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Municipality of East Hants

Route 214 CORRIDOR STUDY

April, 1998

Streetwise Traffic Engineering
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1. INTRODUCTION

1.1 BACKGROUND

Route 214 is a two lane highway which begins in Elmsdale at Trunk 2 and runs in a northwest direction to Trunk 14 near Nine Mile River. The one kilometer section from Trunk 2 to the interchange at Highway 102 (Exit 8) has commercial development along the Trunk 2 end and a major shopping centre at the Highway 102 end. Some additional land along Route 214 at the Highway 102 end has recently been redesignated for commercial development. A McDonalds restaurant has recently opened in this area and other commercial development applications are expected. Continued pressure for additional developable commercial lands may result in these two commercial nodes expanding, and eventually joining, so that land use along this entire section of Route 214 becomes nearly all commercial.

The Municipality recognizes that this change in land use will have a significant impact on traffic along Route 214. For a number of years individual commercial developers have been required to identify traffic impacts expected from their development and to undertake any necessary improvements required to the adjacent roadway network resulting from those impacts. In the case of Route 214, where several commercial developments are expected in a relatively short period of time, this approach leads to piecemeal upgrading of the roadway with no long term vision.

1.2 OBJECTIVE

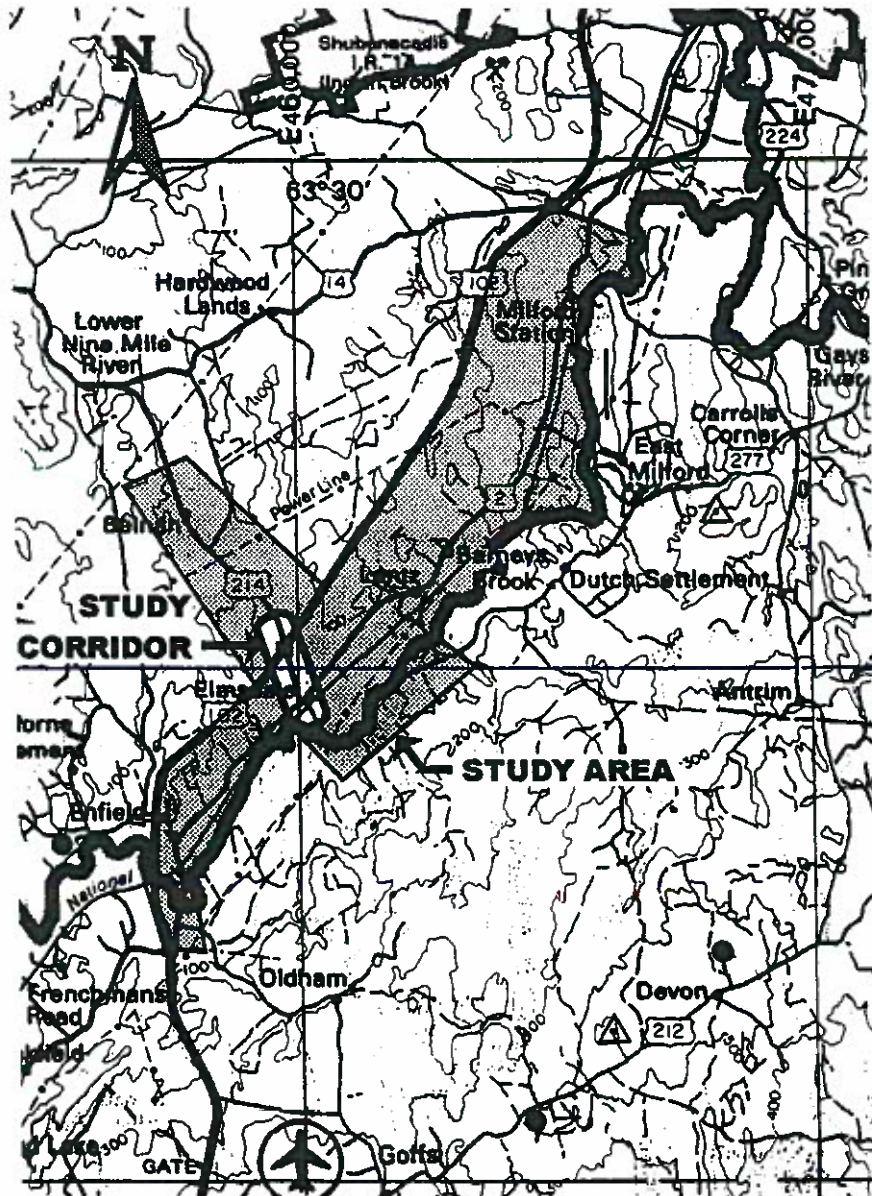
The objective of the Corridor Study was to identify the expected traffic loading on Route 214 resulting from both commercial development along its length and residential growth within its collection area, and to determine the geometric improvements that would be required to safely and effectively manage this traffic loading. In addition, other objectives include development of guidelines for determining future points of access to Route 214, review of interconnection between commercial or potential commercial businesses and investigation of the impacts on pedestrian traffic.

1.3 STUDY AREA

The Study Area was made up of the areas feeding traffic to Trunk 2 from Enfield to Milford and the areas feeding traffic to Route 214 from Elmsdale to Nine Mile River. This area roughly corresponds to Districts 2, 2A, 3, and District 1 below Highway 102. The Study Corridor consisted of the section of Route 214 from its intersection at Trunk 2 to a point four

hundred metres north of its intersection at the Highway 102 southbound ramps. The study corridor included Route 214 itself and the approach section of any roadway or driveway which does or will intersect with it.

The study area and study corridor are shown in Figure 1.



SCALE 1 : 150 000



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STUDY AREA AND STUDY CORRIDOR

FIGURE 1

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2. LEVEL OF SERVICE ANALYSIS

2.1 METHODOLOGY

2.1.1 Introduction

Level of service is a technical measurement of how well a roadway or intersection is performing given the traffic loading that is placed on it. Level of service is expressed as a letter grade ranging from 'A', which indicates free-flow conditions, to 'F', an indication of extreme congestion. Normally, a level of service 'D' is acceptable, although it is an indication that operation is poor and action may need to be taken soon. When the level of service reaches an unacceptable level, it may be improved either by increasing the capacity, normally with the addition of lanes, or by diverting traffic away from the facility by constructing alternative roadway links.

The level of service analysis for Route 214 consisted of an assessment of four traffic management related aspects within the corridor:

- ▶ flow on Route 214 itself
- ▶ the signalized intersection at Trunk 2
- ▶ the signalized intersection at the Elmsdale Shopping Centre driveway
- ▶ a typical unsignalized commercial driveway intersection

The Highway Capacity Software was used to perform the level of service analysis. Other reference sources, the Geometric Design Standards for Ontario Highway (Ontario Ministry of Transport; 1985) and the Geometric Design Standards for Canadian Roads (Transportation Association of Canada; 1986), were used to determine warrants and length requirements for left turn storage lanes at intersection approaches.

2.1.2 Simulating Traffic Flow with the QRS Model

With increasing population and commercial growth in the study area, it can be expected that traffic volumes will grow and flow patterns change. A computer model which simulates traffic flow based on demographic characteristics is valuable in predicting what traffic loading can be expected in the future. QRSII was used in this study to model traffic flow. To build the model, information on employment and dwelling units was collected for thirteen traffic generation zones within the study area. Verification of the model was achieved by comparing simulated volumes for the existing employment and population with traffic counts taken specifically as part of this study. Once calibrated, the model is

capable of projecting traffic loading for future growth scenarios or modifications to the roadway network.

Baseline data used in developing the model is included in Appendix A of this report. A more detailed description of the roadway network modeling can be found in Appendix B.

2.1.3 Growth Scenarios

To test the impact of growth on the roadway network, two future growth horizons were identified. The extent of residential and commercial growth, as well as the geographic area in which the growth is expected, was identified in consultation with the Municipality. Table 1 provides a summary of the two growth scenarios.

TABLE 1 GROWTH HORIZONS

	DWELLING UNITS		RETAIL EMPLOYMENT		NON-RETAIL EMPLOYMENT	
Existing	2100		560		430	
Horizon One	2900	+38%	800	+43%	670	+ 56%
Horizon Two	3700	+ 76%	1100	+ 96%	900	+ 109%

It can be expected that employment will increase at a faster rate than population in an area such as this which is maturing from a bedroom community to a self-sustaining urban area.

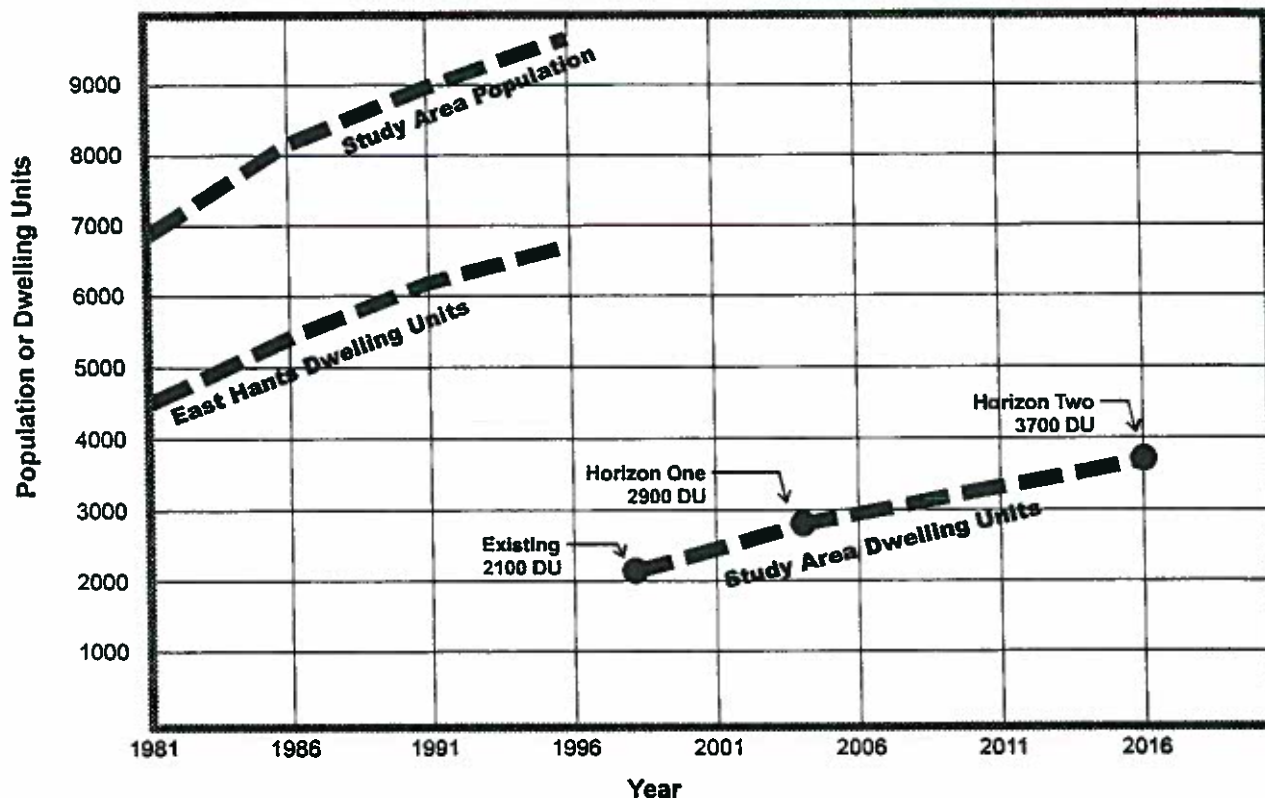
The intent of this study was to relate the timing of roadway improvements and other actions directly to the growth horizons. A determination of when particular milestones are reached, or are nearly reached, can be made by comparing current dwelling counts and/or employment to the figures provided in Table 1. An alternative method would be to compare future counted traffic to horizon traffic projected in this report.

It is important, for planning purposes, to determine an expected year when each growth horizon will be reached. To accomplish this, recent growth in population and dwelling units has been plotted in Figure 2. This slope of these lines has then been used to extend the existing 2100 dwelling unit count within the study area. The figure projects that Horizon One will be reached in the year 2004 and Horizon Two will be reached in the year 2016. The slope of the line has been made to "flatten out" as it approaches Horizon Two since this represents nearly a "build-out" of the study area.

2.1.4 Potential Improvements to the Roadway Network

In addition to a potential widening of Route 214, some additions to the roadway network within the study area have been suggested from various sources. Four conceptual roadway improvement plans are shown in Figure 3. Each of these improvement plans is

FIGURE 2 GROWTH HISTORY AND PROJECTION OF HORIZONS

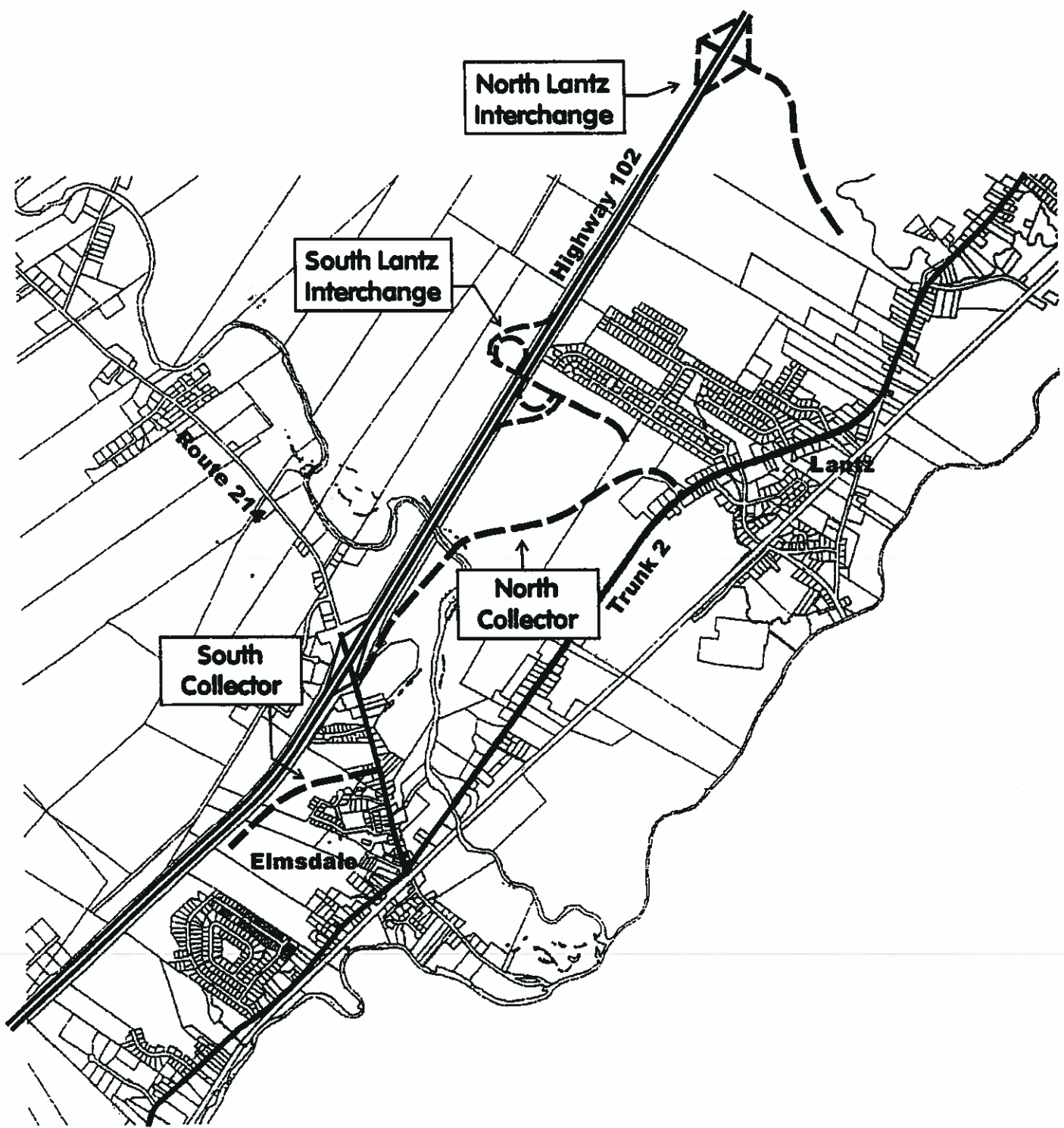


likely to have a significant effect on Route 214 traffic. It is important to note that these roadways are being considered conceptually at this time and no attempt has been made to locate and align them to optimally suit the social and natural environment. The proposed improvements are:

Widening of Route 214 - Constraints of existing development along Route 214, as well as the physical constraints of the Nine Mile River make significant widening of Route 214 difficult. Furthermore, a four- or five- lane roadway would not fit the semi-rural character of the area. It is practical, however, to consider widening the roadway from two to three lanes. A center two-way left turning lane is well suited to this type of roadway where commercial activity creates a frequent number of turning movements. Removing turning traffic from the through travel lanes will provide some increase in overall capacity.

North Lantz Interchange - A new diamond interchange would be constructed on Highway 102 north of Lantz. Collector roadways will connect future subdivisions to the interchange and a connector to Trunk 2 will divert some traffic from Trunk 2 onto Highway 102.

South Lantz Interchange - A new interchange would be constructed on Highway 102 south of Lantz. Collector roadways will connect future subdivisions to the interchange and a connector to Trunk 2 will divert some traffic from Trunk 2 onto Highway 102. This connector



1:30 000 SCALE



Route 214 Corridor Study
**POTENTIAL ADDITIONS TO THE
ROADWAY NETWORK**

FIGURE 3
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would have no accesses other than points where minor collector roadways servicing existing and future subdivisions connect to it. A park design, as shown in Figure 4, is recommended for this interchange to increase the spacing from the existing interchange at Route 214.

North Collector - This roadway will collect traffic from new subdivisions and traffic diverted from Trunk 2 north of Elmsdale and deliver it to Route 214. To meet the objective of relieving traffic loading on Route 214, it is important to make the connection to Route 214 as close to the Highway 102 interchange as possible. Figure 5 shows two alternative opportunities for making this connection. It is expected that the portion of this roadway that connects Trunk 2 to Route 214 will have no access other than points where minor collector roadways servicing existing and future subdivisions connect to it. The roadway would be posted at 70 to 80 kph.

South Collector - This roadway will collect traffic from existing and developing residential areas south of Elmsdale. This roadway will be expected to carry only moderate volumes of traffic and could connect to Route 214 using an existing street such as Roulston Circle or Pinehill Drive.

2.2 RESULTS

As would be expected, the level of service on Route 214 decreases significantly as future growth increases traffic loading. The results are shown in Figures 6 and 7.

Route 214 is at the point where getting in and out of driveways at unsignalized locations can be accomplished relatively easily, but even small increases in through traffic will make this more difficult. An increase in traffic loading is particularly noticeable at the Trunk 2 / Route 214 intersection where a higher number of turning movements will occur.

In addition to level of service concerns, there is limited storage room for turning queues at the approaches to the existing intersections. Table 2 shows these deficiencies. The table illustrates how increasing traffic volumes will increase the storage requirements beyond what can currently be provided and how relieving traffic loading by adding links to the roadway network can reduce volumes to more manageable levels. With the existing build up around the approaches to these intersections, there is limited ability to increase the amount of turning queue storage length.

Proposed South Lantz Interchange

420m
Acceleration
Length + Taper

230m
Deceleration
Length + Taper

950m
Weaving
Length

1000m
Weaving
Length

570m
Deceleration
Length + Taper

530m
Acceleration
Length + Taper

Existing Interchange

HWY 102

Route 214

Nine Mile River

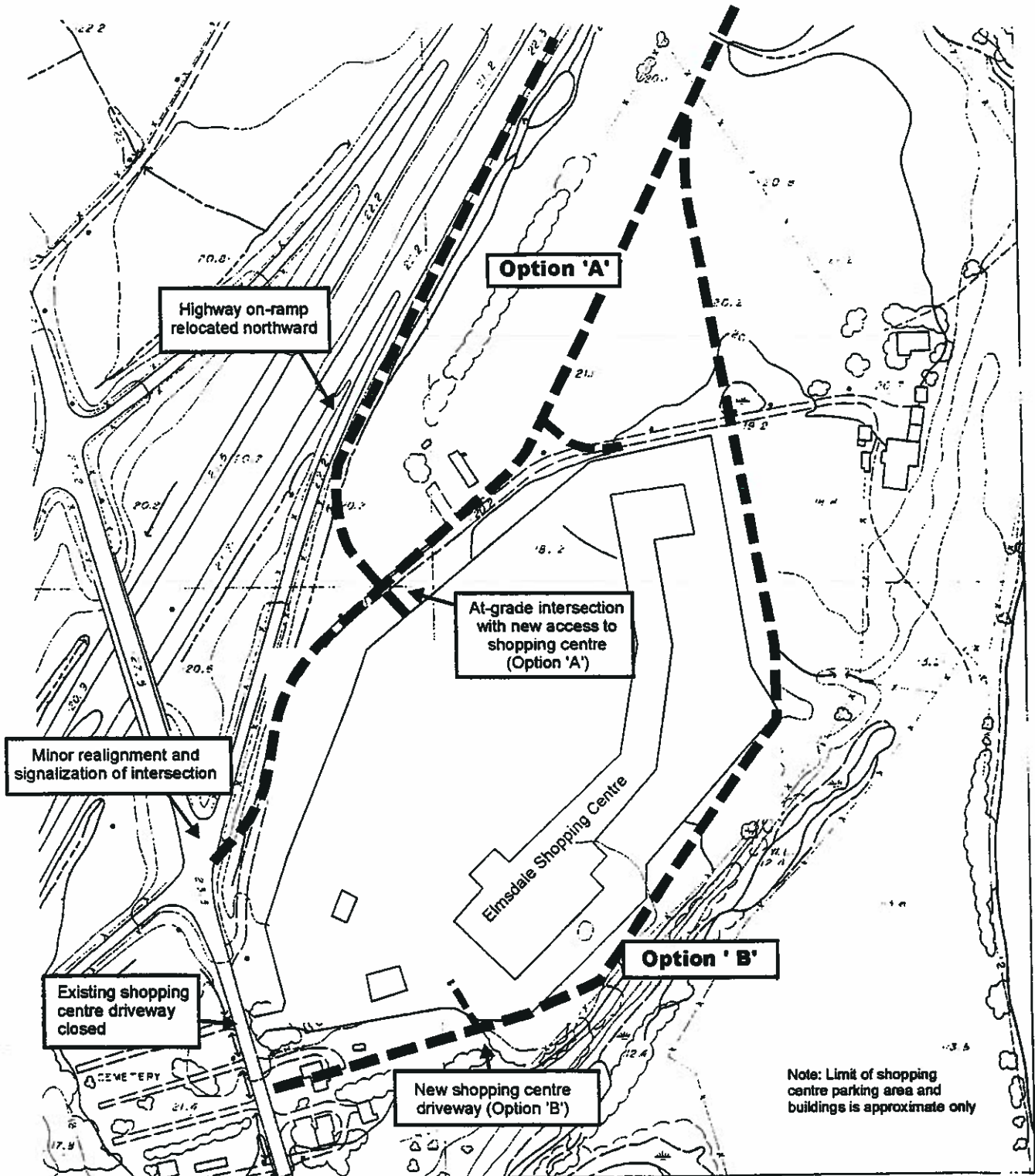
Existing Subdivision

Water Tower

Trunk 2



Interchange Design Assumptions
 Minimum ramp curvature = 120m (60 kph DS)
 Mainline design speed = 110 kph
 Acceleration/deceleration lengths and tapers according to Geometric Design Standards for Canadian Roads (Transportation Association of Canada) Tables E.5.2.2.2 and E.5.2.1.2



SCALE 1:2500



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**CONNECTION OF A NORTH COLLECTOR
TO ROUTE 214**

FIGURE 5

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FIGURE 6 LEVEL OF SERVICE ON ROUTE 214 THROUGH GROWTH HORIZONS

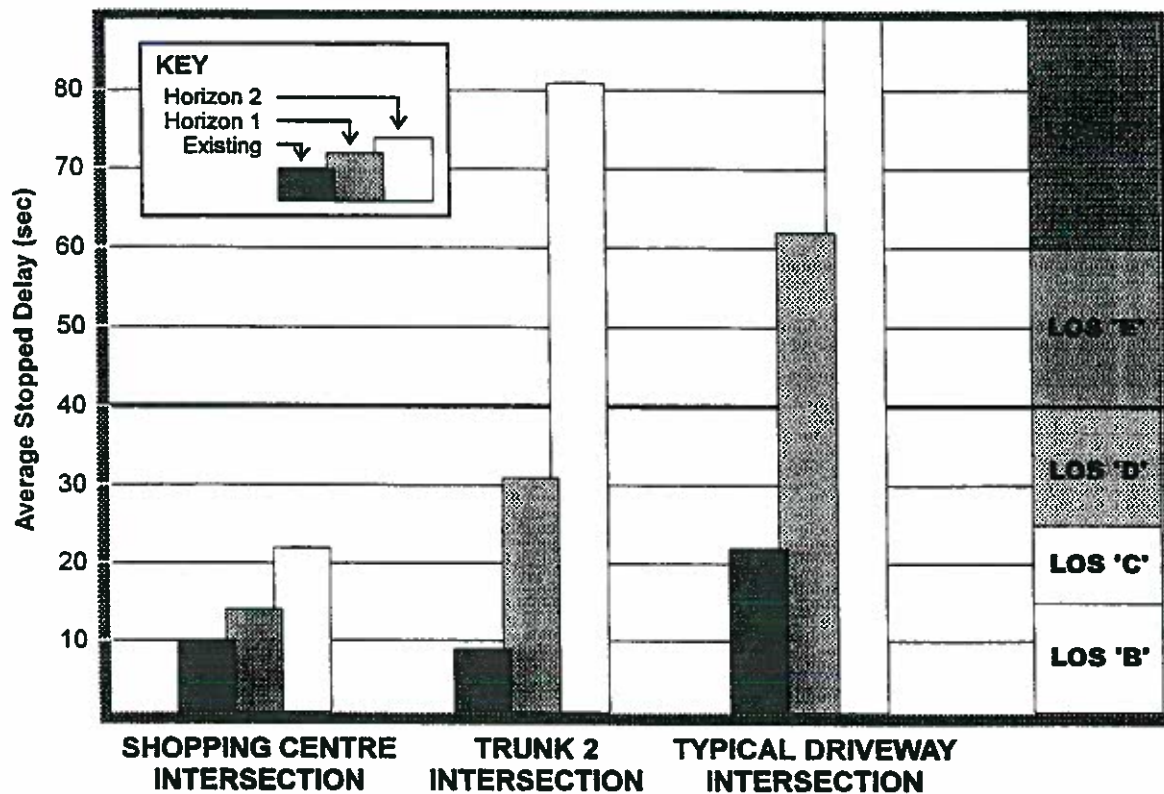


FIGURE 7 LEVEL OF SERVICE ON ROUTE 214 WITH ROADWAY NETWORK ADDITIONS

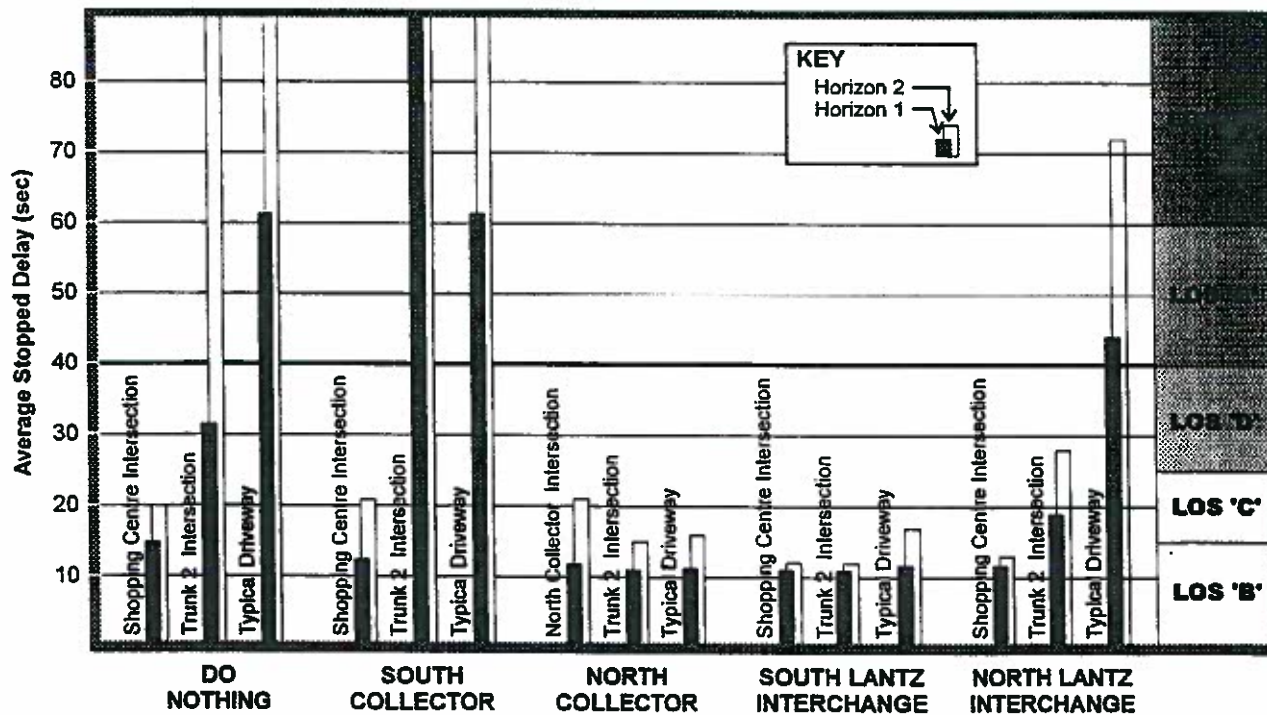


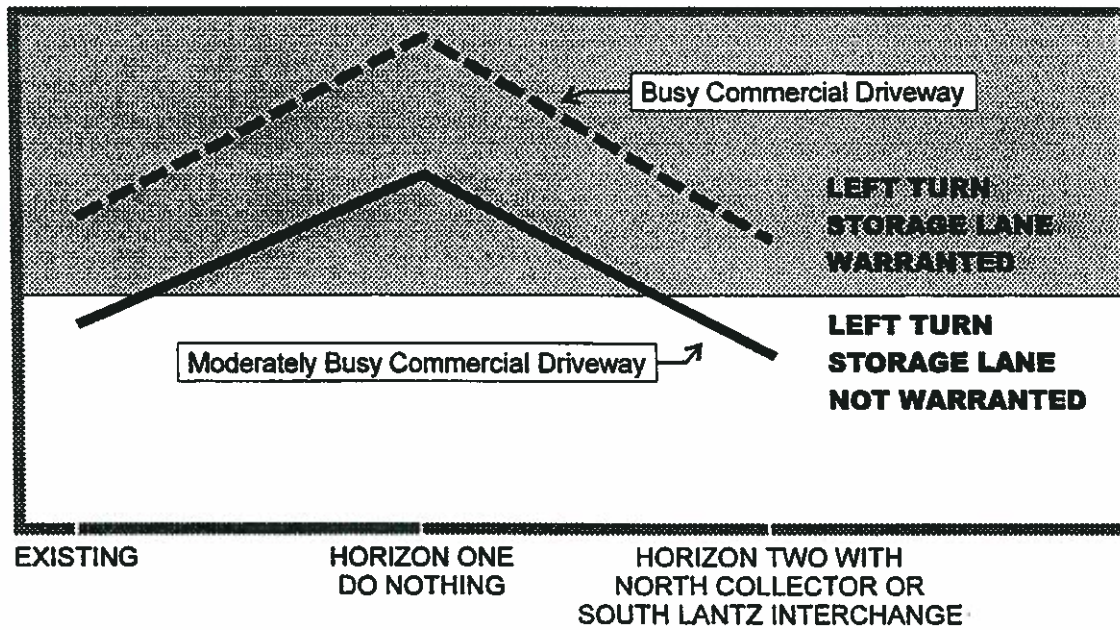
TABLE 2 LEFT TURN STORAGE LENGTH REQUIREMENTS

	STORAGE LENGTH (m)			
	Rte 214 eastbound to Trk 2 northbound (signalized)	Rte 214 eastbound to Shopping Centre (signalized)	Rte 214 eastbound to North Collector (signalized)	Rte 214 westbound to Hwy 102 southbd (unsignalized)
<i>Currently provided</i>	30	50	30	0
<i>Required:</i>				
Existing traffic	65	40	--	0
Horizon One Do-Nothing	130	40	--	15
Horizon Two Do Nothing	160	50	--	30
Horizon Two N. Interchange	100	55	--	25
Horizon Two S. Interchange	60	65	--	15
Horizon Two North Collector	30	--	105	30

A methodology for determining whether a left turn storage lane is required for traffic turning into a driveway was applied to a busy driveway (140 turning movements per hour) and a moderately busy driveway (70 turning movements per hour) on Route 214. The results are shown in Figure 8.

Adding new linkages in the roadway network will have varying impacts on the level of service on Route as shown in Figure 8. The south collector will divert some traffic away from the Trunk 2/Route 214 intersection, but will have only a small effect on the level of service. The North Collector will have a significant impact on traffic volumes and carry much of the traffic that now uses Trunk 2 and Route 214 to access Highway 102. The South Lantz interchange will have a similar effect. The North Lantz interchange, however, does not do as well at attracting Highway 102-bound traffic since much of the residential growth area must 'back-track' when making a trip southbound on Highway 102.

FIGURE 8 REQUIREMENTS FOR LEFT TURN STORAGE LANE ON ROUTE 214



3. FUNCTIONAL DESIGN COMPONENTS

3.1 IMPLEMENTATION STRATEGY

3.1.1 Short Term Plan - Widening Route 214

Currently, any driveway with moderately high traffic volumes should have a storage area for left turns provided on Route 214. By Horizon One, the requirement for providing left turn storage will extend to even lower-volume driveways. In an area with 'strip' commercial development, it is more practical to provide a continuous two-way left turning lane rather than individual left turn storage slots.

Route 214 should be widened to three lanes in areas where commercial redevelopment is occurring. The center lane will be used for two-way left turning. These three-lane sections of Route 214 should have curb-and-gutter drainage and sidewalks on both sides.

The ability of future additions to the roadway network to relieve traffic loading on Route 214 is so considerable, the need for left turn storage on Route 214 is even less at Horizon Two than it is currently. Nevertheless, implementation of a center two-way left turning lane appears warranted regardless of what future roadways are constructed.

Consideration should be given, in the short term, to increasing storage length for left turning traffic on the Exit 8 overpass bridge. Increasing the left turn storage capacity is warranted with existing volumes and will certainly be required if a north collector roadway is constructed. Within the existing bridge railings, there is a curb-to-curb roadway width of 10.5 meters plus a 1.5 metre wide sidewalk. Although the existing curb-to-curb width is marginally acceptable for providing two through lanes plus a left turn storage lane, a better solution may be to reduce or remove the existing sidewalk, possibly replacing it with a sidewalk cantilevered from the bridge.

3.1.2 Longer Term Plan - Addition to the Roadway Network

Once Horizon One is reached, exiting commercial driveways on Route 214 will be very difficult and the signalized intersection at Route 214 and Trunk 2 will be a solid level of service 'D'. As there is limited opportunity to increase the capacity of Route 214 itself or the intersection at Trunk 2, it will be necessary to divert traffic loading. The South Lantz interchange and the North Collector roadway appear to show the greatest traffic management benefits in this regard.

There is little to distinguish between the implementation cost of these two preferred plans. Although the new interchange will cost slightly less, the collector roadway provides access to a greater amount of developable land and may be more compatible with the developing commercial node at Exit 8. In addition, the geometry of the north collector intersection at Route 214 and storage area for turning queues is less than ideal. A rough summary of costs for both plans is provided in Table 3.

TABLE 3 COST COMPARISON FOR ROADWAY NETWORK ADDITIONS

ITEM	UNIT PRICE	SOUTH INTERCHANGE		NORTH COLLECTOR	
		QUANTITY	PRICE	QUANTITY	PRICE
Two-lane roadway (m)	\$500	1000	\$500,000	2200	\$1,100,000
Interchange ramps (m)	\$450	2400	\$1,080,000	800	\$360,000
Bridge structure (m)	\$20,000	80	\$1,600,000	100	\$2,000,000
Intersection upgrading (each)	\$200,000	1	\$200,000	2	\$400,000
TOTAL			\$3,380,000		\$3,860,000

3.2 DRIVEWAY ACCESS CONTROL

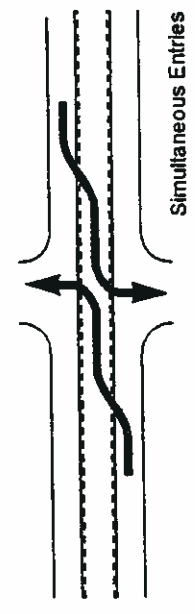
The safety and function of an arterial roadway, particularly one with a center left turning lane, is improved when driveways are well-defined and reasonably well-spaced. There is a good opportunity, when an area is redeveloping, to control the number of driveways with good planning regulations. Figure 9 illustrates potential turning conflicts created with a two-way center left turn lane and Figure 10 provides guidelines for locating driveways to minimize potential turning conflicts.

In addition to driveway spacing criteria, it is suggested that each commercial property be permitted only one driveway. In the case of gas and service stations or other businesses where maneuvers other than parking are required, two driveways may be permitted.

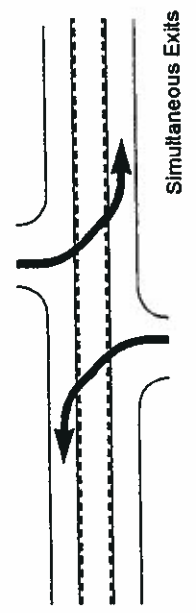
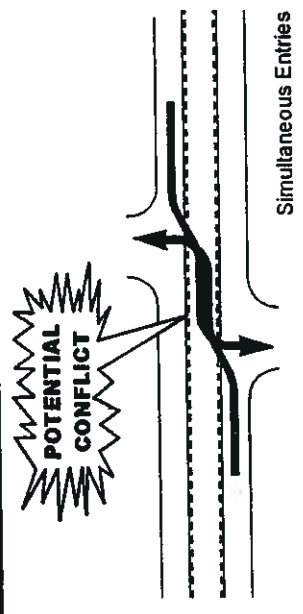
As new commercial properties develop, owners may be permitted to place new driveways on Route 214 to suit the operation of their site, provided the driveway location guidelines are met. As more driveways are added, it is possible that a yet undeveloped commercial property may not be able to locate a driveway which satisfies the guidelines. In a case like this, the owner would be required to purchase additional property or arrange to share an existing driveway.

In addition to the location guidelines, there are some other characteristics of driveways and parking areas that should be considered, either as a regulation or a desired objective:

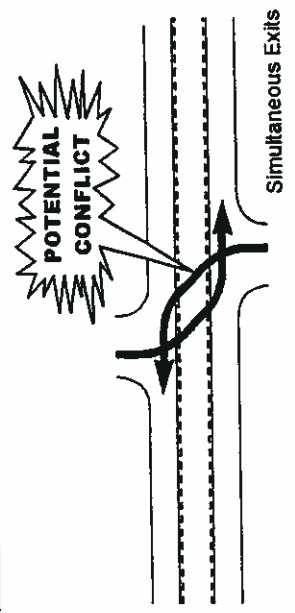
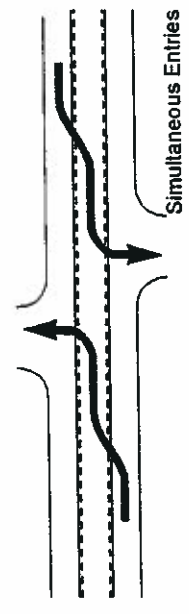
**Aligned
Driveways**



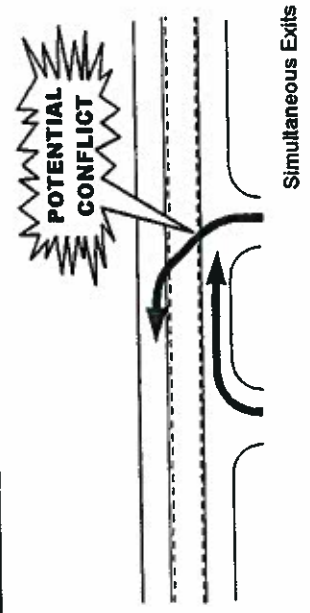
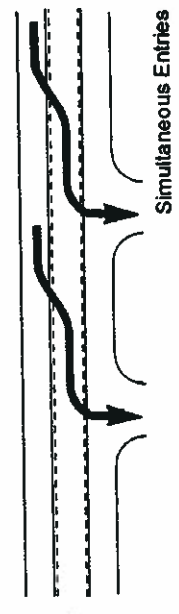
**Right-Left
Driveways**



**Left-Right
Driveways**

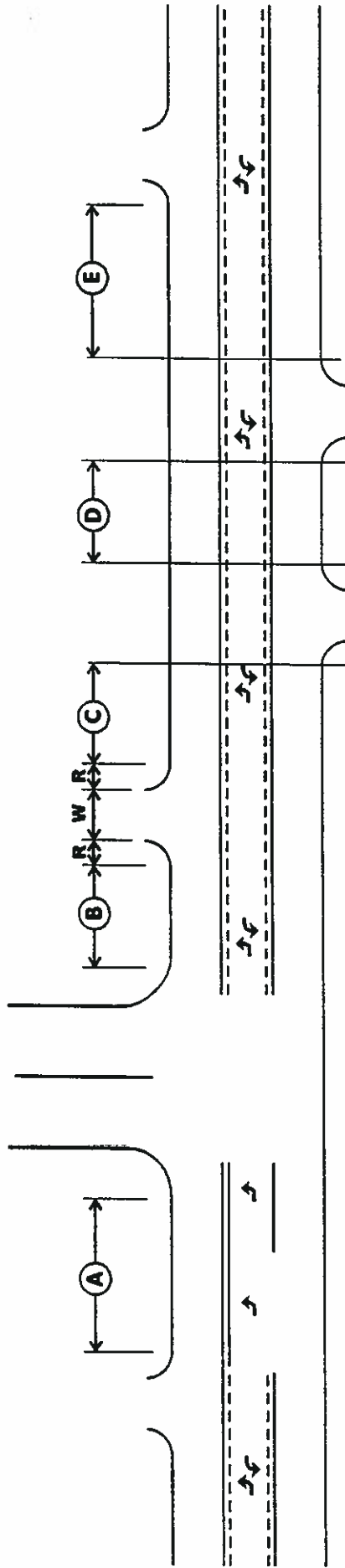


**Same Side
Driveways**



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**POTENTIAL CONFLICTS
WITH OFFSET DRIVEWAYS**



DRIVEWAY SEPARATION

A	Major T-intersection to driveway on leg with major street left turn	30 m
B	Major T-intersection to driveway on leg with major street right turn	25 m
C	Left-side driveway to right-side driveway	20 m
D	Two driveways on the same side of the street	20 m
E	Right-side driveway to left-side driveway	30 m

Notes: Minor local streets should be considered as driveways when determining spacing.

Spacing is exclusive of driveway curb radius (see below)

Driveways can be better located directly across from each other provided all separation distances are met. (centerlines coincide within 1.5 m)

DRIVEWAY DIMENSIONS

Driveway width **W** = 7.5 - 11.5 m

Curb radius **R** = 5.0 - 7.5 m

Sources: Urban Supplement to the Geometric Design Guide for Canadian Roads; Transportation Association of Canada; 1995. Figures U.K.2.6 and U.K.5

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RECOMMENDED DRIVEWAY SEPARATION DISTANCES

FIGURE 10

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- ▶ Properties abutting side streets should connect their driveway to the side street.
- ▶ Parking areas should be shared or at least inter-connected
- ▶ Driveways should straddle property lines so that they can be shared.

Figure 11 portrays a fictitious area that has been developed commercially using these objectives.

3.3 SIDEWALKS AND CROSSWALKS

It is certain that pedestrian activity along Route 214 will increase with commercial development. Pedestrian activity should be encouraged, as it can reduce the number of vehicles and turning movements on Route 214. For this reason, sidewalks should be provided on both sides of Route 214 in areas of commercial development.

A methodology for determining what type of crosswalk treatment is applicable at a certain location (Pedestrian Crossing Manual; Transportation Association of Canada; 1993) was applied to the intersection of Route 214 and Brook Court using existing vehicle and pedestrian volumes. Currently, a marked crosswalk is warranted, but overhead crossing signals are not. An increase of 20% in vehicular traffic combined with a 25% increase in pedestrian traffic will be enough to warrant overhead crossing signals. As commercial activity develops in the area, it is expected that this warrant will quickly be met. Current practice in the province is to provide overhead crossing signals at any crosswalk traversing more than two lanes.

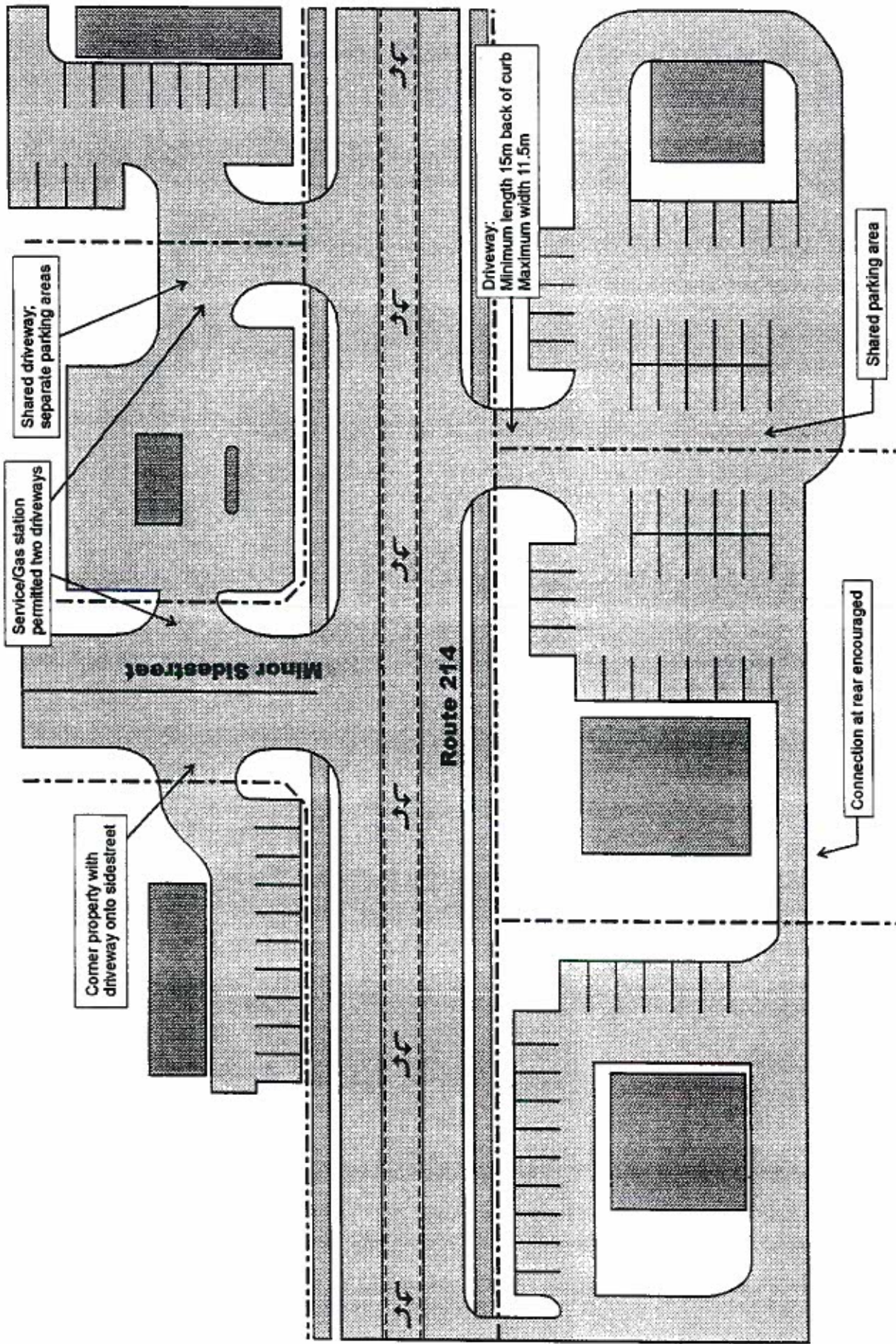
3.4 IMPLEMENTATION

It is intended, from the previous discussion that Route 214, will have the following characteristics in areas where commercial redevelopment has occurred:

- ▶ a three-lane width with a two-way center left turning lane;
- ▶ sidewalks on both sides of the street;
- ▶ curb and gutter drainage; and
- ▶ the number of driveways and their locations limited by planning controls.

In the more rural setting north of Highway 102, consideration may be given to using ditch drainage and doing without sidewalks.

It is acknowledged that the modifications to Route 214 are necessitated by the increased vehicular and pedestrian activity generated by commercial development. It is reasonable, therefore, to place the burden of constructing these improvements on the commercial businesses that develop in this area and stand to benefit from the improvements directly.



Route 214 Traffic Corridor Study

**DESIRABLE CHARACTERISTICS FOR
COMMERCIAL DRIVEWAYS AND PARKING AREAS**



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FIGURE 11

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Construction of a two-way center left turning lane and a continuous sidewalk is something that cannot be undertaken in a piecemeal fashion as individual properties develop. It is more practical to construct substantial sections of the improved roadway prior to development of the commercial properties, then allocate cost responsibilities as the properties develop.

Several properties along Route 214, roughly between Brook Court and the Elmsdale Shopping Centre, have recently been zoned commercial. A functional plan showing widening of a 220 metre long section of Route 214 to a three-lane roadway through this potential redevelopment area has been provided at the back of this report.

The projected cost of the proposed widening is provided in Table 4. These costs are approximate only and have been determined using tendered unit prices from projects of a similar scale. The total project cost is expected to be within twenty percent of these projections.

TABLE 4 IMPLEMENTATION COST PROJECTIONS FOR ROUTE 214 WIDENING

ITEM	UNIT PRICE	PROPOSED ALIGNMENT		"CENTERED" ALIGNMENT	
		QUANTITY	PRICE	QUANTITY	PRICE
New subgrade & asphalt base (m ²)	\$30	700	\$21,000	700	\$21,000
Subcut & fill (m ²)	\$15	200	\$3,000	200	\$3,000
Asphalt overlay (m ²)	\$9	2000	\$18,000	2000	\$18,000
Concrete curb & gutter (m)	\$70	200	\$14,000	350	\$24,500
Sidewalk (m)	\$230	130	\$29,900	300	\$69,000
Retaining structures			\$25,000		\$20,000
Catchbasins and storm sewer			\$16,000		\$18,000
Utility relocation			\$12,000		\$1,500
Line painting			\$5,000		\$5,000
Overhead signs			\$1,100		\$1,100
Pedestrian crossing signal			\$16,000		\$16,000
Landscaping			\$2,000		\$2,900
Contingency & engineering			\$27,000		\$30,000
TOTAL			\$190,000		\$230,000

The cost of widening this section of Route 214 has been minimized by leaving the curb and sidewalk on the southwest side intact and accomplishing all of the widening on the northeast side. The down side of this approach is that the widened roadway will no longer

be centered within the right-of-way and the crown of the roadway will not be at the center of the road. Cross-sections showing the proposed construction and the alternative of centering the roadway within the right-of-way are provided in Figure 12.

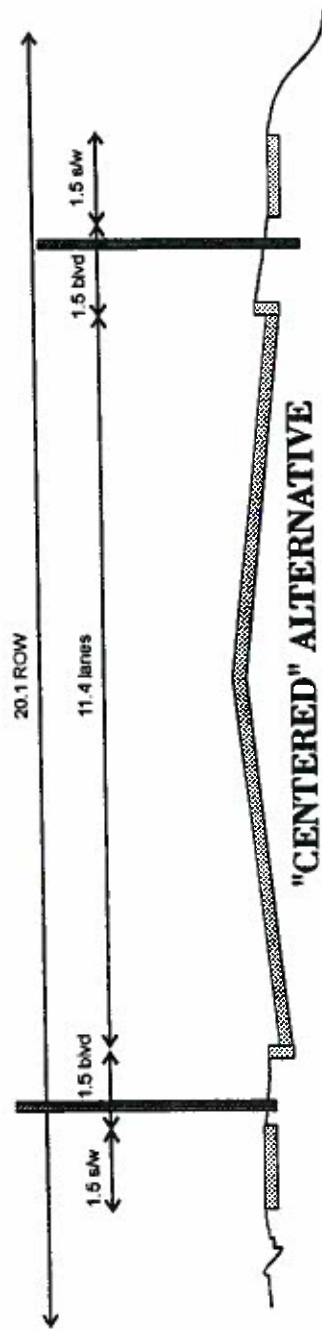
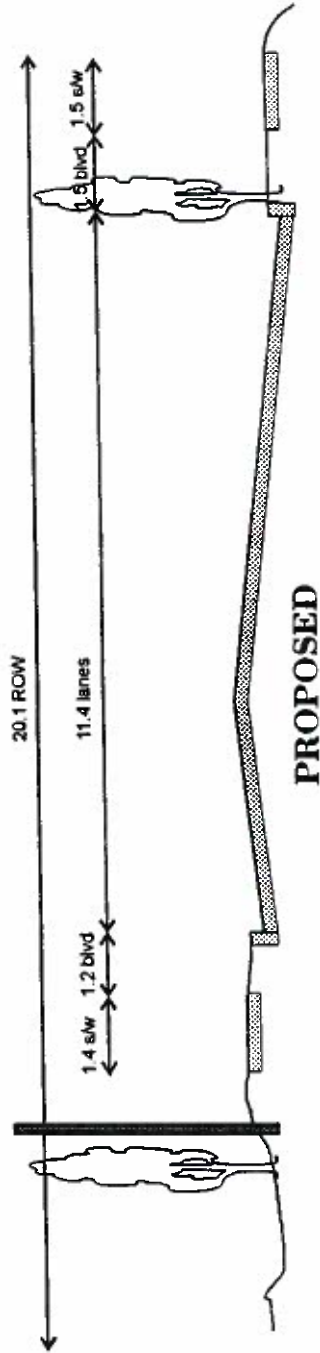
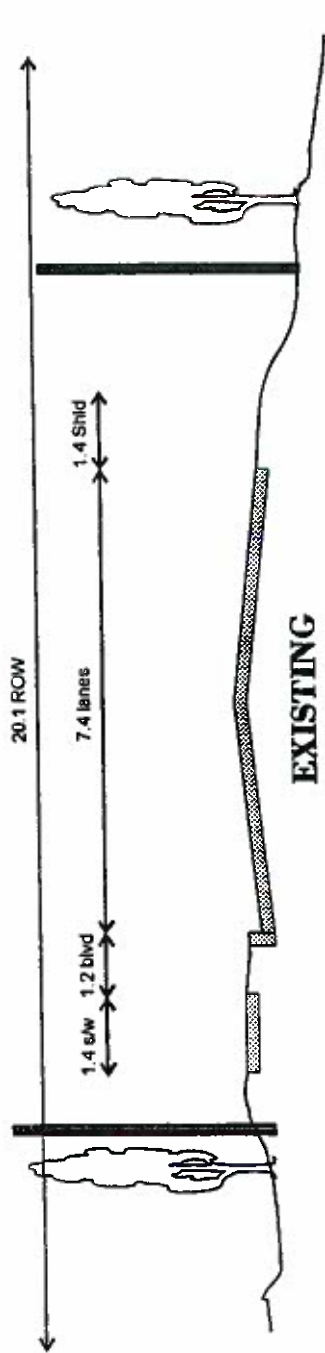
Table 5 summarizes the frontage for properties within the existing commercial zoning and fronting the improvements show in the functional plan developed as part of this study.

If the cost of improving the south section of Route 214 were to be divided evenly per linear foot of undeveloped (commercially) frontage, the per linear foot charge would be \$288.

TABLE 5 LINEAR FRONTAGE IN ROUTE 214 COMMERCIAL AREA SOUTH OF HIGHWAY 102

PROPERTY ID	COMMERCIAL FRONTAGE (FT)	
	DEVELOPED	UNDEVELOPED
85016	220	
84993		100
84983	85	
83332	15	
84969		130
84936		180
84902		120
84886		130
TOTAL	320	660

Commercial redevelopment is also expected on Route 214 just north of the Highway 102 interchange. Background traffic volumes on this section of Route 214, however, are not expected to rise as dramatically as a result of residential growth. For this reason, plus the fact that individual commercial properties tend to be larger, impacts on Route 214 can be best addressed on a site-by-site basis as development occurs. Driveway spacing guidelines identified earlier should be applied to this section of roadway to reduce turning conflicts. Also, it is desirable to focus turning movements at the existing intersection of Park Road and Route 214 so that turning lanes and eventual signalization can be considered. To achieve this objective, no commercial driveways should be permitted between the Highway 102 interchange and Park Road. A service frontage road may be required on the southwest side of Route 214 to accomplish this.



NOTE
 Cross-sections are veiwed
 facing southeast and are
 not to scale

Route 214 Traffic Corridor Study

**ALTERNATIVE CROSS-SECTIONS
 FOR WIDENING OF ROUTE 214**



FIGURE 12

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4. RECOMMENDATIONS

4.1 SHORT TERM PLAN

It has been demonstrated in this report that Route 214 should be widened to three lanes in areas of commercial redevelopment. This will provide a center two-way left turning lanes to assist in managing high volumes of turning traffic and reducing delay and exposure to collision for through vehicles.

A functional plan showing widening for a portion of Route 214 has been provided at the back of this report. It is recommended that detailed design be started immediately in preparation for implementation prior to commercial development.

It is suggested that the cost of implementing this widening of Route 214 be borne directly by the commercial developers fronting along the improved roadway, as it is the traffic expected to be generated by these sites that necessitates the upgrading. It is further suggested that guidelines on driveway numbers and spacing be instituted as described in section 3.2. Recovery of costs and enforcement of driveway guidelines could become part of the Municipality's development agreement process.

4.2 LONGER TERM PLAN

It is evident that traffic in the study area will continue to grow and eventually require Route 214 to operate beyond its capabilities. It is recommended that action be taken to reduce traffic loading on Route 214 once Horizon One is reached. This horizon corresponds to a study area dwelling unit count of 2900 or a peak hour two-way traffic flow of 1600 on Route 214 (measured midway between Highway 102 and Trunk 2).

It is apparent that either the South Lantz Interchange or the North Collector Roadway will provide the best opportunity for reducing traffic loading on Route 214. Additional detailed investigation should be undertaken to determine which of these two options provides the most cost-effective solution and is most compatible with existing and future land uses. This functional planning work will identify optimal connector road alignments and a preferred intersection point on Trunk 2. This work should be initiated quickly to prevent further development from interfering with potential alignments. When considering the alignment of the North Collector Roadway, the route between the shopping centre and Highway 102 (Option 'A' in Figure 5) should be preferred due to its lessened impact on existing commercial land uses.

This study has shown that implementation of a North Collector Roadway or a South Lantz interchange will capably manage expected traffic loading and that the North Lantz Interchange and the South Collector will provide minimal additional traffic management benefits. Therefore, the North Lantz interchange and the South Collector should no longer be considered for implementation.

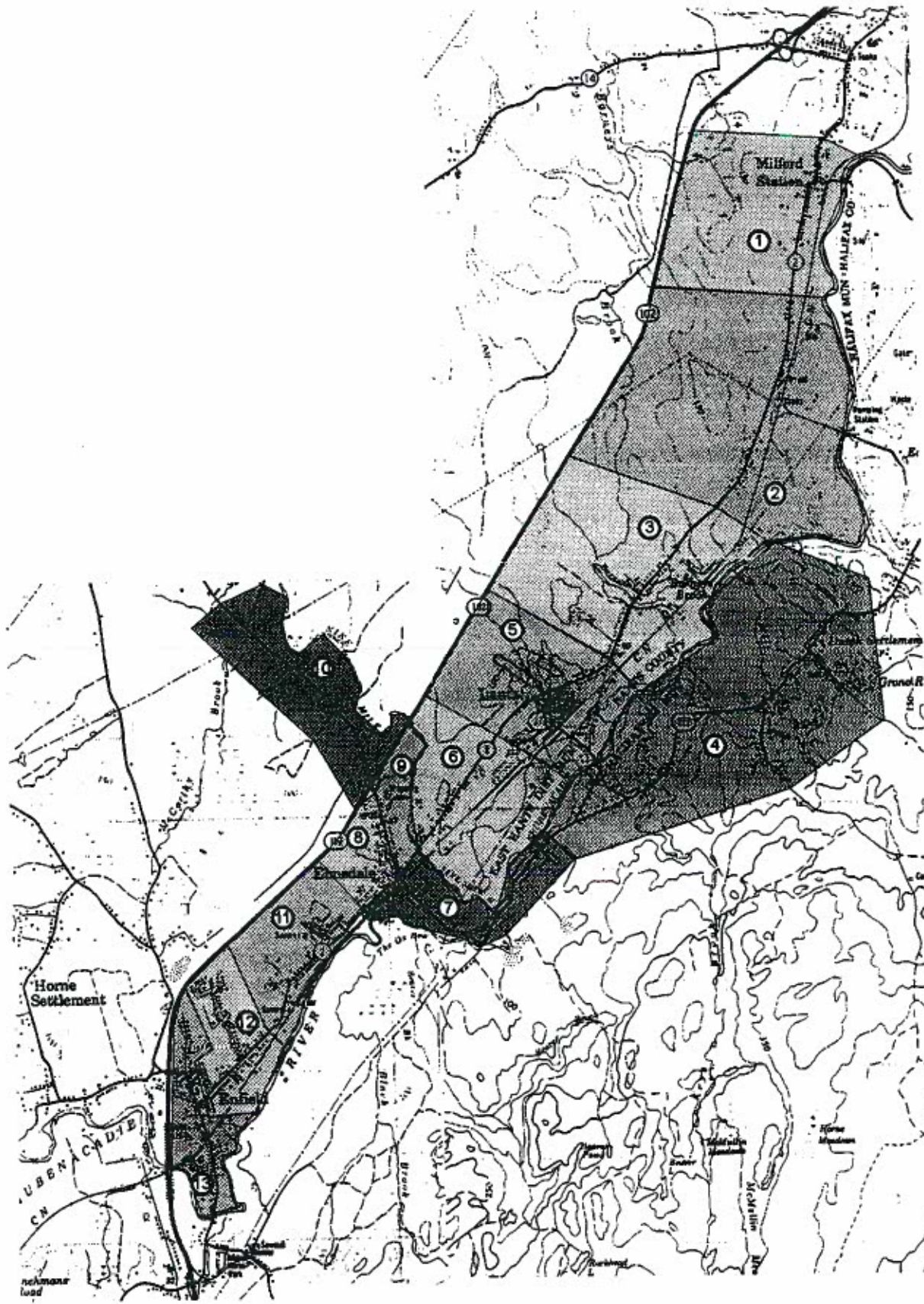
The traffic management analysis has shown that this longer term plan provide a satisfactory level of service through Horizon Two. Since Horizon Two represents close to a "build-out" scenario, it is evident that further major improvements to the roadway network within the study area may never be required.

**APPENDIX A
BASELINE DATA**

TABLE A.1 BASELINE DEMOGRAPHIC DATA AND PROJECTIONS

Zone	DWELLING UNITS			RETAIL EMPLOYEES			NON-RETAIL EMPL		
	Exist	Horiz 1	Horiz 2	Exist	Horiz 1	Horiz 2	Exist	Horiz 1	Horiz 2
1	80	90	100	10	10	20	30	30	40
2	50	60	200	10	10	10	70	70	70
3	160	320	500	0	0	0	0	50	50
4	230	350	400	10	10	30	20	20	20
5	450	650	650	20	30	40	90	90	100
6	20	50	300	0	0	0	0	0	0
7	70	80	100	20	20	20	20	20	20
8	210	280	350	90	200	340	30	80	160
9	0	0	0	250	260	300	30	40	50
10	110	120	150	30	120	190	50	170	280
11	250	370	400	50	50	50	40	40	40
12	290	340	350	20	40	50	40	50	60
13	180	190	200	50	50	50	10	10	10
Total	2100	2900	3700	560	800	1100	430	670	900
TRIP PRODUCTIONS									
HBW	4704	6496	8288	0	0	0	0	0	0
HBNW	17934	24766	31598	0	0	0	0	0	0
NHB	6762	9338	11914	0	0	0	0	0	0
Total	29400	40600	51800	0	0	0	0	0	0
TRIP ATTRACTIONS									
HBW	0	0	0	1008	1440	1980	774	1206	1620
HBNW	2520	3480	4440	7840	11200	15400	344	536	720
NHB	1470	2030	2590	1288	1840	2530	1247	1943	2610
Total	3990	5510	7030	10136	14480	19910	2365	3685	4950

Key to trip types: HBW - home-based work; HBNW - home-based non-work; NHB non-home-based



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FIGURE A-1



TRAFFIC ZONES

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<p style="text-align: center;">TRUNK 2 @ ROUTE 214</p> <p style="text-align: center;">Monday, October 29, 1997</p>													
Time	A	B	C	D	E	F	G	H	I	J	K	L	Total
4:00													
4:15	33	14	5	6	29	0	7	15	46	51	28	42	234
4:30	28	24	1	7	12	2	11	19	46	36	24	38	210
4:45	31	25	1	9	27	2	15	26	45	41	27	58	249
5:00	33	28	4	15	25	7	21	25	44	63	42	55	307
5:15	29	25	0	13	13	2	12	20	45	38	41	53	238
5:30	27	23	0	7	15	2	14	32	48	37	40	38	245
5:45													
PMPk	120	101	5	44	80	13	62	103	182	179	150	204	

<p style="text-align: center;">TRUNK 2 @ ROUTE 227</p> <p style="text-align: center;">Tuesday, October 30, 1997</p>							
Time	A	B	C	D	E	F	Total
4:15							0
4:30	11	33	14	7	25	9	99
4:45	12	36	12	5	31	10	106
5:00	14	39	10	10	33	11	117
5:15	17	49	5	14	31	6	122
5:30	18	41	4	10	35	8	116
PM Peak	35	165	31	39	130	35	461

**HIGHWAY 102 RAMPS
EXIT 8**

Tuesday, October 30, 1997

Time	From Northbound Off-Ramp		To Northbound On-Ramp		From Southbound Off-Ramp		To Southbound On-Ramp		Total
	Left	Right	Left	Right	Left	Right	Left	Right	
4:15	11	95			11	0	29	31	177
4:30	6	96			16	6	27	34	185
4:45	12	102			25	2	23	29	193
5:00	13	116			25	5	27	36	222
5:15	10	105			18	0	25	40	198
5:30	11	90			12	1	22	26	61
PM Pk	41	419	0	0	84	13	102	139	798

**APPENDIX B
QRS MODEL: INPUTS & RESULTS**

TABLE B.1 DISTRIBUTION OF EXTERNAL TRIPS

Destination	% of External Trips
Hwy 102 South (Halifax)	65 %
Hwy 102 North (Truro)	15 %
Trunk 2 South (Wellington)	5 %
Trunk 2 North (Stewiacke)	5 %
Route 214 West (Nine Mile River)	5 %
Route 277 East (Dutch Settlement)	5 %

TABLE B.2 VOLUME OF EXTERNAL TRIPS

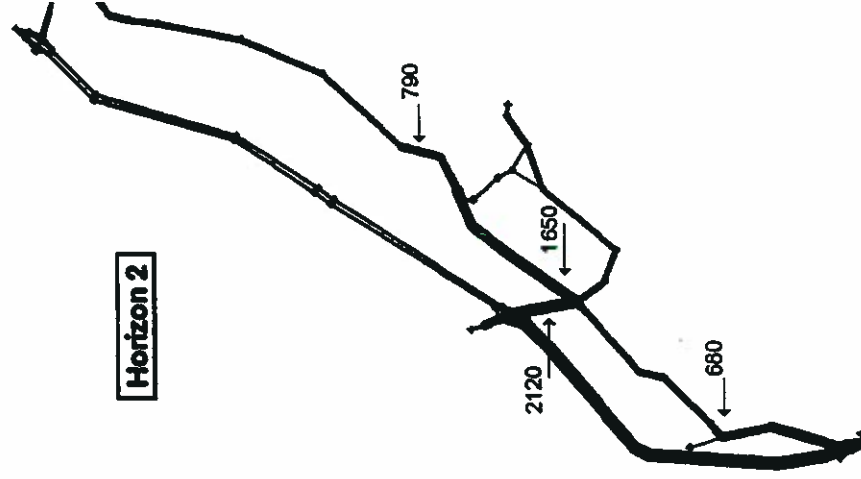
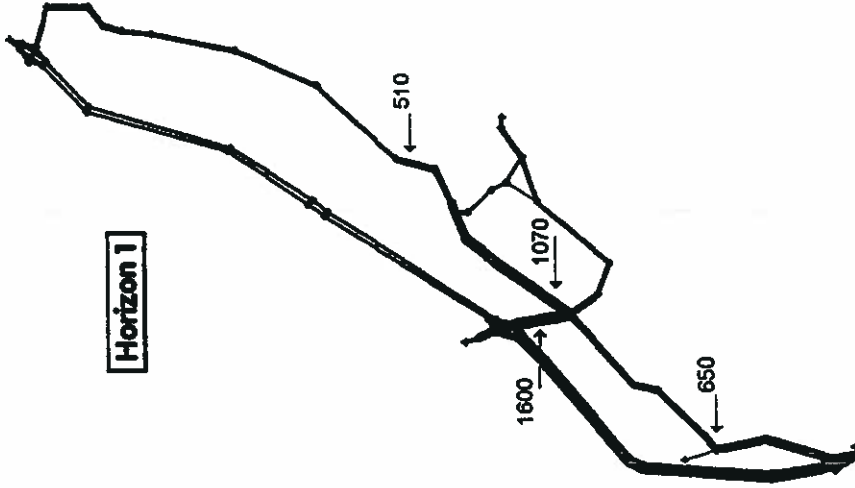
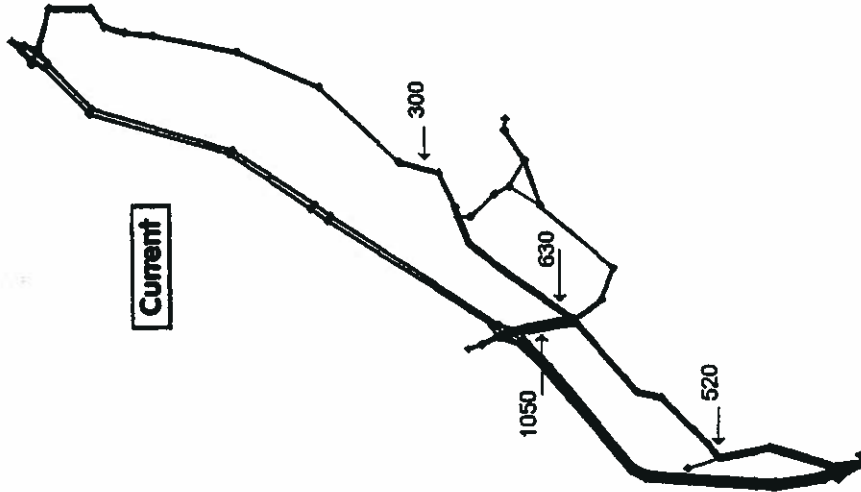
	Current			Horizon 1			Horizon 2		
	Hfx	Truro	Other	Hfx	Truro	Other	Hfx	Truro	Other
HBW Productions	289	67	22	430	99	33	585	135	45
HBNW Productions	696	161	54	989	228	76	1336	308	103
NHB Productions	260	60	20	378	87	29	502	116	39
HBW Attractions	2189	505	168	2933	677	226	3632	838	279
HBNW Attractions	5395	1245	415	7197	1661	554	8511	1964	655
NHB Attractions	2052	474	158	2669	616	205	3222	744	248

TABLE B.3 TURNING MOVEMENTS AT ROUTE 214 / TRUNK 2 INTERSECTION

	Approach											
	north			south			east			west		
	l	t	r	l	t	r	l	t	r	l	t	r
COUNTED	5	101	120	182	103	62	44	80	13	204	150	179
CURRENT (calibration)	9	57	174	121	70	52	47	80	12	311	135	172
HORIZON 1	10	76	315	190	97	60	52	127	13	556	215	276
HORIZON 1 (N interchange)	9	70	204	197	79	62	53	124	11	354	208	269
HORIZON 1 (S interchange)	9	65	38	192	71	63	55	55	10	29	80	266
HORIZON 1 (N collector)	7	58	7	184	69	64	56	39	10	13	59	261
HORIZON 1 (S collector)	10	78	302	148	99	61	53	126	13	552	214	210
HORIZON 2	13	103	495	232	136	63	53	156	17	881	266	328
HORIZON 2 (N interchange)	12	93	301	247	105	65	54	153	13	523	255	323
HORIZON 2 (N collector)	10	75	38	236	93	67	57	57	12	68	86	321
HORIZON 2 (S collector)	13	105	486	177	138	64	53	156	17	879	265	245
HORIZON 2 (S interchange)	12	92	145	241	105	65	55	73	13	186	106	322

TABLE B.4 TURNING MOVEMENTS AT ELMSDALE SHOPPING CENTRE INTERSECTION

	Approach								
	north		east		west		south		
	l	r	t	r	l	t	l	t	r
COUNTED	168	170	239	181	181	364	-	-	-
CURRENT (calibration)	210	156	239	151	124	452	-	-	-
HORIZON 1	229	160	427	165	129	777	-	-	-
HORIZON 1 (North interchange)	203	107	350	145	70	597	-	-	-
HORIZON 1 (South interchange)	146	164	174	102	220	112	-	-	-
HORIZON 1 (North collector)	123	348	116	135	242	153	46	408	77
HORIZON 1 (South collector)	230	80	421	165	50	783	-	-	-
HORIZON 2	258	184	600	185	148	1080	-	-	-
HORIZON 2 (North interchange)	220	221	485	157	177	783	-	-	-
HORIZON 2 (South interchange)	173	259	313	122	202	379	-	-	-
HORIZON 2 (North collector)	104	341	323	74	274	397	-	-	-
HORIZON 2 (South collector)	260	181	598	187	147	1089	-	-	-



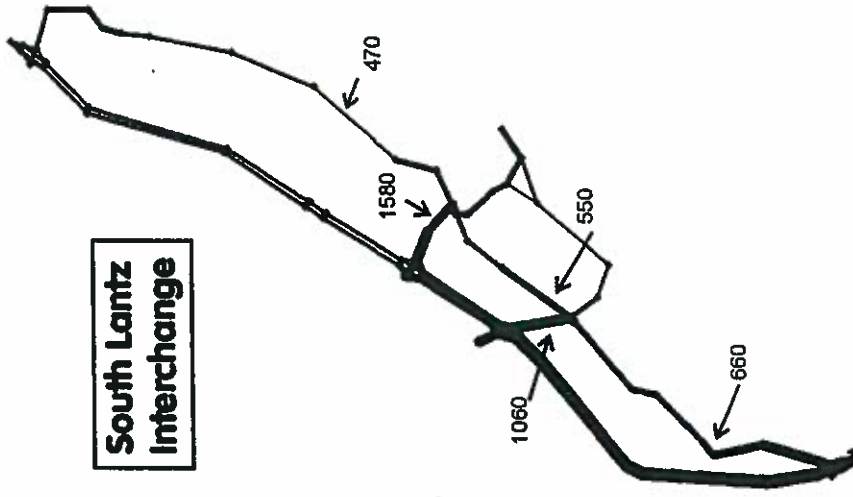
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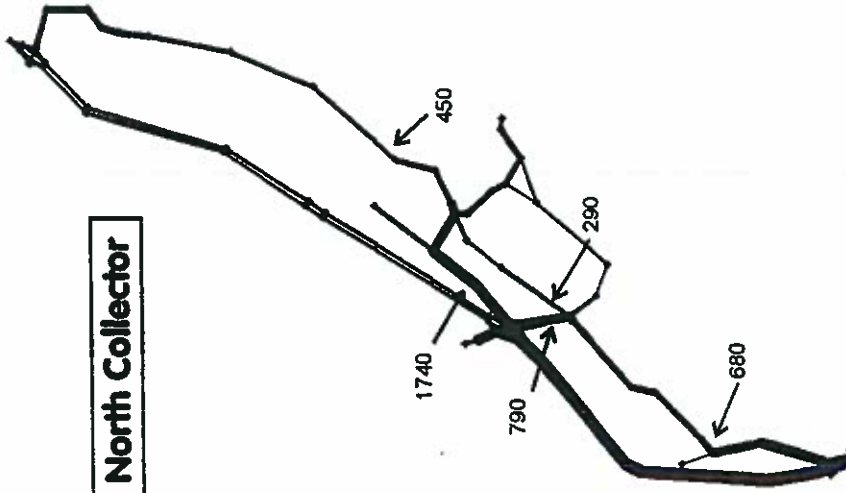
**TWO-WAY PEAK HOUR TRAFFIC VOLUMES
NO ADDITIONS TO ROADWAY NETWORK**

FIGURE B-1

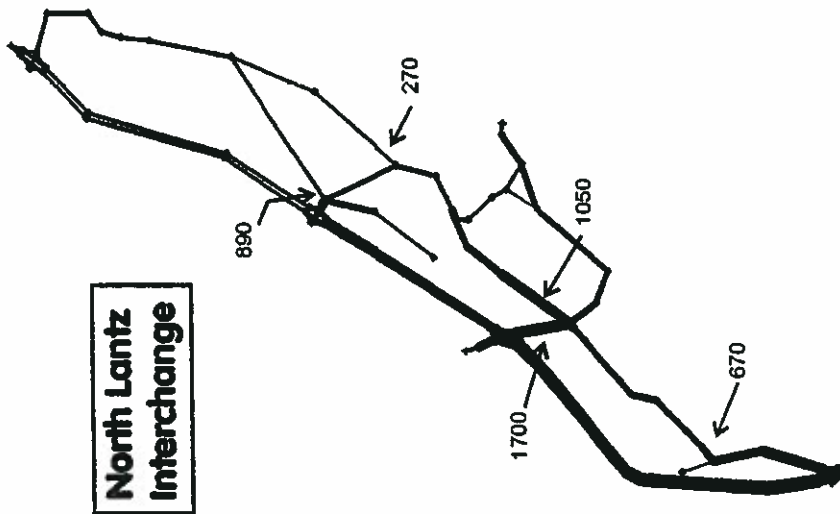
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South Lantz Interchange



North Collector



North Lantz Interchange

NOTES

Thickness of lines corresponds to traffic volumes

Traffic on Highway 102 represents study area trips only

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FIGURE B-2

PROJECTED HORIZON TWO TWO-WAY PEAK HOUR VOLUMES WITH ROADWAY ADDITION ALTERNATIVES

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