APPENDIX E
TRANSPORTATION

Highway 7 Planning Study – Kitchener to Guelph

Transportation Appendix

This appendix assembles the work carried out related to traffic forecasts in the Highway 7 corridor. Part I of the appendix is the Transportation section from the EA Report 1997. It describes the existing conditions when the study started in 1989, the methodology to forecast traffic to 2001 and 2011, and a review of the roadway type that could accommodate the forecast traffic volume.

Part II of the appendix includes traffic data that was collected during the MTO Review, including a summary of the traffic data that was presented to the public.

Part III of the appendix is the 'Independent Review' of the traffic forecasts and roadway type capacity. One of the areas included in the MTO Review was an assessment of traffic conditions in 2000 / 2001. There was concern raised by members of the public that the traffic forecasts were too high and that the future demand in the corridor could be addressed by widening the existing highway to four lanes. The Independent Review assessed four roadway cross section types, similar to the cross section types developed in the Original EA, and determined the capacity at Level of Service D as well as Level of Service E, (at capacity, where v/c =1.0). The process differs from the original work in that the traffic volumes are based on peak hour peak direction flow, as compared with Annual Average Daily Traffic (AADT) that was the basis for analysis in the Original EA. Using AADT provides an overview order of magnitude for comparison, however using peak period directional volumes provides a more detailed assessment. For all of the work carried out for the MTO Review, the traffic data is stated in vehicles per hour per direction (vphpd).

The relationship between AADT and p.m. peak hour directional traffic volumes is a function of percentage of directional split and the relationship between one hour traffic volumes and all day traffic volumes. Peak hour volumes are typically in the range of 8% to 12% of the daily volume, with the average being 10%. The p.m. peak hour directional split in the Highway 7 corridor is typically in the range from 55 / 45 to 65 / 35. The 65 / 35 split would be the most conservative and would create a p.m. peak direction to two way p.m. peak factor of 1.54 (1/.65). When the daily volume / peak hour volume factor is combined with the two way peak hour factor, the conversion from p.m. peak hour peak direction to AADT would be in the range of 13 to 19, with 15.4 representing a 10% p.m. peak hour factor. For example, the 1999 / 2000 actual counts of 22,000 to 23,000 AADT would be 1,430 to 1,495 vphpd.

Traffic forecasts were based on population and employment data from the municipalities as well as population projections from the Ministry of Finance to Year 2028, (July 2000). The Independent Review concludes that either of the 4-lane right-in / right-out or the 4-lane expressway cross sections would be adequate to maintain at least Level of Service D beyond 2028.

Part IV is an excerpt from the Highway Capacity Manual that describes the likely operating conditions for each of the defined Levels of Service (LOS).

PART I

Transportation Section from EA Report 1997

3.4 Transportation

a) Data Sources

i) Data from three sources was used to establish an understanding of the existing travel patterns within the study area:

a) A computer model developed by the RMW which simulates vehicle travel demand on its road facility network on a local inter-regional basis;

b) Traffic and accident data provided by the MTO and the associated municipalities; and

c) A traffic survey to determine origins/destinations by recording licence plates was carried out in the City of Guelph for vehicles travelling westbound on Highway 7. The licence plates were recorded over a three day period, with the survey station located between the Hanlon Expressway and County Road 86.

Region of Waterloo Demand Forecast Model

The Region of Waterloo's model consists of two parts; the road facility network and an appropriate trip table. A trip table is a matrix of vehicle (or transit) trip origins and destinations by an established network of traffic zones. The Region of Waterloo trip table is a 266 x 266 matrix.

The analysis of traffic volumes in the Highway 7 corridor was facilitated by calibrating the model to reflect, in its simulation, how the road network has been observed to operate. Initially, the model was calibrated by carrying out a capacity restraint assignment using the Region's 1988 p.m. peak hour trip table and base network. The model's output volumes were compared with 1988 MTO counts and the appropriate adjustments were made to the network to increase the accuracy of the simulation.

Existing Traffic and Accident Data

The County of Wellington/City of Guelph's land use and traffic data were not in a computer model format. Therefore, traffic and accident data was used (provided by the MTO, City of Guelph and the County of Wellington) to analyse traffic and identify existing conditions along the Highway 7 corridor. Both peak hour link volumes and turning movements and AADTs were used in the analysis to assess volume to capacity ratios at different locations through the corridor.

Traffic Survey

A traffic survey was carried out to establish traffic patterns as a base for assessing the existing traffic information. The survey, which aided in determining the inter-regional travel patterns along the Highway 7 corridor, was carried out for the westbound direction on Highway 7 just west of Highway 6.

b) General Description

i) Existing Conditions

Highway 7 between Kitchener and Guelph has been identified as a roadway with existing transportation deficiencies. The Ministry of Transportation, Southwestern Region has completed a report detailing the results of a traffic analysis within the study corridor and is included in Appendix E and is summarized in this Section. This report outlines the existing traffic conditions (1988-90) and future traffic demands. The report also analyses various roadway alternatives in terms of operating level of service for the short term (2001) and the long term (2011).

The Level of Service is a measure to describe the operating condition on a road. There are six levels of service, A through F, which cover the range from excellent to very congested, forced flow traffic conditions.

At the present time, Victoria Street (Highway 7) in Kitchener is an urban, five lane undivided roadway (four through lanes with a centre left turn lane) from the Kitchener-Waterloo Expressway (Highway 86) to just west of the CN railway bridge. This section of Highway 7 functions as an urban arterial roadway and is under the jurisdiction of the Regional Municipality of Waterloo. The adjacent land uses are predominantly commercial and prestige industrial. The Annual Average Daily Traffic (AADT) for this section of highway ranges from 22,600-32,000 vehicles (1988) and operates at a level of service (LOS) 'D' in the peak hour (see Exhibit 3-6). The most recent counts indicate an AADT in the range of 31,500 - 35,300 (1994).

Between the CN Rail crossing and the Hopewell Creek crossing, the roadway functions as a 4 lane arterial highway. The land uses along this stretch of the highway (approximately 2.5 km) are transitional from industrial/commercial to agricultural/open space. AADT for this section of highway is 15,700 (1989) and operates at an LOS 'A' (see Exhibit 3-6). Traffic counts taken in 1993 indicate an AADT in the range of 18,800 - 21,600.

Between the Hopewell Creek and the west limits of the City of Guelph, the roadway functions as a 2 lane rural arterial highway. The land use along this approximately 8.3 km long section is predominantly agricultural with some scattered highway commercial and other land uses including a cemetery, service stations and garden centres as well as several large field nursery operations. AADTs (1989) for this section of highway range between 15,700 vehicles (west of Townline Road) and 18,200 vehicles (west of Guelph city limits); it operates at an LOS 'E' (see Exhibit 3-6). Traffic counts in 1993 indicate an AADT in the range of 20,500 - 21,700.

The remaining section of Highway 7 between the west limits of Guelph and Highway 6 (Hanlon Expressway) functions as a 4 lane and 5 lane urban arterial roadway and is under the jurisdiction of the City of Guelph. The adjacent land uses are predominantly prestige industrial and commercial, including many car dealerships. AADT for this section of Highway 7 ranges from 17,600-22,500 (1989) vehicles and operates at LOS 'C' (see Exhibit 3-6). Traffic counts taken in 1995 indicate an AADT in the range of 18,500 - 24,000.

ii) Future Conditions

Based on the analysis of existing travel patterns, future travel demand forecasts were developed by taking into consideration land use changes and growth expectations in the two centres and adding this growth to existing traffic data. All traffic projections along the Highway 7 corridor in the RMW were based on the provided travel demand model. From

the model, a more detailed sub-area model was derived for the study area so that an analysis of different roadway alternatives could be carried out.

Population and employment growth data provided by the City of Guelph and County of Wellington and the results from the traffic survey made it possible to carry out a manual trip assignment to determine future traffic within the County of Wellington. From this base data and the determined growth factor, AADT and p.m. peak volumes were projected to the years 2001 and 2011.

Under the 'low' population growth scenario and the 'high' population growth scenario future AADTs along Highway 7 would be 24,200 and 26,050 respectively by the year 2006.

These AADTs illustrate that the transportation corridor would be experiencing high traffic volumes which would exceed existing capacity.

iii) Integration of Traffic Data

Travel patterns within the Highway 7 corridor were identified by:

- using a computer-based model for the RMW; and
- conducting a traffic survey for Wellington County

From the results of the traffic survey, a trip table and traffic zone system was established. After the Wellington County trip table was calibrated based on existing traffic counts, the results were consistent with the RMW trip table for origin-destination trips.

Therefore, future traffic projections, using both a manual assignment for the Wellington County trip table and the computer model for the Waterloo Region trip table, were considered to be accurate on both a local and an inter-regional level.

iv) Future Conditions

Four scenarios, including the 'Do Nothing' alternative, were analyzed to measure the effects of different improvements to existing Highway 7 on the study area road network. Each alternative was analysed using 4 screenlines along Highway 7 between the Hanlon Expressway and the KWE for the forecast years of 2001 and 2011. The screenlines were located at the KWE, Regional Road 17, Townline Road and east of County Road 86. The analysis was carried out for the p.m. peak hour, peak direction. The peak direction was westbound.

Scenario 1: Do Nothing

The Do Nothing scenario would have lane configurations as follows: five lanes from the Kitchener-Waterloo Expressway (KWE) to approximately the CN railway bridge, 4 lanes to Hopewell Creek, 2 lanes to the Guelph City limits and 4 lanes to the Hanlon Expressway (see Exhibit 3-6). Existing and future traffic demand would exceed the capacity of Scenario 1 at both the Townline and County Road 86 screenlines by the forecast year 2001. Demand at all screenlines would exceed capacity by the forecast year 2011. The roadway would be an undivided arterial.

Scenario 2: Minimum Upgrade

The minimum upgrade scenario would have lane configurations as follows: seven lanes from the KWE to the CN Rail crossing along existing Victoria Street, 4 lanes from the CN Rail crossing to the Guelph City Limits, and five lanes from this point to the Hanlon Expressway (Woodlawn Road) (see Exhibit 3-6). The road would be an undivided arterial.

Scenario 2 would provide adequate capacity along the improved rural 4 lane section of Highway 7 for the year 2001, however, the capacity would be exceeded by the year 2011. The capacities of the seven lane section in Kitchener and five lane section in Guelph would also be exceeded by the year 2011.

Scenario 3: Combined New Route and Existing Highway 7

In addition to Victoria Street in Kitchener, Scenario 3 would include a new 4 lane controlled access highway from the KWE to Woolwich Road 66, four or five lanes (right-in, right-out) along the existing Highway 7 alignment to east of Guelph Road 3, and a new 4 lane facility along a new alignment to the north of the Guelph City Limits connecting to the Hanlon Expressway (see Exhibit 3-6). The road would be a divided freeway at the east and west ends, and a divided arterial in the central section.

Scenario 3 would relieve some of the congestion on Victoria Street in Kitchener and Woodlawn Road in Guelph for the forecasted demand for both year 2001 and 2011. The capacity of the upgraded 4 lane rural section would meet demand for the year 2001, however, capacity would be exceeded by the year 2011.

Scenario 4: New Route

A new route alternative would be a 4 lane controlled access highway from the KWE to the Hanlon Expressway with interchanges located at Riverbend Drive/Shirley Avenue, Bridge Street, Regional Road 17, Regional Road 30, County Road 86, and Woodlawn Road (see Exhibit 3-6). This scenario would provide a reasonable level of service for the forecast demand for both year 2001 and 2011. The Traffic Report is included as Appendix E.

c) Significance and Sensitivity

The existing traffic data and the forecasted demand for the years 2001 and 2011 indicate that there is a deficiency on existing Highway 7 and that the deficiency will continue to worsen as traffic volumes increase. The results of the network simulations illustrate how the network would function with the forecasted demand.

The classification of the roadways is described for each of the scenarios. Roadway safety is an important consideration in the study and has been identified as one of the study objectives. Roadway safety can be best achieved through separation of traffic conflicts such as left turns and opposing traffic flow. Roadway safety increases as the conflicts are removed, i.e. the roadway safety improves when the facility is divided, access controlled and grade separated at crossing roads.

The need to provide adequate capacity to handle the forecasted demand is one of the objectives of the Highway 7 Planning Study.

SCENARIO	TRAFFIC DATA																			
	EXISTING CONDITIONS								YEAR 2001 FORECAST								YEAR 2011 FORECAST							
	KWE TO RR 17		RR 17 TO TOWNLINE		TOWNLINE TO COUNTY ROAD 86		COUNTY ROAD 86 TO HANLON EXPRESSWAY		KWE TO RR 17		RR 17 TO TOWNLINE		TOWNLINE TO COUNTY ROAD 86		COUNTY ROAD 86 TO HANLON EXPRESSWAY		KWE TO RR 17		RR 17 TO TOWNLINE		TOWNLINE TO COUNTY ROAD 86		COUNTY ROAD 86 TO HANLON EXPRESSWAY	
	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS	AADT	LOS
	CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION		CLASSIFICATION	
1. Do Nothing	21,600-35,300(1993-5)	D	21,400-21,700 (1993)	E	20,500-21,700 (1993)	E	18,500-24,000 (1995)	C	38,200	E	21,000	E	26,800	F	30,800	F	46,000	F	37,600	F	30,200	F	34,700	F
	4/5 lane UAU80		2 lane RAU100		2 lane RAU100		4 lane UAU80		5 lane UAU80		4 lane RAU100		2 lane RAU100		4 lane UAU80		5 lane UAU80		4 lane RAU100		2 lane RAU100		4 lane UAU80	
2. Minimum Upgrade	n/a		n/a		n/a		n/a		45,000	D	21..200	C	26,800	D	30,800	C	53,000	E	37,600	F	30,200	D/E	34,700	D
									7 lane UAU80		4 lane RAU100		4 lane RAU100		5 lane UAU80		7 lane UAU80		4 lane RAU100		4 lane RAU100		5 lane UAU80	
3. Combined New/Route/Existing Highway 7	n/a		n/a		n/a		n/a		29,400	B	13,500*	A	26,800	C	24,000	A/B	50,000	C	29,000	B	33,000	D	25,000	B
									4 lane RFD110		4 lane RFD120		4 lane RIRO RAD100		4 lane RFD110		4 lane RFD110		4 lane RFD120		4 lane RIRO RAD100		4 lane RFD110	
4. New Route	n/a		n/a		n/a		n/a		29,400	B	13,500*	A	17,200	A	24,000	A/B	51,000	C	29,000	B	28,400	B	25,000	B
									4 lane RFD110		4 lane RFD120		4 lane RFD120		4 lane RFD110		4 lane RFD110		4 lane RFD120		4 lane RFD120		4 lane RFD110	

* assumes new Highway 7 is constructed to Regional Road 30, balance of traffic would be on existing Highway 7

n/a not applicable

LEGEND				
AADT	• Average Annual Daily Traffic			
LOS	• Level of Service			
CLASSIFICATION AND DESIGN SPEED	• RFD	(Rural Freeway Divided)	-	110 km/h design speed
	• RFD	(Rural Freeway Divided)	-	120 km/h design speed
	• UAU	(Urban Arterial Undivided)	-	80 km/h design speed
	• RAU	(Rural Arterial Undivided)	-	100 km/h design speed
	• RAD	(Rural Arterial Divided)	-	100 km/h design speed

PART II

Traffic Data Collected During MTO Review

PRESENTED AT MARCH 2000 PUBLIC INFORMATION CENTRES

Review of Traffic

The most recent traffic counts (taken in 1998/1999) were assembled and were compared with the traffic projections carried out in 1989/ 1990. The actual counts were generally greater than the projected values. It is concluded that the forecasting carried out in the Environmental Assessment is reasonable.

Review of Need and Justification

The review also assessed the need for the project. Traffic demand for three areas: Kitchener (urban), Guelph (urban) and the Central section (rural) is summarized below.

Kitchener

- 1998 volumes from KW Expressway to the CN Rail range from 25,300 to 34,400
- EA forecast of 39,300 vehicles on Highway 7 by year 2011
- Based on 1998 volumes, the 1999 review indicates vehicle volumes on Highway 7 to be between 38,200 and 49,300 by year 2011

Central Rural Section

- 1999 volumes average 22,000
- EA forecast of 30,200 vehicles on Highway 7 by year 2011
- 1999 review indicates vehicle volumes based on 1999 volumes on Highway 7 to be between 25,300 and 34,700 by year 2011

Guelph

- 1998 volumes from Guelph City Limits to Hanlon Expressway on Woodlawn Road range from 20,500 to 26,100
- EA forecast of 36,700 vehicles on Highway 7 (Woodlawn Road) by year 2011
- Woodlawn Road widened since EA to 5 lanes from Guelph City Limits to Hanlon Expressway
- 1999 review indicates vehicle volumes on Woodlawn Road to be 35,500 by year 2011

INCLUDED IN NOVEMBER 2001 INFORMATION CENTRE PACKAGE

TRAFFIC

Following the March 2000 Public Information Centres, and further consultation with municipal representatives, an independent review to assess demand and capacity in the Highway 7 corridor was carried out. The following was presented at the February 2001 Public Information Centre and summarizes the results of this review:

Demand

The travel demand in the corridor was predicted using the most current information available, including:

- the 1996 TTS (Transportation Tomorrow Survey) data,
- 2028 Population and Employment forecasts (as prepared by the Ministry of Finance in 2000),
- existing traffic counts.

The review confirmed the demand forecasts developed previously. The 2028 demand would be in the range of 2,350 to 2,600 vehicles per hour.

Highway Capacity

The highway capacity analysis assessed the practical capacity of:

(i) a four lane undivided highway (permitting right and left turns);
(ii) a four lane highway with a median barrier and right-in/right-out (RIRO) access control (with grade separations at crossing roads to allow access across the highway); and
(iii) a four lane divided "expressway" with controlled access at interchanges (CAH).

Capacity is generally expressed as the volume at which the roadway reaches Level of Service 'D'. Level of Service (LOS) categories define the degree of traffic congestion, and range from LOS A (free flow conditions with high level of comfort and convenience) to LOS F (forced flow with extensive congestion and queuing).

The findings of the review are summarized as follows:

i. Widening existing Highway 7 to a four lane undivided highway would not reasonably accommodate future demand. Level of Service 'D' will be reached before 2010.

ii. A RIRO alternative would accommodate predicted traffic at a Level of Service 'D' or better to at least 2028 (assuming MTO exercises strict control over the number of new entrances). This differs from our earlier assessment, which suggested that the RIRO

alternative would reach capacity much sooner. The difference is based on the factors considered in the capacity calculation (e.g. number of entrances, grade, design speed). The central section of Highway 7 does not exhibit characteristics of a 'rural' condition or a 'suburban' condition, but in fact exhibits characteristics of both. Our new capacity calculation attempts to evaluate each factor based on these hybrid conditions.

iii. A CAH alternative would accommodate predicted traffic at a LOS C well beyond 2028.

Both the RIRO and the CAH would provide at least LOS D up to 2028. The practical capacity of the RIRO alternative would be in the range of 2,850 vehicles per hour and the practical capacity of the CAH alternative would be in the range of 3,400 vehicles per hour.

PART III

Independent Review Memo

Traffic Report Addendum – September 2000

Since a decade has elapsed since the traffic report was conducted for inclusion in the December 1997 Environmental Assessment Report, it was considered prudent to revisit existing and future traffic requirements at this time.

In the intervening years, we have gained a better understanding of travel patterns in the area through the conduct of the 1996 Transportation Tomorrow Survey (TTS). Updated population and employment projections are now available from both the Regional Municipality of Waterloo and the Ontario Minister of Finance. Finally, we have had an additional 10 years to observe area traffic volumes.

Background

It is obvious that the rural two-lane section of Highway 7 between Guelph and Kitchener-Waterloo is fast approaching obsolescence. The onset of severe congestion has been delayed due to the nature of the peak-period users (every-day commuters), the small numbers of commercial vehicles and turning movements, and the lack of appreciable side-friction. However, analysis shows that the highway will not be able to fulfill it's intended function for much longer. Furthermore, observations indicate that traffic attempting to enter or cross the highway from intersecting streets is subject to excessive delay and exposed to an appreciable safety risk.

Given that improvement of the highway is necessary, the principle question revolves around the level of improvement. What design should the highway be improved to so that it can fulfill its intended function over an extended design life of 30 years or more? It is important from a financial point-of-view that the highway not become obsolete again within that time period. It is also important for the stability of the adjacent land-uses and land-owners that long-term traffic and land requirements be provided for now.

Four possible cross-sections were evaluated as follows:

1. 2-lane rural highway on the existing right-of-way (100 km/h design speed, 80 km/h posted speed);
2. 4-lane undivided rural highway on the existing right-of-way (100 km/h design speed, 80 km/h posted speed);
3. 4-lane divided rural highway on the existing right-of-way with right-in/right-out access (RIRO) only (110 km/h design speed, 90 km/h posted speed);
4. 4-lane undivided expressway on a new right-of-way with full access control (120 km/h design speed, 100 km/h posted speed).

From a transportation perspective, three principle criteria must be considered in arriving at a design recommendation:

1. the ability of the design to accommodate traffic growth over the 30-year period at a level-of-service no worse than 'D';
2. the safety of the design, with particular consideration of entering and crossing traffic and the movement of farm vehicles;
3. the ability to provide a reasonable level of access, without excessive delay, to traffic wishing to enter or exit from abutting land-uses and cross-streets.

Evaluation of the ability of the design to accommodate traffic growth over the 30-year period at a level-of-service no worse than 'D'

Two alternative approaches were employed to forecast future traffic requirements for Highway 7.

The first approach involved projection of past traffic growth trends into the future based on historical Annual Average Daily Traffic (AADT) volumes taken from the Highway 7 counting location between Townline and Regional Road 32 from the Ministry's database.

Since past trends between 1985 and the present appear to involve two different growth regimes separated by an apparent decrease in traffic in the early nineties, two separate growth rates were considered. The first, a rate increase of 550 vehicles/day per year or 25-30 vehicles in the peak direction during the peak hour, was based on the entire period between 1985 and the present. This is considered a baseline trend projection. The second, a rate increase of 770 vehicles/day per year or 35-40 vehicles in the peak direction during the peak hour, was based on the period between 1992 and the present and is termed a 'high' projection. It is important to note that due to the shorter history involved, the 'high' rate should not be projected into the longer-term future, say beyond a ten-year period (beyond the year 2011).

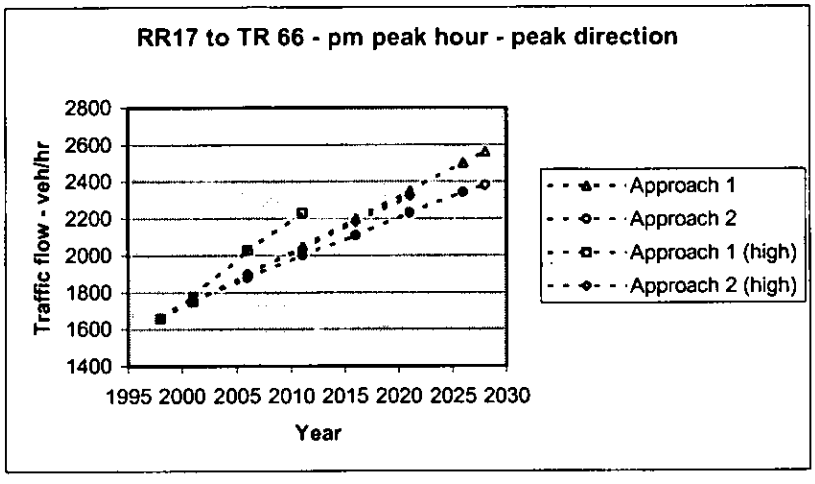
The second approach involved the projection of future population and the application of factors relating population to the number of peak-hour trips on Highway 7 to produce traffic volume estimates for future time periods. Analysis of the TTS data for 1996 indicated that the vast majority of trips on Highway 7 are between Kitchener-Waterloo and Guelph.

The Minister of Finance recently (July, 2000) released population projections for Ontario's municipalities up to the year 2028. These were used to generate baseline traffic forecasts. The Regional Municipality of Waterloo has produced population and employment projections for the year 2021. Being higher than the corresponding Ministry of Finance projections, these were used to generate a 'high' projection.

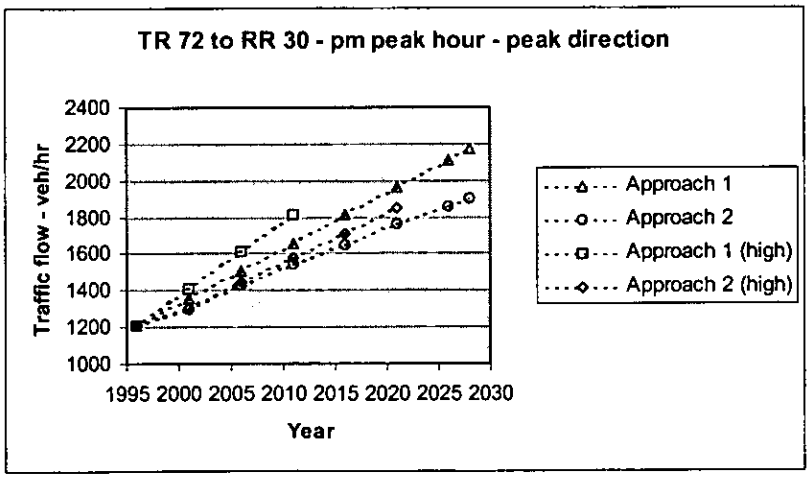
Factors relating the number of all-purpose, auto-driver trips on Highway 7 by direction to the populations of Kitchener-Waterloo and Guelph were developed through an analysis of 1996 Transportation Tomorrow Survey (TTS) data. This analysis confirms that Highway 7 functions as a commuter highway in both directions between Kitchener / Waterloo and Guelph.

Consideration was also given to other portions of the travel market to see if these might have a significant effect on traffic volumes. The first of these is commercial traffic. Peak-hour commercial traffic on this section of Highway 7 is relatively modest at around 5% of total traffic. No specific factors were identified to suggest that this will change significantly in the future. The second is recreational and tourist traffic. This section of Highway 7 has been classified as having a 'Commuter' traffic profile with relatively low variation from season to season. Typically, summer volumes are only about 10% higher than average annual volumes. Again, no specific factors have been identified that might suggest significant future changes in this situation. The final component is traffic with either an origin or destination external to Kitchener-Waterloo or Guelph. The TTS data and comparison with observed traffic volumes suggests that this is a small part of the overall traffic flow and unlikely to exert a major influence on future volumes.

The following graph summarizes the 'baseline' traffic projections at 5-year intervals developed using both approaches along with their 'high' variations. The 'high' methods are both for shorter time periods. In the case of the first approach, this is due to the shorter historic time-series as mentioned previously. For the second approach, this limit is based on the year for which population forecasts were available from the Regional Municipality of Waterloo. Forecasts were generated for two sections of Highway 7, the 4-lane section between Regional Road 17 and Woolwich Road 66 which has the highest volumes among all of the rural sections, and the 2-lane central section. Existing traffic data between the west portion of Woolwich Road 72 and Regional Road 30, which has the highest peak-hour volume among the 2-lane sections of Highway 7 was used for the analysis.



Traffic forecasts for 4-lane Highway 7 between Regional Road 17 and Woolwich Road 66.



Traffic forecasts for central section of Highway 7

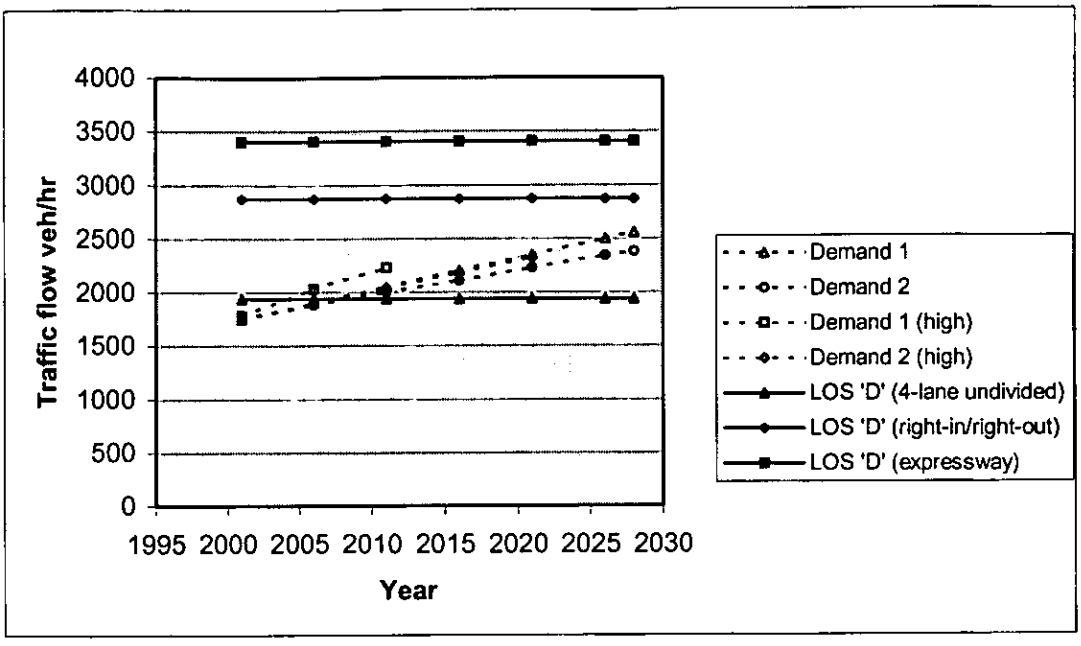
The next stage in this analysis involved the calculation of roadway capacities/service volumes for the four alternative road cross-sections. Using the methods contained in the Ministry's Geometric Design Standards for Ontario Highways, the values for peak-hour, peak-direction capacity and service volume at level-of-service 'D' were calculated as shown in the following table:

	Capacity/Service Volume	
	LOS 'D'	LOS 'E' (capacity)
2-lane rural highway	680	1200
4-lane undivided highway	1940	2400
4-lane divided highway (right-in/right-out)	2870	3340
4-lane expressway (access controlled)	3410	3510

The values for the 4-lane undivided alternative have been modified to recognize the loss of about 25% of the basic capacity due to traffic signals at major cross-streets. It is also important to note that the capacities and service volumes associated with the first three alternatives on the existing alignment would likely be reduced where side friction was present in the form of slow-moving farm machinery or access points to commercial activities. This would not affect the access-controlled expressway alternative. It should also be noted that the construction of an expressway in a new alignment would mean that the capacity of the existing Highway 7 would continue to be available.

The capacities shown here are somewhat higher in some cases than those presented in the original analysis. Part of the difference, offsetting in some cases is due to different assumptions with respect to the effect of commercial vehicles and the terrain. However, the majority of this difference is due to the use of different peak hour factors and, more importantly, the fact that a suburban roadside environment was assumed in the previous analysis and a rural roadside environment in this analysis. The capacity methodology provides limited guidance in how the roadside environment should be classified. If appreciable roadside development with accompanying higher volumes of entering and exiting traffic occurs in the future, the capacities and service volumes of all design alternatives with the exception of the 4-lane expressway could be reduced by up to 15%.

Combining the predicted future traffic volumes with the calculated capacities and service volumes yields the following graphs for the two sections of Highway 7 under consideration. From these graphs, it is concluded that the 4-lane undivided configuration will only be adequate to maintain level-of-service 'D' over the short-term in the central rural section. Either of the 4-lane right-in/right-out or 4-lane expressway configurations would appear to be adequate to maintain at least level-of-service 'D' to beyond 30 years. Other decision factors are discussed below and in the main EA report, such as potential conflicts with slow moving (farm) equipment, potential for loss of business and safety.



Comparison of forecast traffic volumes with LOS 'D' service volumes

Comments on the safety of the design, with particular consideration of entering and crossing traffic and the movement of farm vehicles.

Slow-moving farm vehicles and entering, exiting, and crossing traffic are a fact of life on this section of Highway 7. At present, traffic consists primarily of commuters who are familiar with the road and have some level of expectation that they might encounter one of these situations. Upgrading the highway to a higher design standard will likely lead to higher travel speeds and a lower level of expectation concerning hazardous situations.

In the case of the 4-lane undivided configuration, speed increases will be minimal. Drivers will still be required to stop for traffic signals and safety could still be maintained with judicious use of left-turn lanes, wide shoulders and appropriate access design.

Upgrading further to a divided, right-in/right-out configuration will result in posted and travel speed increases and a reduced expectation concerning the need to slow or stop since there will be no traffic signals and an apparently high design standard. In this case, slow-moving vehicles should be accommodated outside the travelled portion of the road, preferably on service/frontage roads, recognizing that the centre divider will prevent highway crossings. Access to abutting land uses should be restricted to only those cases where no other alternative exists and provision should be made for deceleration and acceleration of entering and exiting vehicles.

In the case of the expressway configuration, slow-moving vehicles and entering, exiting, and crossing traffic would remain on the existing Highway 7 and the expressway would be unaffected.

Comments on the ability to provide a reasonable level of access, without excessive delay, to traffic wishing to enter or exit from abutting land-uses and cross-streets.

Excessive delay is currently the norm, particularly during peak periods, for drivers wishing to enter, cross, or left turn exit from Highway 7.

Improvement to an undivided 4-lane configuration may provide some additional gaps to accommodate entering, crossing, or exiting traffic but the wider cross-section will mean that longer gaps are required to attempt these manoeuvres and safety will be reduced. Additional traffic signals may be warranted over time at intersections with crossing streets.

Upgrading to a 4-lane right-in/right-out configuration will reduce delay for movements on grade-separated cross-streets but will increase trip circuity and delay for movements not readily accommodated by the planned grade separations. The extent of this increase will depend on the efficiency of any service/frontage road system.

Upgrading to an expressway will reduce the delay associated with most movements to, from, and across Highway 7 since a substantial portion of the through traffic will be diverted to the new expressway.

Preliminary Conclusions.

1. **The existing two-lane configuration is fast approaching obsolescence.**

2. **The 4-lane undivided configuration will not likely be able to accommodate future traffic at level-of-service 'D' or better over the next 10 years.**

3. **Either the 4-lane divided (right-in/right-out) or 4-lane expressway (on new alignment) configurations will be able to accommodate future traffic at level-of-service 'D' or better until beyond the 30-year horizon.**

4. **The expressway option will reduce accident risk somewhat and reduce delay associated with movements to, from, and across existing Highway 7. However, this must be balanced against increased financial and environmental cost.**

PART IV

LEVEL OF SERVICE DEFINITIONS

Level of Service

Level of Service A describes free flow operations. Free-flow speeds prevail. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. The effects of incidents or point breakdowns are easily absorbed at this level.

Level of Service B represents reasonably free flow, and free flow speeds are maintained. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and point breakdowns are still easily absorbed.

Level of Service C provides for flow with speeds at or near the free flow speeds of the freeway. Freedom to maneuver with the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver. Minor incidents may still be absorbed, but the local deterioration in service will be substantial. Queues may be expected to form behind any significant blockage.

Level of Service D is the level at which speeds begin to decline slightly with increasing flows and density begins to increase somewhat more quickly. Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort levels. Even minor incidents can be expected to create queuing, because the traffic stream has little space to absorb disruptions.

Level of Service E describes operation at capacity. Operations at this level are volatile, because there are virtually no usable gaps in the traffic stream. Vehicles are closely spaced, leaving little room to maneuver with the traffic stream. Any disruption of the traffic stream, such as vehicle entering from a ramp or a vehicle changing lanes, can establish a disruption wave that propagates throughout the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate even the most minor disruption, and any incident can be expected to produce a serious breakdown with extensive queuing. Maneuverability with the traffic stream is extremely limited, and the level of physical and psychological comfort afforded the driver is poor.

Level of Service F describes breakdowns in vehicular flow. Such conditions generally exist within queues forming behind breakdown points. Breakdown points occur for a number of reasons:

- Traffic incidents can cause a temporary reduction in capacity of a short segment, so that the number of vehicles arriving at the point is greater than the number of vehicles that can move through it.
- Points of recurring congestion, such as merge or weaving segments.

Level of Service F is also used to describe conditions at the point of a breakdown or bottleneck and the queue discharge flow that occurs at speeds lower than the lowest speeds for Level of Service E. Whenever Level of Service F conditions exist, they have the potential to extend upstream for significant distances.

Source: Highway Capacity Manual, Transportation Research Board National Research Council, 2000