gq, (see Exhibit C16-4,5,6,7,8)		3.40			
gu=g-gq if gq>=gf, or = g-gf if gq<gf		29.52			
=Max(gq-gf)/2,0)		0.00			
PTHo=1-PLTo		1.00			
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]		0.53			
EL1 (refer to Exhibit C16-3)		2.30			
EL2=Max((1-Ptho**n)/Plto, 1.0)					
fmin=2(1+PL)/g or fmin=2(1+Pl)/g		0.09			
gdiff=max(gq-gf,0)		0.00			
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)		0.65			
Plt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)					
Or flt=[fm+0.91(N-1)]/N**					
Left-turn adjustment, fLT		0.781	0.915	1.000	

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

	EB	WB	NB	SB
Effective pedestrian green time, gp (s)	34.7	34.7	37.9	13.6
Conflicting pedestrian volume, Vped (p/h)	0	0	0	0
Pedestrian flow rate, Vpedg (p/h)	0	0	0	0
vCpedg	0.000	0.000	0.000	0.000
Opposing queue clearing green, gq (s)	3.40	2.74	1.78	4.47
Eff. ped. green consumed by opp. veh. queue, gq/gp	0.098	0.079	0.047	0.328
vCpedu	0.000	0.000	0.000	0.000
Opposing flow rate, Vo (veh/h)	500	268	127	140
vOCCr	0.000	0.000	0.000	0.000
Number of cross-street receiving lanes, Nrec	1	1	2	2
Number of turning lanes, Nturn	1	1	1	2
vbT	1.000	1.000	1.000	1.000
Proportion of left turns, PLT	0.209	1.000	1.000	1.000
Proportion of left turns using protected phase, PLTA	0.000	0.000	0.000	0.000
Left-turn adjustment, fLpb	1.000	1.000	1.000	1.000

Permitted Right Turns

Effective pedestrian green time, gp (s)	34.7	29.4	13.6	37.9
Conflicting pedestrian volume, Vped (p/h)	0	0	0	0
Conflicting bicycle volume, Vbic (bicycles/h)	0	0	0	0
vedg	0	0	0	0
vOCCpedg	0.000	0.000	0.000	0.000
Effective green, g (s)	34.7	34.7	37.9	37.9
vicg	0	0	0	0
vCbicg	0.020	0.020	0.020	0.020
vOCCr	0.000	0.000	0.000	0.000
Number of cross-street receiving lanes, Nrec	1	1	2	2
Number of turning lanes, Nturn	1	1	1	1
vbT	1.000	1.000	1.000	1.000
Proportion right-turns, PRT	0.198	0.532	1.000	0.843

Right turn adjustment, fRpb 1.000 1.000 1.000 1.000

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Cycle length, C 114.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v		559		691
v/c ratio from Capacity Worksheet, X		0.78		0.72
Protected phase effective green interval, g (s)		33.4		24.3
Opposing queue effective green interval, gq		2.74		4.47
Unopposed green interval, gu		31.96		9.13
Red time r=(C-g-gq-gu)		45.9		76.1
Arrival rate, qa=v/(3600(max[X,1.0]))		0.16		0.19
Protected ph. departure rate, Sp=s/3600		0.427		0.968
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)		0.26		0.74
XPerm		1.49		2.55
XProt				
Case		5		5
Queue at beginning of green arrow, Qa		4.09		10.46
Queue at beginning of unsaturated green, Qu		7.55		15.46
Residual queue, Qr		0.00		0.00
Uniform Delay, d1		22.6		37.1

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 29.0 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

LaneGroup	Eastbound	Westbound		Northbound			Southbound	
Init Queue	LTR	DefL	TR	L	T	R	L	TR
Flow Rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
o	141	559	500	91	140	279	356	127
o.Lanes	1900	1900	1900	1900	1900	1900	1900	1900
SL	0 2 0	0	2 0	1	1	1	2	1 0
LnCapacity	1545	1537	1919	1229	2137	1545	1795	1693
low Ratio	470	716	1100	409	255	637	492	563
/c Ratio	0.09	0.36	0.26	0.07	0.07	0.18	0.20	0.08
Grn Ratio	0.30	0.78	0.45	0.22	0.55	0.44	0.72	0.23
I Factor	0.30	0.29	0.60	0.33	0.12	0.41	0.33	0.33
T or PVG	1.000		0.484		1.000			1.000
ltn Ratio	3	2	3	3	3	3	3	3
F2	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00
Q1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
B	3.4	16.2	7.4	2.1	4.2	6.3	8.9	2.9
2	0.8	0.4	0.4	0.5	0.4	0.6	0.6	0.6
Average	0.3	1.2	0.3	0.1	0.4	0.5	1.4	0.2
	3.8	17.5	7.7	2.2	4.6	6.8	10.3	3.1

Q Storage											
Q S Ratio											
70th Percentile Output:											
fB%	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
BOQ	4.7	20.3	9.1	2.6	5.5	8.1		12.1	3.7		
QSRatio											
85th Percentile Output:											
fB%	1.5	1.5	1.5	1.6	1.6	1.5		1.5	1.6		
BOQ	5.8	25.6	11.8	3.5	7.2	10.5		15.6	4.8		
QSRatio											
90th Percentile Output:											
fB%	1.7	1.6	1.7	1.8	1.7	1.7		1.6	1.7		
BOQ	6.5	27.4	12.9	3.9	7.9	11.5		16.9	5.3		
QSRatio											
95th Percentile Output:											
fB%	2.1	1.7	1.9	2.0	2.0	1.9		1.8	2.0		
BOQ	7.8	30.2	14.6	4.5	9.0	13.0		18.9	6.2		
QSRatio											
98th Percentile Output:											
fB%	2.4	2.0	2.3	2.5	2.4	2.3		2.2	2.5		
BOQ	9.0	34.2	17.4	5.6	11.0	15.6		22.2	7.6		
QSRatio											

ERROR MESSAGES

West bound right is shared but does not move with the adjacent movement.
West bound right is shared but does not move with the adjacent movement.

HCS2000: Signalized Intersections Release 4.1c

Analyst: Stacy D. Muise
Agency: O'Halloran Campbell Consultant
Date: 07/05/2002
Period: PM Peak (4:00 to 5:00 PM)
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
E/W St: Route 214

Inter.: Southbound Ramp/Route 214
Area Type: All other areas
Jurisd: NSTPW
Year : 2022 - Option No. 14
N/S St: Southbound Ramp

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	2	0	1	1	0	0	0	0	1	0	1
LGConfig		TR		L	T					L		R
Volume		849	279	254	1308					148		124
Lane Width		12.1		12.1	14.1					12.1		12.1
RTOR Vol			100									30

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left								
Thru	P							
Right	P							
Peds	X							
WB Left	P	A						
Thru	P	A						
Right								
Peds	X	X						
NB Right								
SB Right								
Green	55.1	31.0						
Yellow	3.5	3.5						
All Red	0.5	0.5						

NB Left								
Thru								
Right								
Peds								
SB Left	A							
Thru								
Right	A							
Peds								
EB Right								
WB Right								
	15.9							
	3.5							
	0.5							

Cycle Length: 114.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	1631	3375	0.70	0.48	30.1	C	30.1	C
Westbound								
	633	1727	0.45	0.79	6.9	A		
T	1560	1974	0.93	0.79	19.9	B	17.8	B
Northbound								
Southbound								
L	243	1743	0.67	0.14	53.8	D		
	211	1516	0.49	0.14	47.1	D	51.2	D

Intersection Delay = 25.1 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1c

Stacy D. Muise
Route 214 from Soeys to Superstore
Baseline

Phone:
E-Mail:
Fax:

OPERATIONAL ANALYSIS

Analyst:	Stacy D. Muise
Agency/Co.:	O'Halloran Campbell Consultant
Date Performed:	07/05/2002
Analysis Time Period:	PM Peak (4:00 to 5:00 PM)
Intersection:	Southbound Ramp/Route 214
Area Type:	All other areas
Jurisdiction:	NSTPW
Analysis Year:	2022 - Option No. 14

Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Southbound Ramp

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		849	279	254	1308					148		124
% Heavy Veh		5	3	5	3					4		7
PHF		0.90	0.90	0.90	0.90					0.90		0.90
K 15 Vol		236	78	71	363					41		34
Hi Ln Vol												
% Grade		0			0						0	
Ideal Sat		1900		1900	1900					1900		1900
ParkExist												
NumPark												
No. Lanes	0	2	0		1	1	0	0	0	0	1	0	1
LGConfig		TR		L		T				L		R
Lane Width		12.1		12.1	14.1					12.1		12.1
PTOR Vol			100									30
Adj Flow		1142		282	1453					164		104
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.174			0.000							1.000
Peds Bikes	0		0								0	
Buses		0			0			0		0		
PrtInProtPhase				0	0					0		0
Duration	0.25			0.0								

Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0					0.0		0.0
Arriv. Type		2		4	2					3		3
Unit Ext.		3.0		3.0	3.0					3.0		3.0

I Factor	0.808		0.773					1.000			
Lost Time	2.0		2.0	2.0				2.0		2.0	
Ext of g	2.0		2.0	2.0				2.0		2.0	
Ped Min g											

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left								
Thru	P							
Right	P							
Peds	X							
WB Left	P	A						
Thru	P	A						
Right								
Peds	X	X						
NB Right								
SB Right								
NB Left								
Thru								
Right								
Peds								
SB Left					A			
Thru								
Right					A			
Peds								
EB Right								
WB Right								
Green	55.1	31.0			15.9			
Yellow	3.5	3.5			3.5			
All Red	0.5	0.5			0.5			

Cycle Length: 114.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V		849	279	254	1308					148		124
PHF		0.90	0.90	0.90	0.90					0.90		0.90
Adj flow		943	199	282	1453					164		104
No. Lanes	0	2	0	1	1	0	0	0	0	1	0	1
Lane group		TR		L	T					L		R
Adj flow		1142		282	1453					164		104
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.174			0.000							1.000

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound		Westbound		Northbound			Southbound		
LG	TR		L	T				L		R
So	1900		1900	1900				1900		1900
Lanes	2	0	1	1	0	0	0	1	0	1
fW	1.005		1.005	1.070				1.005		1.005
fHV	0.956		0.952	0.971				0.962		0.935
fG	1.000		1.000	1.000				1.000		1.000
fP	1.000		1.000	1.000				1.000		1.000
fBB	1.000		1.000	1.000				1.000		1.000
fA	1.00		1.00	1.00				1.00		1.00
fLU	0.95		1.00	1.00				1.00		1.00
fRT	0.974			1.000						0.850
fLT	1.000		0.950	1.000				0.950		
Sec.			0.117							

fLpb	1.000	1.000	1.000		1.000	
fRpb	1.000		1.000			1.000
S	3375	1727	1974		1743	1516
Sec.		213				

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	1142	3375	0.34	0.48	1631	0.70
Right							
Westbound							
Prot		179	1727	0.10	0.307	530	0.34
Perm		103	213	0.48	0.483	103	1.00
Left	L	282			0.79	633	0.45
Prot							
Perm							
Thru	T	1453	1974		0.79	1560	0.93
Right							
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Southbound							
Prot							
Perm							
Left	L	164	1743	0.09	0.14	243	0.67
Prot							
Perm							
Thru							
Right	R	104	1516	0.07	0.14	211	0.49

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.00
Total lost time per cycle, L = 0.00 sec
ritical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.00

Control Delay and LOS Determination

ppr/ ane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Incremental Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
astbound												
TR	0.70	0.48	23.0	1.220	1631	0.50	2.1	0.0	30.1	C	30.1	C
estbound												
L	0.45	0.79	23.8	0.274	633	0.11	0.4	0.0	6.9	A		
	0.93	0.79	9.5	1.200	1560	0.45	8.5	0.0	19.9	B	17.8	B

Northbound

Southbound

L	0.67	0.14	46.6	1.000	243	0.25	7.2	0.0	53.8	D	
R	0.49	0.14	45.3	1.000	211	0.11	1.8	0.0	47.1	D	51.2 D

Intersection delay = 25.1 (sec/veh) Intersection LOS = C

SUPPLEMENTAL PERMITTED LT WORKSHEET for exclusive lefts

Input

	EB	WB	NB	SB
Cycle length, C	114.0 sec			
Total actual green time for LT lane group, G (s)		90.1		
Effective permitted green time for LT lane group, g(s)		55.1		
Opposing effective green time, go (s)		55.1		
Number of lanes in LT lane group, N		1		
Number of lanes in opposing approach, No		2		
Adjusted LT flow rate, VLT (veh/h)		282		
Proportion of LT in LT lane group, PLT		1.000		
Proportion of LT in opposing flow, PLTo		0.00		
Adjusted opposing flow rate, Vo (veh/h)		1142		
Lost time for LT lane group, tL		4.00		
Computation				
LT volume per cycle, LTC=VLTC/3600		8.93		
Opposing lane util. factor, fLUo	1.00	0.95		
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)		19.03		
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g		0.0		
Opposing platoon ratio, Rpo (refer Exhibit 16-11)		0.67		
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]		0.68		
gq, (see Exhibit C16-4,5,6,7,8)		29.19		
gu=g-gq if gq>=gf, or = g-gf if gq<gf		25.91		
gl=Max(gq-gf)/2,0)		14.59		
PTHo=1-PLTo		1.00		
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]		1.00		
EL1 (refer to Exhibit C16-3)		4.02		
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g		0.07		
gdiff=max(gq-gf,0)		0.00		
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)		0.12		
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)], (fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT		0.117		

For special case of single-lane approach opposed by multilane approach, see text.

If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET

for shared lefts

Input

	EB	WB	NB	SB
Cycle length, C 114.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				
Number of lanes in LT lane group, N				
Number of lanes in opposing approach, No				
Adjusted LT flow rate, VLT (veh/h)				
Proportion of LT in LT lane group, PLT	0.000	0.000		
Proportion of LT in opposing flow, PLTo				
Adjusted opposing flow rate, Vo (veh/h)				
Lost time for LT lane group, tL				
Computation				
LT volume per cycle, LTC=VLTC/3600				
Opposing lane util. factor, fLUo	1.00	0.95		

Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach, see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

	EB	WB	NB	SB
Effective pedestrian green time, gp (s)		55.1		
Conflicting pedestrian volume, Vped (p/h)		0		
Pedestrian flow rate, Vpedg (p/h)		0		
PCCpedg		0.000		
Opposing queue clearing green, gq (s)		29.19		
Eff. ped. green consumed by opp. veh. queue, gq/gp		0.530		
PCCpedu		0.000		
Opposing flow rate, Vo (veh/h)		1142		
OCCr		0.000		
Number of cross-street receiving lanes, Nrec		1		
Number of turning lanes, Nturn		1		
ApbT		1.000		
Proportion of left turns, PLT		1.000		

Proportion of left turns using protected phase, PLTA	0.000
Left-turn adjustment, fLpb	1.000
Permitted Right Turns	
Effective pedestrian green time, gp (s)	55.1
Conflicting pedestrian volume, Vped (p/h)	0
Conflicting bicycle volume, Vbic (bicycles/h)	0
Vpedg	0
OCCpedg	0.000
Effective green, g (s)	55.1
Vbicg	0
OCCbicg	0.020
OCCr	0.000
Number of cross-street receiving lanes, Nrec	1
Number of turning lanes, Nturn	1
ApbT	1.000
Proportion right-turns, PRT	0.174
Proportion right-turns using protected phase, PRTA	0.000
Right turn adjustment, fRpb	1.000

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

Cycle length, C 114.0 sec

	EBLT	WBLT	NBLT	SBLT
Adj. LT vol from Vol Adjustment Worksheet, v		282		
v/c ratio from Capacity Worksheet, X		0.45		
Protected phase effective green interval, g (s)		35.0		
Opposing queue effective green interval, gq		29.19		
Unopposed green interval, gu		25.91		
Red time r=(C-g-gq-gu)		23.9		
Arrival rate, qa=v/(3600(max[X,1.0]))		0.08		
Protected ph. departure rate, Sp=s/3600		0.480		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)		0.13		
XPerm		1.90		
XProt				
Case		5		
Queue at beginning of green arrow, Qa		2.93		
Queue at beginning of unsaturated green, Qu		4.16		
Residual queue, Qr		0.00		
Uniform Delay, d1		23.8		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
estbound								
Northbound								

Southbound

Intersection Delay 25.1 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound	Westbound		Northbound			Southbound	
LaneGroup	TR	L	T				L	R
Init Queue	0.0	0.0	0.0				0.0	0.0
Flow Rate	601	282	1453				164	104
So	1900	1900	1900				1900	1900
No.Lanes	0 2 0	1	1 0	0	0	0	1 0	1
SL	1776	1727	1974				1743	1516
LnCapacity	858	633	1560				243	211
Flow Ratio	0.34	0.16	0.74				0.09	0.07
v/c Ratio	0.70	0.45	0.93				0.67	0.49
Grn Ratio	0.48	0.79	0.79				0.14	0.14
I Factor	0.808		0.773				1.000	
AT or PVG	2	4	2				3	3
Pltn Ratio	0.67	1.20	0.92				1.00	1.00
PF2	1.12	0.25	1.06				1.00	1.00
Q1	16.7	0.5	38.8				4.9	3.0
kB	1.0	0.7	0.8				0.3	0.3
Q2	2.4	0.6	7.1				0.7	0.3
Q Average	19.0	1.2	46.0				5.6	3.3
Q Spacing								
Q Storage								
Q S Ratio								
70th Percentile Output:								
fB%	1.2	1.2	1.1				1.2	1.2
BOQ	22.9	1.4	52.0				6.6	4.0
QSRatio								
85th Percentile Output:								
fB%	1.4	1.6	1.4				1.5	1.6
BOQ	26.8	1.8	62.7				8.7	5.2
QSRatio								
90th Percentile Output:								
fB%	1.5	1.8	1.4				1.7	1.7
BOQ	28.7	2.0	66.2				9.5	5.8
QSRatio								
95th Percentile Output:								
fB%	1.6	2.1	1.5				1.9	2.0
BOQ	30.9	2.4	71.1				10.9	6.7
QSRatio								
98th Percentile Output:								
fB%	1.7	2.6	1.7				2.4	2.5
BOQ	33.0	3.0	79.5				13.2	8.3
QSRatio								

ERROR MESSAGES

No errors to report.

HCS2000: Signalized Intersections Release 4.1c

Analyst: Stacy D. Muise
Agency: O'Halloran Campbell Consultant
Date: 07/05/2002
Period: PM Peak (4:00 to 5:00 PM)
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
E/W St: Route 214

Inter.: Northbound Ramp/Route 214
Area Type: All other areas
Jurisd: NSTPW
Year : 2022 - Option No. 14
N/S St: Northbound Ramp

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	0	2	1	2	0	1	0	0	0
LGConfig	L	T			T	R	L		R			
Volume	172	825			956	181	606		582			
Lane Width	12.0	14.8			14.8	12.1	12.1		15.7			
RTOR Vol						90			150			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left	A	P			NB Left	A		
	Thru	A	P			Thru			
	Right					Right	A		
	Peds	X	X			Peds			
WB	Left					SB Left			
	Thru		P			Thru			
	Right		P			Right			
	Peds		X			Peds			
NB	Right					EB Right			
SB	Right					WB Right			
Green		14.8	46.1				41.1		
Yellow		3.5	3.5				3.5		
All Red		0.5	0.5				0.5		

Cycle Length: 114.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
T	327	1805	0.61	0.57	35.8	D		
	1136	1995	0.76	0.57	4.2	A	10.1	B
Westbound								
T	1548	3827	0.70	0.40	26.8	C	26.7	C
	602	1488	0.17	0.40	25.2	C		
Northbound								
L	1219	3382	0.62	0.36	31.0	C		
	618	1714	0.76	0.36	37.6	D	33.5	C
Southbound								

Intersection Delay = 24.0 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1c

Stacy D. Muise
Route 214 from Soeys to Superstore
Baseline

Phone:
E-Mail:
Fax:

OPERATIONAL ANALYSIS

Analyst:	Stacy D. Muise
Agency/Co.:	O'Halloran Campbell Consultant
Date Performed:	07/05/2002
Analysis Time Period:	PM Peak (4:00 to 5:00 PM)
Intersection:	Northbound Ramp/Route 214
Area Type:	All other areas
Jurisdiction:	NSTPW
Analysis Year:	2022 - Option No. 14

Project ID: Highway 102/Route 214 Interchange Area Transportation Study
East/West Street: Route 214
North/South Street: Northbound Ramp

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	172	825			956	181	606		582			
% Heavy Veh	0	4			3	9	4		6			
PHF	0.87	0.95			0.88	0.87	0.80		0.92			
K 15 Vol	49	217			272	52	189		158			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat	1900	1900			1900	1900	1900		1900			
ParkExist												
NumPark												
No. Lanes	1	1	0	0	2	1	2	0	1	0	0	0
LGConfig	L	T			T	R	L		R			
Lane Width	12.0	14.8			14.8	12.1	12.1		15.7			
RTOR Vol						90			150			
Adj Flow	198	868			1086	105	757		470			
%InSharedLn												
Prop LTs	1.000	0.000			0.000							
Prop RTs		0.000			0.000	1.000			1.000			
Peds Bikes					0	0		0			0	
Buses	0	0			0	0	0		0			
InProtPhase	0.0											
Duration	0.25											

Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Unit Unmet	0.0	0.0			0.0	0.0	0.0		0.0			
Arriv. Type	1	5			4	2	3		3			
Unit Ext.	3.0	3.0			3.0	3.0	3.0		3.0			

I Factor	0.635		0.642		1.000		
Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	
Ext of g	2.0	2.0	2.0	2.0	2.0	2.0	
Ped Min g							

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A	P			NB Left	A		
Thru	A	P			Thru			
Right					Right	A		
Peds	X	X			Peds			
WB Left					SB Left			
Thru		P			Thru			
Right		P			Right			
Peds		X			Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	14.8	46.1				41.1		
Yellow	3.5	3.5				3.5		
All Red	0.5	0.5				0.5		

Cycle Length: 114.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	172	825			956	181	606		582			
PHF	0.87	0.95			0.88	0.87	0.80		0.92			
Adj flow	198	868			1086	105	757		470			
No. Lanes	1	1	0	0	2	1	2	0	1	0	0	0
Lane group	L	T			T	R	L		R			
Adj flow	198	868			1086	105	757		470			
Prop LTs	1.000	0.000			0.000							
Prop RTs	0.000			0.000	1.000				1.000			

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound				Westbound				Northbound				Southbound			
	L	T			T	R	L		R							
So	1900	1900			1900	1900	1900		1900							
Lanes	1	1	0	0	2	1	2	0	1	0	0	0				
fW	1.000	1.092			1.092	1.005	1.005		1.125							
fHV	1.000	0.962			0.971	0.917	0.962		0.943							
fG	1.000	1.000			1.000	1.000	1.000		1.000							
fP	1.000	1.000			1.000	1.000	1.000		1.000							
fBB	1.000	1.000			1.000	1.000	1.000		1.000							
fA	1.00	1.00			1.00	1.00	1.00		1.00							
fLU	1.00	1.00			0.95	1.00	0.97		1.00							
fRT		1.000			1.000	0.850			0.850							
fLT	0.950	1.000			1.000		0.950									
Prec.	0.111															

fLpb	1.000	1.000			1.000		1.000				
fRpb		1.000			1.000	1.000			1.000		
S	1805	1995			3827	1488	3382		1714		
Sec.	211										

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)		Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound								
Prot		198	1805		0.11	0.130	234	0.85
Perm		0	211		0.00	0.439	93	0.00
Left	L	198				0.57	327	0.61
Prot								
Perm								
Thru	T	868	1995	#	0.44	0.57	1136	0.76
Right								
Westbound								
Prot								
Perm								
Left								
Prot								
Perm								
Thru	T	1086	3827		0.28	0.40	1548	0.70
Right	R	105	1488		0.07	0.40	602	0.17
Northbound								
Prot								
Perm								
Left	L	757	3382		0.22	0.36	1219	0.62
Prot								
Perm								
Thru								
Right	R	470	1714	#	0.27	0.36	618	0.76
Southbound								
Prot								
Perm								
Left								
Prot								
Perm								
Thru								
Right								

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.71
Total lost time per cycle, L = 8.00 sec
ritical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.76

Control Delay and LOS Determination

ppr/ ane Grp	Ratios v/c	g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	LOS	Approach Delay	LOS
astbound												
L	0.61	0.57	18.0	1.881	327	0.19	2.0	0.0	35.8	D		
T	0.76	0.57	18.7	0.119	1136	0.32	2.0	0.0	4.2	A	10.1	B
estbound												
T	0.70	0.40	28.2	0.890	1548	0.50	1.7	0.0	26.8	C	26.7	C

R	0.17	0.40	21.8	1.140	602	0.50	0.4	0.0	25.2	C		
Northbound												
L	0.62	0.36	30.0	1.000	1219	0.20	1.0	0.0	31.0	C		
R	0.76	0.36	32.1	1.000	618	0.31	5.5	0.0	37.6	D	33.5	C
Southbound												

Intersection delay = 24.0 (sec/veh) Intersection LOS = C

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input

		EB	WB	NB	SB
Cycle length, C	114.0 sec				
Total actual green time for LT lane group, G (s)		64.9			
Effective permitted green time for LT lane group, g(s)		50.1			
Opposing effective green time, go (s)		46.1			
Number of lanes in LT lane group, N		1			
Number of lanes in opposing approach, No		2			
Adjusted LT flow rate, VLT (veh/h)		198			
Proportion of LT in LT lane group, PLT		1.000			
Proportion of LT in opposing flow, PLTo		0.00			
Adjusted opposing flow rate, Vo (veh/h)		1086			
Lost time for LT lane group, tL		4.00			
Computation					
LT volume per cycle, LTC=VLTC/3600		6.27			
Opposing lane util. factor, fLUo		0.95	1.00		
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)		18.10			
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g		0.0			
Opposing platoon ratio, Rpo (refer Exhibit 16-11)		1.33			
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]		0.46			
gq, (see Exhibit C16-4,5,6,7,8)		28.93			
gu=g-gq if gq>=gf, or = g-gf if gq<gf		21.17			
n=Max(gq-gf)/2,0)		14.47			
PTHo=1-PLTo		1.00			
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]		1.00			
EL1 (refer to Exhibit C16-3)		3.80			
EL2=Max((1-Ptho**n)/Plto, 1.0)					
fmin=2(1+PL)/g or fmin=2(1+Pl)/g		0.08			
gdiff=max(gq-gf,0)		0.00			
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)		0.11			
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)], (fmin<=fm<=1.00)					
or flt=[fm+0.91(N-1)]/N**					
Left-turn adjustment, fLT		0.111			

For special case of single-lane approach opposed by multilane approach, see text.

If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. or special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET

for shared lefts

Input

	EB	WB	NB	SB
Cycle length, C 114.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				
Number of lanes in LT lane group, N				
Number of lanes in opposing approach, No				
Adjusted LT flow rate, VLT (veh/h)				
Proportion of LT in LT lane group, PLT	0.000	0.000		
Proportion of LT in opposing flow, PLTo				
Adjusted opposing flow rate, Vo (veh/h)				
Lost time for LT lane group, tL				
Computation				
LT volume per cycle, LTC=VLTC/3600				
Opposing lane util. factor, fLUo	0.95	1.00		
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)				
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g				
Opposing platoon ratio, Rpo (refer Exhibit 16-11)				
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]				
gq, (see Exhibit C16-4,5,6,7,8)				
gu=g-gq if gq>=gf, or = g-gf if gq<gf				
n=Max(gq-gf)/2,0)				
PTHo=1-PLTo				
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]				
EL1 (refer to Exhibit C16-3)				
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)				
Flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

* For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

	EB	WB	NB	SB
Effective pedestrian green time, gp (s)	46.1			
Conflicting pedestrian volume, Vped (p/h)	0			
Pedestrian flow rate, Vpedg (p/h)	0			
PCCpedg	0.000			
Opposing queue clearing green, gq (s)	28.93			
Eff. ped. green consumed by opp. veh. queue, gq/gp	0.628			
PCCpedu	0.000			
Opposing flow rate, Vo (veh/h)	1086			
OCCr	0.000			
Number of cross-street receiving lanes, Nrec	1			
Number of turning lanes, Nturn	1			
ApbT	1.000			
Proportion of left turns, PLT	1.000			

Proportion of left turns using protected phase, PLTA	0.000	
Left-turn adjustment, fLpb	1.000	
Permitted Right Turns		
Effective pedestrian green time, gp (s)		46.1
Conflicting pedestrian volume, Vped (p/h)		0
Conflicting bicycle volume, Vbic (bicycles/h)		0
Vpedg		0
OCCpedg		0.000
Effective green, g (s)		46.1
Vbicg		0
OCCbicg		0.020
OCCr		0.000
Number of cross-street receiving lanes, Nrec		1
Number of turning lanes, Nturn		1
ApbT		1.000
Proportion right-turns, PRT		1.000
Proportion right-turns using protected phase, PRTA		0.000
Right turn adjustment, fRpb		

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	114.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v		198			
v/c ratio from Capacity Worksheet, X		0.61			
Protected phase effective green interval, g (s)		14.8			
Opposing queue effective green interval, gq		28.93			
Unopposed green interval, gu		21.17			
Red time r=(C-g-gq-gu)		49.1			
Arrival rate, qa=v/(3600(max[X,1.0]))		0.05			
Protected ph. departure rate, Sp=s/3600		0.501			
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)		0.14			
Perm		0.94			
XProt		0.47			
Case		1			
Queue at beginning of green arrow, Qa		2.70			
Queue at beginning of unsaturated green, Qu		1.59			
Residual queue, Qr		0.00			
Uniform Delay, d1		18.0			

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								

Southbound

Intersection Delay 24.0 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup	L	T		T	R		L	R				
Init Queue	0.0	0.0		0.0	0.0		0.0	0.0				
Flow Rate	198	868		571	105		390	470				
So	1900	1900		1900	1900		1900	1900				
No.Lanes	1	1	0	2	1	0	2	1	0	0	0	0
SL	1805	1995		2014	1488		1743	1714				
LnCapacity	327	1136		814	602		628	618				
Flow Ratio	0.11	0.44		0.28	0.07		0.22	0.27				
v/c Ratio	0.61	0.76		0.70	0.17		0.62	0.76				
Grn Ratio	0.57	0.57		0.40	0.40		0.36	0.36				
I Factor		0.635		0.642			1.000					
AT or PVG	1	5		4	2		3	3				
Pltn Ratio	0.33	1.67		1.33	0.67		1.00	1.00				
PF2	1.74	0.24		0.89	1.20		1.00	1.00				
Q1	5.1	5.1		13.4	2.5		10.2	13.1				
kB	0.5	0.5		0.7	0.6		0.6	0.6				
Q2	0.8	1.7		1.7	0.1		1.0	2.3				
Q Average	5.8	6.8		15.1	2.7		11.1	15.4				
Q Spacing												
Q Storage												
Q S Ratio												
70th Percentile Output:												
fB%	1.2	1.2		1.2	1.3		1.2	1.2				
BOQ	6.9	8.0		18.2	3.4		13.1	18.0				
QSRatio												
85th Percentile Output:												
fB%	1.5	1.5		1.4	1.6		1.5	1.5				
BOQ	9.0	10.5		21.3	4.2		16.8	22.8				
QSRatio												
90th Percentile Output:												
fB%	1.7	1.7		1.5	1.8		1.6	1.6				
BOQ	9.9	11.5		23.0	4.8		18.1	24.4				
QSRatio												
95th Percentile Output:												
fB%	1.9	1.9		1.6	2.2		1.8	1.8				
BOQ	11.3	13.0		24.9	5.8		20.3	27.0				
QSRatio												
98th Percentile Output:												
fB%	2.3	2.3		1.8	2.6		2.1	2.0				
BOQ	13.7	15.6		26.7	6.9		23.7	30.9				
QSRatio												

ERROR MESSAGES

No errors to report.

HCS2000: Signalized Intersections Release 4.1c

Analyst: Stacy D. Muise
Agency: Route 214 from Soeys to Superst
Agency: O'Halloran Campbell Consultant
Date: 07/05/2002
Period: PM Peak (4:00 to 5:00 PM)
Project ID: Highway 102/Route 214 Interchange Area Transportation Study
E/W St: Route 214

Inter.: Elmsdale Shop Centre/Route 214
Area Type: All other areas
Area Type: All other areas
Jurisd: NSTPW
Year : 2022 - Option No. 14
N/S St: Elmsdale Shopping Centre

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	0	2	1	0	0	0	2	0	1
LGConfig	L	T			T	R				L		R
Volume	506	901			694	339				391		443
Lane Width	12.1	12.1			12.1	12.1				12.1		11.2
RTOR Vol						0						0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left	A	P			NB	Left		
	Thru	A	P				Thru		
	Right						Right		
	Peds	X	X				Peds		
WB	Left					SB	Left	A	
	Thru		P				Thru		
	Right		P				Right	A	
	Peds		X				Peds		
NB	Right					EB	Right		
SB	Right	A				WB	Right		
Green		39.0	39.1					20.1	
Yellow		4.5	4.5					3.0	
All Red		0.5	1.4					1.9	

Cycle Length: 114.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
	762	1777	0.80	0.74	40.3	D		
T	1329	1801	0.77	0.74	3.9	A	17.5	B
Westbound								
T	1242	3454	0.61	0.36	32.3	C	33.5	C
	577	1605	0.65	0.36	36.0	D		
Northbound								
Southbound								
L	642	3483	0.78	0.18	50.5	D		
	885	1554	0.54	0.57	16.0	B	33.6	C

Intersection Delay = 26.6 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1c

Stacy D. Muise
Route 214 from Soeys to Superstore
Baseline

Phone:
E-Mail:
E-Mail:

Fax:

Analyst:	Stacy D. Muise
Agency/Co.:	Route 214 from Soeys to Superst
Agency/Co.:	O'Halloran Campbell Consultant
Analysis Time Period:	4:00 pm
Intersection:	Elmsdale Shop Centre/Route 214
Intersection:	Rte 214 & Elmsdale Shopping Cen2022 - Option No. 14
Jurisdiction:	
Jurisdiction:	NSTPW
Analysis Year:	2022 - Option No. 14

Project ID: Highway 102/Route 214 Interchange Area Transportation Study
Rte 214 Elmsdale Shopping Centre
Route 214 Elmsdale Shopping Centre

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	506	901			694	339				391		443
% Heavy Veh	2	6			5	1				1		1
PHF	0.83	0.88			0.91	0.91				0.78		0.92
PK 15 Vol	152	256			191	93				125		120
Hi Ln Vol												
% Grade		0			0						0	
Ideal Sat	1900	1900			1900	1900				1900		1900
ParkExist												
NumPark												
No. Lanes	1	1	0	0	2	1	0	0	0	2	0	1
LGConfig	L	T			T	R				L		R
Lane Width	12.1	12.1			12.1	12.1				12.1		11.2
VOR Vol						0						0
Adj Flow	610	1024			763	373				501		482
%InSharedLn												
Prop LTs	1.000	0.000			0.000							
Prop RTs		0.000			0.000	1.000						1.000
Peds Bikes					1	0						
Buses	0	0			0	0				0		0
PrtInProtPhase	0.0											
Duration	0.25											

Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0			0.0	0.0				0.0		0.0
Arriv. Type	2	4			3	3				3		3
Unit Ext.	3.0	3.0			3.0	3.0				3.0		3.0

I Factor		0.682			1.000						1.000				
Lost Time	2.0	2.0			2.0	2.0					2.0			2.0	
Ext of g	3.0	3.0			3.9	3.9					2.9			2.9	
Ped Min g															

PHASE DATA

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A	P			NB Left			
Thru	A	P			Thru			
Right					Right			
Peds	X	X			Peds			
WB Left					SB Left	A		
Thru		P			Thru			
Right		P			Right	A		
Peds		X			Peds			
NB Right					EB Right			
SB Right	A				WB Right			
Green	39.0	39.1				20.1		
Yellow	4.5	4.5				3.0		
All Red	0.5	1.4				1.9		

Cycle Length: 114.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V	506	901			694	339				391		443
PHF	0.83	0.88			0.91	0.91				0.78		0.92
Adj flow	610	1024			763	373				501		482
No. Lanes	1	1	0	0	2	1	0	0	0	2	0	1
Lane group	L	T			T	R				L		R
Adj flow	610	1024			763	373				501		482
Prop LTs	1.000	0.000			0.000							
Prop RTs	0.000			0.000	1.000							1.000

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
	L	T			T	R				L		R
So	1900	1900			1900	1900				1900		1900
Lanes	1	1	0	0	2	1	0	0	0	2	0	1
fW	1.005	1.005			1.005	1.005				1.005		0.972
fHV	0.980	0.943			0.952	0.990				0.990		0.990
fG	1.000	1.000			1.000	1.000				1.000		1.000
fP	1.000	1.000			1.000	1.000				1.000		1.000
fBB	1.000	1.000			1.000	1.000				1.000		1.000
fA	1.00	1.00			1.00	1.00				1.00		1.00
fLU	1.00	1.00			0.95	1.00				0.97		1.00
fRT		1.000			1.000	0.850						0.850
fLT	0.950	1.000			1.000					0.950		
Sec.	0.190											

fLpb	1.000	1.000	1.000		1.000	
fRpb		1.000	1.000	0.999		1.000
S	1777	1801	3454	1605	3483	1554
Sec.	356					

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot		610	1777	# 0.34	0.351	624	0.98
Perm		0	356	0.00	0.387	138	0.00
Left	L	610			0.74	762	0.80
Prot							
Perm							
Thru	T	1024	1801	0.57	0.74	1329	0.77
Right							
Westbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	763	3454	0.22	0.36	1242	0.61
Right	R	373	1605	# 0.23	0.36	577	0.65
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Southbound							
Prot							
Perm							
Left	L	501	3483	# 0.14	0.18	642	0.78
Prot							
Perm							
Thru							
Right	R	482	1554	0.31	0.57	885	0.54

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.72
Total lost time per cycle, L = 12.90 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.81

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Incremental Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
L	0.80	0.74	20.0	1.802	762	0.34	4.3	0.0	40.3	D		
T	0.77	0.74	9.1	0.219	1329	0.32	2.0	0.0	3.9	A	17.5	B
Westbound												
T	0.61	0.36	30.0	1.000	1242	0.50	2.3	0.0	32.3	C	33.5	C

R	0.65	0.36	30.5	1.000	577	0.50	5.5	0.0	36.0	D	
Northbound											
Southbound											
L	0.78	0.18	44.3	1.000	642	0.33	6.2	0.0	50.5	D	
R	0.54	0.57	15.3	1.000	885	0.14	0.7	0.0	16.0	B	33.6 C

Intersection delay = 26.6 (sec/veh) Intersection LOS = C

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input

	EB	WB	NB	SB
Cycle length, C 114.0 sec				
Total actual green time for LT lane group, G (s)	83.1			
Effective permitted green time for LT lane group, g(s)	44.1			
Opposing effective green time, go (s)	41.0			
Number of lanes in LT lane group, N	1			
Number of lanes in opposing approach, No	2			
Adjusted LT flow rate, VLT (veh/h)	610			
Proportion of LT in LT lane group, PLT	1.000			
Proportion of LT in opposing flow, PLTo	0.00			
Adjusted opposing flow rate, Vo (veh/h)	763			
Lost time for LT lane group, tL	4.90			
Computation				
LT volume per cycle, LTC=VLTC/3600	19.32			
Opposing lane util. factor, fLUo	0.95	1.00		
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)	12.72			
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g	0.0			
Opposing platoon ratio, Rpo (refer Exhibit 16-11)	1.00			
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]	0.64			
gq, (see Exhibit C16-4,5,6,7,8)	20.96			
gu=g-gq if gq>=gf, or = g-gf if gq<gf	23.14			
=Max(gq-gf)/2,0)	10.48			
THo=1-PLTo	1.00			
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]	1.00			
L1 (refer to Exhibit C16-3)	2.76			
L2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g	0.09			
gdiff=max(gq-gf,0)	0.00			
m=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)	0.19			
lt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)], (fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
eft-turn adjustment, fLT	0.190			
eft-turn adjustment, fLT	0.190			

For special case of single-lane approach opposed by multilane approach, ee text.

If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. or special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET

for shared lefts

Input

	EB	WB	NB	SB
Cycle length, C	114.0 sec			
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				
Number of lanes in LT lane group, N				
Number of lanes in opposing approach, No				
Adjusted LT flow rate, VLT (veh/h)				
Proportion of LT in LT lane group, PLT	0.000	0.000		
Proportion of LT in opposing flow, PLTo				
Adjusted opposing flow rate, Vo (veh/h)				
Lost time for LT lane group, tL				
Computation				
LT volume per cycle, LTC=VLTC/3600				
Opposing lane util. factor, fLUo	0.95	1.00		
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)				
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g				
Opposing platoon ratio, Rpo (refer Exhibit 16-11)				
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]				
gq, (see Exhibit C16-4,5,6,7,8)				
gu=g-gq if gq>=gf, or = g-gf if gq<gf				
n=Max(gq-gf)/2,0)				
PTHo=1-PLTo				
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]				
EL1 (refer to Exhibit C16-3)				
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g				
gdiff=max(gq-gf,0)				
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)				
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)], (fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT				
Left-turn adjustment, fLT				

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

* For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.

For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

	EB	WB	NB	SB
Effective pedestrian green time, gp (s)	39.1			
Conflicting pedestrian volume, Vped (p/h)	1			
Pedestrian flow rate, Vpedg (p/h)	2			
PCCpedg	0.001			
Opposing queue clearing green, gq (s)	20.96			
Opposing queue clearing green, gq (s)	20.96			
PCCpedu	0.001			
Opposing flow rate, Vo (veh/h)	763			
OCCr	0.000			
Number of cross-street receiving lanes, Nrec	1			
Number of turning lanes, Nturn	1			
ApbT	1.000			
Proportion of left turns, PLT	1.000			

Proportion of left turns, PLT	1.000
Left-turn adjustment, fLpb	1.000
Left-turn adjustment, fLpb	1.000
Effective pedestrian green time, gp (s)	39.1
Conflicting pedestrian volume, Vped (p/h)	1
Conflicting bicycle volume, Vbic (bicycles/h)	0
Vpedg	2
CCpedg	0.001
Effective green, g (s)	41.0
Effective green, g (s)	41.0
CCbicg	0.020
CCr	0.001
Number of cross-street receiving lanes, Nrec	1
Number of turning lanes, Nturn	1
ApbT	0.999
Proportion right-turns, PRT	1.000
Proportion right-turns using protected phase, PRTA	0.000
Right turn adjustment, fRpb	
Right turn adjustment, fRpb	

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

Cycle length, C 114.0 sec

	EBLT	WBLT	NBLT	SBLT
Adj. LT vol from Vol Adjustment Worksheet, v	610			
v/c ratio from Capacity Worksheet, X	0.80			
Protected phase effective green interval, g (s)	40.0			
Opposing queue effective green interval, gq	20.96			
Unopposed green interval, gu	23.14			
Red time r=(C-g-gq-gu)	29.9			
Arrival rate, qa=v/(3600(max[X,1.0]))	0.17			
Protected ph. departure rate, Sp=s/3600	0.494			
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)	0.19			
XPerm	1.71			
XProt	0.60			
Case	3			
Queue at beginning of green arrow, Qa	8.18			
Queue at beginning of unsaturated green, Qu	3.55			
Residual queue, Qr	3.11			
Uniform Delay, d1	20.0			

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								

Southbound

Intersection Delay 26.6 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound		Westbound		Northbound			Southbound	
LaneGroup	L	T	T	R				L	R
Init Queue	0.0	0.0	0.0	0.0				0.0	0.0
Flow Rate	610	1024	401	373				258	482
So	1900	1900	1900	1900				1900	1900
No.Lanes	1	1 0	0 2	1	0	0	0	2 0	1
SL	1777	1801	1817	1605				1795	1554
LnCapacity	762	1329	653	577				330	885
Flow Ratio	0.34	0.57	0.22	0.23				0.14	0.31
v/c Ratio	0.80	0.77	0.61	0.65				0.78	0.54
Grn Ratio	0.74	0.74	0.36	0.36				0.18	0.57
I Factor		0.682	1.000					1.000	
NT or PVG	2	4	3	3				3	3
Pltn Ratio	0.67	1.29	1.00	1.00				1.00	1.00
PF2	1.00	1.00	1.00	1.00				1.00	1.00
Q1	7.0	19.7	10.4	9.9				7.8	9.5
RB	0.6	0.6	1.0	0.9				0.4	0.7
Q2	0.0	0.0	0.0	0.0				0.0	0.0
Q Average	7.0	19.7	10.4	9.9				7.8	9.5
Q Spacing									
Q Storage									
Q S Ratio									
70th Percentile Output:									
RB%	1.2	1.2	1.2	1.2				1.2	1.2
BOQ	8.3	22.9	12.7	12.0				9.2	11.2
QSRatio									
85th Percentile Output:									
RB%	1.5	1.5	1.4	1.4				1.5	1.5
BOQ	10.8	28.7	15.0	14.2				11.9	14.5
QSRatio									
90th Percentile Output:									
RB%	1.7	1.5	1.6	1.6				1.7	1.6
BOQ	11.8	30.5	16.3	15.5				13.0	15.7
QSRatio									
95th Percentile Output:									
RB%	1.9	1.7	1.7	1.7				1.9	1.9
BOQ	13.4	33.5	18.0	17.1				14.7	17.7
QSRatio									
98th Percentile Output:									
RB%	2.3	1.9	1.9	1.9				2.2	2.2
BOQ	16.1	37.8	19.7	18.8				17.5	20.8
QSRatio									

ERROR MESSAGES

No errors to report.