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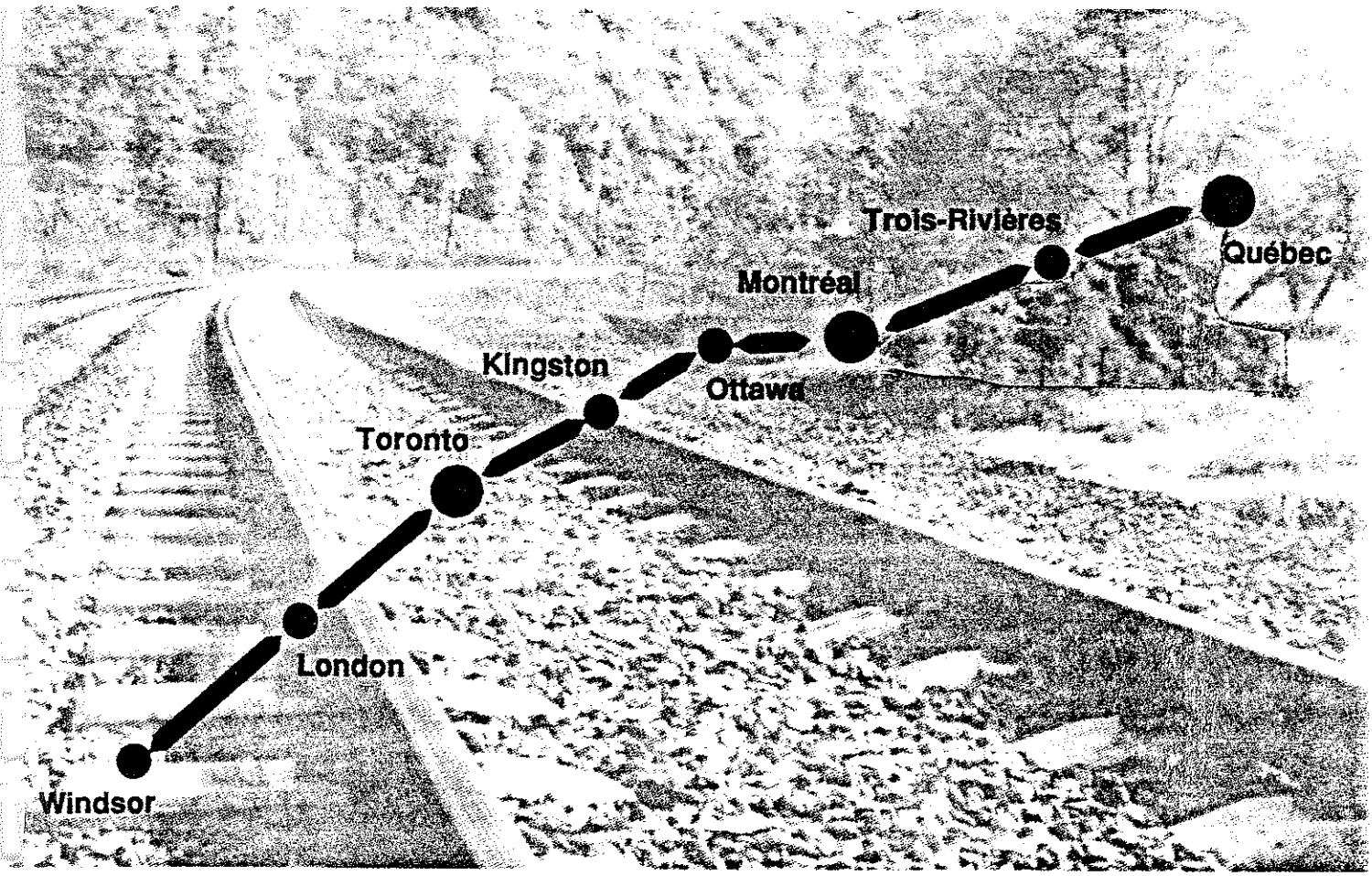
Quebec-Ontario High Speed Rail Project

Preliminary Routing Assessment and Costing Study

Interim Report No. 2
Detailed Routing Analysis

September, 1993



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QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT NO. 2
DETAILED ROUTING ANALYSIS

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INTRODUCTION

This interim report, the second submitted during the study, documents the findings of the Detailed Routing Analysis phase of the Routing Assessment and Costing Study. The purpose of this phase, which commenced in November 1992, was to analyze in more detail, the representative routes selected from the evaluation of route options in Phase 1 of the Study. Interim Report No. 1 documented the evaluation process and described the routes selected as representative for each of the three technology/right-of-way (ROW) combinations under consideration i.e.

- *200-250 kph tilting technology using mostly existing ROW*
- *over 300 kph non-tilting technology using mostly existing ROW*
- *over 300 kph non-tilting technology in a new ROW*

This report is structured firstly to provide a record of the assumptions adopted, design standards used and various sources of data obtained for the Québec-Windsor corridor. The second objective is a concise description of the infrastructure required and documentation of the environmental impact for each alignment developed.

An appendix to the report, bound separately, contains the alignment geometry, shown in schematic form as well as a tabular record of the infrastructure quantities developed for each route.

1. ASSUMPTIONS GOVERNING INFRASTRUCTURE CHARACTERISTICS

1.1 RIGHT-OF-WAY (ROW)

The detailed analysis of the two scenarios aimed at maximizing the use of existing ROW requires certain assumptions to be made concerning the sharing of the existing ROW or plant contained therein, by HSR and other passenger or freight services. This need also arises where the route of the new ROW scenario accesses urban areas. This section documents the assumptions adopted for this study, following extensive discussion involving the Technical Committee, the Technology Review consultant and representatives of the Transport Canada Rail Safety Group and the FRA in Washington D.C.

1.1.1 ROW Sharing in Urban Areas

- HSR vehicle technologies will comply with all Transport Canada and any other safety-related regulatory requirements for HSR operation. The Technologies will be permitted to operate in shared ROW in urban areas at speeds up to 250 kph. The speed of HSR operation will be affected by alignment geometry, track spacing, safety requirements, noise impacts and the presence or otherwise of at-grade crossings.

- As assumed in previous HSR studies, the ROW can be shared by existing commuter rail and freight service operating at lower speeds.

- It is considered desirable to schedule HSR and freight trains at different times if freight services are operated over any adjacent commuter rail tracks.

- When HSR operating speeds are low (under 200 kph), dedicated high speed tracks can be placed at the standard minimum of 4.27 metres from commuter rail tracks. This spacing would be greater if electrification catenary supports are located between HSR and commuter tracks, (e.g. 7-8 metres). This assumption also implies that maintenance access to conventional tracks is possible from the opposite side of the ROW to that occupied by HSR tracks.

- When HSR dedicated tracks are separated from conventional tracks by an 8-10 metre centre-to-centre distance, assuming ROW width to achieve such separation can be obtained without excessive cost, operating speed in this situation can be up to 250 kph assuming no other operating or environmental constraints exist.

1.1.2 ROW Sharing in Rural Areas

While it is recognized that some sharing of ROW in rural areas will be necessary, it is assumed that consolidation of CN and CP freight operations, or acquisition of ROW, would be achieved in the following subdivisions, resulting in their existing ROW becoming available for exclusive HSR use:

- CP Windsor (CN Caso as freight alternative)
- CP Belleville (CN Kingston as freight alternative)
- CN Smiths Falls (acquisition of ROW)
- CP Trois Rivières (acquisition of ROW)
- CP Brockville (acquisition of ROW)

Consolidation of the freight operations will require resolution of several operational and business issues which were raised in discussions with the railways during the study. These include:

- the need to construct link trackage, at the limits of subdivisions acquired for HSR, so that the railway moved to an adjacent ROW maintains route continuity and access to customers in urban areas at the ends of acquired rights-of-way.

- the potential requirement for additional rail infrastructure on subdivisions designated for co-location to accommodate the increased traffic resulting from consolidation.

- the business consequences of both railways participating in consolidation having access to customers formally served exclusively by one of the railways.

- the negotiation of compensation to the freight operator for loss of business opportunities resulting from sale of ROW for dedicated HSR use.

- the need to comply with environmental legislation requiring audits to determine whether contaminated soil is present in rights-of-way slated for sale to an HSR operator.

Where this consolidation or acquisition is not realistic, the following is assumed for both 200-250 kph and over 300 kph technology families:

- The ROW can be shared by freight or conventional passenger trains and HSR service if freight consolidation, freeing a ROW for exclusive HSR service, is impractical.

- In shared ROW, HSR tracks for high speed service will be placed a minimum of 8-10 metres centre-to-centre to the nearest conventional track, thus permitting operation at speeds up to 250 kph. HSR service operating at speeds up to 200 kph, could operate on tracks closer to conventional track in constrained areas.

- Intrusion-detection systems (active) will be provided in the 8-10 metre separation. It is assumed that the infrastructure for these systems can also be located to accommodate the maintenance access requirements of the adjacent conventional railway authority.

- Where necessary, existing conventional tracks will be relocated to the side of the ROW to maximize the space for HSR tracks and minimize or avoid acquisition of land to widen ROW. This will only apply to locations where widening cannot be achieved, as it is expected that, in most cases, rural land acquisition will be more cost-effective than relocation of existing operating tracks.

1.1.3 Land Acquisition for New ROW

- Generally, a width of 50 metres would be acquired for new HSR ROW. In areas with severe constraints, a 30 metre width will be assumed.

- Wider ROW would be acquired in areas of rugged terrain to accommodate large fills or cuts as necessary.

- An allowance for grade separations, stations, sub-stations and other ancillary facilities will be included in land acquisition quantities.

Actual ROW acquired for recent HSR network extensions in Europe has averaged between 45 and 50 metres, hence for a feasibility study of this nature the average ROW width assumptions are considered reasonable to accommodate all infrastructure required and environmental mitigation such as drainage control and noise barriers.

1.2 TRACK STRUCTURE

1.2.1 Track Sharing

The following approach is assumed for both Urban and Rural Areas of the routes and is considered advisable given the position of Transport Canada's Rail Safety Group and the FRA.

- Tracks for HSR service operating at speeds up to 200 kph, can be shared by commuter or other passenger rail, given that the HSR train technology will be designed to comply with all safety and crashworthiness regulations. However, sharing of these tracks by freight trains is considered inadvisable, in view of the potential for service interruption due to accident events and the increased maintenance and operating considerations.

  This approach eliminates potential track damage from North American freight traffic (high axle loads and unsprung mass, more frequent wheel defects, less sophisticated suspension causing higher track forces). Possible exceptions are the Mont Royal Tunnel and certain major bridges where considerable capital cost savings may be possible if capacity is available through existing structures.

- When operating speed is above 200 kph, HSR service will operate on dedicated HSR tracks.

1.2.2 Track Capacity

The assumption that HSR service will share tracks with other passenger or freight services implies that the following requirements can be met:

- complete compatibility of the electrification system and infrastructure with existing ROW plant and signalling systems;
- adequate track capacity over a twenty-four hour period to accommodate the desirable schedules of all operators, potentially HSR, commuter, low-speed passenger and freight;
- sufficient time for maintenance of the shared tracks to HSR standards;
- integrated train dispatching.

For the purpose of this study, it has been assumed that this would be achieved.

1.3 AT-GRADE CROSSINGS

In defining the infrastructure requirements to accommodate existing at-grade crossings, the following assumptions were made:

- Crossing of HSR track at-grade will not be acceptable on any ROW (new or existing), in areas where HSR operating speed exceeds 200 kph.

  Since, by definition the tilting train technology will operate at a maximum speed of 200 kph, only Provincial Highways or highways carrying high traffic volumes will be grade separated. If the number and consequent cost of grade separation of crossings in urban areas becomes prohibitive, this assumption could be reassessed for lower speed zones.

- Any at-grade crossings on routes where either technology is operated at speeds between 160 and 200 kph will be provided with improved protection and collision avoidance systems.

1.4 SAFETY MEASURES

As stated in the Final Report of the Technology Review carried out by the Technology Consultant, it has been established that for a Canadian application, each of the representative technologies would be modified to achieve compliance with existing FRA regulatory standards and AAR industry practices. This removes technology compatibility as a major factor in establishing right-of-way requirements and safety measures for shared track or shared ROW operation in the lower speed ranges defined earlier in Section 1.

Resulting from investigations of HSR operations elsewhere in the world as part of the Technology Review, the following safety measures have been assumed as necessary for the three technology/ROW scenarios analyzed:

1.4.1 Security Fencing

Security fencing will be provided along the entire ROW to discourage both human and animal intrusion. For areas where the ROW is shared with conventional rail service on tracks less than 8m from HSR tracks, the fencing is assumed to enclose both conventional and HSR tracks. If freight trains share the ROW, hot box, hot wheel and dragging equipment detectors will be placed no more than 25km apart.

1.4.2 Intrusion Detection

Active intrusion detection devices linked to the train control system will be incorporated in the security fencing design. The application of these devices in relation to proposed operating speed is discussed further in the report of the Technology Review.

All grade separations passing over the HSR ROW will have intrusion detection measures along the sides of the structure and approaches to detect vehicles that have penetrated bridge parapets or guardrails. The devices will also be linked to the train control system such that an intrusion will place signals to danger.

It is also assumed that detection systems will be incorporated to ensure the integrity of the ROW against potential occurrences such as:

- earthquakes
- rock slides
- snow slides/drifting
- flooding adjacent to the ROW resulting from beaver dams or other causes.

Precedents for these types of detection do exist on HSR operations elsewhere in the world.

1.4.3 At-Grade Crossing Protection

The following improved protection is assumed for at-grade crossings, deemed to be acceptable on a site-specific basis in zones where operating speed is between 160 kph and 200 kph:

- crossing-occupancy detection circuits linked to the train control system.
- full-width barriers fitted with vehicle intrusion detection.

- improved signage and adequate sight lines.
- avoidance of hazardous road conditions approaching the crossing.

1.5 RELATIONSHIP BETWEEN ROW INFRASTRUCTURE CHARACTERISTICS AND OPERATING SPEED

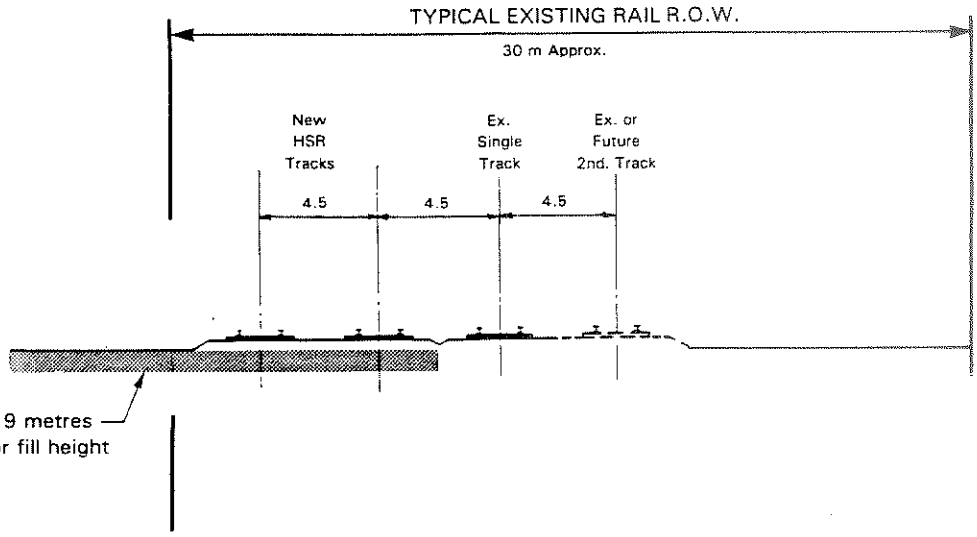
The assumptions outlined in this section have been adopted for all three Technology/ROW scenarios since their basis is not related to technology, but primarily the need to ensure HSR operation in a fail safe manner, no derailments or collisions and no fatalities or injuries to passengers, general public or operating personnel.

This approach leads to the establishment of specific operating speed ranges appropriate for each set of ROW Infrastructure Characteristics utilized along the representative routes. The resulting relationship is tabulated below.

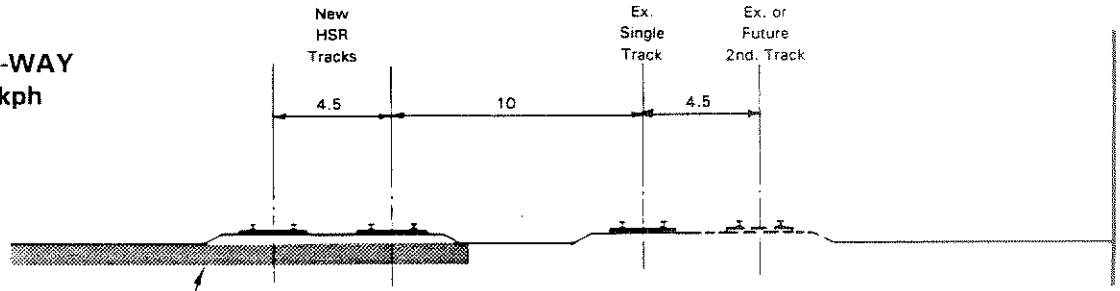
ROW INFRASTRUCTURE CHARACTERISTICS	PERMISSIBLE OPERATING SPEED (kph)
HSR service sharing well-maintained, existing track with conventional commuter or freight service without restrictions or special conditions.	0-160
HSR service sharing track with conventional commuter or freight service or on dedicated tracks 4.5 metres from conventional tracks. Service operated under special conditions relating to track construction, maintenance and inspection, signalling and train control, training and operating procedures	0-200
HSR service in a shared ROW but on dedicated tracks, separated from conventional tracks by 10m. Active intrusion detection linked to train control provided between HSR and other tracks.	0-250
HSR service in a parallel ROW on dedicated tracks separated from conventional tracks by a minimum of 30 metres (or a physical intrusion barrier), Active intrusion detection linked to train control provided between HSR and other tracks.	Over 250

Exhibit 1.1 illustrates the relationship of HSR ROW to existing ROW for each speed range.

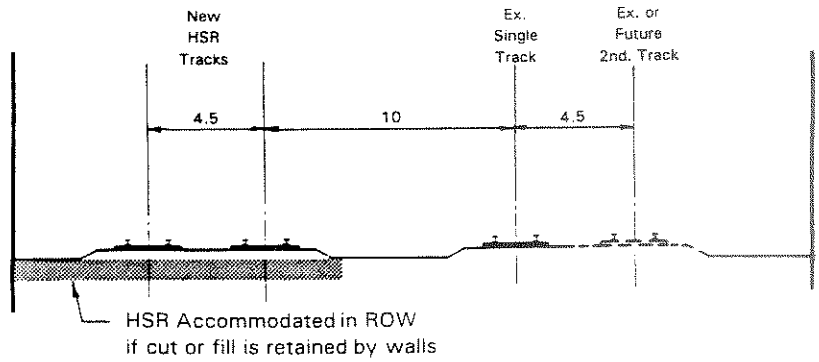
SHARED RIGHT-OF-WAY
HSR SPEED 0-200 kph

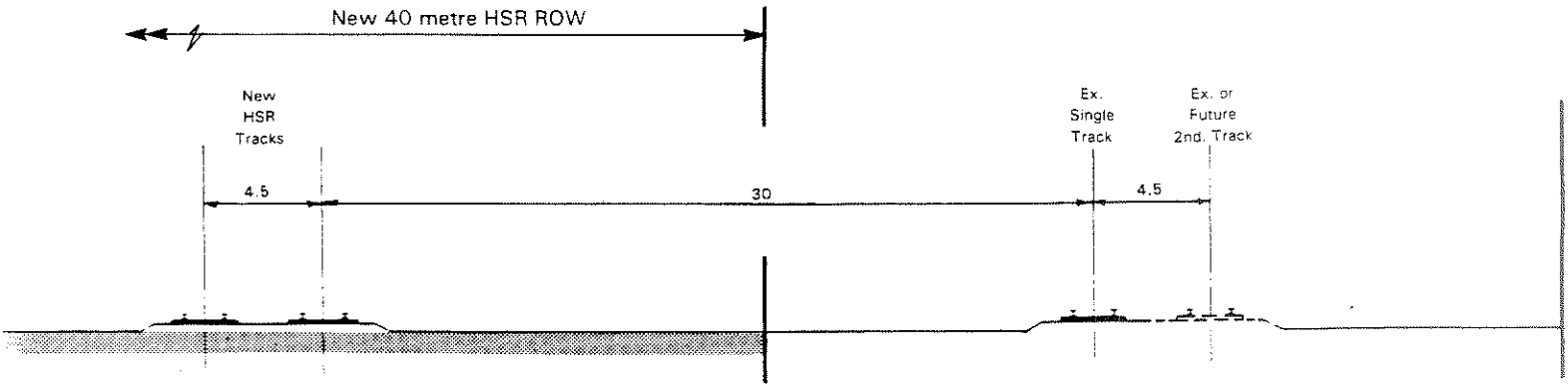


SHARED RIGHT-OF-WAY
HSR SPEED 0-250 kph



SHARED RIGHT-OF-WAY
HSR SPEED 0-250 kph
EXISTING TRACK(S) RELOCATED





SHARED CORRIDOR
HSR SPEED 0-350 kph

RIGHT-OF-WAY AND CORRIDOR SHARING ASSUMPTIONS

Exhibit 1.1

2 DESIGN STANDARDS

2.1 ALIGNMENT

A set of geometric design standards for horizontal and vertical alignment was provided by the Technology Review Consultant for the Project. These standards, based on the performance characteristics of each of the two candidate technologies consisted of the following:

- tabulations of the relationship of horizontal curve radius to speed through the curve for varying amounts of track superelevation and degree of lateral acceleration;
- recommended maximum amount of track superelevation in horizontal curves and desirable degree of carbody tilt in the case of the tilting technology;
- maximum acceptable gradients; and
- recommended radius of vertical curvature between gradients for each speed range and degree of vertical acceleration.

In addition, guidelines and recommendations for development of alignment for the French TGV system were provided by Canarail, a member of the study team.

The alignments for each of the representative routes were developed assuming maximum operating speeds of:

- 250 kph for the tilting technology and;
- 350 kph for the non-tilting technology.

This approach was taken to ensure that the infrastructure costed would be capable of accommodating future generations of the technology families.

A summary of the alignment design criteria adopted is presented in the following table.

Technology Alignment Design Criteria	Technology	
	Over 300 kph (non-tilting)	**200-250 kph (tilting)**
Desirable Horizontal Curve Radius	6000m or greater	2000m or greater
Minimum Horizontal Curve Radius (only in exceptional situations - using highest speed possible)	from speed/curve radius relationships with 180mm superelevation and 0.08g uncompensated lateral acceleration.	from speed/curve radius relationships with 150mm superelevation and 0.08g uncompensated lateral acceleration and up to 100mm tilt.
Profile Grade - Maximum - Desirable	3.5% (for current technologies, potentially 5.0%) 0 to 2%	3.5% (for current technologies, potentially 5.0%) 0 to 2%
Vertical Curve Radius	23,000 - 33,000m with 0.03g vertical acceleration.	10,000 - 17,000m with 0.03g vertical acceleration.

The influence of alignment on travel time was also considered in the detailed route analysis, including recognition of the acceleration and braking characteristics of each of the technologies. The influence of these characteristics, provided by the Technology Review Consultant in the form of speed and time versus distance curves, on the alignment selection stems mainly from consideration of the relationship between the technically achievable speed at any point within the acceleration or braking distances and the geometry within these distances.

A snapshot of the performance characteristics of the technology families is provided in the tables below:

a) **Acceleration:**

Technology	Distance to reach				Time to reach			
	160kph	200kph	250kph	300kph	160kph	200kph	250 km	300 kph
Tilting 200-250 kph	2.5 km	5 km	14 km	N/A	100 secs	150 secs	300 sec	N/A
Non-Tilting, Over 300 kph	2.7	5.2 km	9 km	16 km	125 secs	160 secs	225 sec	330 secs

b) **Braking**

Technology	Distance to stop from				Time to stop from			
	160 kph	200 kph	250kph	300kph	160kph	200kph	250kph	300kph
Tilting 200-250 kph	2.6 km	3.8 km	5.8 km	N/A	120 secs	145 secs	180 secs	N/A
Non-Tilting, Over 300 kph	2.6 km	4 km	6.2 km	km	130 secs	155 secs	195 secs	230 secs

2.2 TYPICAL CROSS-SECTIONS

Application of the assumptions for right-of-way utilization, described in Section 1.0, results in a range of situations for both urban and rural portions of the representative routes. These are illustrated by the typical cross-sections shown in Exhibits 2.2.1 to 2.2.5. Their application is described below:

a) New HSR ROW in Rural Areas (remote from existing rail or highway ROWs) - Section 1

This section represents the most straightforward situation where HSR service is operated at speeds in the 200 - 350 kph range without any influence from adjacent rail or highway ROWs or facilities.

This section would also apply when an existing CN or CP subdivision has been acquired for exclusive use by HSR service. Noise attenuation and snow control measures are not shown but would be costed on an as required basis for sensitive areas.

Although a representative nominal ROW width of 50 metres has been assumed, in practice the ROW acquired could be 40 metres for flat areas (top-of-rail within +/- 2.5 metres of existing ground) and 50 metres for rolling areas with up to 5 metres of cut or fill. Wider ROW will be necessary in rugged areas with cuts or fills over 5 metres, although in rocky terrain side slopes could probably be steeper than 1.5:1.

b) **HSR ROW paralleling existing ROW in existing rail or highway corridor in Rural Areas - Sections 2 to 4**

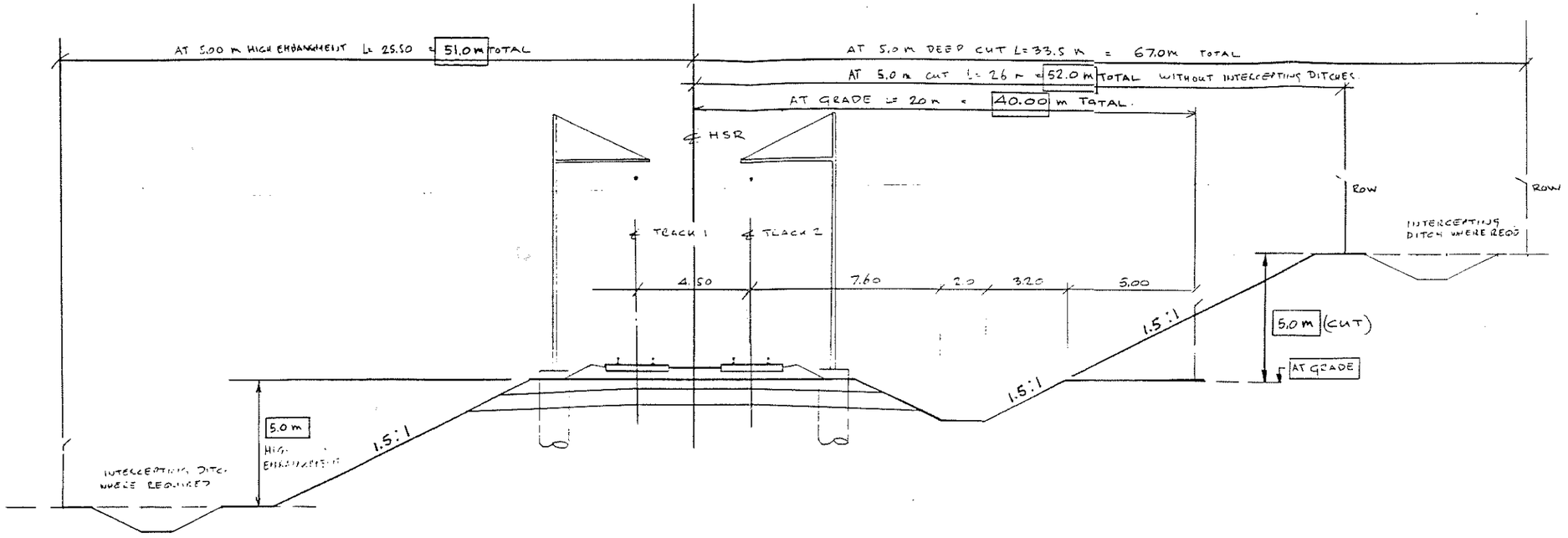
HSR service in this situation would operate at speeds in the 300 kph range. Existing conventional freight or passenger rail services would also operate without temporal separation in this rural configuration.

The merits of sharing part of the existing ROW, by placing HSR tracks closer, were assessed and found to be of marginal benefit in that the maximum reduction of new ROW required would be in the order of only 7-8 metres. The operational issues, and institutional complications associated with ROW sharing are likely to offset any benefits from this reduction.

The only way greater use of the existing ROW could be achieved is by relocation of existing conventional tracks to one side of the ROW. This could be achieved in specific locations in urban areas, however extensive relocation of rural subdivisions, with high freight traffic volumes, is not considered practical.

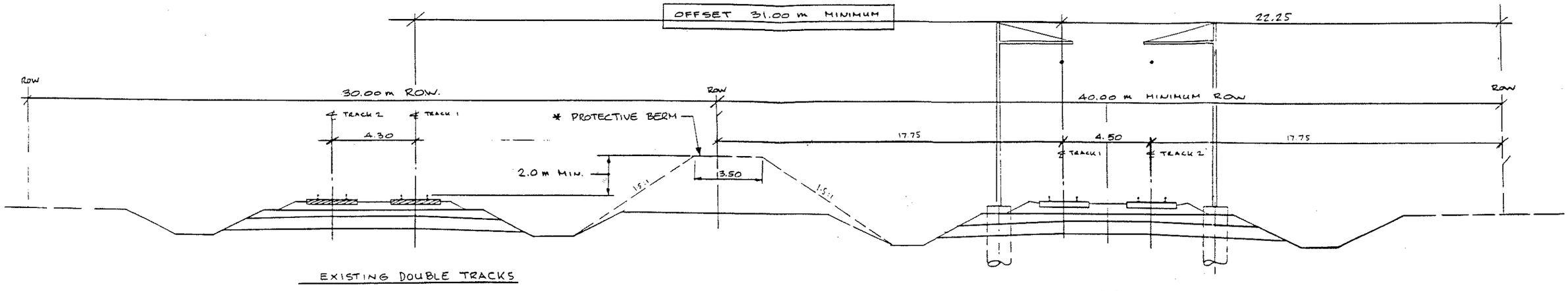
Placing a nominal 40 metre wide new ROW alongside a typical existing 30 metre rail ROW will likely result in a track centre-to-centre separation of 26-31 metres depending on the location of existing tracks. This offers an opportunity for several forms of passive or active intrusion protection ranging from berms (sloping or vertical) to fences with frangible wires.

Sections 3 and 4 show the implications of this shared corridor situation at existing or new grade separations. The former highlights the need to grade separate both HSR and conventional rail (or highway) while the latter shows that, at existing grade separations, some regrading of approach embankments would also be required unless the HSR grade can be depressed to the appropriate profile to achieve clearances.



SECTION 1

New HSR ROW in Rural Areas (remote from existing rail or highway ROWs.)



EXISTING DOUBLE TRACKS

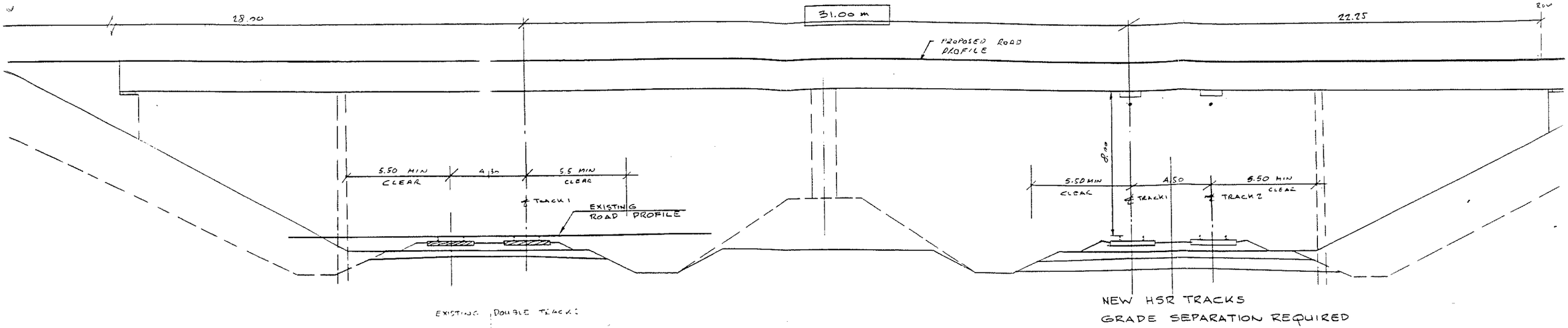
NEW HSR DOUBLE TRACKS

* PROTECTIVE BERM MAY NOT BE PLACED ON ROW OF ADJACENT USER

SECTION 2

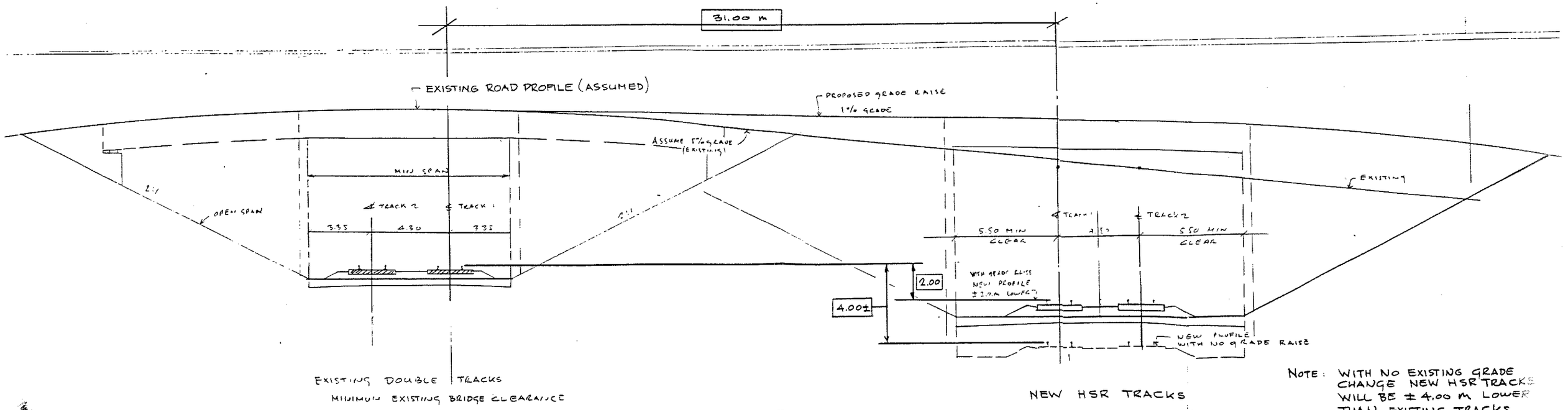
HSR ROW in existing rail or highway corridor paralleling existing ROW in Rural Areas

EXHIBIT 2.2.2



SECTION 3

HSR ROW in existing rail or highway corridor paralleling existing ROW in Rural Areas

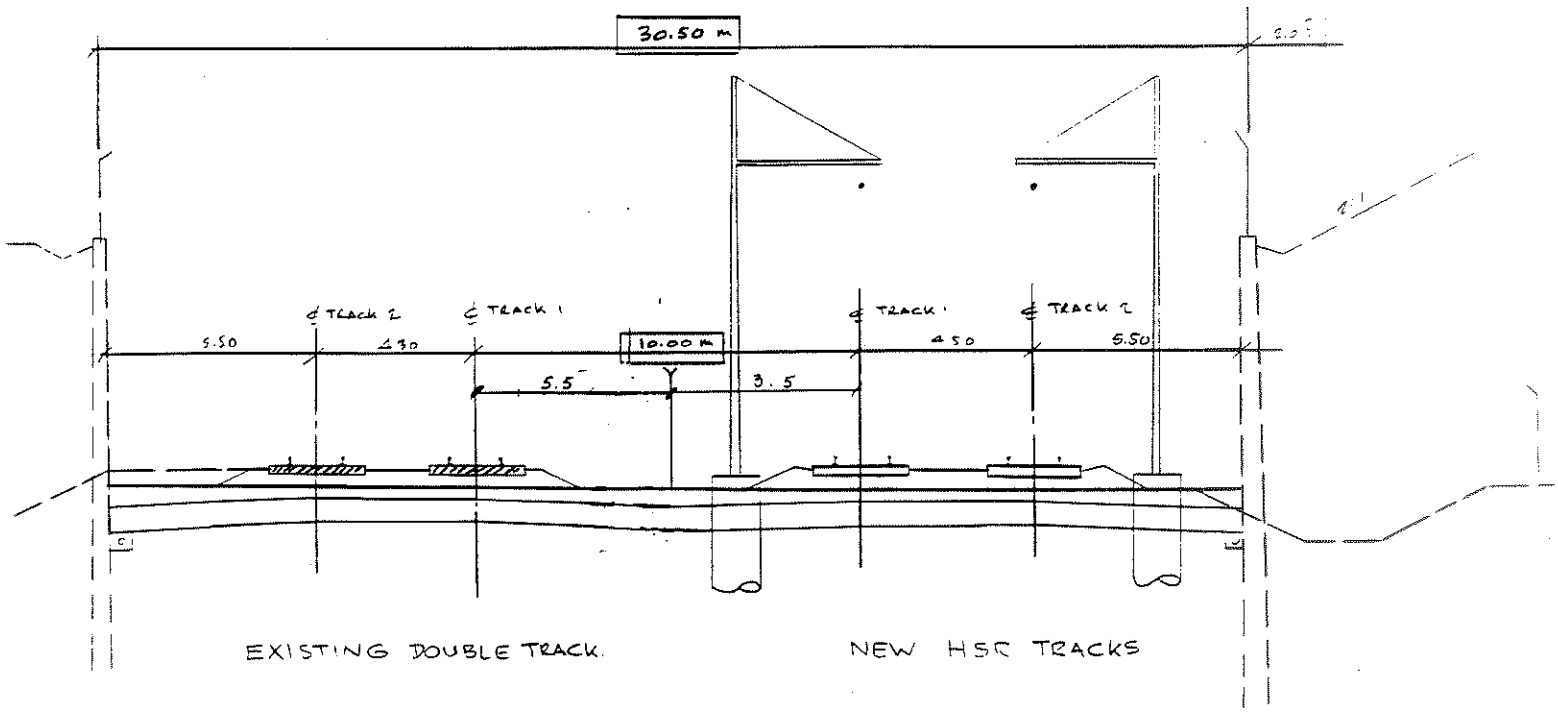


NOTE: WITH NO EXISTING GRADE CHANGE NEW HSR TRACKS WILL BE ± 4.00 m LOWER THAN EXISTING TRACKS

SECTION 4

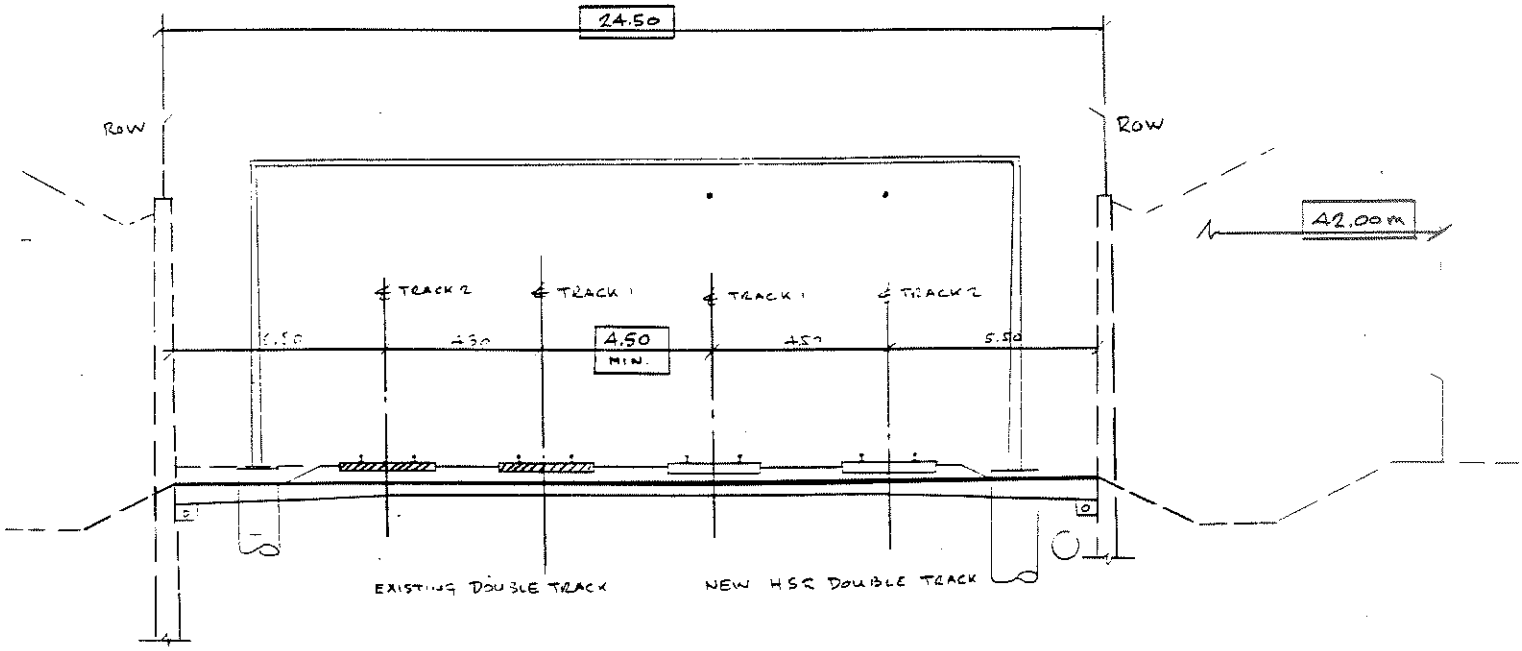
HSR ROW in existing rail or highway corridor paralleling existing ROW in Rural Areas

EXHIBIT 2.2.3



SECTION 5

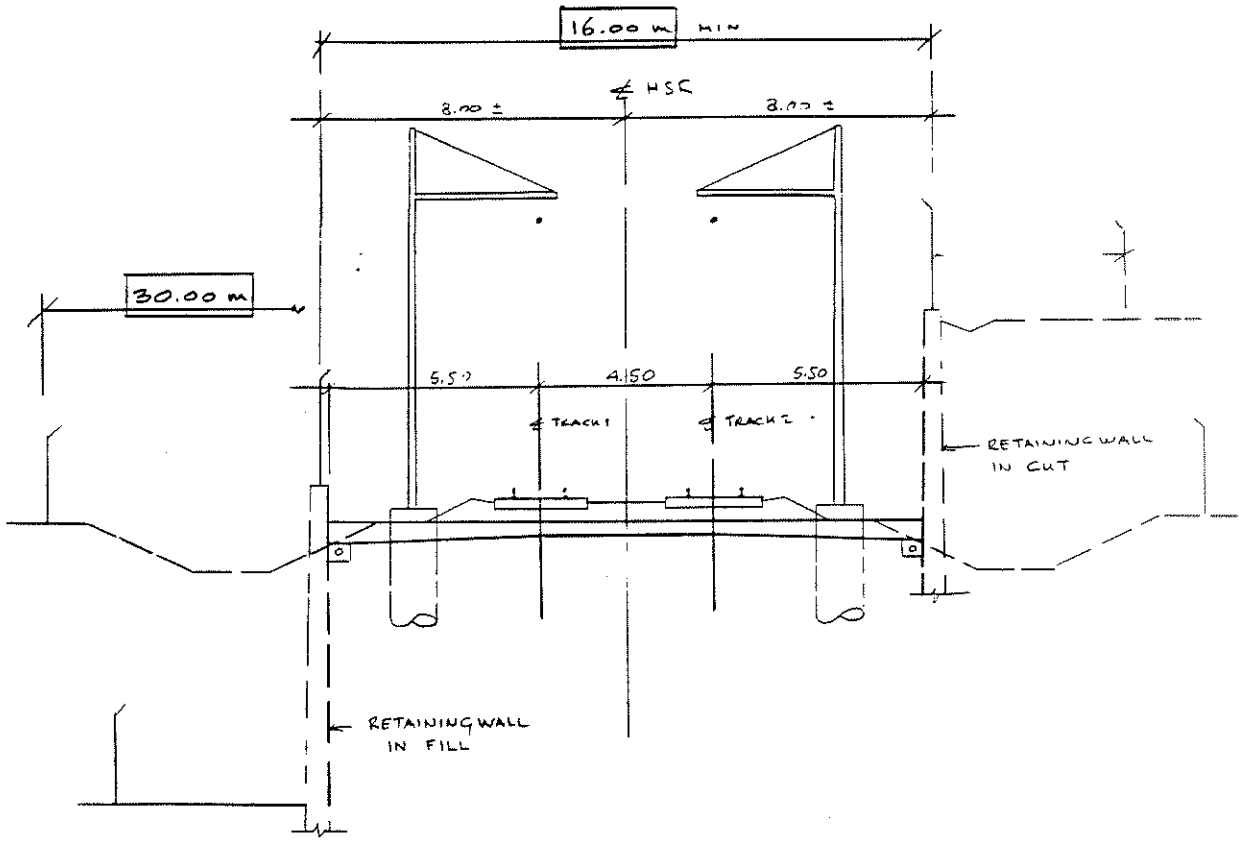
HSR service sharing existing rail ROW in Urban Areas with adjacent development constraining ROW widening



SECTION 6

HSR service sharing existing rail ROW in severely constrained Urban Areas (Low-speed HSR Operation)

EXHIBIT 2.2.4



SECTION 7

New HSR ROW in Urban Areas (remote from existing rail or highway ROWs)

EXHIBIT 2.2.5

c) HSR service sharing existing rail ROW in Urban Areas with adjacent development constraining ROW widening - Section 5

This section shows the consequences of accommodating new HSR tracks and two conventional tracks within a typical 30 metre (100 ft.) ROW in an urban area.

As stated in the assumptions in Section 1.0, it is assumed that commuter rail service would operate simultaneously adjacent to HSR but that freight trains on the existing tracks would be separated temporally. Accommodating four tracks as shown with the suggested 10 metre minimum separation between systems, will almost certainly require relocation of the existing mainlines to the side of the ROW. Significant reinstatement of rail access to existing industrial customers will also be necessary in some areas. A wider ROW would be required if existing service tracks additional to the two mainline tracks are needed by the conventional rail operator.

Assuming that it is desirable for HSR to operate at higher than conventional speeds in these areas, it will be necessary to adopt some form of active intrusion protection system. This can be placed within the 10 metre separation and would take the form of a fence-mounted detection system located approximately 5.5 metres from the nearest conventional track. This would likely be acceptable to the railways.

With appropriate intrusion protection, it is assumed that HSR service could operate up to 250 kph in these areas if regulations permit.

The section also illustrates the use of retaining walls if space is not available for cut or fill slopes.

d) HSR service sharing existing rail ROW in severely constrained Urban Areas - Section 6.

The overriding assumption in this situation is lower-speed operation of HSR trains (i.e. up to 200 kph) alongside commuter rail or conventional passenger service. Freight trains would be separated temporally. In other words, HSR operates as one of several users of a multi-track ROW, preferably with exclusive use of two of the tracks. A further requirement is compatibility of signalling and electrification systems. Again, retaining walls could be provided as required by track grading and adjacent land use.

e) **New HSR ROW in Urban Areas (remote from existing rail or highway ROWs) - Section 7.**

This section illustrates the width requirements for a new exclusive HSR right-of-way through an urban area. It is assumed that no existing or proposed road or rail ROWs are in the vicinity, hence width available is dependent on the adjacent land use. Width required will also depend on the HSR profile relative to existing ground. In the extreme, a 16 metre minimum width may be feasible in severely constrained areas. Generally, a 30 metre ROW would be desirable to minimize retaining structures and lower the cost of drainage systems. If noise attenuation is provided and operating regulations permit, there is no reason why HSR speeds could not exceed present conventional rail speeds, i.e. over 160 kph, on fully grade-separated dedicated ROW.

2.3 STATIONS

The investigation of station locations and facilities along the representative routes was based on meeting the following planning criteria:

a) the need to provide access to HSR service in areas with potential to generate significant ridership as determined by the demand forecasting analysis.

b) the need to identify a downtown site in the major urban centres of Montréal, Toronto and Ottawa/Hull. Implicit in this criterion was an assessment of the suitability of the existing main rail passenger terminals in each centre for high speed rail.

c) the requirement for an intermodal station providing access to the major airports in the corridor i.e. Mirabel, Dorval and Pearson.

d) the requirement to assess opportunities to develop stations with convenient intermodal connections to local urban transit systems in the major urban areas.

e) the need to locate stations for intermediate centres either at suitable downtown sites in the case of routes passing through the urban area or at convenient regional or suburban sites along routes bypassing the urban area.

f) the provision of approximately 400 metres of straight alignment at a grade not exceeding 0.5% to accommodate station platforms for two 8 car non-tilting trains with a power car at each end, and 300 metres for one ten car tilting train with two power cars.

2.4 TRACK STRUCTURE

2.4.1 Track on Grade

The investigation of current HSR track structures in use in Europe, carried out by the Technology Review Consultant has revealed that, for new construction there are virtually no differences in the basic track structure for the two technology families. (i.e. 200-250 kph and over 300 kph).

In developing the infrastructure requirements for each technology ROW scenario, a typical arrangement of track structure elements has been used based on information and drawings provided by both Swedish and French HSR authorities. Exhibit 2.4.1 illustrates the track structure arrangement adopted and includes the recommended specifications for each element as proposed by the Technology Review study.

2.4.2 Track on Bridges or Viaducts

In order to avoid the problems associated with transitions from ballasted track to "direct-fixation" type track on structures, it is the practice of HSR systems to require all bridges to be capable of supporting a ballasted track structure.

Consequently, all new HSR-carrying bridges are assumed to have concrete decks proportioned to accept the required ballast profile while any existing double-track bridges along the routes are assumed to require new concrete decks.

2.5 TUNNELS

In accordance with the standards provided by the Technology Review study, the following double-track tunnel cross-sectional areas have been assumed for tunnels on the representatives routes:

i) 41 sq.m in zones where speed will not exceed 200 kph
ii) 71 sq.m in zones where speed is 200-270 kph
iii) 90 sq.m in zones where speed is 270-300 kph
iv) 150 sq.m in zones where speed is 300-350 kph

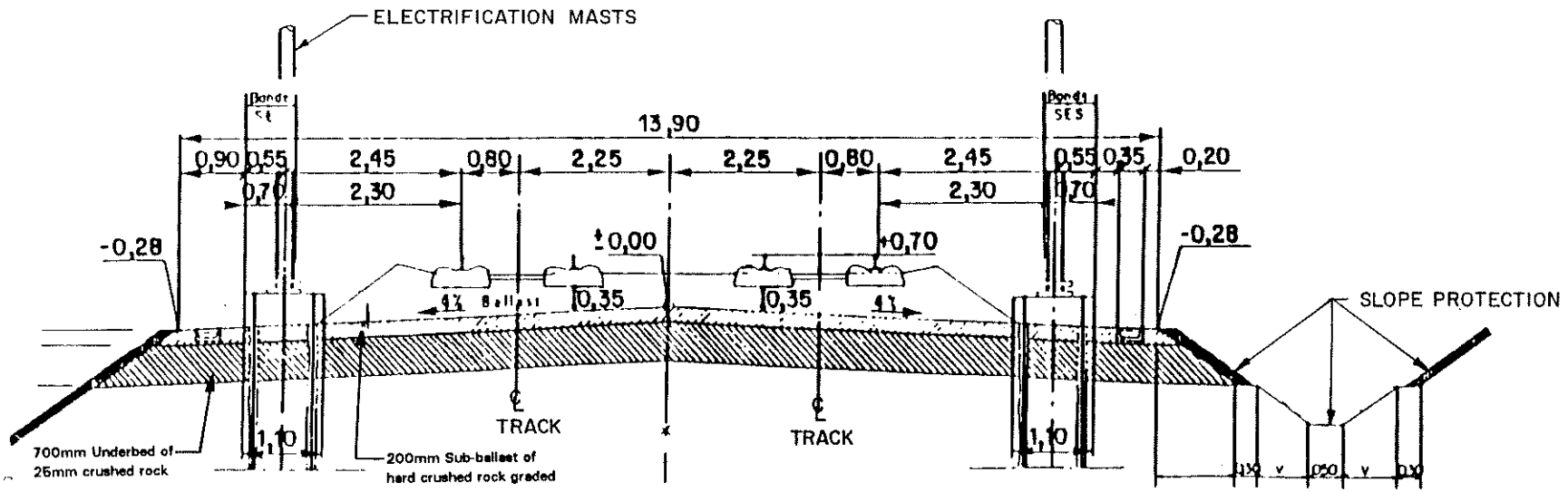
The tunnel cross-sectional area is increased to accommodate the aerodynamic effects of higher speed operation.

Exhibit 2.4.2 illustrates typical cross-sections for single and double track tunnels.

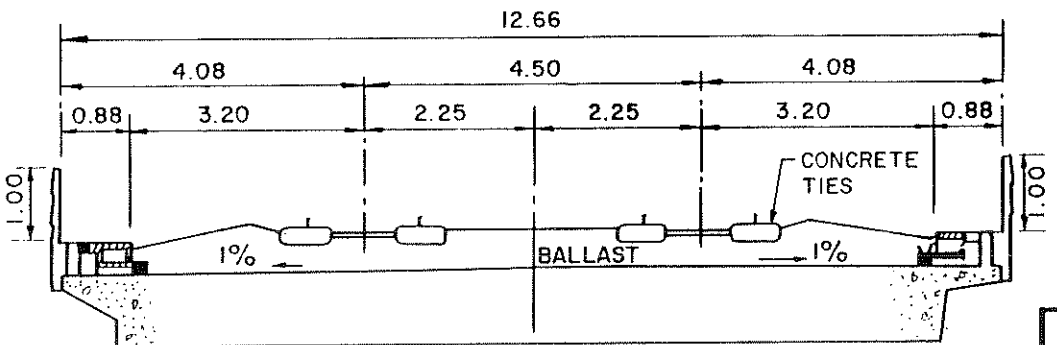
2.6 NOISE CRITERIA

LGL & Associates, the specialist noise consultant, for the study, identified four relevant noise standards or guidelines, as summarized in the accompanying table. Note that many pre-existing activities, including conventional railroad operations, may be non-compliant.

APPLICABLE NOISE STANDARDS AND GUIDELINES		
Authority	**Source**	**Noise Limits**
Montréal Bylaw 4996	As at left	L_{Aeq} 1h of 80 dBA between 0700 and 2300:50 dBA between 2301 and 0659[a]
Province of Ontario	Model Municipal Noise Control Bylaw - Final Report (publication NPC-131)	L_{Aeq} 1bh of 55 dBA between 0700 and 2300; Aeq of 50 dBA between 2301 and 0659[b]
Province of Québec	Ministry of Environment	L_{Aeq} 24h of 55 dBA for new mobile sources



Typical Cross Section At-Grade



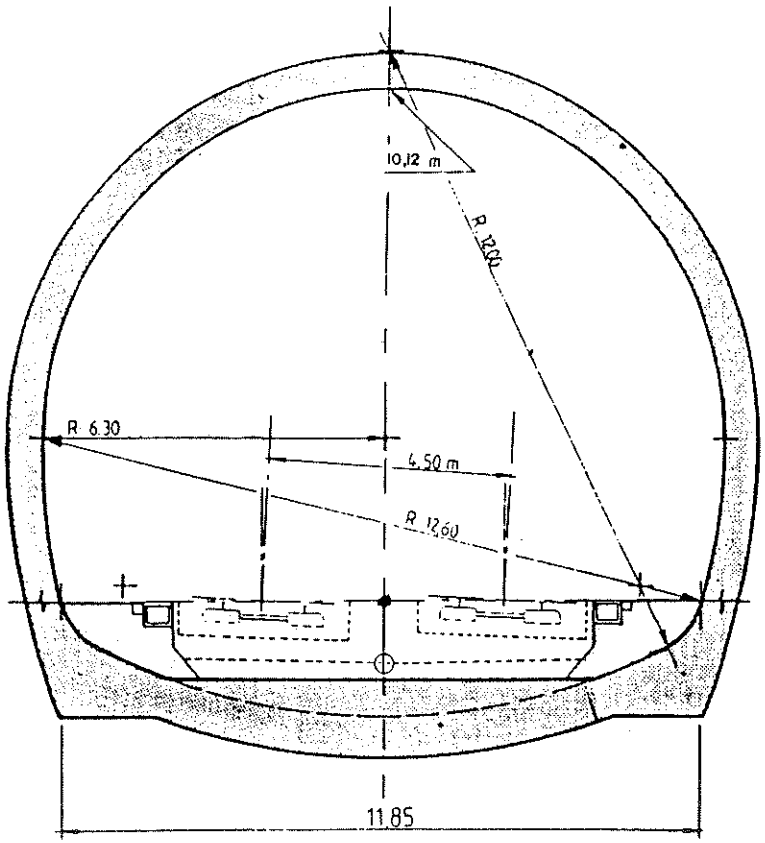
Typical Structure Cross Section

QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

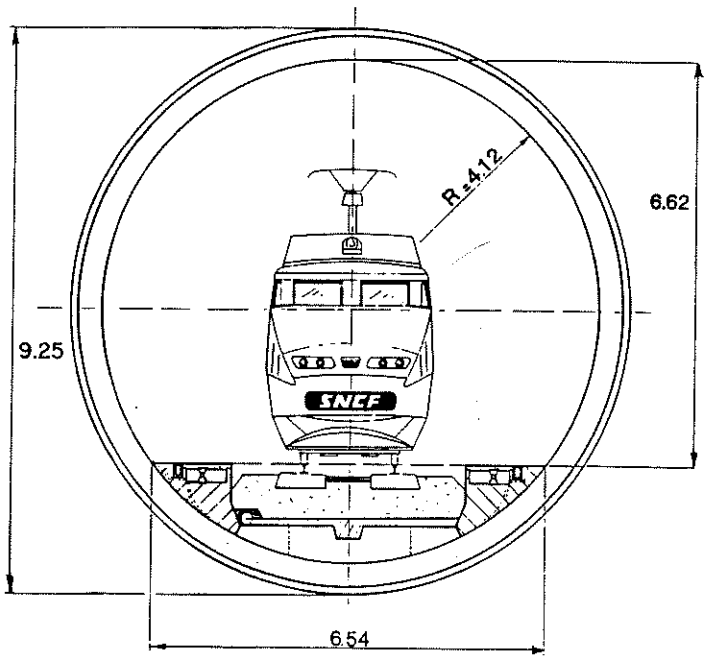
INTERIM REPORT NO. 2

TYPICAL HSR CROSS SECTIONS

EXHIBIT 2.4.1



Double Track
(For 300 kph Operating Speed)



Single Track
(For 270 kph Operating Speed)

QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT
AND COSTING STUDY

INTERIM REPORT NO. 2

TYPICAL TUNNEL CROSS SECTIONS

EXHIBIT 2.4.2

APPLICABLE NOISE STANDARDS AND GUIDELINES		
Authority	**Source**	**Noise Limits**
CMHC	Road and rail Noise: Effects on Housing	L_{Aeq} of 55 dBA for outdoor recreation areas
a) The values cited are for the maximum noise level of intensity of a normalized noise as defined in the Bylaw. The normalized noise is determined according in the level of background (ambient) noise, the duration of emission of the measured intermittent noise and the type of noise.		
b) The cited publication refers to the noise environment on the site of proposed residential or other sound-sensitive development in an urban area; the limits are for outdoor sound levels.		

Estimated HSR Noise Levels

Subsequently, LGL were able to calculate the L_{Aeq} 1h noise levels for the X-2000 and for the TGV, making use of data provided by the respective suppliers and drawn from the literature. The results of these analyses indicate that at top speed the noise (L_{Aeq} 1h) generated by the X-2000 generally will range from 59 dBA to 63 dBA at a 25m offset; and the noise generated by the TGV will generally range from 60 dBA to 65 dBA for the same respective offset distances respectively. Note that the top speed for X-2000 is 240 kph, while that for TGV is 300 kph. The results shown are for one passing train per hour and do not take directivity into account.

These results should be interpreted with caution for the following reasons:

- the maximum noise L_{Aeq} lh depends on the quality of the wheel and rail running surfaces (poor track geometry or defective wheels cause more noise), the type of track structure (ballasted track versus slab, concrete ties and elastic fasteners versus wood and cut spikes), and the train length and configuration (i.e., power car forward or at rear);

- the equivalent noise L_{Aeq} lh of a train pass-by is dependent on the L_{Amax} the train length, the distance from the track of the noise receptor, the train speed, and (for a time period other than 1h), the value of T in L_{Aeq} T

- the results are estimated for a free sound field and are valid for 25 to 75m distances over flat reflective ground; and

- for multiple trains per hour, L_{Aeq} 1h (x trains) = L_{Aeq} 1h (1 train) + 10 log x.

Noise Mitigation

While noise reduction at source is the most elegant mitigation technique, more pragmatic approaches are often needed. Noise barriers and/or berms located adjacent to the track are an effective technique that is widely used in Europe and elsewhere, in particularly circumstances, such as the alignment of the TGV-A into Paris-Montparnasse and a number of locations on new high speed lines in Germany. Placement in deep cuts or even cut-and-cover tunnels may be required.

Generally, a 2-m barrier or berm is sufficient to control noise generated by the wheel-rail interaction and other noise sources located below the top of the barrier. However, if aerodynamic noise is the principal concern, as it will be at full speed for the TGV, higher barriers will be required.

2.7 ROADBED SUPPORTING TRACK STRUCTURE

High Speed Rail service operated at speeds in excess of 200kph requires high quality, uniform, well-drained, roadbed earthworks constructed on a competent subgrade. Current practice in Europe also requires the placement of two layers of selected material over the general roadbed surface. The lower layer forms a 700mm deep underbed below the upper 200mm thick subballast layer.

From the standards provided by the Technology Review study and cross-section drawings and specifications obtained from Sofrerail and Swederail during this study, the quantities of the various elements of the roadbed were determined for the three route scenarios. The determination of these quantities was made using the following procedure:

- the type of existing roadbed was defined in three categories based on scrutiny of geological mapping of the routes.
- roadbed preparation standards for each category were adopted, involving varying degrees of replacement of the subgrade material depending on bearing strength.

- the calculation of cut and fill for general earthworks was made from alignment profiles.
- the volume of crushed rock material for the subballast layers was determined by applying the standard cross-section, shown in Exhibit 2.4.1, to the route-kms for each scenario.

This approach was readily applicable for the new ROW scenario and any sections of new or parallel ROW within the existing ROW scenarios.

The determination of construction requirements to achieve a roadbed of the required standard in sections where existing ROW is acquired or shared raises the issue of the degree to which the existing roadbed can be utilized or rehabilitated. This issue was discussed at meetings on shared ROW matters held with CP and CN representatives. During these discussions, it became apparent that while the quality of the existing roadbed and its year-round integrity is a factor in rehabilitation need assessment, a major consideration is the requirement to convert the largely single-track existing ROW cross-section into the high quality double-track roadbed specified for HSR operations.

For the case of HSR routes in ROW acquired from CN or CP for exclusive use, the conversion process would commence with the removal of the existing track structure including ballast since existing rail, ties and fasteners are not considered suitable for HSR service. Some re-use of good quality ballast may be possible but this would require selection, cleaning and stockpiling. This potential cost-saving has not been included in the approach for this study as it is considered to be minor. The existing roadbed subballast layer is known to be very variable in composition and quality and generally not more than 300mm thick. Again, this material would almost certainly have to be removed. Re-use of this material would require screening to remove unsuitable material and stockpiling so that it could become a source of general fill for the new wider roadbed earthworks.

Widening of the existing general earthworks to accommodate the double-track cross-section entails four primary phases:

- the inspection and testing to determine the condition of the existing subgrade followed by removal of failed or incompetent material below or adjacent to the existing earthworks.

- the removal and replacement of unsuitable material in the general roadbed embankment along with the rehabilitation and extension of existing drainage systems.

- the preparation of the edges of existing embankments to accept new fill alongside and the subsequent placement and compaction to achieve a uniform, competent widened roadbed.

- the placement and compaction of new subballast layers totalling 900mm in depth over the widened earthworks.

It can be seen from the above that, despite the presence of an existing single track roadbed, the roadbed in acquired ROWs requires significant reworking to achieve the necessary standards for HSR operations. Nevertheless, saving in overall material required is likely due to re-use of suitable existing fill and, in the case of existing cuts, a reduction in the amount of excavation as these would only require widening. Consequently, for existing rights-of-way acquired for exclusive HSR use, the excavation and fill quantities have been reduced from those for new ROW construction.

In the situations where dedicated HSR tracks are to be offset 10 metres from existing tracks in a shared ROW, the roadbed preparation and earthworks has been measured as new construction. It is felt that the small saving in quantities due to the overlapping of new and existing cross-sections will be entirely offset by the added complications of construction adjacent to existing operating tracks in the shared ROW.

Where HSR tracks are proposed at 4.5 metres from existing tracks in shared ROW, earthworks and roadbed preparation have been measured under an item representing the works required to upgrade the existing roadbed, including widening.

2.8 ELECTRIFICATION

The traction voltage assumed for all three technology/ROW scenarios for the Québec-Windsor corridor is 25 kV nominal phase to ground using equipment in the 50 KV three-phase class. Due to the distance involved for the inter-city sections of the route and the relatively small number of utility power lines crossing the main ROW it is assumed that the system would use the 2 x 25 kV, auto-transformer method of catenary power distribution for the majority of the line routes. It is possible, for the sections of track within a city to operate a 1 x 25 kV feeder arrangement particularly when feeding into a terminal station or feeding a spur track for maintenance or garage facilities. The interface between the two systems can be made at any auto-transformer/paralleling station.

With the 2 x 25 kV design each main catenary section is effectively double and fed while the utility infeeds are radial with no interconnection between utility stations. The overall design concept also assumes that the utility would not be prepared to accept regenerative braking current or back feeds into their system as this would require special relaying. Regenerative braking resistors on the traction vehicles have therefore been assumed for the + 300 kph technology. However, since the supplier of the X-2000, tilting technology has indicated a reluctance to install regenerative braking resistors on the vehicles, wayside braking resistors have been assumed for the 200-250 kph tilting technology scenario.

3 DATA SOURCES

3.1 MAPPING

The detailed routing analysis was carried out using topographical base mapping obtained from Energy Mines and Resources, Canada, the Ontario Ministry of Natural Resources and the Ministère de l'Énergie et des Résources of the Gouvernement du Québec. The general corridor alignment was developed on 1:50,000 scale with contours at 10 metre intervals. 1:20,000 maps with a 10 metre contour interval were also used to optimize the alignment in Québec.

For the parts of Ontario with more varied terrain, the 1:10,000 Ontario Base Maps were used. Unfortunately, although they offered a larger horizontal scale, contours, where available, were still plotted at 10 metre intervals. This larger scale also provided greater detail in areas where the alignment was influenced by prominent natural features or the built environment.

In addition, topographic mapping at scales such as 1:5000 or 1:10,000 and aerial photographs from previous studies, enabled the suitability of urban rights-of-way to be verified. Typical examples of the alignment, developed to the standards previously described, are shown on extracts of the mapping in Exhibits 3.1.1 to 3.1.3.

In pursuing suitable base mapping, an effort was made to obtain the most current mapping available for each portion of the corridor. Ultimately, the base maps available ranged in age from 1979 to 1990. Visits were made to certain urban sections along the corridor to verify that a ROW through the current development was feasible.

3.2 EXISTING RAILWAY PLANT

As noted in the introductory remarks, the Study Terms of Reference, requires an assessment of opportunities for HSR service in existing rail right-of-ways (ROWs). Consequently, it was necessary to assemble any readily available data on existing railway plant in these ROWs. Working through their nominated contacts, arrangements were made to obtain relevant data from CN Rail, CP Rail and VIA Rail. The data obtained and utilized in the analysis consisted of the following items for the rail subdivisions under consideration for HSR service:

- condensed profiles;
- operating diagrams;
- event lists/plant inventory;
- ROW widths; and
- potential abandonments

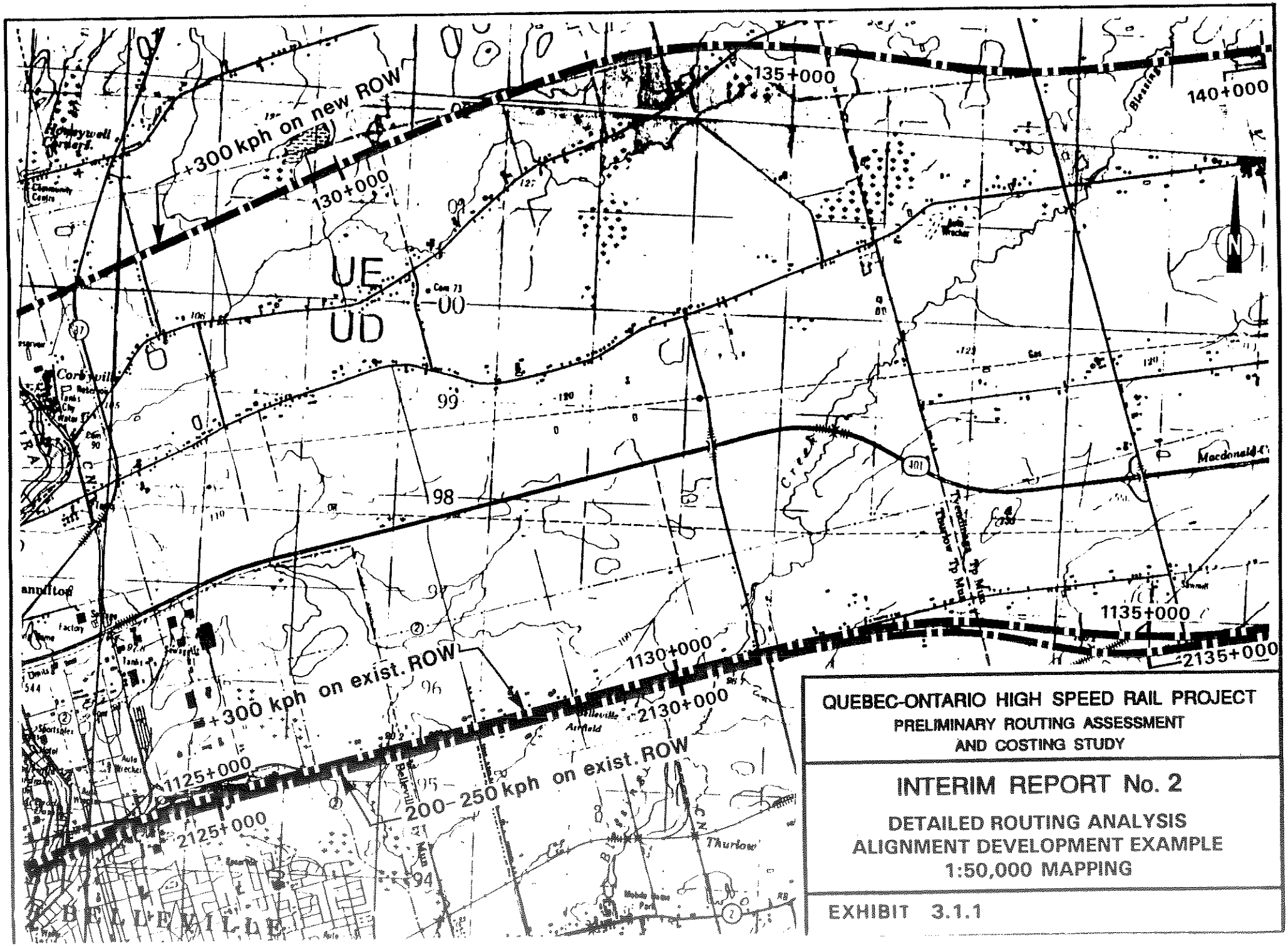
Subdivisions for which data was obtained were:

CANADIAN NATIONAL	CANADIAN PACIFIC
Caso	Windsor
Strathroy	Galt
Dundas	North Toronto
Oakville	Belleville
Halton	Brockville
York	Ellwood
Kingston	Lachute
Smiths Falls	Ste-Agathe
Beachburg	M & O
Montréal	Vaudreuil
Mont-Royal	St. Luc Branch
St. Laurent	Adirondack
Bridge	Park Avenue
	Trois-Rivières

3.3 GEOLOGICAL CONDITIONS

The geotechnical review for the high speed rail study was carried out using available maps and geological reports. The main sources of information included the following:

- EMR Canada Topographic Maps Scale 1:20,000 and 1:50,000
- Geological Survey of Canada Reports and Papers
- Ontario Geological Survey Drift Thickness Maps
- Ontario MNDM Quaternary Geology Maps
- Ontario MNDM Industrial Minerals Reports
- Québec Ministry of Natural Resources Geotechnical Reports



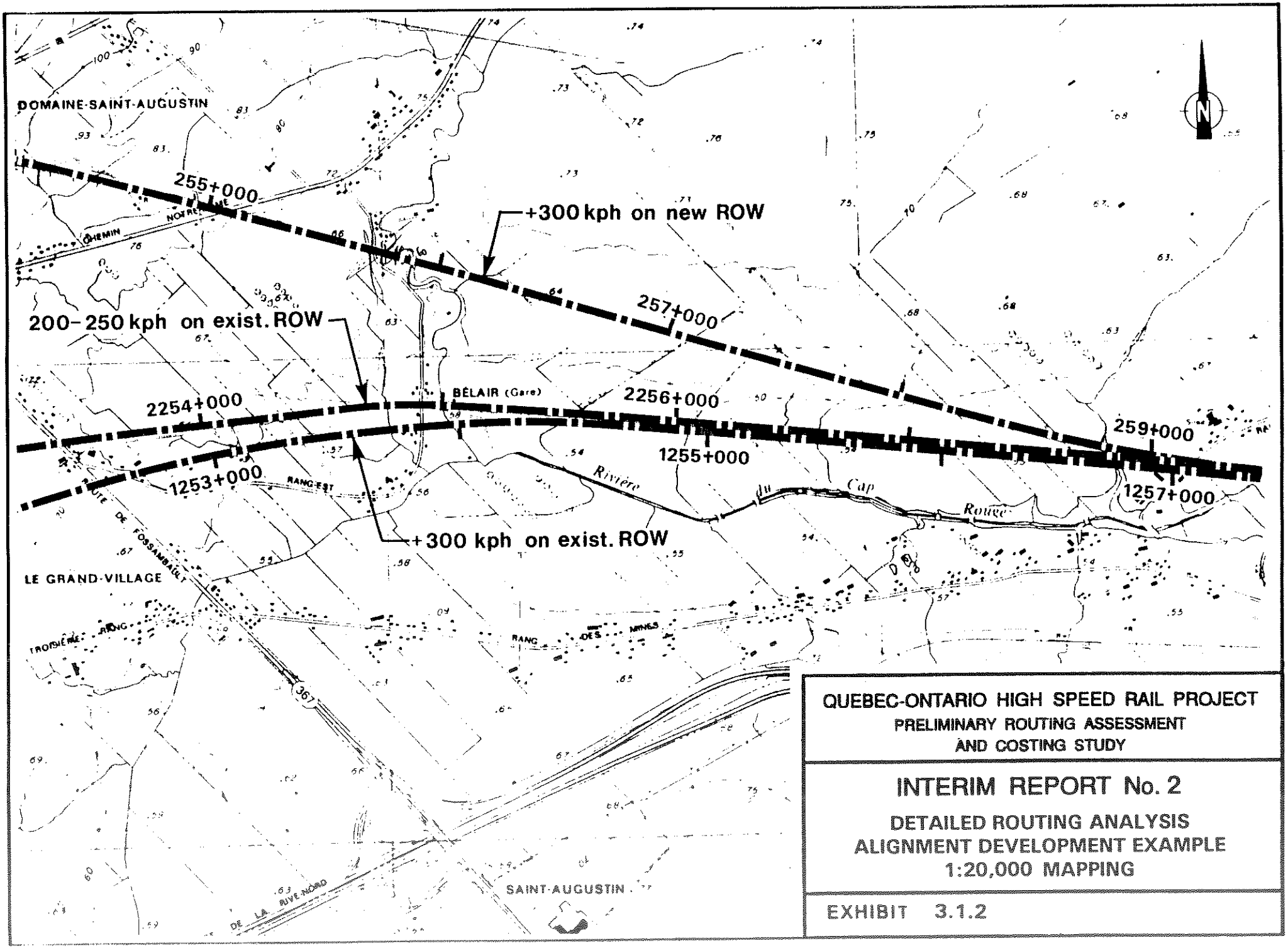
QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT

PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

DETAILED ROUTING ANALYSIS
ALIGNMENT DEVELOPMENT EXAMPLE
1:50,000 MAPPING

EXHIBIT 3.1.1



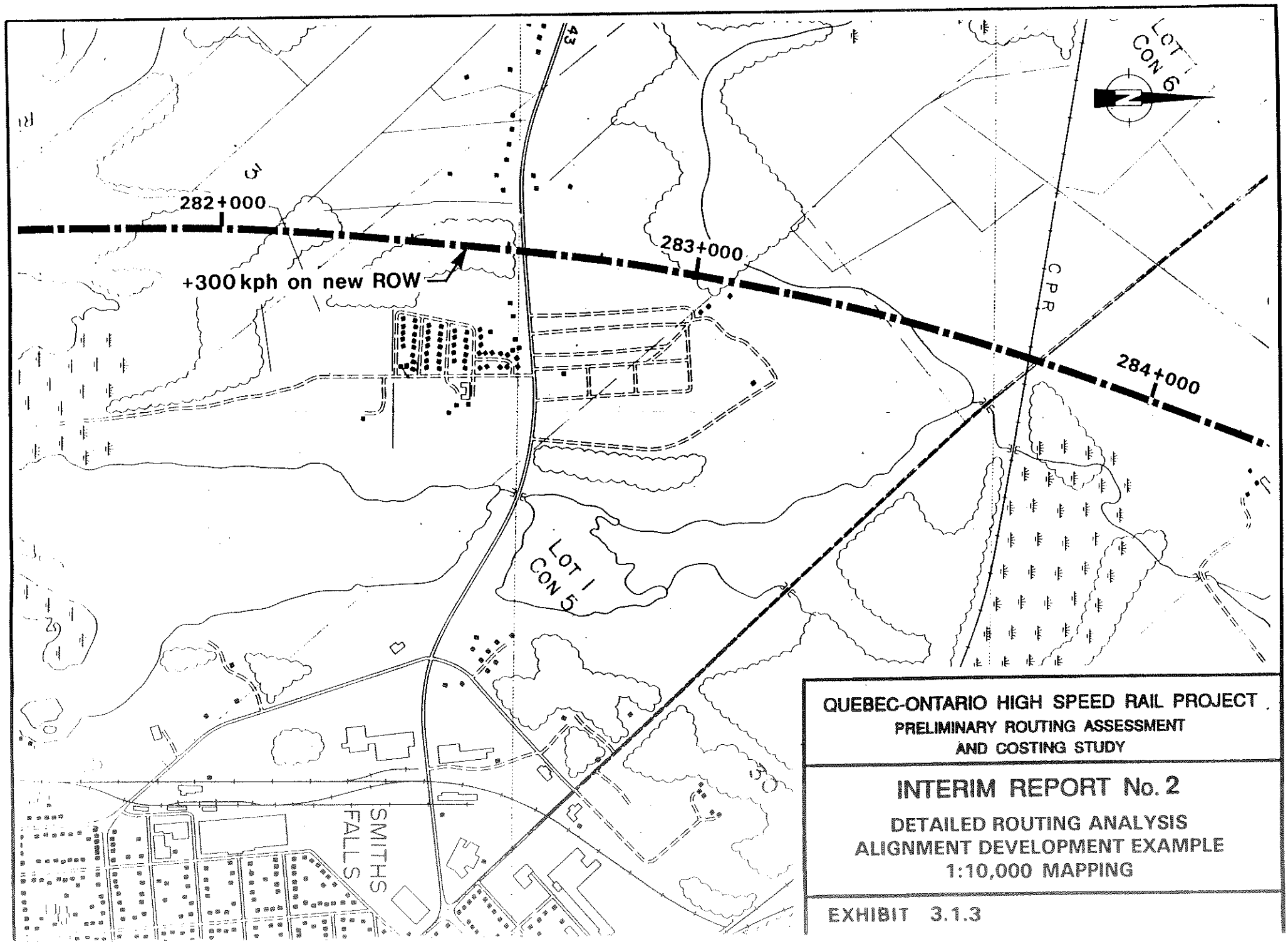
QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT

PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

DETAILED ROUTING ANALYSIS
ALIGNMENT DEVELOPMENT EXAMPLE
1:20,000 MAPPING

EXHIBIT 3.1.2



QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT

PRELIMINARY ROUTING ASSESSMENT
AND COSTING STUDY

INTERIM REPORT No. 2

DETAILED ROUTING ANALYSIS
ALIGNMENT DEVELOPMENT EXAMPLE
1:10,000 MAPPING

EXHIBIT 3.1.3

- Québec Ministry of Natural Resources Geological Maps
- Québec Ministry of Agriculture Pedological Reports

Of particular assistance was Ontario Geological Survey Special Volume No. 2 "The Physiography of Southern Ontario, Third Edition, 1984" by L.J. Chapman and D.F. Putnam and G.S.C. Memoir 359 "Pleistocenc Geology of the Central St. Lawrence Lowland, 1971 "by N.R. Gadd.

In addition to published reports and maps, the resources of the Geocon and CNFS geotechnical report files were employed to provide specific information at locations along or near the route.

3.4 CLIMATIC CONDITIONS

Data was selected from the Environment Canada records to provide an overview of the climate conditions likely to influence the infrastructure design for HSR service in the corridor. The data obtained for each month of the year included:

- Days with frost
- Days with freezing rain
- Greatest snowfall
- Total snowfall
- Total rainfall
- Extreme maximum temperature
- Mean maximum temperature
- Extreme minimum temperature
- Mean minimum temperature

The data was analyzed for weather stations at Québec, Trois-Rivières, Montréal (Dorval), Ottawa, Kingston, Trenton, Toronto (Pearson) London and Windsor. Some of the implications of Canadian climate conditions on infrastructure components have been discussed in the Final Report of the Technology Review.

3.5 LAND USE IN THE CORRIDOR

Land-use was classified in six different categories for the purpose of the study:

A combination of data sources was used to determine the land-uses along the proposed corridor. These included regional plans, cadastral maps, topographical base maps, and maps of environmental parameters. The approach was to determine segment by segment the various existing and proposed land-uses as established by regional planning authorities.

3.5.1 Data Collection

- residential
- commercial
- industrial
- agricultural A
- agricultural B
- other uses

The distinction between agricultural A and agricultural B does not refer to the quality of agricultural land, but reflects the foreseen difficulty of land acquisition. All the land presently used for agriculture or reserved for that use was classified as agricultural. When it was apparent that the establishment of the right-of-way would interfere with agricultural operations, either because of the proximity of farm buildings or because part of land was rendered inaccessible, the land was classified as agricultural A.

3.5.2 Land Acquisition and Expropriation Rights Issues

This section includes extracts from the "Review of Institutional Options and Legislative and Labour Issues" by KPMG and is provided as general background on the process of acquisition of right-of-way.

Railway Act

The Railway Acts of Canada and Québec are very similar and spell out clearly the railways rights to expropriate the land to build a right-of-way, acquire needed resources such as gravel

pits and the rights-of-way to access such resources. However the limits to these rights are also clearly defined:

- limits on the right-of-way width (100 ft or 30m)
- obligation to provide crossings (public and private)

The railway is permitted however to purchase any land and resell such portions of that land not needed for a given project if to do so reduces the costs to the railway. The key word here however is 'purchase' not 'expropriate'.

Sections 106 of the Railway Act establishes a railway's general power, including the power to enter lands to make surveys, to take lands or other property necessary for the construction of the railway, and to divert highways and other transportation facilities for construction purposes (subject to a restitution obligation in section 107).

The new railway may not commence construction until the (National Transportation Agency) has approved the general location and the construction plan has been deposited with and approved by the NTA (Section 111). The plan must show:

- The right of way with lengths of sections in miles;
- the names of terminal points;
- the station grounds;
- the property lines and owners names;
- the areas and lengths and width of lands proposed to be taken, in figures, stating every change of width, or other accurate description thereof;
- the bearings; and
- all open drains, watercourses, highways and railways proposed to be crossed or affected.

The NTA is free to adopt any procedure for reviewing a plan. Conceivably, the plan review and the application proceeding for the certificate of public convenience and necessity (PC & N), required for a new railway company establishing a new line, could be joined instead of being sequential as provided by the Act. The plan review process could involve public hearings and consider both environmental, negotiating procedure, and economic issues similar to current National Energy Board pipeline facility approval proceedings.

In granting its sanction for the plan, or in giving leave to expropriate, the NTA may fix a "use it or lose it" period as well as a mandatory notice period prior to binding arbitration on land owner compensation.

No Crown lands or native reserve lands or statutorily recognized land claims may be taken without the consent of the Governor in Council but a railway does, otherwise, have the capacity to take federal and provincial Crown lands and lands of other federal undertakings, such as other railways.

Sections 160 to 188 of the **Railway Act** provide a comprehensive expropriation code for lands covered in the plan. Any compensation disputes that remain after arbitration are to be settled by the court of the country in which the lands lie.

Sections 200 to 207 provide a structure for the construction of highway crossings and the payment of construction costs pursuant to an application for construction authority to the NTA. Payment to adjacent and abutting land owners is determined through arbitration. The NTA may apportion such construction costs among the railway, the relevant municipality or other person to whom the NTA's order to allow construction is directed.

The railway is required to provide adequate farm crossings and land owners may apply to the NTA for an order directing construction of a suitable crossing consistent with the terms of the **Railway Safety Act.**

The **Railway Act** provides an adequate framework for dealing with level crossing, and farm crossing disputes. The legal framework for adjudicating appropriate arrangements between highway owners and neighbouring land owners on the one hand and the railway right of way owner on the other is adequately set out under present federal and provincial railway legislation.

The real issue here is one of money. Given that both federal and provincial governments are likely to provide funds or non-cash support towards the development of the roadbed component of the business, it is likely that crossing engineering and funding matters will, to a large degree, be resolved through intergovernmental negotiation, possibly with some recourse to arbitration through the independent NTA as provided under the Railway Act. The extent to which such negotiations become a public event is a policy matter for the governments involved. However, note again that a NTA railway PC&N certificate proceeding will likely involve a fairly high public profile.

It should be noted that the construction of both crossings at grade and grade separations cannot begin without the permission of the NTA.

The expropriation power of the **Railway Act** would provide for the acquisition of adequate property rights for the construction and operation of a high speed rail corridor including, if necessary, the forced acquisition of private property rights (including private property rights of existing railways) and existing provincial and municipal rights of way where negotiated solutions proved to be impractical. The expropriation powers of the federal **Railway Act** are currently adequate to ensure the capacity to develop and construct a self contained high speed rail corridor.

The expropriation powers of the federal **Railway Act** are exercised in the context of an overall licensing proceeding directed by the National Transportation Agency upon receipt of a railway licence application (i.e. a request for a PC&N certificate) and a related request for leave to expropriate which is built upon a detailed plan of the railway undertaking identifying the specific lands required and overall engineering of the project. Thus, expropriation decisions as well as environmental impact decisions can be internalized in the processes of an independent regulatory agency which to date has had a preference towards conducting major matters through public hearings.

The NTA provides a forum for municipal land use policies to be taken into account given that these measures could not be enforced against a federal HSR undertaking.

Expropriation Act

The federal **Expropriation Act** provides an alternative basis for forced acquisition and compensation of private property for railway construction. This legislation has been incorporated by reference into the special Acts of major federal public works such as the St. Lawrence Seaway Authority.

The Act provides for direct ministerial control over defining what should be expropriated. However, objectors still can activate a public hearing on the merits of the notice of expropriation, although the hearing process can only result in non-binding recommendations. Compensation is determined by a market-value based statutory formula administered by independent appraisers. Compensation disputes are resolved through the courts at the instances of the expropriated party.

The time frames under the **Expropriation Act** are potentially tighter than under the **Railway Act,** with the exception of compensation dispute resolution.

The principal difference between acquisition of land under the **Expropriation Act** and under the **Railway Act** is that the decision to expropriate under the **Expropriation Act** resides at the ministerial level and that this decision is exercised independently of other necessary decisions addressing the viability of the railway project and its environmental impacts.

It is worth noting the expropriation of any lands for a high speed rail corridor at the end of this century could involve the taking of some lands having a high opportunity value as well as the taking of lands in areas which are much more built-up than during Canada's original railway construction phase. This could involve greater environmental sensitivities than in past railway projects.

Based on work performed by Canac for VIA it would appear that although VIA would have the right to expropriate under the Railway Act in practice it would probably be expected to operate under the much more recent Expropriation Act since this legislation protects more comprehensively the rights of the expropriated party. In Canac's opinion should a high speed rail project go ahead under the auspices of the Railway Act it would only be permitted to do so after the Railway Act had been amended to more closely conform with the Expropriation Act.

3.6 ENVIRONMENTAL PARAMETERS

During Phase 1 of this study, the primary objective of the environmental overview was to provide the Routing and Infrastructure Team with an indication of major environmental implications which could influence decisions made in the selection of representative technology routes. During the current investigations (Phase 2), a somewhat more detailed analysis of environmental parameters was conducted in order to derive additional quantifiable potential impacts associated with each of the three routing scenarios. In particular, more information has been collected for agricultural variables. Artificial drainage systems were not examined in any detail in the Toronto to Ottawa and Ottawa to Montréal sections based on the expected low degree of significance of this indicator vis-a-vis areas in Southwestern Ontario where tile system and major municipal drains are extensive. This expectation was based on the following general assumptions and conditions:

1) Incidence of well drained soils in the Lake Ontario corridor;

2) Predominance of Canadian Shield and associated low degree of agricultural capability/high incidence of wetland and forested areas on the north-south segments up to Ottawa and the routes between Ottawa and Montréal;

The 1:25,000 scale mapping of artificial drainage systems was the only readily available indicator of capital intensity relative to agricultural activities adjacent to the corridors under consideration. Research related to other typical indicators (e.g. field inventories of livestock operations and analysis of Statistics Canada census data) was not included in the scope of investigations for this study.

The objective in this phase has been to identify the major environmental implications of implementing the various **routing** options, and possible mitigation considerations relative to their cost ramifications. In the latter regard, the Environmental Team has contributed to the itemization of cost elements and mitigation considerations will be reflected in the costing exercise (Work Package 4).

In this interim report the potential impacts to sensitive features and areas are identified. More generic and environmental advantages and disadvantages associated with the **technology** options (e.g. air quality enhancement, energy savings, economic benefits, construction, operational and maintenance impacts) will be addressed by others. For the purposes of this study, unit costs include the application of current standard engineering and construction techniques to address such matters as erosion and sediment control, relative to the protection of watercourses and mitigation of common potential impacts to fisheries resources.

As in Phase 1, the level of investigation has generally been consistent with that being pursued by the Routing and Infrastructure Team and has included (where available) the use of resource inventory mapping (1:50,000 scale in Ontario, 1:20,000 scale in Québec), 1:50,000 scale militia mapping and 1:10,000 base mapping/aerial photography (where warranted and available). Specific environmental factors and indicators used in the overview analysis, including source material, are shown in Table 3.6.1 (Note : due to delays in obtaining comprehensive information on potential noise and vibration impacts, these effects have not been included in this Interim Report. It is expected that the appropriate data will be available for inclusion in the final report submission).

Throughout this report, the description of environmental considerations has been subdivided by technology routing options and subsequently on the basis of the following geographical sections:

- Windsor To Toronto
- Toronto To Ottawa
- Ottawa to Montréal
- Montréal To Québec

The mechanisms by which environmental factors will be evaluated in the future will be determined either through the concurrent Environmental Assessment Requirements study or at a future feasibility or EA stage. This study calls for the identification, where possible, of additional studies which may be required to meet Federal and Provincial needs relative to environmental assessment procedures. In addition, the detail and scope of environmental indicators investigated in this study will require expansion to approach the level of effort required for environmental assessment purposes.

Major archaeological resources have been accounted for within Socio-Economic indicator 1 - Major Parks and Historic Sites/Areas to the extent that historic sites and areas will typically include commemorative plaques, interpretive centres and/or remnants of resource materials and artifacts. Only these major sites were deemed significant enough to influence the routing options under consideration.

As a minimum, the following external data sources and contacts will likely be required to obtain/confirm data on all known archaeological sites within or in close proximity to the representative corridors, should investigations proceed to the next level of feasibility and/or environmental assessment:

- Canadian Heritage Inventory Network (CHIN)
- Archaeological Survey of Canada (ASC)
- Canadian Museum of Civilization (CMC)
- responsible provincial and federal ministries and departments

The representative corridor options outlined in this report include a range of property acquisition scenarios, including some existing railway rights-of-way, as well as new rights-of-way either adjacent to or remote from existing rights-of-way (greenfield). These strategies include an inherent risk related to the potential legal liabilities associated with the acquisition of properties

DETAILED ROUTING ANALYSIS
WORK PACKAGE 2 **ENVIRONMENTAL OVERVIEW FACTORS** Table 3.6.1

FACTOR	INDICATOR	PRIMARY SOURCES
NATURAL ENVIRONMENT		
• Provincially Significant Features (Wetlands, Provincial/ Regional Areas of Natural and Scientific Interest (ANSIs) and Environmentally Significant Areas (ESAs))	• Length of encroachment/ severance through Class 1-3 wetlands/ wetland complexes[1], recognized earth/life science ANSIs and ESA's designated by Conservation Authorities or Municipalities.	• 1:50,000 OMNR Inventory Resource mapping • Conservation Authority ESA studies • Municipal Official Plans • OMNR Provincially and Regionally Significant Wetlands in Southern Ontario (1987)
• Ecological Reserves/ Wildlife Management Areas[2]	• Length of encroachment/ severance through federal wildlife reserves, migratory bird sanctuaries, protected waterfowl nesting/staging areas and fisheries sanctuaries, and recognized sensitive wildlife habitat.	• Guide Méthodologique, Hydro-Québec (May 1986) • 1:2,000 MLCP Habitats Fauniques (1988) • 1:50,000 OMNR IRM
• Significant Fisheries/ Aquatic Habitat[3]	• Crossings of recognized cold/cool and warm water fisheries. Encroachment on spawning/ nursery and migratory zones.	• 1:2,000 MLCP • 1:50,000 OMNR IRM • OMNR District Fisheries Management Plans
• Significant Forests/ Woodlots	• Length of encroachment/ severance through recognized rare forest areas.	• Mapping of Critical Unprotected Areas in the Carolinian Life Zone of Canada (1985)
• Floodplain/Geotechnical Hazards	• Incidence of wetland areas and recognized potential areas of erosion/instability on major valley walls, river banks and railway embankments.	• Hydro-Québec mapping • Routing Analysis geotechnical investigations (1992)
SOCIO-ECONOMIC ENVIRONMENT		
1. Major Parks and Historic Sites/Areas[4]	• Length of encroachment on major parks or historic areas managed by federal, provincial or municipal governments.	• 1:50,000 militia mapping • Hydro-Québec mapping • 1:10,000 aerial photography
2. Major Tourism/Recreation /Conservation Areas	• Length of encroachment on major public and private sector recreation facilities and Conservation Areas.	• 1:50,000 militia mapping • Hydro-Québec mapping • Municipal Official Plans/mapping
3. Urban Perimeters[5]	• Length of encroachment on municipally defined settlement areas outside urban areas directly served by high speed rail.	• 1:50,000 militia mapping • Municipal Official Plans

DETAILED ROUTING ANALYSIS
WORK PACKAGE 2 **ENVIRONMENTAL OVERVIEW FACTORS** Table 3.6.1

FACTOR	INDICATOR	PRIMARY SOURCES
4. Rural Communities	• Length of route within 500m of municipally defined settlement area[6]. • Length of route directly through or within 250m of clusters of buildings outside municipally defined settlement areas[7].	• 1:50,000 militia mapping • Hydro-Québec mapping
5. Agriculture[8]	• Length of route traversing soils with Class 1 and 2 capability to support agriculture. • Length of route directly affecting specialty crops[9]. • Length of route traversing artificial drainage systems[10]. • Orientation of route to lot lines[11].	• 1:250,000/1:50,000 CLI mapping • 1:50,000 Agricultural Land Use Systems mapping • 1:25,000 Artificial Drainage mapping • Hydro-Québec mapping • 1:20,000 Québec forestry mapping • 1:20,000 MAPAQ[12] Tile Drainage mapping
6. Federal Reserves	• Length of encroachment on federal (DND) military bases; airport sites. • Length of encroachment on Indian Reserves.	• 1:50,000 militia mapping • Hydro-Québec mapping • Public Works Canada
7. Major Natural Resource Areas	• Length of encroachment on harvestable woodlots. • Length of encroachment on aggregate resource areas. • Length of encroachment on oil/gas pools.	• 1:50,000 militia mapping • 1:250,000 OMNR oil/gas resource mapping • OMNR District Land Use Guidelines
8. Waste Management Sites	• Length of encroachment on major existing/proposed/ candidate waste management sites.	• 1:50,000 militia mapping • MAPAQ • Ontario Interim Waste Authority[13]

Notes :

1. Based on OMNR/federal evaluation/classification system for wetlands south of the Precambrian Shield.
2. MLCP - Québec Ministère du Loisir, de la Chasse et de la Pêche.
3. Includes cross-referencing to Routing and Infrastructure Team analysis of watercourse crossings.
4. In Québec, includes all sites and structures identified under the Loi Sur Les Biens Culturels
5. Includes judgmental update of built-up areas not shown on outdated militia maps. Excludes Québec, Trois Rivières, Montreal, Ottawa, Kingston, Toronto, Cambridge, London and Windsor.
6. Reflects proximity to defined (primarily rural) settlements where existing routes have been altered for bypass purposes or where new routes come close to villages.
7. Reflects sensitivity of generally undefined communities/strip development (at least 5 structures within 1 km).
8. In Québec, all sensitivities are inside area zoned Agricultural by the Commission Protection du Territorire Agricole du Québec (CPTAQ).
9. Includes major tobacco, fruit, vegetable, sugar bush areas.
10. Includes systematic and random tile drainage and municipal drains as an indicator of capital intensity.
11. Orientation categories : LL1-parallel (route parallel to lot line; least impact); LL2-perpendicular rear (route perpendicular to lot line at rear of farm; moderate impact); LL3-perpendicular front/middle (route perpendicular to lot line through interior of farm or in proximity to main buildings; major impact).
12. MAPAQ-Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec.
13. Current IWA search for landfill sites in Metropolitan Toronto and the Regional Municipalities of York, Durham and Peel.

that may be contaminated or be a source of contamination. This liability is a concern given the financial implications attached to the cost of:

1) Environmental **audits** undertaken to ensure informed decisions on property conditions and possible clean-up costs (the responsibility for which may be subject to contractual negotiations);

2) The actual cost for **mitigation (clean-up)**, which can affect market value (cost), proposed site activities and total project cost.

The potential for encountering such conditions has been recognized and an assessment of the potential quantities affecting cost has been made. Line items costs for audits, potentially contaminated sites and allowances for clean-up have been included in Interim Report No. 3 where the costs of establish the HSR right-of-way have been collected.

3.7 ENVIRONMENTAL IMPACTS AND MITIGATION: GENERAL ASSUMPTIONS

This section outlines general assumptions applied to the assessment of potential adverse condition changes and possible mitigation treatment for three key environmental components for which concerns have been identified by the Advisory Committee.

1) Fisheries Resources
2) Wildlife
3) Noise

3.7.1. Fisheries

The Study Team has been cognizant of provincial and federal policy imperatives relative to potential impacts of linear transportation corridors on fisheries resources, particularly the Federal Fisheries Act in relation to alteration and destruction of habitat. However, unlike highways, rail corridors exhibit characteristics, related to their basic design (especially the requirement for a relatively flat profile), that minimize the potential for long term adverse impacts to aquatic resources. These include

1. Drainage of water away from the railbed maintains a dry, nutrient-poor environment that discourages the establishment of unwanted vegetation.

2. Porous stable ballast serves to prevent concentrated runoff and slope erosion. The ballast filters out particulates and many potential chemical pollutants such as creosote, oil, grease, paint, or metals.

3. A service road or other strip (even a very narrow one of a few feet) serves to prevent shift of material such as ballast spoils beyond the toe of the embankment slopes.

4. Drainage ditches parallel to the railway prevent uncontrolled sheet flow and erosion, serve as sediment traps and filter beds for railroad runoff, and insulate adjoining land from the possible impact of uncontrolled channel flow.[1]

Consequently, the introduction of extensive stormwater quality and quantity measures is considered to be unwarranted and it has been assumed that the average 50m right-of-way is adequate to accommodate standard drainage system related control measures. However, an allowance has been included for a stormwater facility (e.g. detention pond) every 20 km to account for requirements that may be imposed at major watercourse crossings which may be receiving runoff from sections of lengthy longitudinal grades.

It is also recognized that fisheries production and migration zones, as well as general cold and warm water habitat, may be affected by the representative corridors and the need to extend or introduce culverts. Site (watercourse) specific investigations to identify candidate locations for special mitigation treatment (e.g. introduction of bridges rather than culverts or areas where extraordinary construction operational constraints or habitat compensation may be required) are not within the scope of this study.

3.7.2 Wildlife

In general, the most significant impacts to wildlife populations will be related to potential long term alteration or disruption of migration corridors and dispersal orientation associated with the barrier effects created by the rail corridor over various sections, as well as the outright displacement of habitat.

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1 De Santo, R.S. and Smith D.G. "Environmental Auditing" Environmental Management Volume 17, No.1 P.113 (1993)

Short term impacts (e.g. noise and vibration; runoff of sediment and pollutants; and decrease in habitat/foraging areas during the construction period) are generally unavoidable or can be reduced through the use of what have become standard environmentally acceptable engineering techniques and construction practices, including timing constraints. In this manner, the stress associated with losses which affect breeding season and foraging or staging areas may be temporary and minimized to a large degree.

During this study, the potential for long term habitat loss and fragmentation has been reduced through prudent selection of representative corridors (i.e. avoidance of large tracts of identified sensitive habitat). Further, although large potions of the corridors unavoidably intersect habitat areas such as valley and river corridors (as opposed to running parallel, which would be more desirable), many of the crossings require bridge spans large enough to maintain migration opportunities. In addition, the rail corridors may benefit adjacent habitats by incorporating linear features (e.g. ditching and fencing) which serve to interconnect otherwise isolated habitats.

Nevertheless, it is acknowledged that barrier effects may be created, not only in greenfield segments but in existing corridors where existing farm/page wire fencing will be augmented to create more substantial obstructions for security and safety purposes. These effects are expected to be most pronounced in areas external to urban settlement areas.

Other rail corridor and highway studies have shown that the use of underpasses, one-way gates, culverts and overpasses can reduce barrier effects and facilitate wildlife movements across transportation corridors. Additional features such as drift fences and noise/visual screening may augment the effectiveness of such passageways. For the purposes of costing such facilities in this study, we have assumed that an underpass of 4.25m x 4.25m (minimum) with natural substratum inverts will be introduced every 10 km in rural areas. This will account for such variables as other (inherent) crossing opportunities (i.e. bridged valley and stream corridors) and areas where the introduction of such passageways may simply be impractical (e.g. areas of deep cut).

3.7.3 Noise

The potentially intrusive effects of noise directly attributable to operation of the candidate HSR technologies can only be assessed in general terms because of uncertainty attached to variables influencing achievable speeds and train frequency (both high speed and others) in shared ROW, particularly in urban areas.

The situation is complicated by the fact that, as other studies have shown, existing ambient noise levels in active rail corridors typically already exceed those established in guidelines, criteria and (draft) protocol developed by Provincial agencies. Secondly, HSR operating on shared trackage or in a shared right-of-way will be constrained by the current approach of the Railways, which is to avoid retrofitting their corridors with noise attenuation devices. This position is apparently based on the anticipated precedent setting nature of such devices resulting in pressure to retrofit other corridors for other operations on a nationwide basis. Further, the general lack of available data on existing and projected rail traffic in existing corridors makes it difficult to assess current and future ambient noise environments.

The determination of the need for, and type of, attenuation to ensure the acceptability of the HSR service by agencies having jurisdiction requires the following:

- an overall characterization of the existing sound and vibrational environments in sensitive areas by observing actual sources;

- an identification of critical sectors along the routes in relation to land use, type of housing, proximity of houses, ambient sound level, the service proposed (speed, number of trains and cars/train);

- an evaluation of the sound and vibrational levels generated by the high speed train in relation to its speed; and frequency

- a knowledge of the operational patterns of both HSR and conventional rail traffic in the case of shared ROW.

Since a detailed analysis of the specific situations along the routes is inconsistent with the level of detail of physical and operational planning available in the study, the following assumptions were adopted to assess the potential for incremental noise arising from operation of the HSR technologies:

(1) Where HSR operation is in existing right-of-way to be fully acquired from Railway (existing operation displaced), the existing conventional rail noise source will be replaced by new HSR noise source with no significant increase in noise levels.

(2) Where HSR operation is in shared right-of-way or corridor, speed restrictions on HSR trains for other reasons and existing ambient levels will obviate noise concerns.

(3) Where HSR operation is in new greenfield right-of-way, a cost item for noise attenuation adjacent to residential areas will be included in the Cost Analysis.

In order to assess the significance of the above assumptions, the potential capital cost of an "upper limit" scenario was calculated. This scenario, based on including noise barriers on both sides of the HSR ROW throughout all urban areas, resulted in barrier costs in the $250 - $300 million range for each representative route i.e. approximately 3-4% of the anticipated HSR infrastructure cost. Clearly, the likely noise mitigation requirements will be much less than this cost, given the proportion of non-sensitive land use along the existing rail corridors under consideration for HSR and the ROW sharing scenario adopted in some urban sections. The latter will generally imply high ambient noise levels resulting in a low incremental effect.

4 INFRASTRUCTURE DESCRIPTION - 200-250 KPH TILTING TECHNOLOGY

4.1 GENERAL OUTLINE OF ROUTE

In accordance with the Terms of Reference, the objective of this technology/ROW scenario was to maximize the use of existing railway ROW. The representative route developed between downtown Windsor and Québec has a total length of 1249 km made up of 470 km of CN ROW, 361 km of CP ROW, 150 km of abandoned rail ROW now owned by VIA Rail and 268 km of new ROW. Exhibits 4.1.1 and 4.1.2 illustrate this route.

4.1.1 Windsor to Toronto

The route starts at the south end of the Windsor - Detroit Tunnel in downtown Windsor and, with the exception of new bypasses of Tilbury and Chatham, follows the CP ROW to London. From London, it continues east to Hamilton, bypassing Woodstock and Paris. The route skirts the northern limits of Hamilton and after passing through Burlington, Oakville and Mississauga along the CN ROW, enters Metropolitan Toronto.

The CN ROW along the lakeshore through Etobicoke is used to reach Union Station. Continuing eastward, the CN ROW is again used to leave the urban area through Scarborough, Pickering, Ajax, Whitby and Oshawa.

4.1.2 Toronto to Montréal

From Oshawa, the route continues eastward in the CN ROW, passing through Port Hope, Cobourg and Trenton en route to Kingston and Brockville. The National Capital Region is reached from the Brockville area by bypassing the town to the west and following the CP ROW up to Smiths Falls. The route also bypasses Smiths Falls to the west and then joins the CN ROW which is used to continue north-east up to the National Capital Region.

After bypassing Richmond, the route enters Ottawa along the CN ROW through Federal junction and on to the existing VIA Station. From the station the route leaves the Ottawa urban area using the CN ROW leading to the abandoned CP ROW which continues eastward through

Bourget, Vankleek Hill and St-Eugene to Rigaud. A bypass of Rigaud and Hudson rejoins the CP ROW at Vandreuil and Dorion from where the route enters the Montréal urban area along the combined CN and CP ROW. This ROW is followed through Baie D'Urfé, Beaconsfield, Kirkland, Pointe Claire and Dorval to Lachine where the CN ROW is adopted to reach Central Station.

4.1.3 Montréal to Québec

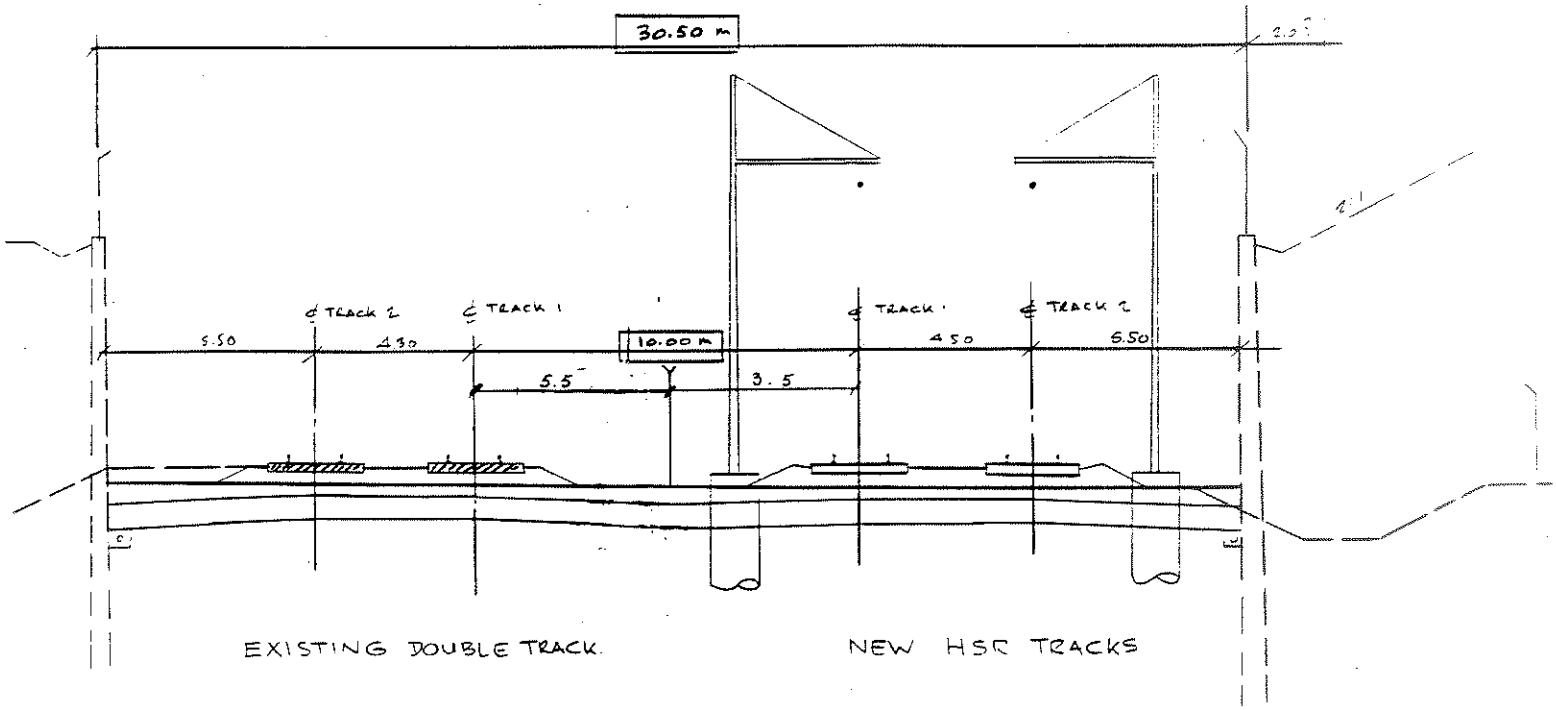
Since the selected representative route for the Montréal-Québec segment follows the north shore of the Saint-Laurent River, the route leaves Central Station northward through the Mont Royal Tunnel. It passes through Laval along the CP ROW, which is then followed to Trois-Rivières passing south of L'Épiphanie, north of Berthierville and including bypasses of Maskinongé, Louiseville and Yamachiche.

Geometric constraints in Trois-Rivières are avoided by adopting a new route north of the City. The new route rejoins the CP ROW east of Cap-de-la-Madeleine, bypasses Portneuf and Pont-Rouge and follows the existing ROW eastward to Ancienne-Lorette. From Ancienne-Lorette, the route continues into the Québec urban area along the CP ROW as far as Allenby Junction where it joins the CN ROW. The CN ROW is used to reach Gare du Palais through Vanier and the Limoilou Yards.

4.2 STATION LOCATIONS

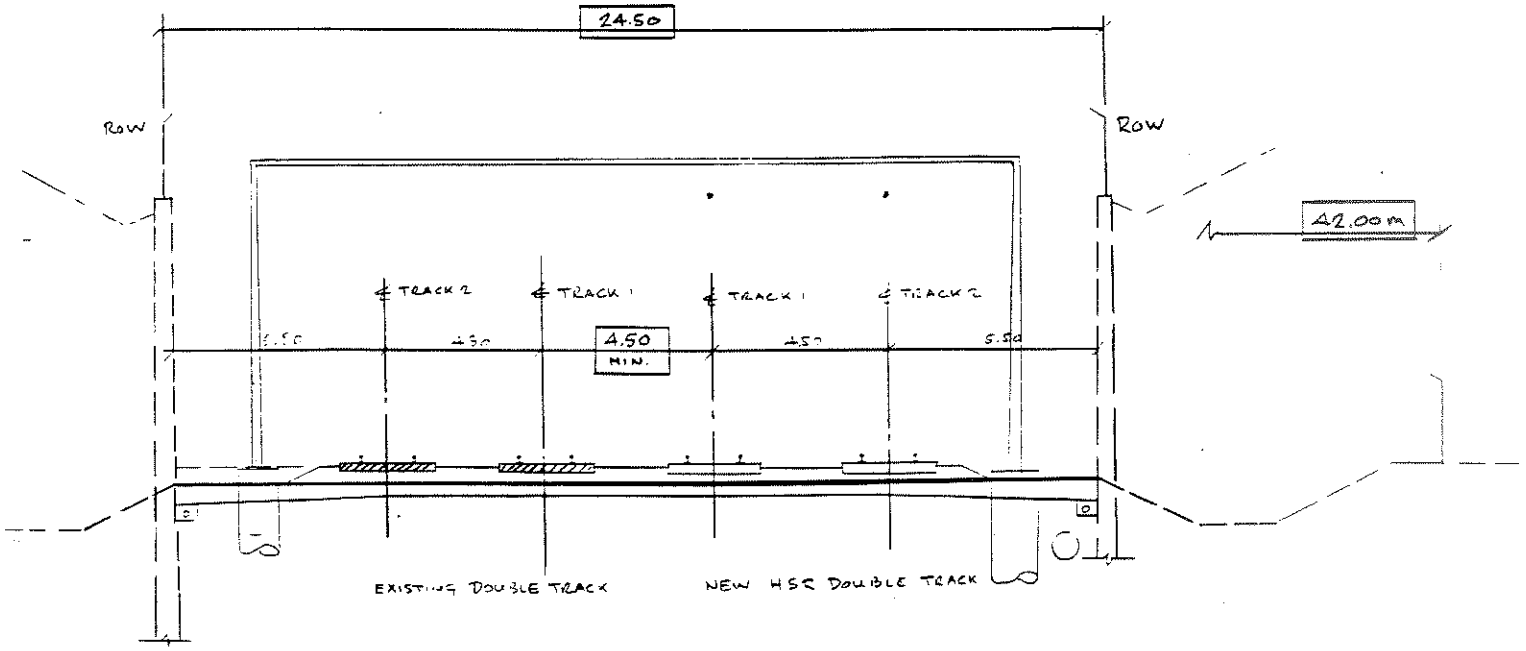
The following 14 locations were identified as potential station sites for HSR service along the representative route for 200-250 kph tilting technology:

Station Location	Urban Area Served	Infrastructure Assumed
South of Windsor - Suburban	Detroit/Windsor	New Station
Downtown London	London/St. Thomas	New Station
NE of Hamilton - (Suburban Waterdown Rd, Burlington)	Hamilton/Burlington	New Station
Metro Toronto Downtown Within existing Union station area	Greater Toronto Area	Existing Modified
East Pickering - Suburban	Eastern Greater Toronto Area	New Station



SECTION 5

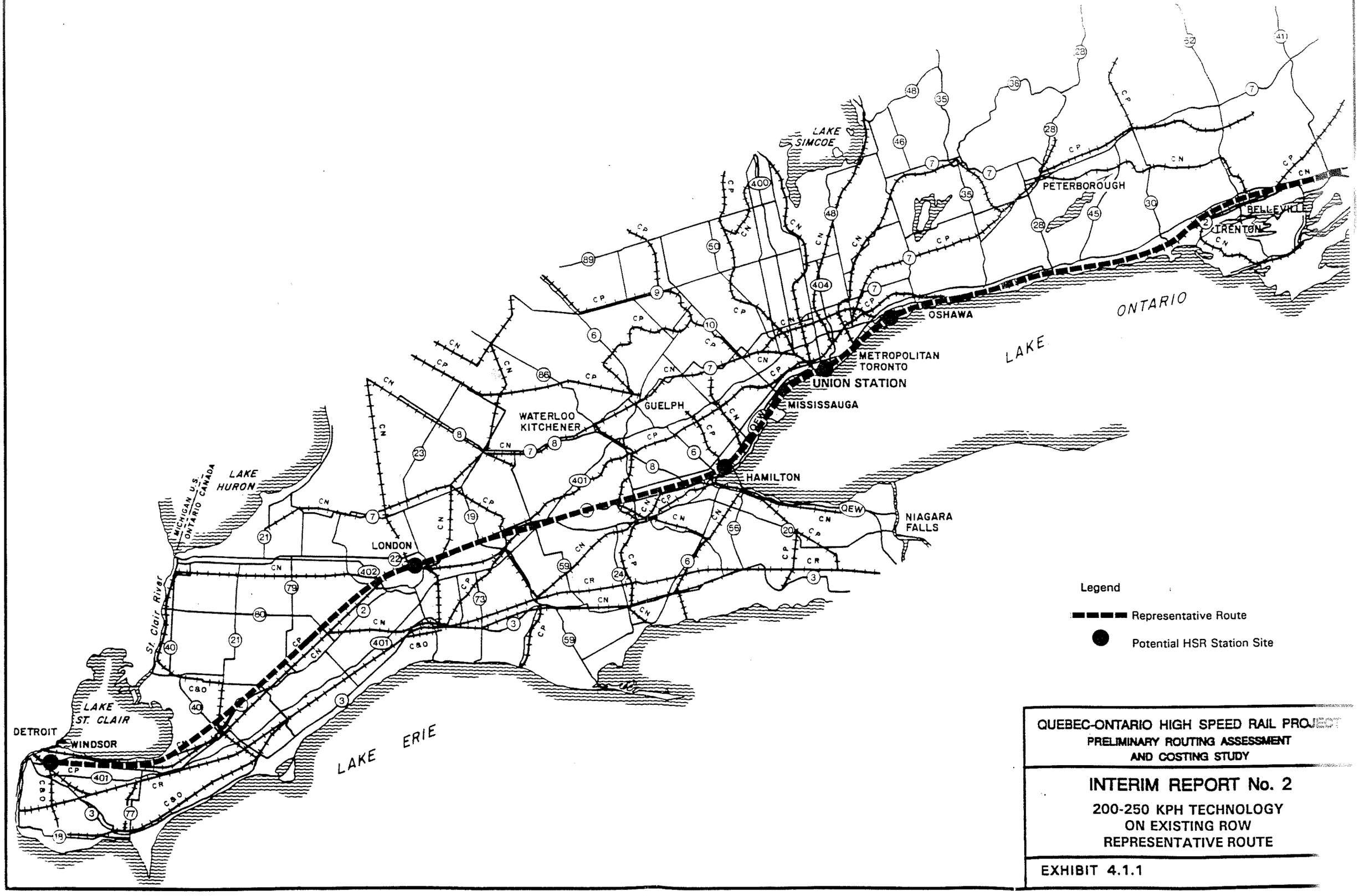
HSR service sharing existing rail ROW in Urban Areas with adjacent development constraining ROW widening



SECTION 6

HSR service sharing existing rail ROW in severely constrained Urban Areas (Low-speed HSR Operation)

EXHIBIT 2.2.4

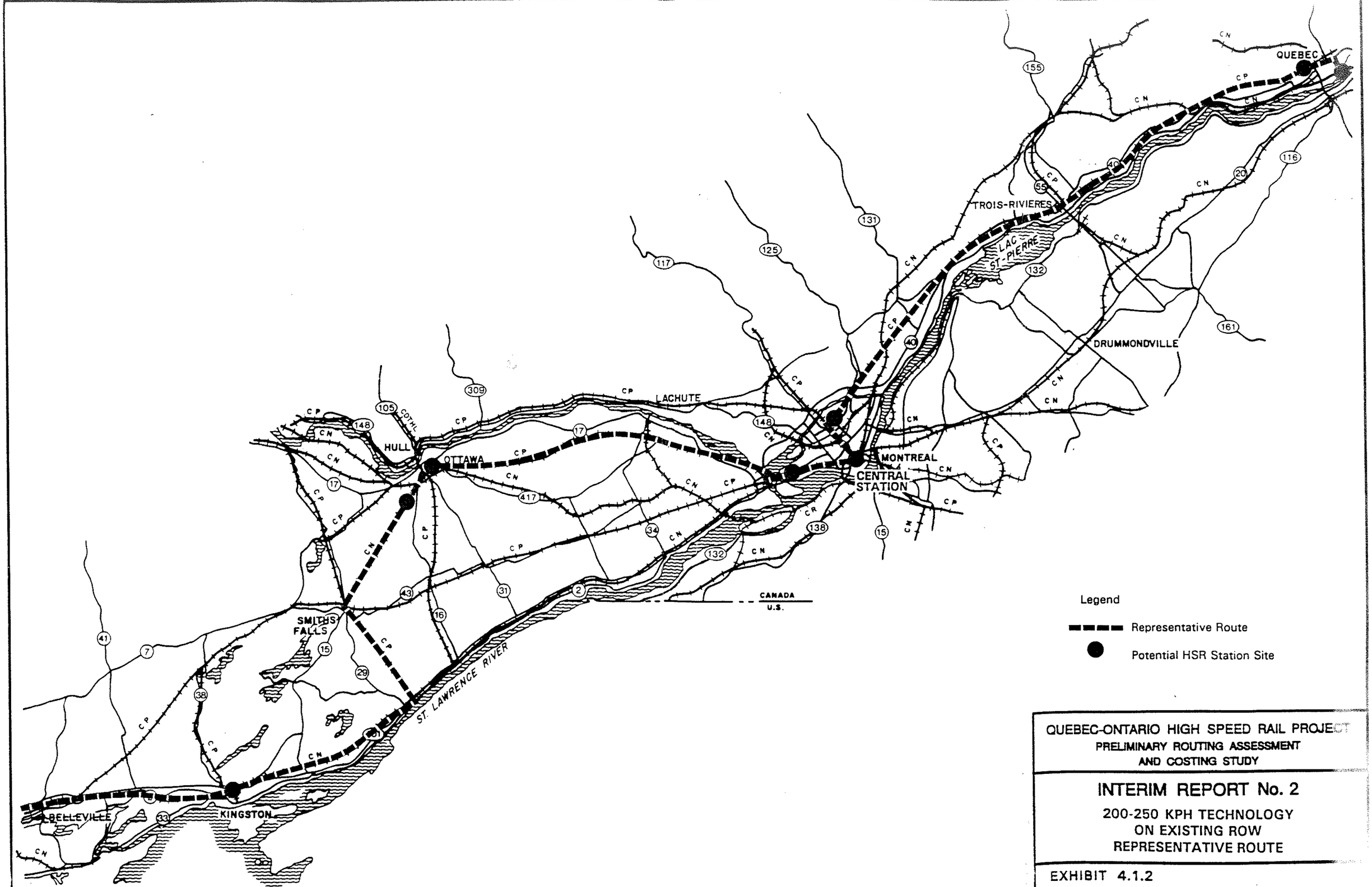


QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

200-250 KPH TECHNOLOGY
ON EXISTING ROW
REPRESENTATIVE ROUTE

EXHIBIT 4.1.1



Legend

Representative Route

Potential HSR Station Site

QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT
AND COSTING STUDY

INTERIM REPORT No. 2

200-250 KPH TECHNOLOGY
ON EXISTING ROW
REPRESENTATIVE ROUTE

EXHIBIT 4.1.2

Station Location	Urban Area Served	Infrastructure Assumed
Suburban - existing VIA Kingston site	Kingston Region	Existing Modified
Suburban - Merivale, South of Ottawa	National Capital Region	New Station
Existing VIA Ottawa station	National Capital Region	Existing Modified
Existing VIA Ottawa station site	Dorval Airport W. Montréal	Existing Modified
Central Station - Montréal	Montréal Urban Community	Existing Modified
Laval	E. Montréal Region	New Station
North of Trois-Rivières - Suburban	Trois-Rivières	New Station
Ancienne-Lorette - Suburban	W. Québec Region	New Station
Gare du Palais	Québec	Existing Modified

In selecting the station locations, the input obtained from meetings with the local municipal officials was recognized, as well as the planning criteria outlined earlier in Section 2.3. Suburban locations emerged as preferable in Windsor, Hamilton, Kingston (existing VIA station) and Trois-Rivières. In London, Metro Toronto, Ottawa Hull, Montréal and Québec, it was deemed necessary to provide a station in a downtown location. Additional suburban station sites were identified to serve the regional metropolitan areas surrounding Toronto, Ottawa, Montréal and Québec. The above locations are identified in Exhibits 4.1.1 and 4.1.2. Potential Station sites in the major urban centres are also shown in Exhibits 4.1.3, 4.1.4, 4.1.5 and 4.1.6. The implications of operating HSDR service from the existing downtown stations in Toronto and Montréal are discussed in the following paragraphs.

Toronto Union Station

The existing railway plant in the Toronto Terminal Railway Corridor, passing through Union Station in downtown Toronto, is used by CN and CP freight trains, VIA Rail inter-city passenger trains and GO Transit commuter rail service. In recent years, studies and discussions have been pursued by the rail operators using the corridor and station, with a view to establishing the allocation of track and station facilities for the future.

The primary outcome of these analyses and deliberations has been the designation of the northern half of the tracks and platforms in the station and approaches as commuter rail plant

for GO Transit current and future operations. This arrangement assumes that the southern nine tracks and three platforms would be utilized for VIA inter-city service and freight movements through the corridor. Modifications and additions to the rail plant in the corridor east and west of the station are also under consideration to accommodate expanded commuter rail service and maintain the other traffic in the corridor.

At present the main upper level concourse and platform access facilities are utilized by VIA Rail with GO Transit operating from the lower level concourse on the east side of the building. GO Transit has considered the development of a second concourse to the west of the main concourse. Both existing concourses offer an excellent internal link to the Toronto subway system. The existing platform lengths vary from 300 metres in the centre to 350 metres on the south side with widths varying from 3 to 5.4 metres.

On the assumption that the northern half of the platform and station track area is committed to commuter rail service, it would be necessary to develop HSR facilities in a re-configured southern portion of the station and approach corridors. The desired 6 station tracks with wide centre platforms can only be accommodated if major relocation of existing tracks is carried out so that platforms can be widened. It seems that the existing trainshed will be high enough to accommodate the electrification catenary for HSR.

As far as passenger handling facilities are concerned, two options exist at Union Station. The present main concourse and platform access tunnel used by VIA could be upgraded and re-configured to provide the required capacity for the projected demand, improved levels of convenience and comfort and full compliance with safety codes in force at the time of implementation of HSR service. Alternatively, a new HSR passenger concourse could be constructed south of the existing trainshed thus providing direct access to the southernmost tracks assumed to be allocated to HSR trains. Although this latter option offers the opportunity for development of new state-of-the art passenger access and egress facilities, it would require purchase of additional property and the construction cost of a totally new building envelope. The new concourse option would also render the existing main concourse and heritage building largely redundant since most VIA services would be replaced by HSR services. Desirably, an alternative use would have to be found for the existing facilities. For the purpose of this study, modification of the existing facilities has been assumed.

While Union Station provides good intermodal access to the TTC rapid transit and GO Transit commuter rail systems, automobile access and parking facilities would have to be improved to encourage HSR ridership.

REGION OF PEEL

REGION OF YORK

REGION OF DURHAM

REGION OF HALTON

METROPOLITAN TORONTO

LAKE ONTARIO

HIGHWAY 400

HIGHWAY 404

HIGHWAY 407

HIGHWAY 401

HIGHWAY 403

CNR NEW MARKET SUB.

CNR BALA SUB.

CNR UXBRIDGE SUB.

CPR HAVELOCK SUB.

CPR BELLEVILLE SUB.

CNR YORK SUBDIVISION

CNR HALTON SUB.

CNR WESTON SUB.

CNR KINGSTON SUB.

CPR NORTH TORONTO

CPR GALT SUB.

CNR OAKVILLE SUB.

Q. E. W.

PICKERING

PEARSON

N

LEGEND:

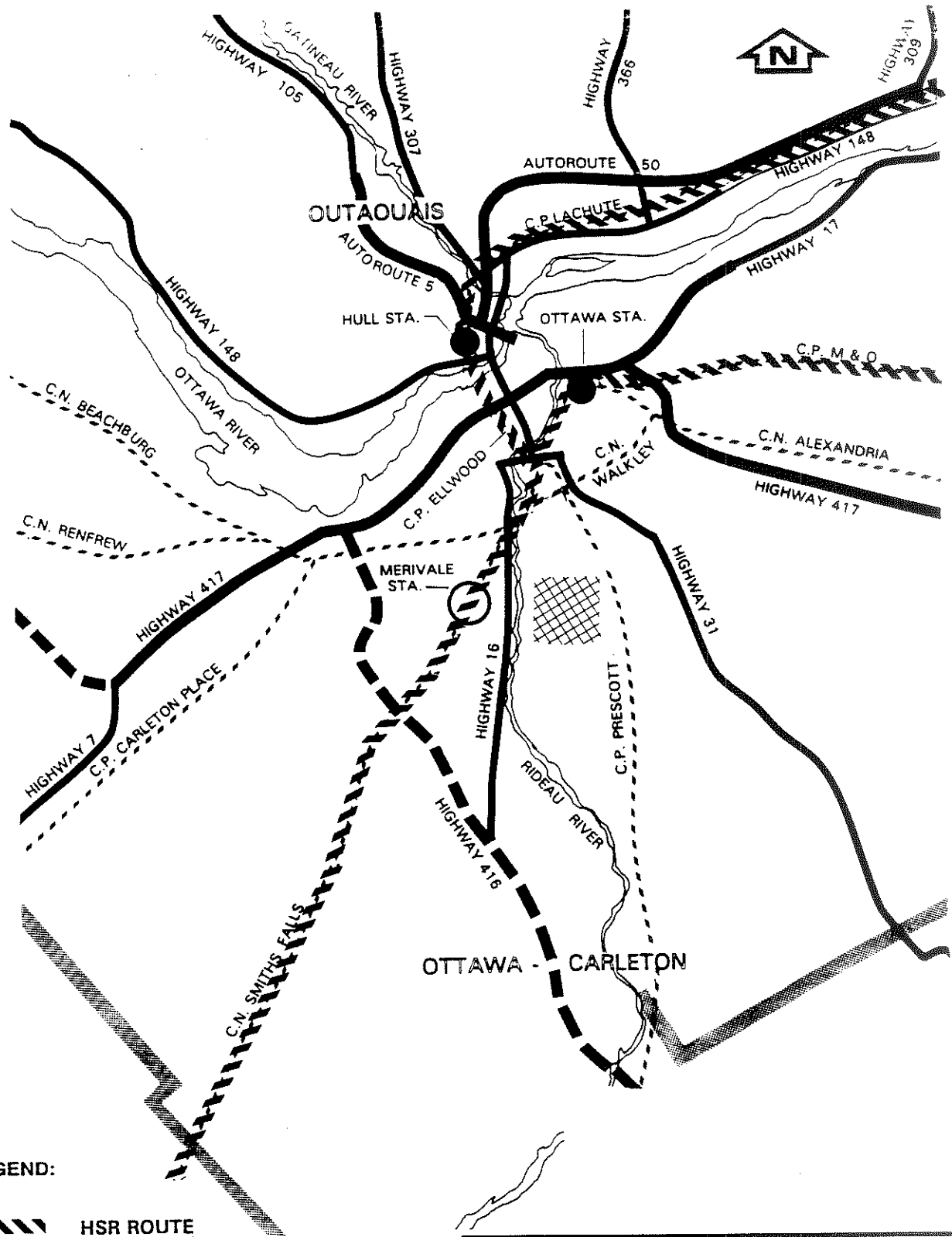
- HSR ROUTE
- MAJOR HIGHWAYS
- PROPOSED MAJOR HIGHWAYS
- RAILWAYS
- MUNICIPAL BOUNDARIES
- EXISTING/POSSIBLE INTERNATIONAL AIRPORTS
- POSSIBLE STATION SITES
- POSSIBLE SUBURBAN STATION SITES

QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

GREATER TORONTO URBAN AREA
HSR ROUTES AND EXISTING TRANSPORTATION CORRIDORS

EXHIBIT **4.1.3**



LEGEND:

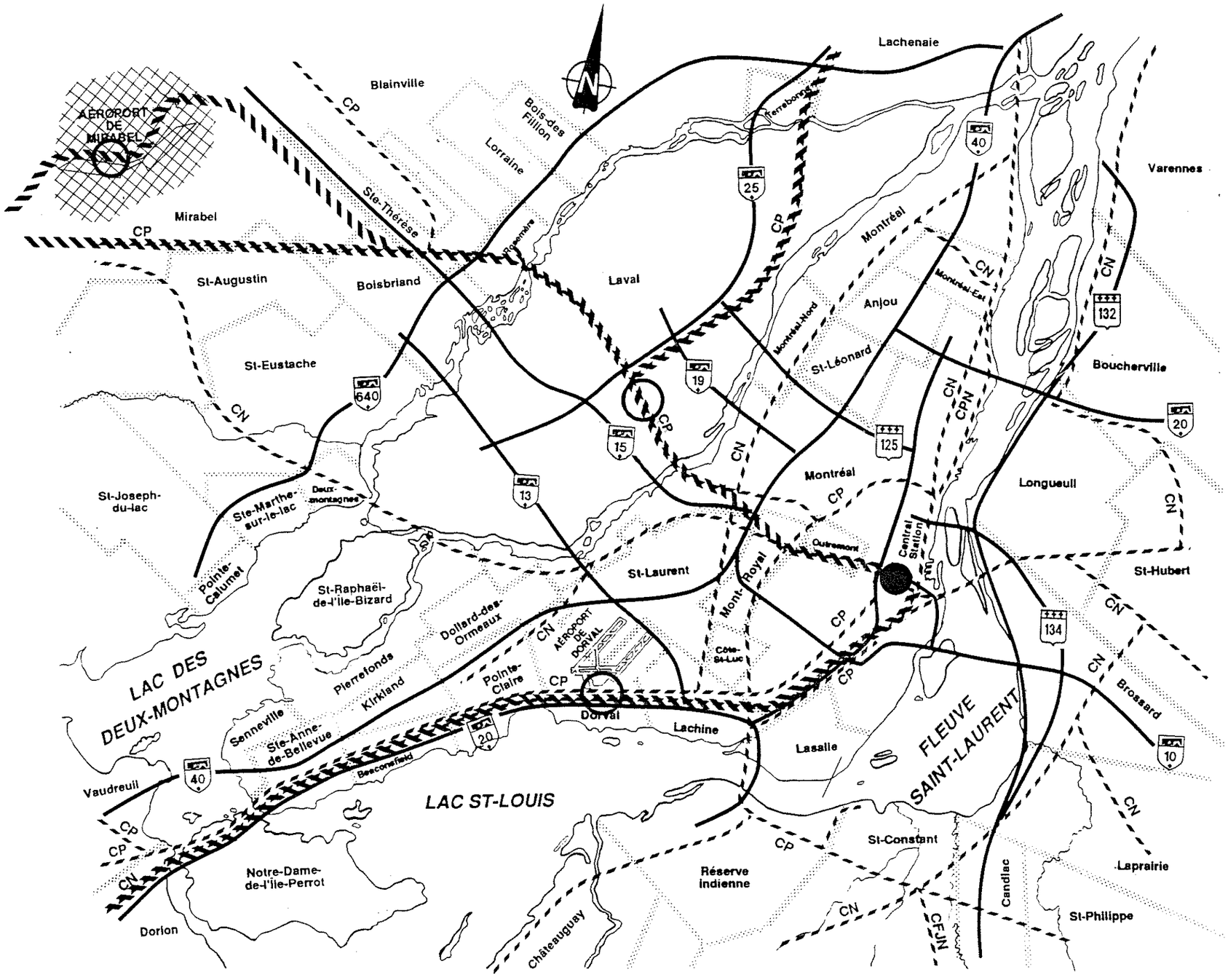
- HSR ROUTE
- MAJOR HIGHWAYS
- PROPOSED MAJOR HIGHWAYS
- RAILWAYS
- MUNICIPAL BOUNDARIES
- EXISTING/POSSIBLE INTERNATIONAL AIRPORTS
- POSSIBLE STATION SITES
- POSSIBLE SUBURBAN STATION SITES

QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

NATIONAL CAPITAL REGION HSR ROUTES AND EXISTING TRANSPORTATION CORRIDORS

EXHIBIT 4.1.4



LEGEND:

- HSR ROUTE
- MAJOR HIGHWAYS
- RAILWAYS
- MUNICIPAL BOUNDARIES
- EXISTING INTERNATIONAL AIRPORTS
- POSSIBLE STATION SITES
- POSSIBLE SUBURBAN STATION SITES

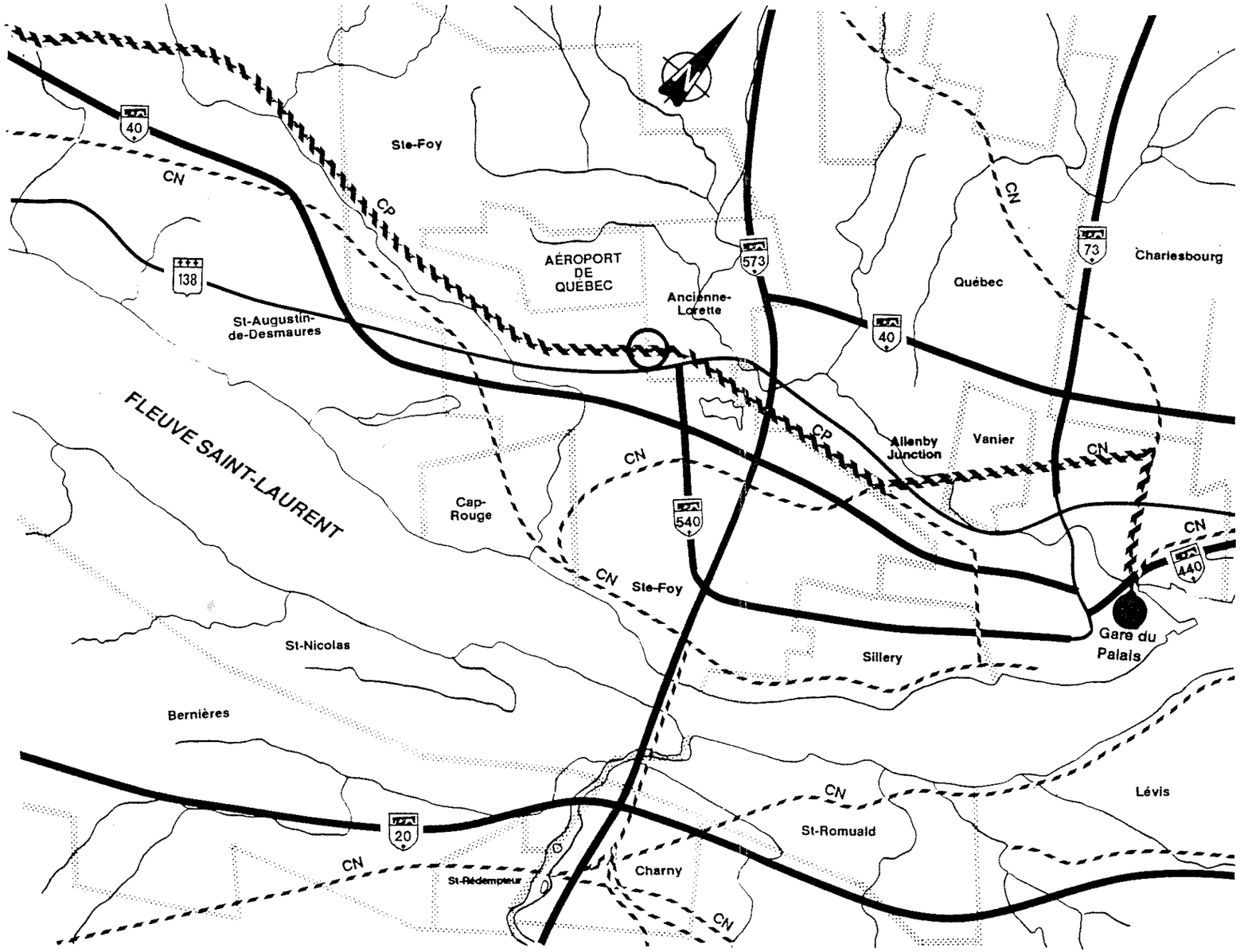
SCALE: 1: 100 000

QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

MONTREAL URBAN AREA HSR ROUTES AND EXISTING TRANSPORTATION CORRIDORS

EXHIBIT 4.1.5



LEGEND:

- HSR ROUTE
- MAJOR HIGHWAYS
- RAILWAYS
- MUNICIPAL BOUNDARIES
- EXISTING INTERNATIONAL AIRPORTS
- POSSIBLE STATION SITES
- POSSIBLE SUBURBAN STATION SITES

SCALE: 1: 100 000

QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

QUEBEC URBAN AREA HSR ROUTES AND EXISTING TRANSPORTATION CORRIDORS

EXHIBIT 4.1.6

Montréal Central Station

In the 200-250 kph scenario, HSR service would enter Central Station on upgraded tracks in CN Rail's Montréal Subdivision which is elevated at the station entrance above Rue St. Antoine. The present track layout includes 11 tracks which permit access to the existing Mont Royal Tunnel to the north of the platforms. The island platforms served by these tracks vary in length from 390 to 400 metres and are generally 7.3 metres wide. The existing main passenger concourse is shared by the MUTC commuter rail service and the present VIA Rail inter-city services.

For introduction of HSR service to Central Station, the following utilization of the facilities was assumed:

- HSR trains would generally have exclusive use of the six easternmost tracks linked to the two Mont Royal Tunnel tracks.

- The platforms, escalators and stairways serving the HSR tracks would be upgraded and modified to provide the required capacity, comfort and convenience and safety levels.

- The eastern half of the existing passenger concourse would be allocated to HSR service with the internal facilities such as reservations, baggage handling, waiting areas and concessions re-configured to provide the quality of access, egress and user convenience associated with HSR service elsewhere in the world.

- The two existing tracks in the Mont Royal Tunnel would be shared by MUTC commuter rail and HSR service. It is understood that sufficient capacity would be available on the existing tunnel tracks to accommodate the projected headway of both services.

4.3 ROUTE CHARACTERISTICS

4.3.1 Right-of-Way

This section provides an overview of the type of ROW acquisition or sharing assumed for the representative route for this scenario. Table 4.3.1 identifies the method proposed for establishing a HSR ROW between Windsor and Québec by segment along the corridor.

The table distinguishes between ROW acquired outright from one or other of the railways and ROW or corridor shared with CN or CP. Corridor sharing refers to the arrangement where HSR is in a dedicated ROW parallel to and contiguous with the existing rail ROW. The length of new ROW required for bypassing urban areas or geometric constraints is also identified. The tabulated data indicates that approximately 36% of the ROW would be acquired (from CP and VIA), 21% would share a rail corridor, 22% would be shared with CN or CP and 21% would be new ROW remote from existing corridors.

Some of the issues associated with acquisition of this ROW are outlined below for each of the primary segments of the route.

- Windsor to London:

Acquisition of industrial frontage land along 14 km of ROW in the Windsor area is required. Grain elevators, totalling 39 silos in all, would have to be acquired.

- London to Hamilton:

Widening of the CP ROW through London to achieve dedicated tracks causes significant impact on residential and industrial property. Acquisition costs could be near $20 million. The recent acceptance of speeds up to 200 kph on shared track would reduce these costs and impacts if this was accepted as the urban area speed limit.

Between London and Hamilton most property acquisition consists of agricultural land and widening of CN ROW. Severance and access issues will have to be addressed. The need for 10m widening for approximately 2km through the Royal Botanical Gardens in Hamilton will require mitigation of environmental concerns.

- Hamilton to Union Station

Development of a widened ROW for HSR tracks configured to permit speeds up to 250 kph; i.e. up to 10 metre offset requires major industrial and residential property acquisition at significant cost. Over 140 residences would be acquired or impacted and total acquisition costs could reach the $160 million range. This major impact could be reduced if operating speeds were constrained to 200 kph and track sharing with commuter and possibly freight trains was negotiated.

Segment	Length (km)	Method of Establishing ROW 200-250 Tilting Technology Table 4.3.1					
		Acquire Entire ROW from CN	Acquire Entire ROW from CP	Acquire Entire ROW from VIA	Sharing CN ROW or (Corridor)	Sharing CP ROW or (Corridor)	Acquire New ROW
Windsor	14					11/*3*	
Windsor to Tilbury	38		38				
Tilbury to Chatham	39						39
Chatham to London	84		84				
London to Woodstock	41					(41)	
Woodstock	19						19
Woodstock to Paris	15				(15)		
Paris to Dundas	24						24
Dundas to Oshawa	145				125/*20*		
Oshawa to Napanee	156				50 (101)		5
Napanee	8				(2)		6
Napanee to Brockville	105				*5* (95)		5
Brockville	17						17
Brockville to Smiths Falls	20		20				
Smith Falls	15						15
Smiths Falls to Richmond	22			22			
Richmond to Confederation Heights	31			17			14
Confederation Heights to Rigaud	111			111			
Rigaud to Vaudreuil	26						26
Vaudreuil to Dorion	6					6	
Dorion to Montréal (Central Station)	41				*41*		
Central Station to Boul. Metropolitan	8				*8*		
Boul. Metropolitan to Riv. Des Prairies	5					*1*	4
Riv. Des Prairies to Jct. Lachute Sd.	4					*3*	1
Jct. Lachute Sd. to Yamachiche	108		84				24
Yamachiche to Cap-de-la-Madeleine	25						25
Cap-de-la-Madeleine to Allenby Jct.	114		70				44
Allenby Jct. to Gare du Palais	8				*8*		
TOTAL LENGTH	1,249	0	296	150	175/*82* (213)	17/7 (41)	268

Lengths in italics represent ROW sharing with 4.5m offsets.
Lengths in parenthesis refer to sharing of the general rail corridor outside of the rail ROW.

- Union Station to Oshawa

As with the urban ROW west of Union Station, widening to achieve dedicated tracks spaced to permit speeds up to 250 kph results in major property impact and acquisition costs exceeding $100 million. Although the potential availability of part of the Scarborough Transportation Corridor has offered a solution in part of this section, the trade-off between land cost with built environment impact and operating speed/track sharing is crucial through the entire Lakeshore corridor.

- Oshawa to Kingston

Acquisition would be mainly new ROW contiguous to the CN ROW with some widening of CN ROW for sharing in urban areas. 2 km of ROW would be required through Darlington Provincial Park. Proximity to Lake Ontario raises land costs in some areas. Widening to maintain a 10 metre offset in the Kingston area requires $11 million of acquisition.

- Kingston to Richmond

Some impact on rural residential and industrial property would occur but most acquisition is from agricultural or natural land, hence acquisition of ROW would have to address compensation and natural environmental issues.

- Richmond to Ottawa

Acquisition of 53 homes would be necessary in the Barrhaven area to eliminate sharp curvature on the existing ROW to be acquired from VIA. The travel time benefits of straightening alignment would have to be weighed against this impact.

Some industrial and commercial impact also results in this section which is assumed to be acquired for exclusive HSR use. CN/CP are in the process of commencing a Plan of Development study for the use of surplus lands at Ottawa station.

- Ottawa to Montréal

ROW acquisition would be largely the M & O Subdivision from VIA Rail and new ROW around Riguad and Hudson. The bypass reduces land costs in the towns. Sharing of CN ROW has been assumed between Dorion and Central Station thus avoiding the need for major costly

widening. The feasibility of this approach hinges on track sharing opportunities in constrained areas (between Autoroute 20 and existing development) and whether projected traffic volumes would permit dedication of HSR tracks elsewhere. If this is not achievable, major property impact and significant land acquisition costs would have to be accepted.

- Montréal (Central Station to Laval)

Between Central Station and Rivière-des-Prairies sharing of the CN or CP ROW is utilized. Track sharing will also be necessary in parts of this section. Major widening has not been assumed since land costs are extremely high. A $5 million dollar allowance for the new tunnel easement has been included. Through Laval, acquisition of the CP ROW has been assumed from Saint-Martin junction eastward. Widening of this ROW is feasible if required for any sharing with freight.

- Laval to Ancienne Lorette

Acquisition would be largely the CP Trois-Rivières Subdivision. Agricultural land would be required for bypasses of urban areas. Severance and access issues will have to be resolved. The Trois-Rivières bypass results in acquisition costs in the $15 million range since presently undeveloped land is zoned residential and/or industrial.

- Ancienne Lorette to Québec

Acquisition of CP ROW and sharing of CN Row is assumed. No widening has been included on the assumption that if dedicated tracks cannot be accommodated, track sharing is acceptable.

4.3.2 Alignment

The alignment defined for the tilting technology scenario generally permits operation of HSR service at speeds in the 220-250 kph range through the rural portions of the corridor. In these rural areas, most speed restrictions due to sharp curvature have been eliminated by alignment improvements to achieve desirable curve radii. In some situations a portion of new ROW has been developed to bypass both urban areas and one or more sharp curves. This approach has confined most geometry - caused speed restrictions to the major urban areas along the route.

Very few locations remain where it is not feasible to provide curvature meeting 250 kph design standards. At these locations, curve radii permitting speeds as close as possible to 200 kph have been selected.

Profile grades for this scenario are based largely on the grades of the existing tracks presently occupying the ROW. Generally, this results in grades between 0 and 1.5%, well within the capabilities of HSR equipment.

The only areas where steeper grades are assumed are the entrances to the new tunnel in north Montréal and the approaches to Québec west of Ancienne Lorette. Two percent grades have also been used for approach grades where it is deemed appropriate to grade separate HSR tracks over other railways or highways.

4.3.3 Structures

The route developed for tilting technology includes tunnels at four locations, namely:

- a 3.25 km tunnel through the escarpment, between Hamilton and Burlington, because the existing CN alignment along the wall of the escarpment cannot be improved without significant environmental and property impact.

- a 2 km tunnel in north Montréal to link the CP Lachute Subdivision to the CN Mont Royal Subdivision thus avoiding sharp curvature on existing ROW's and two major railway junctions.

- a 1.5 km tunnel on the CP Trois-Rivières Subdivision in a fully developed area of Laval to bypass a severe speed restriction (400 metre radius curve) in the existing CP ROW.

- a 2.4 km tunnel through hilly terrain between Rigaud and Hudson, on the section of new ROW, included to bypass the two towns and sharp curvature in the CP ROW passing through them.

In addition to these tunnels, 7.7 km of viaduct structure is required. These have been assumed in locations where the height of an embankment would exceed 20 metres or where the HSR track must pass over a series of existing features such as rivers, lakes, roads, railways or large areas of poor ground. An example is the 2.7 km viaduct required to carry the HSR alignment

through Bayview Junction near Hamilton. This approach is consistent with current practice on HSR lines in Europe.

The topographical mapping and bridge inventory data obtained from the railways was used to identify bridges to carry HSR tracks over rivers. The quantity of these structures, varying in length between 15 and 500 metres, is indicated for each segments in the list below:

- Windsor to Toronto - 38 (11 per 100 km)
- Toronto to Ottawa - 25 (6 per 100 km)
- Ottawa to Montréal - 10 (6 per 100 km)
- Montréal to Québec - 93 (34 per 100 km)

4.3.4 Grade Separations

As stated in Section 1, it has been assumed that grade separations only need to be provided for Provincial Highways or other highways carrying high volumes of traffic. Topographic maps and railway bridge and crossing lists were used to identify the crossings where grade separations would be required. Generally, the HSR profile was developed on the basis that crossing roads would be raised or lowered unless surrounding development or terrain precluded this approach. In the case of rail over rail grade separations, the HSR profile has been raised for the crossing since the steeper grades permitted for HSR trains result in shorter approach fills.

Use of the above approach has resulted in the following requirements for new grade separations in the major segments of the corridor:

- Windsor to Toronto - 36 (10 per 100 km)
- Toronto to Ottawa - 70 (16 per 100 km)
- Ottawa to Montréal - 18 (10 per 100 km)
- Montréal to Québec - 24 (9 per 100 km)

In addition to the above new grade separations, the requirements for modifications of existing grade separations is estimated to be as follows:

- Windsor to Toronto - 68 (19 per 100 km)
- Toronto to Ottawa - 73 (17 per 100 km)
- Ottawa to Montréal - 33 (19 per 100 km)
- Montréal to Québec - 24 (9 per 100 km)

4.4 ACCESS TO URBAN AREAS

In this section, the route adopted to access the major urban areas of Windsor, Greater Toronto, the National Capital Region, Montréal and Québec, is described. Given that the primary objective of this scenario, (200-250 kph technology on existing ROW) is to maximize use of existing rail corridors, the urban access routes follow CP or CN Subdivisions in all of the above urban areas.

4.4.1 Windsor

As indicated in Section 4.1 the route is assumed to start at the south end of the existing Windsor-Detroit Tunnel. This location permits access to Detroit by sharing of the tunnel track with CN and CP, the joint owners of the tunnel. South of the tunnel portal, new tracks immediately adjacent to existing tracks in CN's Caso Subdivision, would carry HSR trains into the CP Windsor Subdivision. This subdivision is followed eastward, through the new HSR station site, to the limits of the Windsor urban area.

4.4.2 Greater Toronto Area

The route enters the Greater Toronto Area along the CN Dundas Subdivision in the north-east corner of Hamilton. After passing through the new tunnel, described in Section 4.3.3, the HSR tracks would run parallel to the Dundas Subdivision to Bayview Junction where a 2.7 km viaduct is necessary to carry the new tracks through the topographical constraints at the junction.

From the junction the CN Oakville Subdivision is used as the corridor to Metropolitan Toronto. New HSR tracks would be constructed on the south side at a 10m offset through Burlington, Oakville, and Mississauga up to Browns Line in Etobicoke. The minimum radius is 8000m up to Dixie Road in the east part of Mississauga where a 3000m curve is introduced. A significant amount of industry exists along the CN Oakville Subdivision so a new industrial spur track

would be necessary south of the HSR tracks for a significant length to maintain access to industrial spurs. East of Browns Line, the HSR tracks would be added to the existing rail corridor with a minimum offset (i.e. 4.5m). In the section from South Kingsway to Dufferin Street extensive retaining walls will be required to construct two new tracks within the existing constrained ROW. The Oakville Subdivision enters the Toronto Terminal Railway territory where HSR tracks would be incorporated into the existing multi-track ROW through Union Station.

From Union Station eastward to Victoria Park Ave. (approximately 9 km) the new HSR tracks would be constructed on the south side, immediately adjacent to the existing tracks (4.5m offset) in the CN Kingston Subdivision.

From Victoria Park Avenue in Scarborough to Whites Road in Pickering (21 km) the new tracks would be located in the CN Subdivision with a 10m offset. The minimum curve radius through this section is 2000m with the exception of a 1750m curve near Victoria Park Avenue. The HSR tracks would encroach on the Scarborough Transportation Corridor to achieve the 10m offset and improved horizontal geometry. The HSR tracks would follow the Scarborough Transportation Corridor as opposed to the CN ROW from Midland Avenue to Markham Road.

Between Whites Road in Pickering and the Oshawa/Newcastle Boundary, the HSR tracks would be on the south side of the existing tracks in the Kingston Subdivision. The curves in this section could readily be improved to the 4500m range with the exception of the east end of Oshawa.

In the ROW between Burlington and Oshawa, 18 GO Transit Stations will be impacted to varying degrees by the addition of the HSR tracks. The impact will range from platform modifications to extensions of existing pedestrian tunnels at the stations.

4.4.3 National Capital Region

As described in Section 4.1, the route approaches the National Capital Region from Smiths Falls using the CN Smiths Falls Subdivision. A 13km section of new ROW is necessary to bypass Richmond and avoid sharp curvature on this Subdivision. At Barrhaven, the straightening of the alignment to avoid a 500 metre radius curve would require acquisition of a significant number of homes over a 1.3 km length of the new ROW through a recently constructed residential subdivision. The existing curve would restrict speed to 150 kph.

From Barrhaven to Federal Junction, the HSR tracks would be placed in the existing rail ROW. At the junction, the curvature of the present ROW would be improved by constructing a new viaduct crossing highway 16, the CN tracks, the Rideau River and Canal and Riverside Drive. Between the viaduct and the existing VIA Station at Alta Vista, the HSR track would be located in the CN Beachburg Subdivision. This ROW, is severely constrained by adjacent development and has six curves between 800 and 2000 metre radius within a 10 km length. A 280 metre curve must be negotiated immediately east of the station. This curve would not present a severe speed restriction for trains decelerating to, or accelerating from, the Ottawa Station.

East of the station, the HSR tracks would be located in the CP M and O Subdivision which provides a corridor to leave the Ottawa urban area in an easterly direction south of Blackburn Hamlet and north of Mer Bleue.

4.4.4 Montréal

For this scenario, the HSR route enters the Montréal urban area over the two bridges crossing the Baie de Vaudreuil east of Dorion. From Ste-Anne-de-Bellevue to Dorval the HSR tracks would share the CN Kingston Subdivision. Except for a 900m radius curve in Ste-Anne-de-Bellevue, the curves in the existing ROW have radii between 3400 and 4750m.

East of the existing station at Dorval, the CN Montréal Subdivision would be used to reach Central Station. This ROW imposes a major speed restriction with numerous curves between 300m and 1400m radius.

To leave Central Station on route to Québec, the existing double track Mont Royal tunnel would be utilized for the first 5km. It has been assumed that HSR trains would share tracks with the proposed upgraded commuter rail service. North of the tunnel portal, the HSR route would leave the CN Mont Royal Subdivision and utilize a new tunnel to reach the CP Lachute Subdivision near Henri Bourassa Boulevard. New dedicated tracks in the CP Subdivision would continue northward to Saint-Martin junction in Laval. At the junction, a 400 metre radius curve must be negotiated to reach the CP Trois-Rivières Subdivision adopted as the route to exit Laval to the east. As noted in the listing of tunnels required for this scenario, the speed restriction imposed by this sharp curve can only be avoided by construction of a new tunnel under the adjacent development.

4.4.5 Québec

The HSR route enters the Québec urban area in the CP Trois-Rivières Subdivision at Ancienne-Lorette. HSR tacks would remain in this subdivision as far as Allenby Junction where the CP ROW meets the CN Bridge Subdivision. Up to this point the minimum curve radius is 1200 m. Between Allenby Junction and Gare du Palais, the HSR tracks would be constructed in the CN Bridge Subdivision ROW. This ROW is severely constrained by adjacent development, hence major expropriation would be required to improve the existing 1200m and 350m radius curves. HSR tracks would pass through the CN Limoilou Yards and cross the Rivières St. Charles to enter the existing Gare du Palais.

4.4.6 Access to Toronto and Montréal Airports

For this tilting technology scenario, the lakeshore route through the Greater Toronto Area precludes any opportunity to provide HSR access to Pearson Airport or a possible future airport in Pickering.

In Montréal, the Dorval Airport can be linked to HSR service passing through the existing CN rail corridor at Dorval Station. Access to the terminal buildings would have to be achieved by some form of people mover or shuttle bus service. Diversion from the rail corridor to pass under or close to the terminal buildings would require an extensive, costly underground alignment beneath fully developed communities and across airport property.

The routing for this scenario precludes any direct access to Mirabel Airport unless the Montréal urban area is accessed from Lachute as in the representative route for the "Over 300 kph, existing ROW" scenario. Clearly, this alternative access would eliminate any direct link to Dorval Airport.

5 ENVIRONMENTAL IMPACT - 200-250 KPH TILTING TECHNOLOGY

5.1 WINDSOR TO TORONTO

This chapter provides a selective overview of potential natural and socio-economic environmental impacts to sensitive features directly affected by the 200-250 kph tilting technology routing option.

5.1.1 Natural Environment

The four natural components affected by this route are Provincially Significant Features, Ecological Reserves/Wildlife Management Areas, Significant Fisheries/Aquatic Habitat and Floodplain/Geotechnical Hazards (refer to Table 5a).

i) Provincially Significant Features

- Affects three Class 1-3 wetlands (3.7 km) Benwell Swamp east of Woodstock, the Rouge Marsh located along the eastern Metro Toronto border and the Second Marsh at the east end of Oshawa);

- Impacts three Areas of Natural and Scientific Interest (ANSIs) (3.4 km). One is located in the Dundas Valley in Hamilton (Spencer's Gorge - provincially significant life science ANSI; regionally significant earth science ANSI; international Biological Preserve) and two in the Rouge Valley system on the eastern periphery of Toronto;

- Affects fourteen (14.4 km) Environmentally Sensitive Areas (ESAs) :

  - From Kitchener to Hamilton the Grand River Forest, Dundas Valley, Spencer Gorge, Borer's Falls - Rock Chapel the Royal Botanical Gardens, and Grindstone Creek are affected;

  - Bronte Creek, Sixteen Mile Creek and six more minor ESAs are located along the route from Oakville to the east limit of the study area.

- Crosses two features declared to be of Provincial Interest (11 km crossing of relatively undisturbed area of the Niagara Escarpment, including 3.3 km in tunnel to avoid running along face of Escarpment in Dundas Valley; 3 km at south end of Rouge Valley Park).

ii) **Ecological Reserves/Wildlife Management Areas**

- Affects one waterfowl habitat, just north of Tilbury, over a length of 2.7 km.

iii) **Significant Fisheries/Aquatic Habitat**

- Majority of the streams and rivers crossed are warm water (178). These are typically less significant in terms of fisheries and aquatic habitat. Only two cold water crossings (Oxbow Creek near Komoka and Grindstone Creek in Burlington);

- Eleven migratory streams; all but one, the Thames River between Haycroft and Kentbridge, are located in the Greater Toronto Area. Major watercourses are Credit River and Etobicoke Creek (west of Toronto) and Oshawa Creek to the east. Other streams are minor (two west of Toronto; five to the east).

iv) **Floodplain/Geotechnical Hazards**

- Crosses eight sections (80.5 km) of deep silty clay with alluvium at river crossings which may constitute an erosion/instability problem or where cut material may not be suitable for reuse as fill. Most extensive areas are from Tilbury to east of Chatham (40.0 km including Baptiste Creek, Jeannette's Creek and Thames River), from Newbury to east of Glencoe (16.0 km including tributaries to Sydenham Creek and Thames River) and from the Metro Toronto boundary east to Oshawa (20.1 km including Lake Ontario Shoreline areas for the Rouge River, Dufferin Creek, Carruthers Creek, Lynde Creek, and Oshawa Creek watersheds);

- Crosses two sections of wetland (peat and muck) soils (5.1 km).

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 5a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 200 Km/h on Existing ROW

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.0	0	0.0	0	0.0
2020-2040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	0.0	0	0.0	0	0.0
2040-2060	0	0.0	0	0.0	0	0.0	1	2.7	0	0.0	0	0.0	0	0.0	7	0.0	0	0.0	0	0.0
2060-2080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.0	0	0.0	0	0.0
2080-2100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.0	0	0.0	0	0.0
2100-2120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2120-2140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2140-2160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0
2160-2180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	8	0.0	0	0.0	0	0.0
2180-2200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.0	0	0.0	0	0.0
2200-2220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	20	0.0	0	0.0	0	0.0
2220-2240	1	1.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	10	0.0	0	0.0	0	0.0
2240-2260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	12	0.0	0	0.0	0	0.0
2260-2280	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	23	0.0	0	0.0	0	0.0
2280-2300	0	0.0	1	0.6	2	2.1	0	0.0	0	0.0	1	11.0	0	0.0	19	0.0	0	0.0	0	0.0
2300-2320	0	0.0	0	0.0	3	1.5	0	0.0	0	0.0	0	0.0	1	0.0	15	0.0	1	0.0	0	0.0
2320-2340	0	0.0	0	0.0	2	6.2	0	0.0	0	0.0	0	0.0	0	0.0	10	0.0	3	0.0	0	0.0
2340-2360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	0.0	1	0.0	0	0.0
2360-2380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.0	0	0.0	0	0.0
2380-2400	1	0.9	2	2.8	2	1.1	0	0.0	0	0.0	0	0.0	0	0.0	8	0.0	1	0.0	0	0.0
2400-2420	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	10	0.0	4	0.0	0	0.0
2420-2440	1	1.5	0	0.0	1	2.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	3	3.6	3	3.4	12	14.5	1	2.7	0	0.0	1	11.0	2	0.0	178	0.0	10	0.0	0	0.0

Station Commencing: 2000+000

Station Ending: 2419+148

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 5a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 200 Km/h on Existing ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Set tlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	1	1.0	0	0.0	1	1.0
2020-2040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.0	0	0.0	2	2.0
2040-2060	0	0.0	0	0.0	1	3.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	2.0
2060-2080	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	3.0
2080-2100	0	0.0	0	0.0	1	17.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2100-2120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0
2120-2140	0	0.0	0	0.0	1	11.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
2140-2160	0	0.0	0	0.0	1	5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2160-2180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	3	3.0
2180-2200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2200-2220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.0	0	0.0
2220-2240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	2.0	0	0.0	5	8.7
2240-2260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	2	1.4
2260-2280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	4	4.0
2280-2300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	9.8	2	9.3	1	3.0	0	0.0	0	0.0
2300-2320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0
2320-2340	0	0.0	1	3.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2340-2360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.6	0	0.0	0	0.0	0	0.0	0	0.0
2360-2380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2380-2400	0	0.0	0	0.0	1	8.1	1	3.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2400-2420	0	0.0	1	1.5	1	14.1	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0	0	0.0	0	0.0
2420-2440	0	0.0	0	0.0	1	2.3	1	1.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	2	5.1	8	80.5	2	4.5	0	0.0	0	0.0	5	11.8	4	10.5	6	7.0	3	4.0	23	26.0

Station Commencing: 2000+000

Station Ending: 2419+148

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 5a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 200 Km/h on Existing ROW

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	3	11.7	0	0.0	3	4.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2020-2040	5	18.8	0	0.0	2	15.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.5
2040-2060	4	19.0	1	0.2	4	18.0	0	0.0	1	2.0	1	2.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2060-2080	2	19.5	2	0.7	4	16.9	0	0.0	1	1.2	2	12.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2080-2100	4	17.4	2	0.2	1	20.0	0	0.0	2	6.9	1	13.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2100-2120	3	18.9	4	0.7	3	17.3	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	6.0
2120-2140	5	16.5	1	0.1	3	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2140-2160	5	9.8	1	0.7	2	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2160-2180	1	19.8	0	0.0	4	11.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2180-2200	3	11.7	0	0.0	3	3.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2200-2220	5	17.6	1	0.4	2	19.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2220-2240	4	18.4	0	0.0	3	4.8	0	0.0	0	0.0	2	18.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2240-2260	5	19.2	1	0.1	4	6.5	0	0.0	1	3.0	3	9.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2260-2280	7	17.3	0	0.0	2	1.8	1	4.6	2	7.1	2	8.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2280-2300	12	7.2	0	0.0	2	1.2	1	6.0	0	0.0	1	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2300-2320	9	6.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2320-2340	4	2.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2340-2360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2360-2380	1	1.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2380-2400	3	18.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2400-2420	3	18.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2420-2440	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	88	291.8	13	3.0	42	180.5	2	10.5	8	20.2	12	67.4	0	0.0	0	0.0	0	0.0	0	0.0	3	7.5

Station Commencing: 2000+000

Station Ending: 2419+148

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 5a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 200 Km/h on Existing ROW

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
2000-2020	0	0.0	0	0.0
2020-2040	0	0.0	0	0.0
2040-2060	0	0.0	0	0.0
2060-2080	0	0.0	0	0.0
2080-2100	0	0.0	0	0.0
2100-2120	0	0.0	0	0.0
2120-2140	0	0.0	0	0.0
2140-2160	0	0.0	0	0.0
2160-2180	0	0.0	0	0.0
2180-2200	0	0.0	0	0.0
2200-2220	0	0.0	0	0.0
2220-2240	0	0.0	0	0.0
2240-2260	0	0.0	0	0.0
2260-2280	0	0.0	0	0.0
2280-2300	0	0.0	0	0.0
2300-2320	0	0.0	0	0.0
2320-2340	0	0.0	0	0.0
2340-2360	0	0.0	0	0.0
2360-2380	0	0.0	0	0.0
2380-2400	0	0.0	0	0.0
2400-2420	0	0.0	0	0.0
2420-2440	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 2000+000

Station Ending: 2419+148

5.1.2 Socio-Economic Environment

i) Major Parks/Historic Sites

- Encroaches (1.5 km) on Darlington Provincial Park east of Oshawa;
- 3 km crossing of Rouge Valley Park.

ii) Major Tourism/Recreation/Conservation Area

- Encroaches on six recreational areas (13.1 km);
- Affects five Conservation Areas (10.5 km), encroaching on four, severing one. Greatest impacts (9.3 km) in Dundas Valley area of Niagara Escarpment (Dundas Valley, Governor's Road, Borer's Falls).

iii) Urban Perimeters

- Relatively minor impacts outside areas being served (six communities, 7.0 km). Excludes 17 km through Windsor and 130 km through Lakeshore conurbation where adjacent industrial land use, reduced operating speeds and high existing noise levels may reduce the significance of noise concerns (Hamilton, Burlington, Oakville, Metropolitan Toronto, Pickering, Ajax, Whitby and Oshawa).

iv) Rural Communities

- Belle River and Thamesford are the only small defined municipal settlements affected by this route (where noise could be a concern). The line encroaches within 500 m of Belle River for 1.0 km and within 500 m of Thamesford for 2.0 km;
- Passes through five small undefined rural communities (Elmstead, St. Joachim Station, Haycroft, Arkwood and Kentbridge) and comes close (within 250 m) to 23 clusters of residences (31.0 km).

v) **Agriculture**

- Traverses a total of 291.8 km of best agricultural soils. Approximately 84% of soils between Windsor and Paris are Class 1 and 2; 70% of soils between Paris and Hamilton are Class 1 and 2. Route runs mainly through developed areas from Hamilton to Oshawa;

- No significant specialty crop areas affected;

- Crosses a total of 180.5 km of artificially drained agricultural land (43.0% of total route). Approximately 80% of the line between Windsor and London (east side) is artificially drained (primarily tile system; includes 111 drains). Impacts somewhat reduced by fact that the line is primarily within existing CP corridor;

- New severance impacts only where route deviates from existing CP corridor (67.4 km). Awkward lot configurations from Tilbury to east of Chatham and from southwest Oxford to Blandford Blenheim East to avoid Woodstock.

vi) **Major Natural Resource Areas**

- Crosses small portions of oil/gas pools west of St. Joachim, north of Thamesville, and west of Bothwell (31.7 km). Minor effect of aggregate resources (4 areas; 1.5 km).

5.2 TORONTO TO OTTAWA

5.2.1 Natural Environment

i) **Provincially Significant Features**

- Affects eleven provincially significant wetland areas (33.2 km). Includes areas associated with river valleys oriented north-south to Lake Ontario (Lakeshore Corridor), areas in the Rideau River system and areas associated with the St. Lawrence lowlands. Includes Marlborough Regional Forest/Wetland Complex northeast of Smiths Falls;

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 5b

SECTION : TORONTO TO OTTAWA

TECHNOLOGY : 200 Km/h on Existing ROW

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.1	0	0.0	0	0.0	0	0.0
2020-2040	1	3.2	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2040-2060	1	1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.4	0	0.0	0	0.0	0	0.0
2060-2080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2080-2100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2100-2120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.2	0	0.0	0	0.0	0	0.0
2120-2140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.3	0	0.0	0	0.0
2140-2160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2160-2180	1	0.6	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.2	0	0.0	0	0.0
2180-2200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2200-2220	1	6.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0
2220-2240	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0
2240-2260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2260-2280	1	5.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2280-2300	2	5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2300-2320	1	1.2	0	0.0	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	2	0.3	0	0.0	0	0.0
2320-2340	1	1.6	0	0.0	1	6.4	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0
2340-2360	1	7.2	0	0.0	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	1	0.0	0	0.0	0	0.0
2360-2380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	5.0	0	0.0	3	1.2	0	0.0	0	0.0
2380-2400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	12	33.2	2	0.4	1	6.4	0	0.0	0	0.0	4	65.0	6	0.7	13	2.3	0	0.0	0	0.0

Station Commencing: 2000+000

Station Ending: 2342+780 (to Richmond)

2379+555 (to Ottawa)

TABLE 5b

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : TORONTO TO OTTAWA
TECHNOLOGY : 200 Km/h on Existing ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Settlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	0	0.0	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	2	3.5	0	0.0	0	0.0
2020-2040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2040-2060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	7.7	0	0.0	1	1.0
2060-2080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.4	0	0.0	1	0.2
2080-2100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	9.7
2100-2120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.4	0	0.0	0	0.0
2120-2140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	7.0	0	0.0	2	6.0
2140-2160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.0	0	0.0	1	0.2
2160-2180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	1	0.2
2180-2200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.5
2200-2220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2220-2240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	4.8
2240-2260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.2
2260-2280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	2	0.4
2280-2300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2300-2320	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.5
2320-2340	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2340-2360	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.0	0	0.0
2360-2380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.1	0	0.0	0	0.0
2380-2400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	3	60.0	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	11	30.0	1	3.0	17	28.7

Station Commencing: 2000+000
Station Ending: 2342+780 (to Richmond)
2379+555 (to Ottawa)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 5b

SECTION : TORONTO TO OTTAWA

TECHNOLOGY : 200 Km/h on Existing ROW

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2020-2040	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2040-2060	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2060-2080	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2080-2100	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2100-2120	3	5.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2120-2140	4	5.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2140-2160	1	2.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.5	0	0.0	0	0.0	0	0.0
2160-2180	2	6.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2180-2200	2	3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2200-2220	2	8.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2220-2240	1	1.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2240-2260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2260-2280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2280-2300	1	3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2300-2320	2	4.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2320-2340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2340-2360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2360-2380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2380-2400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	23	141.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.5	0	0.0	0	0.0	0	0.0

Station Commencing: 2000+000

Station Ending: 2342+780 (to Richmond)

2379+555 (to Ottawa)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : TORONTO TO OTTAWA
TECHNOLOGY : 200 Km/h on Existing ROW

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
2000-2020	0	0.0	0	0.0
2020-2040	0	0.0	0	0.0
2040-2060	0	0.0	0	0.0
2060-2080	0	0.0	0	0.0
2080-2100	0	0.0	0	0.0
2100-2120	0	0.0	0	0.0
2120-2140	0	0.0	0	0.0
2140-2160	0	0.0	0	0.0
2160-2180	0	0.0	0	0.0
2180-2200	0	0.0	0	0.0
2200-2220	0	0.0	0	0.0
2220-2240	0	0.0	0	0.0
2240-2260	0	0.0	0	0.0
2260-2280	0	0.0	0	0.0
2280-2300	0	0.0	0	0.0
2300-2320	0	0.0	0	0.0
2320-2340	0	0.0	0	0.0
2340-2360	0	0.0	0	0.0
2360-2380	0	0.0	0	0.0
2380-2400	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 2000+000
Station Ending: 2342+780 (to Richmond)
2379+555 (to Ottawa)

- Affects 0.4 km ANSI's (0.2 km near Wesleyville; 0.2 km near Napanee) and ESAs (6.4 km) generally associated with wetland and north-south valley areas in Lakeshore corridor and Shrike habitat southwest of Ottawa in the Marlborough Regional Forest 1;

- Shrike habitat is important as nesting area for some of the Province's Loggerhead Shrike. This species was never numerous in Ontario and has suffered noticeable decline in recent years due to habitat destruction. This species is designated as "threatened" in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

ii) **Ecological Reserves/Wildlife Areas**

- Affects 65.0 km of sensitive area concentrated between Smiths Falls and Richmond;

- Major impacts comprise encroachment along the western periphery of Marlborough Regional Forest/Wetland Complex (10.0 km) and the RMOC Greenbelt (5.0 km).

iii) **Significant Fisheries/Aquatic Habitat**

- Crosses a total of 200 watercourses;

In the Marlborough Forest, impacts are expected to be minimal since the HSR operation will displace existing operations in this portion of the CN Rail corridor.

- Crosses 30 streams in Lakeshore Corridor which have migratory salmonoid or cold water fishery importance (includes 0.7 km cold water crossings and 2.3 km warm water crossings). Also includes Rideau River system south of Ottawa (1.2 km).

iv) **Significant Forests**

- Encroaches on western periphery of Marlborough Regional Forest/Wetland Complex. Important deer wintering areas in the Regional Forest, waterfowl habitat and rare plants are some of the sensitive features of this recognized, major wildlife refuge. Total encroachment on sensitive area is 60.0 km.

5.2.2 Socio-Economic Environment

i) **Major Parks/Historic Sites**

- Encroaches on Wilmot Creek Provincial Park (0.3 km).

ii) **Urban Perimeters**

- Passes through 29.5 km of defined settlement area outside centres being served directly (includes Bowmanville, Port Hope, Cobourg, Colborne, Brighton, Trenton, Belleville, Napanee and Barrhaven).

iii) **Rural Communities**

- Comes close (within 500 m) to one urban area over a distance of 3.0 km (Richmond);
- Comes close (within 250 m) to undefined clusters of residential areas over a distance of 29.2 km.

iv) **Agriculture**

- Route traverses 141.3 km (approximately 35% of total length) of Class 1 and 2 soils. Most extensive between Oshawa and west of Trenton (100% of segment to 100 km mark) and extends to Napanee in Lakeshore corridor.

v) **Federal Reserves**

- Encroaches on Tyendinaga Indian Reserve No. 38 (0.4 km) just east of Belleville.

5.3 Ottawa to Montréal

5.3.1 Natural Environment

Natural components affected on this route segment are essentially limited to Provincially Significant Features and Ecological Reserves/Wildlife Areas.

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : OTTAWA TO MONTREAL
TECHNOLOGY : 200 Km/h on Existing ROW

TABLE 5c

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	1	4.0	1	1.2	0	0.0	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	0	0.0
0020-0040	0	0.0	1	0.5	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0040-0060	0	0.0	0	0.0	0	0.0	3	8.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0060-0080	1	1.0	0	0.0	0	0.0	1	8.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0100-0120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0120-0140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	2	5.0	2	1.7	0	0.0	5	16.7	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	0	0.0

Station Commencing: 0000+000
Station Ending: 0400+000

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 5c

SECTION : OTTAWA TO MONTREAL

TECHNOLOGY : 200 Km/h on Existing ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Set-tlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	2	1.3
0020-0040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.8
0040-0060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	4.3
0060-0080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.6
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.2
0100-0120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.0	2	0.6	0	0.0
0120-0140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	4.0	1	2.0	2	0.6	11	8.2

Station Commencing: 0000+000

Station Ending: 0400+000

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : OTTAWA TO MONTREAL
TECHNOLOGY : 200 Km/h on Existing ROW

TABLE 5c

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	1	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0020-0040	3	3.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	1.3	0	0.0
0040-0060	2	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0060-0080	2	5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0100-0120	3	6.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0120-0140	1	1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	12	19.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	1.3	0	0.0

Station Commencing: 0000+000
Station Ending: 0400+000

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 5c

SECTION : OTTAWA TO MONTREAL

TECHNOLOGY : 200 Km/h on Existing ROW

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
0000-0020	0	0.0	0	0.0
0020-0040	0	0.0	0	0.0
0040-0060	0	0.0	0	0.0
0060-0080	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0
0100-0120	0	0.0	0	0.0
0120-0140	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 0000+000

Station Ending: 0400+000

i) **Provincially Significant Features**

- Encroaches on 5.0 km of Class 1 wetland southeast of Ottawa. Mer Bleue (4.0 km) is a sphagnum peat bog. The black spruce and tamarack habitat of Mer Bleue and other flora and fauna of the area are characteristic of peatland habitats, of which there are only a few in the Ottawa vicinity. Also affects Alfred Bog (1.0 km), a Class 1 wetland;

- Affects three ANSIs (1.7 km). Includes provincially significant Mer Bleue wetland and locally significant areas adjacent to route between Navan and Leonard.

ii) **Ecological Reserves/Wildlife Areas**

- Affects a total of 16.7 km of major waterfowl area (predominantly in the area south of Plantagenet);

- The 4.0 km through Mer Bleue is also classified as a reserve/management area.

5.3.2 Socio-Economic Environment

The route exhibits limited potential for creating socio-economic impacts; these are limited to Major Tourism/Recreation/Conservation Areas, Urban Perimeters, Rural Communities, Agriculture and Major Natural Resource Areas.

i) **Major Tourism/Recreation/Conservation Areas**

- South of the Ottawa River, Mer Bleue (4.0 km) also presents a major constraint, in that area is managed by the National Capital Commission for multiple use, including conservation, outdoor education and natural history, and recreation.

ii) **Urban Perimeters**

- Passes through community of Rigaud (2.0 km).

iii) **Rural Communities**

- Comes close (within 500 m) to communities of Hudson and Como for a length of 0.6 km;

- Comes close (within 250 m) to five clusters of residential dwellings over 9.2 km, primarily in the area between Ottawa and west of Hudson (includes Navan, Plantagenet Station, Vankleek Hill Station and St-Eugene).

iv) **Agriculture**

- Approximately 5% of the route (19.3 km) traverses the best (Class 1 and 2 but primarily isolated pockets of Class 2) agricultural soils. Areas of concentration are immediately southeast of Ottawa, near Plantagenet and near Hudson. Minor impacts.

v) **Major Natural Resource Areas**

- Affects three mineral aggregate resource areas between Leonard and Hammond (1.3 km).

5.4 Montréal to Québec

5.4.1 Natural Environment

The 200-250 kph option on or adjacent to the existing CP right-of-way does not cross any Provincially Significant Features or Significant Forests (Regional Forests). However, it will encounter three types of natural elements exhibiting varying degrees of sensitivity: Ecological Reserves/Wildlife Management Areas, Significant Fisheries/Aquatic Habitat (including watercourse crossings) and Floodplain/Geotechnical Hazards (refer to Table 5d).

i) **Ecological Reserves/Wildlife Management Areas**

- Only one zone, used by waterfowl for feeding purposes (5.6 km), will be affected in the agricultural inlands north of Lake Saint-Pierre. This wildlife feeding area has a low level of sensitivity.

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : MONTREAL TO QUEBEC
TECHNOLOGY : 200 Km/h on Existing ROW

TABLE 5d

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2020-2040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
2040-2060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2060-2080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.6
2080-2100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2100-2120	0	0.0	0	0.0	0	0.0	1	5.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2120-2140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2140-2160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2160-2180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2180-2200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
2200-2220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2220-2240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
2240-2260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2260-2280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2280-2300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	0	0.0	0	0.0	1	5.6	0	0.0	0	0.0	0	0.0	139	0.0	0	0.0	6	1.3

Station Commencing: 2006+300 (Central Station)
Station Ending: 2278+800(Gare du Palais)

TABLE 5d

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : MONTREAL TO QUEBEC
TECHNOLOGY : 200 Km/h on Existing ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Set-tlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2020-2040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.2	2	6.2	0	0.0
2040-2060	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	2.2	2	1.7	3	1.6
2060-2080	0	0.0	1	2.5	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	2.1	3	4.5	1	0.2
2080-2100	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	1.7	0	0.0	1	0.2
2100-2120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	1	0.4	1	0.2
2120-2140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	2.2	3	4.4
2140-2160	0	0.0	1	1.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	1.9	1	1.2	0	0.0
2160-2180	0	0.0	1	1.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.8	1	1.5	1	0.1
2180-2200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.6	1	1.2	3	1.7
2200-2220	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	3.1
2220-2240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	4	1.7
2240-2260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	4	1.9
2260-2280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2280-2300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	3	5.1	5	1.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	19	12.3	13	18.9	24	15.1

Station Commencing: 2006+300 (Central Station)
Station Ending: 2278+800(Gare du Palais)

TABLE 5d

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : MONTREAL TO QUEBEC
TECHNOLOGY : 200 Km/h on Existing ROW

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
2000-2020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2020-2040	0	2.2	0	0.0	0	0.0	0	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2040-2060	0	14.0	0	1.3	0	2.6	0	0.0	0	3.8	0	10.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2060-2080	0	8.2	0	6.4	0	1.3	0	0.0	0	13.8	0	6.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2080-2100	0	6.8	0	7.6	0	3.0	0	4.0	0	2.6	0	9.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2100-2120	0	16.8	0	0.3	0	3.7	0	1.5	0	0.2	0	8.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2120-2140	0	17.3	0	0.0	0	0.0	0	0.0	0	5.1	0	12.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2140-2160	0	1.0	0	0.6	0	0.0	0	0.0	0	1.6	0	3.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2160-2180	0	9.0	0	4.7	0	2.4	0	0.0	0	8.6	0	4.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2180-2200	0	6.0	0	1.0	0	2.9	0	3.0	0	5.4	0	9.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2200-2220	0	4.5	0	1.5	0	1.8	0	0.0	0	2.2	0	17.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2220-2240	0	9.8	0	1.8	0	2.8	0	0.0	0	3.3	0	16.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2240-2260	0	11.8	0	1.3	0	0.2	0	0.0	0	4.0	0	16.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2260-2280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2280-2300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	107.4	0	26.5	0	20.7	0	10.7	0	50.6	0	114.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

Station Commencing: 2006+300 (Central Station)
Station Ending: 2278+800(Gare du Palais)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : MONTREAL TO QUEBEC
TECHNOLOGY : 200 Km/h on Existing ROW

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
2000-2020	0	0.0	0	0.0
2020-2040	0	0.0	0	0.0
2040-2060	0	0.0	0	0.0
2060-2080	0	0.0	0	0.0
2080-2100	0	0.0	0	0.0
2100-2120	0	0.0	0	0.0
2120-2140	0	0.0	0	0.0
2140-2160	0	0.0	0	0.0
2160-2180	0	0.0	0	0.0
2180-2200	0	0.0	0	0.0
2200-2220	0	0.0	0	0.0
2220-2240	0	0.0	0	0.0
2240-2260	0	0.0	0	0.0
2260-2280	0	0.0	0	0.0
2280-2300	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 2006+300 (Central Station)
Station Ending: 2278+800(Gare du Palais)

ii) **Significant Fisheries**

- Crosses six spawning areas of particular concern (1.3 km) that cannot be avoided, where aquatic habitats and fisheries are particularly sensitive :

  - Mille-Iles River (100 m);

  - L'Assomption River (2 spawning areas, 600 m);

  - Batiscan and Saint-Anne Rivers (500 m), where spawning Atlantic tomcod (*Microgadus Tomcod*) is an important economic resource, especially on Sainte-Anne River where each winter over 70,000 anglers catch more than 1 million spawning tomcod;

  - Jacques-Cartier River (100 m) equipped with an Atlantic salmon management system which allows for smolt and parr to be stocked on the river.

- A total of 112 stream crossings (<30 m width) and 27 river crossings. Des Prairies and Saint-Maurice Rivers (200-300 m width) are of particular concern in terms of their potential habitat availability and utilization by aquatic fauna and because they are navigable rivers.

iii) **Floodplain/Geotechnical Hazards**

- Route crosses 6.6 km of geotechnically hazardous elements, namely three wetlands representing 5.1 km (the largest (2.5 km) is located east of L'Assomption River) and five small areas of erosion totalling 1.5 km. In the latter case, potential erosion problems (soil instability) may occur along the clayey banks of the rivers subjected to accelerated erosion processes, in particular along the L'Assomption River.

5.4.2 Socio-Economic Environment

This option does not affect any Major Parks/Historic Sites, Major Tourist/Recreation and Conservation Areas, Federal Reserves, Major Natural Resources Areas or Waste Management Sites. However, it encounters three socio-economic factors that are very highly or highly sensitive because of their high concentration of people or intensive activity: Urban Perimeters, Rural Communities and Agriculture (refer to Table 5d).

i) **Urban Perimeters**

- Route passes through nineteen defined small urban and suburban zones representing a total of 12.3 km. The most important urban perimeters affected are Sainte-Anne-de-la-Pérade (1.6 km) and a suburban settlement east of Cap-de-la-Madeleine (800 m);

- Excludes major urban areas, (Montréal (25.7 km) and Québec (18.8 km) metropolitan areas where the reduced speed/operational constraints may make noise a non-issue.

ii) **Rural Communities**

- Comes close (within 500 m) to thirteen urban settlements representing 18.9 km that could be affected by the system (noise problems). Two zones in particular (6.2 km) near Terrebonne are characterized by a high concentration of residents;

- Passes through fifteen undefined small rural communities totalling 4.1 km, the major one being located west of Yamachiche (400 m);

- Comes within 250 m of nine clusters of residence totalling 11.0 km. The two principal clusters are located east of Louiseville (4.0 km).

iii) **Agriculture**

- Encroaches on 107.4 km of the best agricultural soils (Class 1 and 2), in particular, sections between Berthierville and Trois-Rivières-Ouest (34.1 km) and between Portneuf and Québec Airport (21.6 km);

- Affects 26.5 km of specialty crops (tobacco, fruits, market gardens, sugar bushes, etc.) in land protected by agricultural zoning, specially between L'Epiphanie and Berthierville (14.0 km) and between Cap-de-la-Madeleine and Batiscan (4.7 km);

- Crosses 20.7 km of areas of high incidence of artificial drainage system (tile drainage essentially), mainly concentrated between St-Thomas and Louiseville (6.7 km) and between Cap-de-la-Madeleine and Sainte-Anne-de-la-Pérade (5.3 km);

- 114.2 km of route segment where severed or remainder land parcels may be non-viable or unmanageable relative to carrying on agricultural operations (50.0 km concentrated between Sainte-Anne-de-la Pérade and Québec Airport).

6 INFRASTRUCTURE DESCRIPTION - OVER 300 KPH NON-TILTING TECHNOLOGY IN EXISTING RAIL CORRIDORS

6.1 GENERAL OUTLINE OF ROUTE

As with the 200-250 kph tilting technology scenario, the objective in defining this route is again, to maximize the use of existing railway ROW. The detailed analysis for this scenario has highlighted the need to include more sections of new ROW to avoid existing geometry constraints which preclude operation at speeds in the 300 kph range. This requirement and the adoption of a shorter route on new ROW between Kingston and Smiths Falls are the major differences between this route and that described for the tilting technology scenario in Section 4.1. Of the total route length of 1221 km, between Windsor and Québec, 283 km is in CP ROW, 250 km uses CN ROW, 551 km is new ROW and the remaining 120 km is CN and CP ROW between Smith Falls and Rigaud now owned by VIA Rail.

6.1.1 Windsor to Toronto

Starting at the south end of the Windsor-Detroit Tunnel in downtown Windsor, the route generally follows the CP ROW to London, except for new bypasses around Tilbury and Chatham. Geometric constraints in London are avoided with a new ROW bypassing the city to the south. From London, the route continues east to Hamilton using both CP and CN ROW along with new bypasses of Woodstock, Paris and Brantford.

The route skirts the northern limits of Hamilton and rejoins the CN ROW to pass through Burlington, Oakville and Mississauga before entering Metropolitan Toronto.

In Toronto, the CN ROW through Etobicoke is used to reach Union Station in downtown. Continuing eastward from the station, the CN ROW is again used to exit the urban area through Scarborough, Pickering, Ajax, Whitby and Oshawa.

6.1.2 Toronto to Montréal

From Oshawa, the route generally follows the CN ROW to Kingston however bypasses to avoid alignment geometry constraints are required at Port Hope, and Cobourg. Sharp curvature again precludes use of the CN ROW through Napanee and Kingston, hence a new route across the north of the urban areas was developed, leading to a new corridor linking Kingston and Smiths Falls. After bypassing Smiths Falls to the west, this new corridor rejoins the CN ROW between Smiths Falls and Ottawa.

The route follows the CN ROW to Richmond, which it bypasses, entering Ottawa at Federal Junction from where it continues to the existing VIA Station. From the station, the route leaves the National Capital Region using the CN ROW to reach the abandoned CP ROW which is followed eastward to Vankleek Hill. East of Vankleek Hill the route leaves the CP ROW, turning north to cross the Ottawa River near Pointe Fortune. It then continues in a north-easterly direction in a new ROW up to the existing CP north-shore ROW which it joins south-west of Mirabel Airport. From this point the route could either follow the CP ROW eastward to Laval or be diverted through the airport rejoining the CP ROW in Sainte-Thérese before continuing south into Laval.

The CP ROW is used to cross the Rivière-des-Prairies from where a new tunnelled ROW links the route to the CN ROW entering the existing Mont Royal Tunnel. The existing tunnel is used to access Central Station in downtown Montréal.

6.1.3 Montréal to Québec

Since the selected representative route for the Montréal-Québec segment follows the north shore of the Saint-Laurent River, the route leaves Central Station northward through the Mont Royal Tunnel. It passes through Laval along the CP ROW which is then followed to Trois-Rivières passing, south of L'Épiphanie, north of Berthierville and including bypasses of Maskinongé, Louiseville and Yamachiche.

Geometric constraints in Trois-Rivières are avoided by adopting a new route north of the City. The new route rejoins the CP ROW east of Cap-De-la-Madeleine, bypasses Portneuf and Pont-Rouge and follows the existing ROW eastward to Ancienne-Lorette.

This section includes some re-alignment to improve curve radii and permit speeds over 300 kph. From Ancienne-Lorette, the route continues into the Québec urban area along the CP ROW as far as Allenby Junction where it joins the CN ROW. The CN ROW is then used to access the existing Gare du Palais through Vanier and the Limoilou rail yard.

6.2 STATION LOCATIONS

Fourteen potential station locations were identified for HSR service under this "Over 300 kph" scenario. These locations and the urban areas served by them are listed below:

Station Location	Urban Area Served	Infrastructure Assumed
South of Windsor - Suburban	Detroit/Windsor	New Station
SE of London - Suburban	London/St. Thomas	New Station
NE of Hamilton (Suburban - Waterdown Rd, Burlington)	Hamilton/Burlington	New Station
Metro Toronto Downtown Within existing Union station area	Greater Toronto Area	Existing Modified
East Pickering - Suburban	Eastern Greater Toronto Area	New Station
Kingston (North of Highway 401 at Highway 10)	Kingston Region	New Station
Existing VIA station	National Capital Region	Existing Modified
Merivale, South of Ottawa - Suburban	National Capital Region	New Station
On Mirabel Airport property near terminal	Mirabel Airport and N.W. Montréal	Existing Completed
Laval	E. Montréal Region	New Station
Central Station - Montréal	Montréal Urban Community	Existing Modified
North of Trois-Rivières - Suburban	Trois-Rivières	New Station
Ancienne-Lorette - Suburban	W. Québec Region	New Station
Gare du Palais	Québec	Existing Modified

The above locations are identified on Exhibits 6.1.1 and 6.1.2. Potential Station sites in the major urban centres are also shown on Exhibits 4.1.3, 4.1.4, 4.1.5 and 4.1.6.

The implications of the use of Union Station in Toronto and Central Station in Montréal by HSR service in this scenario would be as discussed in Section 4.2 for the 200-250 kph scenario.

6.3 ROUTE CHARACTERISTICS

6.3.1 Right-of-Way

This section provides an overview of the type of ROW acquisition or sharing assumed for the representative route for this scenario. Table 6.3.1 identifies the method proposed for establishing a HSR ROW between Windsor and Québec by segment along the corridor.

The table distinguishes between ROW acquired outright from one or other of the railways and ROW or corridor shared with CN or CP. Corridor sharing refers to the arrangement where HSR is in a dedicated ROW parallel and contiguous with the existing rail ROW. The length of new ROW required for bypassing urban areas or geometric constraints is also identified. The tabulated data indicates that approximately 28% of the ROW would be acquired (from CP and VIA), 9% would share a rail corridor, 18% would be shared with CN or CP and 45% would be new ROW remote from existing corridors.

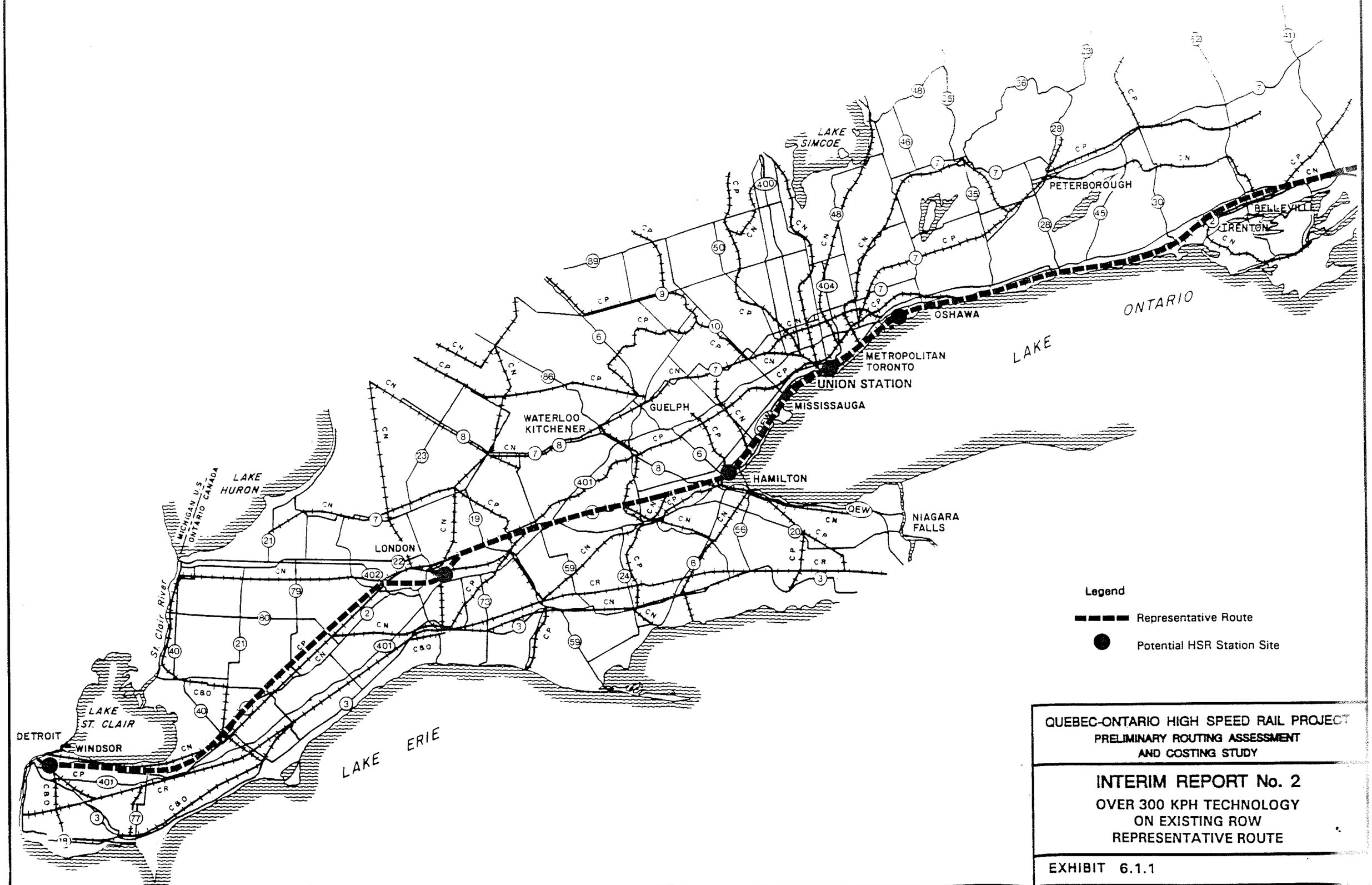
Some of the issues associated with acquisition of this ROW are outlined below for each of the primary segments of the route.

- Windsor to London

Land acquisition in this segment would be similar to the requirements for the 200-250 kph scenario described in Section 4.3.1., although the additional grade separations require more land. The London bypass would require new ROW through recently annexed urban land and impact 15 residential properties. Consequently land costs will be relatively high.

- London to Hamilton

Land acquisition issues are as described for this segment in Section 4.3.1. Again more land is required since the frequency of grade separation is higher.

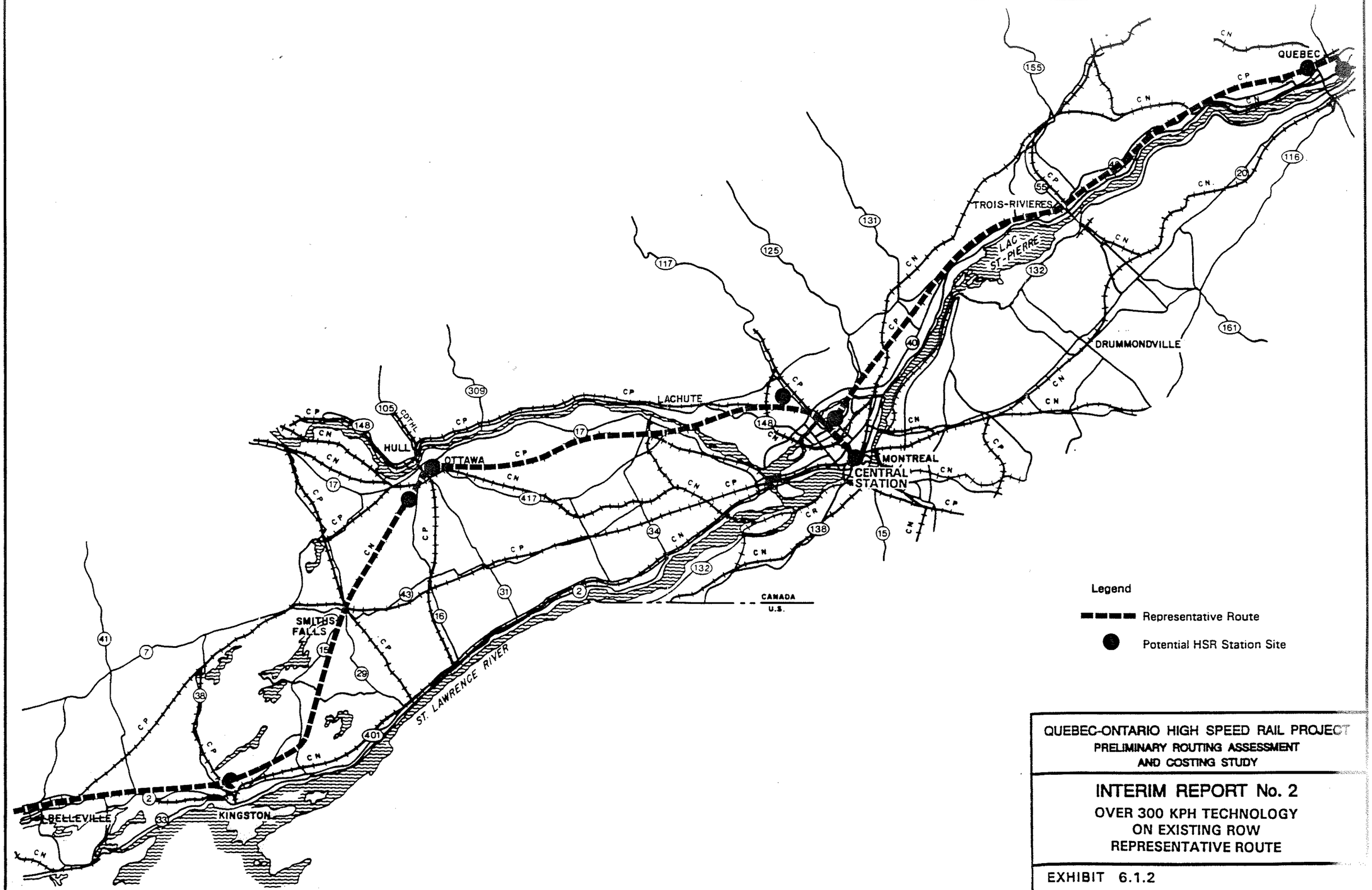


QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

OVER 300 KPH TECHNOLOGY
ON EXISTING ROW
REPRESENTATIVE ROUTE

EXHIBIT 6.1.1



QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

OVER 300 KPH TECHNOLOGY
ON EXISTING ROW
REPRESENTATIVE ROUTE

EXHIBIT 6.1.2

Segment	Length (km)	Method of Establishing ROW 300 on Existing ROW Table 6.3.1					
		Acquire Entire ROW from CN	Acquire Entire ROW from CP	Acquire Entire ROW from VIA	Sharing CN ROW or (Corridor)	Sharing CP ROW or (Corridor)	Acquire New ROW
Windsor	14					11/*3*	
Windsor to Tilbury	38		38				
Tilbury to Chatham	39						39
Chatham to London	61		61				
London	48						48
London to Woodstock	21					(21)	
Woodstock	18						18
Woodstock to Paris	16				(16)		
Paris	23						23
Paris to Dundas	20				(20)		
Dundas to Burlington	7						7
Burlington to Oshawa	119				99/*20*		
Oshawa to Cobourg	63				4(3)		56
Cobourg to Napanee	82				22 (49)		11
Napanee to Smiths Falls	142				(1)		141
Smiths Falls to Richmond	24			24			
Richmond to Confederation Heights	31			17			14
Confederation Hgts.to Carillon Prov.Pk.	95			79			16
Carillon Prov. Pk to Mirabel	39						39
Mirabel	8					8	
Mirabel to Jct. Lachute Sd.	25					*24*	1
Jct. Lachute Sd. to Riv. Des Prairies	8				*8*		
Riv. Des Prairies to Boul. Metropolitan	5					*1*	4
Boul. Metropolitan to Central Station	4					*3*	1
Jct. Lachute Sd. to Yamachiche	108		81				27
Yamachiche to Cap-de-la-Madeleine	25						25
Cap-de-la-Madeleine to Allenby Jct.	113		32				81
Allenby Jct. to Gare du Palais	8				*8*		
TOTAL LENGTH	1,204	0	212	120	125/*36* (89)	19/*31* (21)	551

*This ROW is used to enter and exit Central Station hence an additional 17 km should be added to obtain total route length.
Lengths in italics represent ROW sharing with 4.5m offsets. Lengths in parenthesis refer to sharing of the general rail corridor outside of the rail ROW

- Hamilton to Oshawa (Greater Toronto Area)

Land requirements and potential acquisition costs are the same as noted for the 200-250 kph scenario. The trade-off of land cost and socio-economic impact against operating speed and track sharing is again a major issue for this scenario.

- Oshawa to Kingston

ROW developed from a combination of new remote ROW, contiguous ROW in CN corridor and shorter sections of shared CN ROW. Half the acquisition cost in this segment would be for urban land in the Lakeshore communities. Rural residences would be affected.

- Kingston to Ottawa

New ROW requires acquisition of both natural and agricultural land. Some impact on cottage development north of Kingston and west of Smiths Falls is possible. Loss of private rights-of-way to cottage properties would have to be mitigated.

Between Smiths Falls and Ottawa, the land acquisition issues are as for the 200-250 kph scenario including the impact on the new residential subdivision in Barrhaven.

- Ottawa to Mirabel

Approximately 80 km of the former CP M & O subdivision would be acquired from VIA Rail. Impact on property in communities along the route would be minor.

Agricultural land would be acquired in the Lachute area to link the new Ottawa River crossing to the CP Lachute subdivision. It would be preferable to avoid land acquisition in the Mirabel area, particularly agricultural land. This would be possible if this section of the CP Lachute subdivision were acquired outright.

- Mirabel to Central Station

Industrial land would be acquired between Mirabel and Sainte-Therese along the CP corridor. For the remainder of this segment it has been assumed that the CP and CN right-of-way would be shared and that an easement would be required for the tunnel linking them.

- Laval to Ancienne Lorette

113 km of the CP Trois-Rivières Subdivision would be acquired. The remainder would be new ROW. Approximately 10% more urban land would be required than for the 200-250 kph scenario due to greater lengths of alignment improvement and bypasses.

Acquisition of agricultural land would also be greater as the greater proportion of new ROW causes more severance of farm properties.

- Ancienne Lorette to Québec

Acquisition of CP ROW and sharing of CN ROW is assumed. No widening has been included on the assumption that, if dedicated tracks cannot be accommodated, track sharing would be acceptable.

6.3.2 Alignment

The rural alignment defined for this scenario, where HSR trains are to operate at speeds in the 300-350 kph range, consists of a combination of the straight or gradually curving sections of the existing ROWs and new ROW sections. The latter, included to avoid sharp curvature or urban areas, have been defined with desirable horizontal geometry permitting speeds up to 350 kph. This approach has confined most geometry-caused speed restrictions to the major urban areas along the route. In the rural areas, very few locations remain where it is not feasible to provide curvature meeting 300-350 kph design standards. At these locations, curve radii permitting speeds as close as possible to 300 kph have been selected.

Profile grades for this scenario are based largely on the grades of the existing tracks presently occupying the ROW. Generally, this results in grades between 0 and 1.5%, well within the capabilities of HSR equipment.

The only areas where steeper grades are assumed are the entrances to the new tunnel in north Montréal and the approaches to Québec west of Ancienne Lorette. Two percent grades have also been used for approach grades where it is deemed appropriate to grade separate HSR tracks over other railways or highways.

6.3.3 Structures

Three tunnels are required to achieve the alignment defined for this scenario. These are the following:

- a 3.25 km tunnel through the escarpment, between Hamilton and Burlington, necessary because the existing CN alignment along the wall of the escarpment cannot be improved.

- a 2 km tunnel in north Montréal to link the CP Lachute Subdivision to the CN Mount Royal Subdivision thus avoiding sharp curvature and two major existing railway junctions.

- a 1.5 km tunnel on the Trois-Rivières Subdivision in Laval to bypass a severe speed restriction (400 metre radius curve) in the existing CP ROW.

In addition to the tunnels listed above, 4.3 km of viaduct structure is required in locations where the height of rail embankment would exceed 20 metres.

Bridges to carry HSR tracks over rivers have been identified from the topographical mapping. The quantity of these structures, varying in length between 15 and 500 metres, is indicated for each segment in the list below:

- Windsor to Toronto - 41 (11 per 100 km) *(11 per 100 km)*
- Toronto to Ottawa - 29 (7 per 100 km) *(6 per 100 km)*
- Ottawa to Montréal - 10 (6 per 100 km) *(6 per 100 km)*
- Montréal to Québec - 86 (32 per 100 km) *(34 per 100 km)*

The respective frequency of river crossings for the 200-250 kph tilting technology on existing ROW is quoted in italics for comparison purposes.

6.3.4 Grade Separations

In accordance with the basic assumptions specified in the study Terms of Reference and set out in Section 1.0, the elimination of all at-grade crossings on this representative route has been incorporated in the infrastructure definition. This would be achieved by one of the following measures:

- construction of new grade separations;
- diversion of crossing roads to other locations where grade separations are provided; and
- closure of existing roads at their junction with the ROW.

An initial assessment of the need for grade separation has resulted in the following requirements for new grade separations in each of the major route segments:

- Windsor to Toronto - 126 (35 per 100 km) *(10 per 100 km)*
- Toronto to Ottawa - 172 (42 per 100 km) *(16 per 100 km)*
- Ottawa to Montréal - 75 (42 per 100 km) *(10 per 100 km)*
- Montréal to Québec - 96 (35 per 100 km) *(9 per 100 km)*

In addition to the new grade separations, it will be necessary to modify existing grade separations on the CP or CN ROWs to accommodate HSR tracks. This work would range from minor changes to side spans or new retaining walls to more major openings in existing approach fills to construct new bridges for HSR tracks parallel to existing rail tracks.

The requirements for modifications of existing grade separations is estimated to be as follows:

- Windsor to Toronto - 59 (16 per 100 km) *(19 per 100 km)*
- Toronto to Ottawa - 56 (14 per 100 km) *(17 per 100 km)*
- Ottawa to Montréal - 15 (8 per 100 km) *(19 per 100 km)*
- Montréal to Québec - 25 (9 per 100 km) *(9 per 100 km)*

The respective frequency of new grade separations and modifications of existing grade separations for the 200 - 250 kph tilting technology on existing ROW is quoted in italics for comparison purposes.

6.4 ACCESS TO URBAN AREAS

The general outline of the overall route for this scenario was provided in Section 6.1. This section supplements the general description by describing the infrastructure requirements to gain access to the major urban areas of Windsor, the Greater Toronto Area (GTA), the National Capital Region, Montréal and Québec.

6.4.1 Windsor

The route, from the start of the corridor at the south end of the Windsor-Detroit Tunnel, through the urban area of Windsor, is identical to that described in Section 4.4.1, the 200-250 kph tilting technology scenario. Initially, new HSR tracks would share the CN Caso Subdivision and then curve eastward into the existing CP Windsor Subdivision. For a further 10 km the CP ROW would be shared up to the point where the CP tracks are diverted to the CN Caso Subdivision. The HSR service would then leave the urban area as exclusive user of the existing ROW acquired from CP.

6.4.2 Greater Toronto Area

As outlined in Section 6.1, the route for this scenario also enters the Greater Toronto Area by descending the escarpment through the Dundas valley north of Hamilton. The new tunnel and viaduct to reach Bayview Junction would have an alignment permitting speeds up to 350 kph for this scenario.

From the junction, the route will utilize the CN Oakville Subdivision through Burlington, Oakville, Mississauga and Etobicoke, as described for the 200-250 kph tilting technology scenario. In the Toronto Terminal Railway territory, either side of Union Station, it is assumed that two tracks on the south side of the multi-track ROW would be dedicated to HSR service.

Between Union Station and Oshawa, the CN Kingston Subdivision corridor would be used to pass through the eastern GTA with HSR tracks installed as described in Section 4.4.2 for the tilting technology. The maximum curvature feasible in this corridor would restrict speeds to the 150-200 kph range until east of Oshawa where the track geometry permits speeds of 300 kph as the route leaves the urban area.

6.4.3 The National Capital Region

As described in Section 4.1, the route approaches the National Capital Region from Smiths Falls using the CN Smiths Falls Subdivision. A 13km section of new ROW is necessary to bypass Richmond and avoid sharp curvature on this Subdivision. At Barrhaven, the straightening of the alignment would require acquisition of a significant number of homes over a 1.3 km length of the new ROW through a recently constructed residential subdivision.

From Barrhaven to Federal Junction, the HSR tracks would be placed in the existing rail ROW. At the junction, the curvature of the present ROW would be improved by constructing a new viaduct crossing Highway 16, the CN tracks, the Rideau River and Canal and Riverside Drive. Between the viaduct and the existing VIA Station at Alta Vista, the HSR track would be located in the CN Beachburg Subdivision. This ROW, is severely constrained by adjacent development and has six curves between 800 and 2000 metre radius within a 10 km length. A 280 metre curve must be negotiated immediately east of the station. This curve would not present a severe speed restriction for trains decelerating to or accelerating from the Ottawa Station.

East of the station, the HSR tracks would be located in the CP M and O Subdivision which provides a corridor to leave the Ottawa urban area in an easterly direction south of Blackburn Hamlet and north of Mer Bleue.

6.4.4 Montréal

The route enters the Montréal urban area from the west in the CP Lachute Subdivision, immediately south of Mirabel Airport. HSR tracks would share the CP ROW for a distance of 32 km through to the junction with the CP Trois-Rivières Subdivision in Laval. A direct access to Mirabel Airport was also developed as an alternative routing to the CP ROW. This routing, which permits the use of the provision made for an underground station in the existing airport terminal, requires an additional 6 km of alignment.

For this scenario, the HSR route enters the Montréal urban area following the CP Trois-Rivières Subdivision up to Saint-Martin Junction in Laval. In this section, the minimum curve radius is 2000 m.

From Saint-Martin Junction to Rivière-des-Prairies, the CP Lachute Subdivision would be used where the minimum curve radius is 1000 m.

East of Rivières-des-Prairies, the HSR tracks would follow the CP Lachute Subdivision up to approximately Henri-Bourassa Boulevard where a tunnel is introduced to join the CN ROW Mont Royal Subdivision for access to Central Station through the Mont Royal Tunnel. In this section, the minimum curve radius is 900 m.

To leave Central Station en route to Québec, the HSR route would return to Saint-Martin junction using the same alignment described above. At the junction, the 400 metre radius curve leading to the CP Trois-Rivières Subdivision can only be bypassed by construction of a tunnel under the surrounding developments. This tunnel would allow a speed of 200 kph to be maintained through Laval. From a new portal in the Trois-Rivières Subdivision, the HSR tracks would continue eastward along the existing CP ROW, acquired for exclusive HSR use.

The urban access route described above assumes that HSR service will serve the existing Central Station in downtown Montréal. If it is determined that downtown access is not essential to capture maximum ridership from the Montréal area, alternative suburban terminal station locations providing good intermodal access would have to be investigated.

The terms of reference identified the former CP Park Avenue station site as a potential location. While this site could be accessed by continuing HSR tracks southeastward on the Lachute subdivision instead of aviating through the new tunnel to the CN Mont Royal Subdivision. A track layout for a terminal station probably could be developed at a Park Avenue site however expropriation of adjacent industrial land and construction of a new bridge to carry tracks over Rue Jean Talon would likely be required.

Although the station site has an existing building with potential for rehabilitation and access to the Metro, the area does not offer good automobile access or direct access to downtown Montréal by Metro. The viability of this location as an alternative Montréal terminal would hinge in the ridership levels achievable given its access and egress characteristics.

6.4.5 Québec

The HSR route enters the Québec urban area in the CP Trois-Rivières Subdivision at Ancienne-Lorette. HSR tacks would remain in this subdivision as far as Allenby Junction where the CP ROW meets the CN Bridge Subdivision. Up to this point the minimum curve radius is 1200 m. Between Allenby Junction and Gare du Palais, the HSR tracks would be constructed in the CN Bridge Subdivision ROW. This ROW is severely constrained by adjacent development, hence major expropriation would be required to improve the existing 1200 m and 350 m radius

curves. HSR tracks would pass through the CN Limoilou Yards and cross the Rivières St. Charles to enter the existing Gare du Palais. The platforms in the present station are between 170 and 200 metres in length, hence extensions would be necessary to accommodate two 8-car TGV consist or a 10 car x-2000 consist.

6.4.6 Access to Toronto and Montréal Airports

This scenario follows a lakeshore route through the Greater Toronto Area. Hence any opportunity to provide HSR access to Pearson Airport or the possible future airport in Pickering is precluded by the basic routing.

In Montréal, access to the urban area is from the northwest along the CP Lachute Subdivision immediately south of Mirabel Airport property. Consequently a diversion of the route into the airport property has been investigated. This diversion has an additional length of 6 km and requires 4 km of underground construction to link to the provisions for a future underground station incorporated in the original airport terminal construction. From the east, the route would approach the terminal in a ROW parallel and adjacent to the existing main access road to the terminal.

7 ENVIRONMENTAL IMPACT - OVER 300 KPH NON-TILTING TECHNOLOGY IN EXISTING RAIL CORRIDORS

This chapter provides a selective overview of the potential natural and socio-economic environmental impacts to sensitive features directly affected by the over 300 kph non-tilting technology in existing rail corridors routing option.

7.1 Windsor to Toronto

For the most part, the effects exhibited by this option are similar to those for the 200-250 kph non-tilting technology since it is generally in the same corridor, the major exception being that it bypasses the City of London to the south (with a suburban station) rather than passing through the built-up area (with a downtown station). Potential impacts are presented in Table 7a. The following text highlights differences between the two routes.

7.1.1 Natural Environment

i) Provincially Significant Features

- London bypass encroaches on Dingman Creek Woods ESA (additional 0.8 km).

ii) Significant Fisheries/Aquatic Habitat

- Avoids crossing of Oxbow Creek (cold water feature) near Komoka.

iii) Floodplain/Geotechnical Hazards

- Crosses fourteen sections (84.1 km) of deep silty day with alluvium at river crossings (erosion/stability concern). Includes 3.6 km of sensitive area along London bypass;
- Crosses five sections of wetland (peat and muck) soils (12.2 km). Includes 7.1 km (3 areas) along London bypass.

7.1.2 Socio-Economic Environment

i) **Rural Communities**

- Comes close (within 500 m) to built-up area of Komoka.

ii) **Agriculture**

- Traverses 304.0 km (additional 12.2 km) of Class 1 and 2 agricultural soils;
- Affects 6.0 km specialty crops (additional 3.0 km);
- Crosses 198.8 km of artificial drainage systems (additional 18.3 km);
- Creates awkward severance, which may be non-viable or unmanageable for carrying on agricultural operations, over a length of 118.9 km.

7.2 Toronto to Ottawa

The potential constraints encountered by the over 300 kph non-tilting technology route in an existing right-of-way are similar to those for the 200-250 kph option between Oshawa and Napanee and between Smiths Falls and Richmond since they are generally in the same corridor. The following highlights the major differences.

7.2.1 Natural Environment

i) **Provincially Significant Features**

- Encroaches on eight wetland areas totalling 23.9 km;
- Encroaches on one ANSI (0.1 km near Wesleyville) and 78.2 km of ESA's.

ii) **Ecological Reserves/Wildlife Areas**

- Affects 55.0 km of sensitive area.

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.0	0	0.0	0	0.0
1020-1040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	0.0	0	0.0	0	0.0
1040-1060	0	0.0	0	0.0	0	0.0	1	2.7	0	0.0	0	0.0	0	0.0	7	0.0	0	0.0	0	0.0
1060-1080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.0	1	0.0	0	0.0
1080-1100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.0	0	0.0	0	0.0
1100-1120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1120-1140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1140-1160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.0	0	0.0	0	0.0
1160-1180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	11	0.0	0	0.0	0	0.0
1180-1200	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	14	0.0	0	0.0	0	0.0
1200-1220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	19	0.0	0	0.0	0	0.0
1220-1240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	11	0.0	0	0.0	0	0.0
1240-1260	1	1.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	13	0.0	0	0.0	0	0.0
1260-1280	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	17	0.0	0	0.0	0	0.0
1280-1300	0	0.0	1	0.6	1	2.1	0	0.0	0	0.0	1	9.4	0	0.0	16	0.0	0	0.0	0	0.0
1300-1320	0	0.0	0	0.0	2	4.6	0	0.0	0	0.0	1	1.6	0	0.0	22	0.0	1	0.0	0	0.0
1320-1340	0	0.0	0	0.0	4	3.0	0	0.0	0	0.0	0	0.0	0	0.0	10	0.0	3	0.0	0	0.0
1340-1360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	0.0	1	0.0	0	0.0
1360-1380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.0	0	0.0	0	0.0
1380-1400	1	1.0	2	2.8	2	1.1	0	0.0	0	0.0	0	0.0	0	0.0	7	0.0	0	0.0	0	0.0
1400-1420	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	10	0.0	4	0.0	0	0.0
1420-1440	1	1.5	0	0.0	1	2.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.0	1	0.0	0	0.0
Total	3	3.7	3	3.4	13	15.2	1	2.7	0	0.0	2	11.0	1	0.0	195	0.0	11	0.0	0	0.0

Station Commencing: 1000+000

Station Ending: 1423+797

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Settlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0	1	1.0	0	0.0	1	1.0
,1020-1040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.0	0	0.0	2	2.0
1040-1060	0	0.0	0	0.0	1	3.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	2.0
1060-1080	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	3.0
1080-1100	0	0.0	0	0.0	1	17.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1100-1120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0
1120-1140	0	0.0	0	0.0	1	11.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
1140-1160	0	0.0	0	0.0	1	5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
1160-1180	0	0.0	0	0.0	3	3.6	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	2	2.0
1180-1200	0	0.0	2	3.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	4.0
1200-1220	0	0.0	1	3.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.0	2	1.0
1220-1240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	1	0.0	4	5.0
1240-1260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	1	1.0	3	5.0
1260-1280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	3.0
1280-1300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	6.2	2	5.7	1	3.0	0	0.0	1	1.0
1300-1320	0	0.0	1	3.6	0	0.0	0	0.0	0	0.0	0	0.0	1	3.6	1	3.6	0	0.0	0	0.0	0	0.0
1320-1340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0
1340-1360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.6	0	0.0	0	0.0	0	0.0	0	0.0
1360-1380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1380-1400	0	0.0	0	0.0	1	8.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1400-1420	0	0.0	0	0.0	4	14.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1420-1440	0	0.0	1	1.5	1	2.3	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	5	12.2	14	84.1	0	0.0	0	0.0	0	0.0	6	13.1	5	10.5	6	7.0	4	4.0	28	31.0

Station Commencing: 1000+000

Station Ending: 1423+797

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	3	11.7	0	0.0	3	4.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1020-1040	5	18.8	0	0.0	2	15.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.5
1040-1060	4	19.0	1	0.2	4	18.0	0	0.0	1	2.0	1	2.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1060-1080	2	19.5	2	0.7	4	16.9	0	0.0	1	1.1	2	12.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1080-1100	4	17.4	2	0.2	1	20.0	0	0.0	2	6.9	1	13.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1100-1120	3	18.9	4	0.7	3	17.3	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	12.2
1120-1140	5	16.5	1	0.1	3	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	18.0
1140-1160	6	10.9	3	1.7	3	18.0	0	0.0	0	0.0	1	13.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1160-1180	2	18.0	3	1.3	4	17.6	0	0.0	1	1.7	1	18.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1180-1200	2	20.0	2	0.7	4	15.3	0	0.0	1	0.6	1	19.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1200-1220	4	18.8	0	0.0	3	17.3	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	2	1.3	0	0.0
1220-1240	4	17.9	1	0.4	2	7.3	0	0.0	0	0.0	1	14.3	0	0.0	0	0.0	0	0.0	2	0.2	0	0.0
1240-1260	6	18.5	1	0.1	6	7.5	0	0.0	0	0.0	2	12.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1260-1280	6	17.6	0	0.0	3	2.9	0	0.0	3	10.0	3	10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1280-1300	8	9.3	0	0.0	2	1.2	1	10.5	1	0.1	1	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1300-1320	13	7.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1320-1340	6	4.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1340-1360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1360-1380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1380-1400	3	16.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1400-1420	2	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1420-1440	2	3.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	90	304.0	20	6.0	47	198.8	1	10.5	11	22.4	15	118.9	0	0.0	0	0.0	0	0.0	4	1.5	4	31.7

Station Commencing: 1000+000

Station Ending: 1423+797

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
1000-1020	0	0.0	0	0.0
1020-1040	0	0.0	0	0.0
1040-1060	0	0.0	0	0.0
1060-1080	0	0.0	0	0.0
1080-1100	0	0.0	0	0.0
1100-1120	0	0.0	0	0.0
1120-1140	0	0.0	0	0.0
1140-1160	0	0.0	0	0.0
1160-1180	0	0.0	0	0.0
1180-1200	0	0.0	0	0.0
1200-1220	0	0.0	0	0.0
1220-1240	0	0.0	0	0.0
1240-1260	0	0.0	0	0.0
1260-1280	0	0.0	0	0.0
1280-1300	0	0.0	0	0.0
1300-1320	0	0.0	0	0.0
1320-1340	0	0.0	0	0.0
1340-1360	0	0.0	0	0.0
1360-1380	0	0.0	0	0.0
1380-1400	0	0.0	0	0.0
1400-1420	0	0.0	0	0.0
1420-1440	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 1000+000

Station Ending: 1423+797

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7b

SECTION : TORONTO TO OTTAWA

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.1	0	0.0	0	0.0	0	0.0
1020-1040	1	2.8	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0
1040-1060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5	2	0.1	0	0.0	0	0.0
1060-1080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1080-1100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1100-1120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.2	0	0.0	0	0.0	0	0.0
1120-1140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.3	0	0.0	0	0.0
1140-1160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1160-1180	1	1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.4	0	0.0	0	0.0
1180-1200	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1200-1220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.2	0	0.0	0	0.0
1220-1240	2	3.3	0	0.0	1	18.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.2	0	0.0	0	0.0
1240-1260	1	1.2	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1260-1280	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1280-1300	2	5.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0
1300-1320	1	9.6	0	0.0	1	0.2	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0
1320-1340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0
1340-1360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	15.0	0	0.0	0	0.0	0	0.0	0	0.0
1360-1380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1380-1400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	10	23.9	1	0.1	5	78.2	0	0.0	0	0.0	4	55.0	6	0.8	12	2.6	0	0.0	0	0.0

Station Commencing: 1000+040

Station Ending: 1311+340 (to Richmond)

1348+115 (to Ottawa)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7b

SECTION : TORONTO TO OTTAWA

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Set-tlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	0	0.0	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	2	3.0	0	0.0	0	0.0
1020-1040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1040-1060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	2	7.7	0	0.0	2	0.7
1060-1080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.4	0	0.0	1	0.2
1080-1100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.2	0	0.0	1	6.4
1100-1120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.4	0	0.0	0	0.0
1120-1140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	7.0	0	0.0	2	6.0
1140-1160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	1	0.2
1160-1180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1180-1200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	4.3
1200-1220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.0
1220-1240	1	18.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.6
1240-1260	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1260-1280	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.3
1280-1300	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.6	0	0.0	1	0.2
1300-1320	2	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.5	0	0.0	0	0.0
1320-1340	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1340-1360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1360-1380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1380-1400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	7	118.0	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0	1	0.2	10	32.8	1	0.4	13	20.9

Station Commencing: 1000+040

Station Ending: 1311+340 (to Richmond)

1348+115 (to Ottawa)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7b

SECTION : TORONTO TO OTTAWA

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1020-1040	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1040-1060	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1060-1080	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1080-1100	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1100-1120	3	4.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1120-1140	4	6.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1140-1160	1	2.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0	0	0.0	0	0.0
1160-1180	3	8.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1180-1200	2	2.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1200-1220	2	8.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1220-1240	1	12.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.0	0	0.0
1240-1260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1260-1280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1280-1300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1300-1320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1320-1340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1340-1360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1360-1380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1380-1400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	21	146.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0	1	3.0	0	0.0

Station Commencing: 1000+040

Station Ending: 1311+340 (to Richmond)

1348+115 (to Ottawa)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : TORONTO TO OTTAWA
TECHNOLOGY : 300 Km/h on Existing ROW

TABLE 7b

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
1000-1020	0	0.0	0	0.0
1020-1040	0	0.0	0	0.0
1040-1060	0	0.0	0	0.0
1060-1080	0	0.0	0	0.0
1080-1100	0	0.0	0	0.0
1100-1120	0	0.0	0	0.0
1120-1140	0	0.0	0	0.0
1140-1160	0	0.0	0	0.0
1160-1180	0	0.0	0	0.0
1180-1200	0	0.0	0	0.0
1200-1220	0	0.0	0	0.0
1220-1240	0	0.0	0	0.0
1240-1260	0	0.0	0	0.0
1260-1280	0	0.0	0	0.0
1280-1300	0	0.0	0	0.0
1300-1320	0	0.0	0	0.0
1320-1340	0	0.0	0	0.0
1340-1360	0	0.0	0	0.0
1360-1380	0	0.0	0	0.0
1380-1400	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 1000+040
Station Ending: 1311+340 (to Richmond)
1348+115 (to Ottawa)

iii) **Significant Fisheries/Aquatic Habitat**

- Crosses a total of 199 watercourses;
- Crosses 0.8 km of coldwater streams (primarily in Lakeshore corridor);
- Crosses 2.6 km of warm water streams. Excludes Rideau River crossings near Ottawa.

iv) **Significant Regional Forests**

- Encroaches on 118.0 km of sensitive area including additional area (58.0 km) southwest of Smiths Falls.

7.2.2 Socio-Economic Environment

i) **Major Tourism Areas**

- Encroaches on Port Hope Conservation Area (0.2 km).

ii) **Urban Perimeters**

- Passes through 32.8 km of defined settlement areas (same communities as 200-250 kph option).

iii) **Rural Communities**

- Comes close (within 500 m) to one community over 0.4 km;
- Comes close (within 250 m) to rural residential clusters over 20.9 km of route length.

iv) **Agriculture**

- Traverses 146.2 km of Class 1 and 2 agricultural soils (Toronto to Napanee).

v) **Federal Reserves**

- Encroaches on Tyendinaga Indian Reserve No. 38 (1.0 km) just east of Belleville.

vi) **Major Natural Resource Areas**

- Encroaches on 3.0 km of aggregate resource area near Morton/Leeds south of Ottawa.

7.3 Ottawa to Montréal

The over 300 kph non-tilting technology within an existing corridor is in the same corridor as the 200-250 kph technology between Ottawa and Vankleek Hill and thus exhibits similar potential impacts. At Vankleek Hill this option diverges in a northerly direction, crossing the Ottawa River to connect with the over 300 kph non-tilting technology route in a new corridor. The following text highlights the potential constraints north and east from the divergence point.

7.3.1 Natural Environment

i) **Significant Fisheries/Aquatic Habitat**

- Crosses a total of nine watercourses;

- Major crossings of the Ottawa River (warm water) and Rivière-du-Nord would be encountered with this option, along with several minor watercourses on the Québec side draining into the Ottawa River. The route also traverses a designated fish spawning area on the Ottawa River in the Pointe-Fortune area (0.8 km).

7.3.2 Socio-Economic Environment

i) **Urban Perimeters**

- Passes through Pointe-Fortune 0.2 km.

ii) Rural Communities

- Comes close (within 500 m) to Sainté-Scholastique for 0.6 km.

iii) Agriculture

- Approximately 8% of the route (30.8 km) traverses the best (Class 1 and 2) agricultural soils.

7.4 Montréal to Québec

7.4.1 Natural Environment

Since the over 300 kph non-tilting technology in existing rail corridors is virtually the same routing scenario as the 200-250 kph technology, it affects the same natural elements as those described in Section 5.4 (Table 5d), except for watercourse crossings. This route crosses 122 streams (<30 m) and 30 rivers, of which 18 are wider than 30 m. It will be important to take into account the most important river crossings (200-300 m width) relative to their potential habitat availability and utilization by aquatic fauna, namely the Des Prairies, and Ste-Anne Rivers.

7.4.2 Socio-Economic Environment

This option does not affect any Major Parks/Historic Sites, Major Tourist/Recreation and Conservation Areas, Federal Reserves, Major Natural Resource Areas or Waste Management Sites. However, it affects three socio-economic factors that are very highly or highly sensitive because of high population density and intensive activity: Urban perimeters, Rural Communities and Agriculture (refer to Table 7d).

i) Urban Perimeters

- Route runs through the limits of nineteen small urban areas totalling 10.7 km.

ii) **Rural Communities**

- Comes close (within 500 m) to twelve urban settlements representing 17.5 km that could be affected by noise problems. Two zones (6.2 km) with high concentration of population near Terrebonne;

- Passes through sixteen small rural settlements representing 3.1 km, such as west of Yamachiche (400 m);

- Comes close (within 250 m) to seven clusters of residences (9.1 km), the two principal clusters of buildings (4.0 km) being located east of Louiseville.

iii) **Agriculture**

- Passes through 115.3 km of excellent agricultural soils (class 1-2), 22.2 km concentrated in zoned agricultural land between Terrebonne and Vaucluse (L'Assomption River), 34.2 km between Berthierville and Trois-Rivières-Ouest and 24.5 km between Cap-de-la-Madeleine and Ste-Anne-de-la-Pérade;

- Runs through 25.3 km of specialty crops. Areas of note lie between l'Épiphanie and Berthierville (14.0 km) and between Cap-de-la-Madeleine and Bastican (4.7 km);

- Traverses 19.1 km of areas with high incidence of tile drainage, (most extensive (6.7 km) between St-Thomas and Louiseville);

- 112.2 km of route segment where severed or residual land parcels may be non-viable or unmanageable in terms of carrying on agricultural operations (49.9 km concentrated between Ste-Anne-de-la Pérade and Québec Airport).

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SECTION : OTTAWA TO MONTREAL
TECHNOLOGY : 300 Km/h on Existing ROW

TABLE 7c

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	1	4.0	1	1.2	0	0.0	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	0	0.0
0020-0040	0	0.0	1	0.5	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0040-0060	0	0.0	0	0.0	0	0.0	3	8.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0060-0080	1	1.0	0	0.0	0	0.0	1	8.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0100-0120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.8	0	0.0	1	0.8
0120-0140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	2	5.0	2	1.7	0	0.0	5	16.7	0	0.0	1	4.0	0	0.0	1	0.8	0	0.0	1	0.8

Station Commencing: 0000+000
Station Ending: 0400+000

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7c

SECTION : OTTAWA TO MONTREAL

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Set-tlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	2	1.3
0020-0040	1	2.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.8
0040-0060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	4.3
0060-0080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.6
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7
0100-0120	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	1	0.6	2	0.3
0120-0140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	1	2.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	1	4.0	1	0.2	1	0.6	13	8.2

Station Commencing: 0000+000

Station Ending: 0400+000

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7c

SECTION : OTTAWA TO MONTREAL

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	1	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0020-0040	3	3.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	1.3	0	0.0
0040-0060	2	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0060-0080	2	5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	1	1.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0100-0120	2	11.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.6	0	0.0
0120-0140	1	7.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	12	30.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	1.9	0	0.0

Station Commencing: 0000+000

Station Ending: 0400+000

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TABLE 7c

SECTION : OTTAWA TO MONTREAL

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
0000-0020	0	0.0	0	0.0
0020-0040	0	0.0	0	0.0
0040-0060	0	0.0	0	0.0
0060-0080	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0
0100-0120	0	0.0	0	0.0
0120-0140	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 0000+000

Station Ending: 0400+000

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : MONTREAL TO QUEBEC
TECHNOLOGY : 300 Km/h on Existing ROW

TABLE 7d

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1020-1040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
1040-1060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1060-1080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.6
1080-1100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1100-1120	0	0.0	0	0.0	0	0.0	1	5.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1120-1140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1140-1160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1160-1180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1180-1200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
1200-1220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1220-1240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
1240-1260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1260-1280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1280-1300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	0	0.0	0	0.0	1	5.6	0	0.0	0	0.0	0	0.0	152	0.0	0	0.0	6	1.3

Station Commencing: 1006+300 (Central Station)
Station Ending: 1277+690(Gare du Palais)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7d

SECTION : MONTREAL TO QUEBEC

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Settlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1020-1040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.2	2	6.2	0	0.0
1040-1060	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	2.2	2	1.7	3	1.6
1060-1080	0	0.0	1	2.5	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	2.1	3	4.5	1	0.2
1080-1100	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	1.7	0	0.0	1	0.2
1100-1120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	1	0.4	1	0.2
1120-1140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	2.2	3	4.4
1140-1160	0	0.0	1	1.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	1.6	1	1.0	0	0.0
1160-1180	0	0.0	1	1.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	1	1.5	1	0.1
1180-1200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	3	0.6
1200-1220	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	3.0
1220-1240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	4	1.4
1240-1260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	3	0.5
1260-1280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1280-1300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	3	5.1	5	1.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	19	10.7	12	17.5	23	12.2

Station Commencing: 1006+300 (Central Station)

Station Ending: 1277+690(Gare du Palais)

QUEBEC - ONTARIO H.S.R. STUDY ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7d

SECTION MONTREAL TO QUEBEC

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
1000-1020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1020-1040	0	2.2	0	0.0	0	0.0	0	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1040-1060	0	14.0	0	1.3	0	2.6	0	0.0	0	3.8	0	10.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1060-1080	0	8.2	0	6.4	0	1.3	0	0.0	0	13.8	0	6.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1080-1100	0	6.8	0	7.6	0	3.0	0	4.0	0	2.6	0	9.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1100-1120	0	16.8	0	0.3	0	3.7	0	1.5	0	0.2	0	8.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1120-1140	0	17.4	0	0.0	0	0.0	0	0.0	0	5.1	0	12.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1140-1160	0	1.0	0	0.6	0	0.0	0	0.0	0	2.0	0	4.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1160-1180	0	9.3	0	4.7	0	2.4	0	0.0	0	8.8	0	4.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1180-1200	0	15.2	0	0.5	0	1.7	0	2.1	0	8.1	0	7.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1200-1220	0	3.8	0	1.6	0	1.4	0	0.0	0	2.3	0	17.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1220-1240	0	7.8	0	1.8	0	2.8	0	0.0	0	4.3	0	15.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1240-1260	0	12.8	0	0.5	0	0.2	0	0.0	0	3.0	0	17.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1260-1280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1280-1300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	115.3	0	25.3	0	19.1	0	9.8	0	54.0	0	112.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

Station Commencing: 1006+300 (Central Station)

Station Ending: 1277+690(Gare du Palais)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 7d

SECTION : MONTREAL TO QUEBEC

TECHNOLOGY : 300 Km/h on Existing ROW

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
1000-1020	0	0.0	0	0.0
1020-1040	0	0.0	0	0.0
1040-1060	0	0.0	0	0.0
1060-1080	0	0.0	0	0.0
1080-1100	0	0.0	0	0.0
1100-1120	0	0.0	0	0.0
1120-1140	0	0.0	0	0.0
1140-1160	0	0.0	0	0.0
1160-1180	0	0.0	0	0.0
1180-1200	0	0.0	0	0.0
1200-1220	0	0.0	0	0.0
1220-1240	0	0.0	0	0.0
1240-1260	0	0.0	0	0.0
1260-1280	0	0.0	0	0.0
1280-1300	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 1006+300 (Central Station)

Station Ending: 1277+690(Gare du Palais)

8 INFRASTRUCTURE DESCRIPTION - OVER 300 KPH NON-TILTING TECHNOLOGY IN NEW CORRIDOR

8.1 GENERAL OUTLINE OF ROUTE

For this scenario, the principal objective was to determine the infrastructure required to provide HSR service at over 300 kph mostly in new ROW between Windsor and Québec. The detailed analysis of alignment options revealed that the only feasible route through the major urban areas was the sharing of existing rail ROWs. The route developed for this scenario has a total length of 1262 km, of which 138 km is shared ROW in urban areas.

8.1.1 Windsor to Toronto

As with the other scenarios described previously, this route begins at the south end of the Windsor-Detroit Tunnel, however it remains within the CN Caso ROW up to the limits of the Windsor urban area. From here the route turns east into a new ROW between the CP ROW and the Highway 401 corridor. After bypassing Tilbury and Chatham, the route swings to the north-east and continues towards the southern limits of London generally following the Highway 401 corridor and paralleling the farm property grid.

From the outskirts of London, the route swings north to reach a new more northern ROW which continues eastward between Kitchener-Waterloo and Cambridge to the Niagara Escarpment. After crossing the escarpment in the Highway 401 corridor, the route follows this corridor through Milton where it joins the proposed Highway 407 corridor which provides the opportunity to pass the northern edge of Pearson Airport. At this location, the route swings south into the existing CN ROW which passes through the City of York to access Union Station in downtown Toronto from the west.

8.1.2 Toronto to Montréal

The route for this scenario exits the Metropolitan Toronto urban area by sharing the CP ROW through Leaside, Don Mills and Agincourt Yards in north Scarborough. Continuing north along the CP ROW the route reaches the proposed Highway 407 corridor near Locust Hill. The Highway corridor is followed to bypass Pickering and Oshawa. It has been assumed that a

ROW contiguous with the highway ROW would be developed wherever the highway geometry is compatible with the HSR alignment standards.

East of Oshawa the route continues gradually southward to the Highway 401 corridor near Port Hope and Cobourg.

The route leaves the highway corridor at Colborne and continues east in a new more northerly ROW through Frankford to Kingston. From the outskirts of Kingston, the route swings to the north-east and continues, generally parallel to Highway 15, up to Smiths Falls. After bypassing Smiths Falls to the west, the route joins the CN ROW to enter Ottawa through Federal Junction.

Since the representative route between the National Capital Region and Montréal, was selected to be along the north shore of the Ottawa River, the route leaves the CN ROW in Ottawa and follows the CP ROW across the river to enter downtown Hull. Between Hull and Montréal, the new ROW passes through Gatineau, south of Buckingham, north of Montebello and along the north shore to Lachute. After bypassing Lachute to the south, the route swings north to join the CP ROW at the south-west corner of Mirabel Airport. As described in Section 6.1 the route could either pass through the airport terminal and then south to Laval, or bypass the property to the south and continue to Laval.

From Laval the CP ROW is used to cross the Rivière-des-Prairies from where a new tunnelled ROW links the route to the CN ROW entering the existing Mont Royal Tunnel. The existing tunnel is used to access Central Station in downtown Montréal.

8.1.3 Montréal to Québec

For this scenario, the route from Central Station to the eastern limit of the Montréal urban area is identical to that described in Section 6.1.3 for the "Existing ROW" scenario i.e. north through the Mont Royal Tunnel, up to Laval and then north-east along the CP ROW to Mascouche.

From Mascouche, the new ROW parallels the CP ROW as far as Saint-Barthélémy where it joins the Hydro Québec corridor which it follows to north of Louiseville. The route continues across country to join the bypass of Trois-Rivières developed for the other scenarios. Between Trois-Rivières and La Pérade the route generally follows the Autoroute 40 corridor. At La Pérade, a Hydro Québec corridor north of the Autoroute, is again joined and followed eastward to a point

15 km west of Ancienne-Lorette. From this point, the route swings across to rejoin the CP ROW south of Québec airport.

The route through the urban area uses the CP ROW, with curve improvements in the Les Saules area, to reach the CN ROW at Allenby Junction. From the junction the CN ROW is shared through Vanier and Limoilou to gain access to Gare du Palais.

8.2 STATION LOCATIONS

The following 16 locations were identified as potential station sites for HSR service using 300 kph technology primarily in a new ROW.

Station Location	Urban Area Served	Infrastructure Assumed
South of Windsor - Suburban	Detroit/Windsor	New Station
SE of London - Suburban	London/St. Thomas	New Station
Kitchener (Suburban - Near 401/24) interchange	Kitchener/Waterloo Cambridge	New Station
Pearson Airport (North of airport on Hwy. 407 corridor)	Pearson Airport and W Greater Toronto Area	New Station
Metro Toronto Downtown Within existing Union station area	Greater Toronto Area	Existing Modified
Yonge St. at CP ROW	Metro Toronto (Uptown)	New Station
NE Toronto (Suburban - CP Havelock S/D and Highway 407 corridor)	E. Greater Toronto Area	New Station
Kingston (North of downtown)	Kingston Region	New Station
Downtown Hull	Ottawa - Hull	New Station
Merivale	Ottawa Region	New Station
On Mirabel airport property near terminal	Mirabel Airport N.W. Montréal	Existing Completed
Laval	E. Montréal Region	New Station
Central Station - Montréal	Montréal Urban Community	Existing Modified
North of Trois-Rivières - Suburban	Trois-Rivières	New Station
Ancienne-Lorette (Suburban)	W. Québec Region	New Station
Gare du Palais	Québec	Existing Modified

The above locations are identified in Exhibits 8.1.1 and 8.1.2. Potential Station sites in the major urban centres are also shown in Exhibits 4.1.3, 4.1.4, 4.1.5 and 4.1.6.

The implications of the use of Union Station in Toronto and Central Station in Montréal by HSR service in this scenario would be as discussed in Section 4.2 for the 200-250 kph scenario.

8.3 ROUTE CHARACTERISTICS

8.3.1 Right-Of-Way

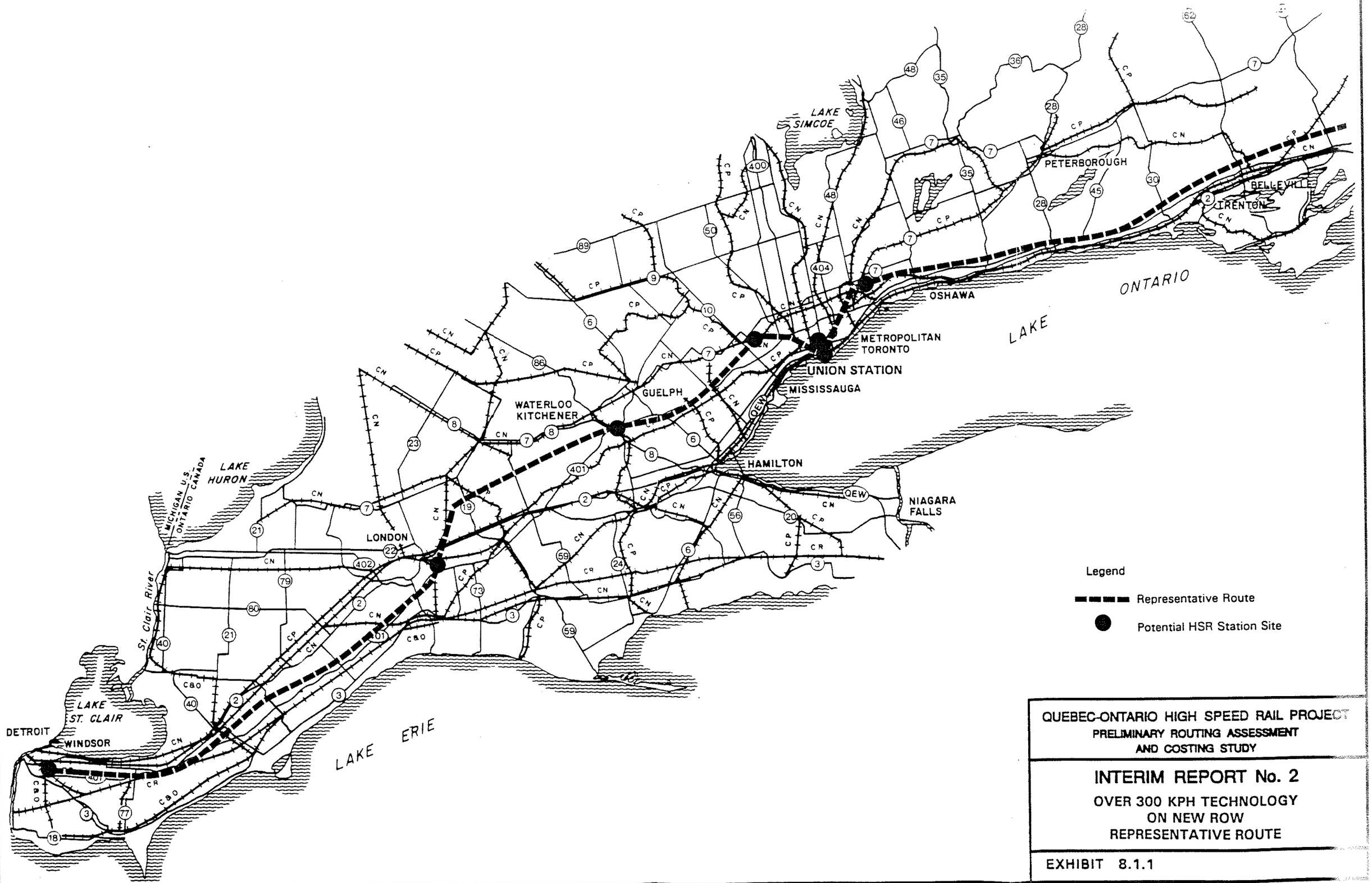
This section provides an overview of the type of ROW acquisition or sharing assumed for the representative route for this scenario. Table 8.3.1 identifies the method proposed for establishing a HSR ROW between Windsor and Québec by segment along the corridor.

The table distinguishes between ROW acquired outright from private owners from one or other of the railways and ROW or corridor shared with CN or CP. Corridor sharing refers to the arrangement where HSR is in a dedicated ROW parallel to and contiguous with the existing rail ROW. The length of new ROW required for bypassing urban areas or geometric constraints is also identified. The tabulated data indicates that approximately 5% of the ROW would be acquired (from CP and VIA), 1% would share a rail corridor, 11% would be shared with CN or CP and 83% would be new ROW remote from existing corridors.

Some of the issues associated with acquisition of this ROW are outlined below for each of the primary segments of the route.

- Windsor to London

Requires less urban land acquisition than existing ROW scenarios as route length in urban area is less. Most rural land acquisition is A1 or A2 agricultural land. 18 homes would be affected in this segment.

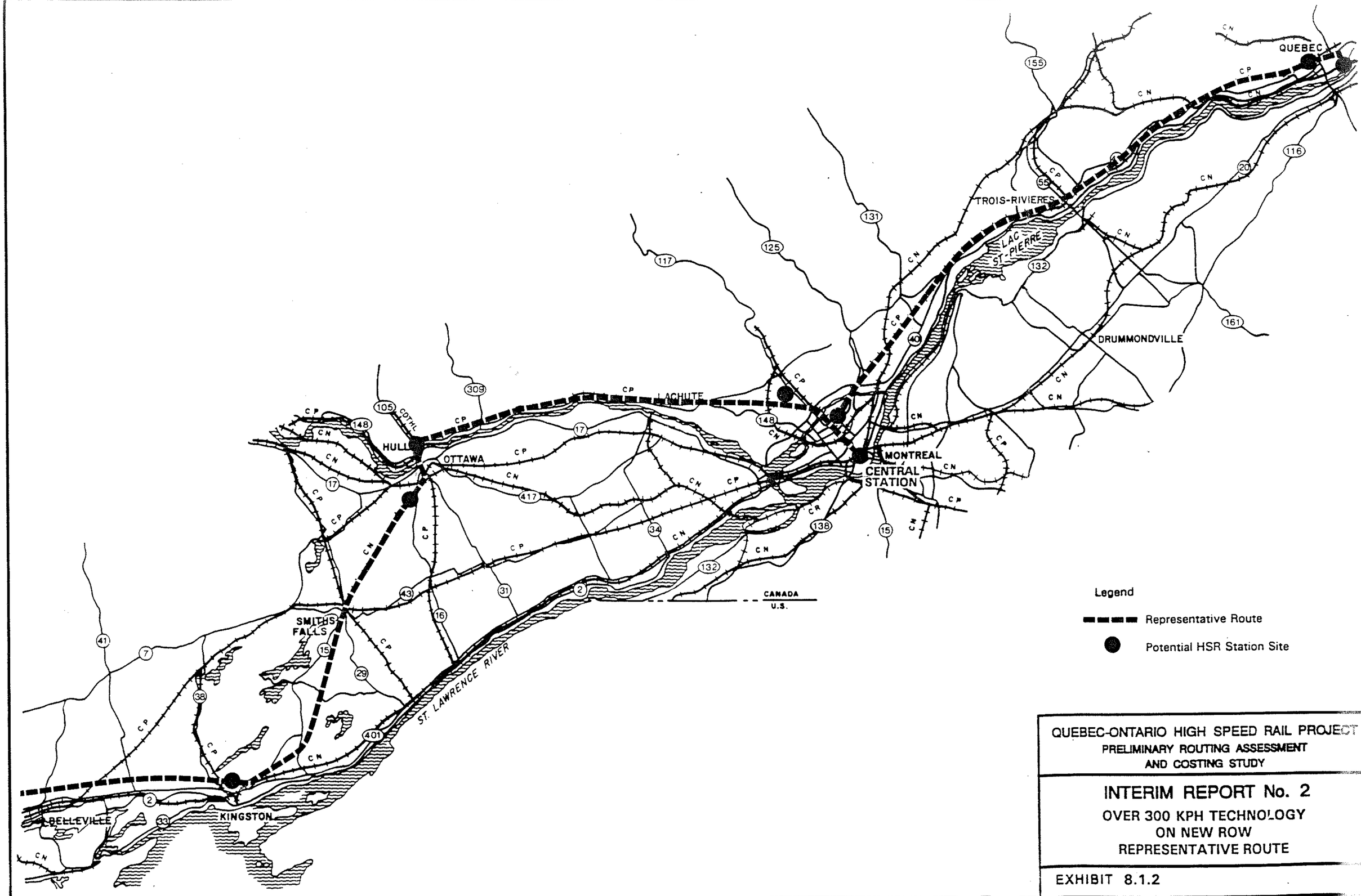


QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT AND COSTING STUDY

INTERIM REPORT No. 2

OVER 300 KPH TECHNOLOGY
ON NEW ROW
REPRESENTATIVE ROUTE

EXHIBIT 8.1.1



QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT
PRELIMINARY ROUTING ASSESSMENT
AND COSTING STUDY

INTERIM REPORT No. 2

OVER 300 KPH TECHNOLOGY
ON NEW ROW
REPRESENTATIVE ROUTE

EXHIBIT 8.1.2

Segment	Length (km)	Method of Establishing ROW 300 on New ROW Table. 8.3.1					
		Acquire Entire ROW from CN	Acquire Entire ROW from CP	Acquire Entire ROW from VIA	Sharing CN ROW or (Corridor)	Sharing CP ROW or (Corridor)	Acquire New ROW
Windsor	10				*7/3*		
Windsor to Toronto	335						335
Toronto (Pearson to Union)	30				30		
Toronto (Union to Locust Hill)	29					*14/15*	
Toronto to Oshawa	37						37
Oshawa to Smiths Falls	292				(2)		290
Smiths Falls to Richmond	24			24			
Richmond to Confederation Heights	31			17			14
Confederation Hgts.to Gatineau	22					*22*	
Gatineau to Mirabel	118						118
Mirabel	13					(13)	
Mirabel to Jct. Lachute Sd.	31					*12*	19
Jct. Lachute Sd. to Riv. Des Prairies	8				*8*		
Riv. Des Prairies to Boul. Metropolitan	5					*1*	4
Boul. Metropolitan to Central Station	4					*3*	1
Jct. Lachute Sd. to Mascouche	23		9				14
Mascouche to Allenby Jct.	225		7				218
Allenby Jct. to Gare du Palais	8				*8*		
TOTAL LENGTH	1,245	0	16	41	37/*19* (2)	14/*53* (13)	1050

*This ROW is used to enter and exit Central Station hence an additional 17km should be added to obtain total route length. Lengths in italics represent ROW sharing with 4.5m offsets. Lengths in parenthesis refer to sharing of the general rail corridor outside of the rail ROW.

- London to Pearson Airport

Approximately 75% of urban land acquisition would be commercial or industrial. Some institutional and recreational property would be required. 50% of the rural land acquisition has been treated as rural speculation lands in Peel Region. 12 homes would be affected.

- Pearson Airport to Union Station

Acquisition of railway property constitutes approximately one-third of land cost. 39 homes and 16 industrial properties would be affected by ROW widening.

- Union Station to North Pickering

Acquisition of CP railway property constitutes approximately one-third of land cost. 53 homes and 3 industrial properties would be affected.

- North Pickering to Kingston

Acquisition of rural land and farm residences constitutes 70% of the land cost. More northerly route avoids significant land costs associated with the Lakeshore corridor.

- Kingston to Ottawa

Since this scenario uses the same route as the other 300 kph option, land acquisition and property impact will be identical as far as Confederation Heights in Ottawa.

- Ottawa to Mirabel

The route from Confederation Heights passes through Hull using the CP Ellwood Subdivision. Competing uses for all or part of this corridor may prove difficult to resolve. These include arterial road or transitway use, City of Ottawa open space corridor and existing rail.

Sharing or acquisition of CP ROW through Hull and Gatineau has been assumed to avoid major urban land acquisition. Most of the route to Mirabel traverses agricultural or natural lands with little community impact. Although ROW widths may be higher than assumed due to rugged terrain, land costs are reasonably low in this segment.

- Mirabel to Central Station

ROW acquisition issues are as described in Section 6.4.2 for the existing ROW scenario.

- Central Station to Laval

ROW is as described in Section 6.3.1 for the existing ROW scenario.

- Laval to Ancienne Lorette

Urban land acquisition is half of what would be required for the 200-250 existing ROW scenario. Also the length of route with potentially difficult agricultural acquisition is only 70km as opposed to 80-93 km for the other scenarios.

- Ancienne Lorette to Québec

In this segment the route rejoins the existing ROW alignment hence land acquisition issues are as noted previously in Section 4.3.1.

8.3.2 Alignment

Generally, the representative alignment defined for this new ROW scenario meets the desirable horizontal curvature criteria for HSR operation up to 350 kph. On the basis of the level of accuracy and detail possible with topographic mapping of the scale available, it appears that horizontal curves in the 6,000-10,000 metre range can be accommodated along most of the rural portions of the route. There are only a few isolated locations, outside of urban areas where the curve radius has had to be reduced to 4000 metres because of topographic or other constraints.

The preliminary profile, developed from contour information on the topographic mapping, shows that the terrain along the route can be traversed largely with grades between 0 and 2 percent. Only in very few areas, are grades between 2 and 3.5 percent required, e.g. on the north shore route approaching Ancienne-Lorette and the new tunnels in north Montréal and Laval. Many sections of the route, particularly between Windsor and London and the south shore of the Ottawa River, are very flat requiring minimal grades.

8.3.3 Structures

The new ROW alignment requires 36.5 km of new tunnels varying in length from 2 to 5.5 km. These occur at the following locations:

- between Kitchener and Cambridge to pass under Highways 401 and 24
- in Ottawa under Dows Lake along the CP Ellwood Subdivision
- east of the Trent Canal north of Trenton because of local ridge
- between Hull and Mirabel near Montebello and Calumet to traverse hilly terrain which would require several very high viaducts and deep cuts for a surface alignment
- between Mont Royal tunnel and Rivière-des-Prairies north of Montréal
- in Laval to eliminate a speed restriction due to a sharp curve in the CP ROW

Tunnelling has been adopted for sections of the route where the depth of cuts would exceed 20-25 metres and also to avoid conflict with highly developed areas or major existing transportation facilities (e.g. rail or highways)

In addition to the tunnels listed above, the alignment necessitates construction of 6 km of viaduct structures. The structures have been assumed where the height of rail embankment would exceed 20 metres. Generally the viaducts range in length from 700 to 3100 metres.

Bridges to carry HSR tracks over rivers have been identified from the topographical mapping. The quantity of these structures, with lengths between 15-500 metres, is given below:

- Windsor to Toronto - 77 (21 per 100 km) *(11 per 100 km)*
- Toronto to Ottawa - 33 (8 per 100 km) *(7 per 100 km)*
- Ottawa to Montréal - 7 (4 per 100 km) *(6 per 100 km)*
- Montréal to Québec - 107 (39 per 100 km) *(32 per 100 km)*

The respective frequency of river crossings for the over 300 kph non-tilting technology on existing ROW is quoted in italics for comparison purposes.

8.3.4 Grade Separations

An initial assessment of the need for grade separations, based on assumptions specified in the study Terms of Reference and set out in Section 1, has resulted in the following requirements for new grade separations in each of the major route segments:

- Windsor to Toronto - 165 (44 per 100 km) *(35 per 100 km)*
- Toronto to Ottawa - 192 (46 per 100 km) *(42 per 100 km)*
- Ottawa to Montréal - 52 (27 per 100 km) *(42 per 100 km)*
- Montréal to Québec - 91 (33 per 100 km) *(35 per 100 km)*

In addition to new grade separations, the requirements for modifications of existing grade separations are estimated to be as follows:

- Windsor to Toronto - 43 (12 per 100 km) *(16 per 100 km)*
- Toronto to Ottawa - 39 (9 per 100 km) *(14 per 100 km)*
- Ottawa to Montréal - 14 (7 per 100 km) *(8 per 100 km)*
- Montréal to Québec - 20 (7 per 100 km) *(9 per 100 km)*

The respective frequency of new grade separations and modifications of existing grade separations for the over 300 kph non-tilting technology on existing ROW is quoted in italics for comparison purposes.

8.4 ACCESS TO URBAN AREAS

The purpose of this section is to describe the infrastructure implications of accessing the urban areas of Windsor, Toronto, the National Capital Region, Montréal and Québec. The description includes an outline of the ROWs adopted in these urban areas and supplements the overview of the rural sections of the "Over 300 kph New ROW" scenario.

8.4.1 Windsor

It has been assumed that any HSR service to Detroit would share tracks in the existing Windsor-Detroit Tunnel. South of the tunnel, new HSR tracks would be located immediately adjacent to CN Caso Subdivision tracks, (approximately 4.5 metre centres) for a distance of

to CN Caso Subdivision tracks, (approximately 4.5 metre centres) for a distance of approximately 10 km to where the route leaves the CN ROW and enters a new exclusive ROW. The proposed station site is located on the new ROW south of Windsor Airport.

8.4.2 Toronto

From the Parkway Belt West/Highway 407 corridor near Pearson Airport, a 4500 metre curve is required to access the CN Weston Subdivision where HSR tracks would be located south of the existing tracks with a 10 metre offset. Just east of Islington Avenue a 500m tunnel would carry HSR tracks to the north side of the corridor. The CP MacTier Subdivision enters the corridor east of Weston Road. From this point south to St. Clair Ave. (6.5 km) the HSR tracks would be between the CN and CP tracks with a 10m offset from each. Immediately south of Lawrence Ave. the HSR tracks would be in a 1250m tunnel to allow interchange tracks between the CN and CP tracks. At St. Clair Avenue the offset between the HSR tracks and the other tracks would be reduced to 4.5m as far as Bathurst Street. From Bathurst Street to Union Station the route is within the TTR signal limits and the HSR trains would run on existing tracks. With the exception of the 1500m curve leading onto the Weston Subdivision the minimum curve radius up to Dundas Street is 2000m.

From Union Station to the CN Bala Subdivision at Bloor Street, trains would share existing tracks. North of Bloor Street, two new tracks with a 4.5m offset would be added. A 250m tunnel would be required to direct the HSR tracks from the CN Bala Subdivision to the CP Belleville Subdivision at the Leaside Yard. The addition of two new tracks in the Leaside Yard would impact the proposed Leslie Street extension and may add 150m to the length of the proposed Leslie Street tunnel. From the Leaside Yard to Highway 401 (10.4 km) the HSR tracks would be located with a minimum offset (4.5m) between CP tracks to the east and proposed future GO tracks to the west. North of Highway 401 the HSR tracks would be offset 10m from both the existing CP tracks and the future GO tracks. A 1500m viaduct with a minimum radius of 2000m would be required at the southwest end of Agincourt yard to carry the HSR tracks to the north side of the yard.

The 11 km section of existing ROW between Union Station and Don Mills Road has sharp curvature with several curves in the 500 - 750 metre range. With the exception of one 1160 metre curve near Lawrence Avenue, the remainder of the route to the north east has curve radii of 2000 metre or greater. Approximately 30 km from Union Station, the route leaves the CP Havelock Subdivision and enters the proposed Highway 407 corridor which is used to exit the Greater Toronto urban area.

The routing through Metro Toronto discussed above assumes that the major station stop in the Metro area will be the existing Union Station. A potential alternative station location, on the CP North Toronto subdivision at Yonge Street, was identified during the study. This location could be reached by a variation to the representative routing described previously.

The variation shown in exhibit 4.1.3 commences at the intersection of the CN Weston and CP North Toronto Subdivisions (the West Toronto diamond). From this point, the route would follow the CP North Toronto Subdivision which runs east-west across the northern edge of the downtown area.

Recent studies by GO Transit have assessed the requirements to accommodate commuter rail service on the North Toronto Subdivision. The ROW width constraint dictates a track sharing approach since the projected track requirements for commuter and freight traffic would leave little opportunity for dedicated HSR tracks.

Establishing a station at the Yonge Street/CP Rail grade separation would provide a convenient link to the TTC Subway system and GO Transit, should this corridor become part of the commuter rail network, but the location does not offer good automobile access to the express-way system. The integration of a HSR station into proposed redevelopment of the node, and any future commuter rail facilities would require extensive further study to assess spatial constraints for both passenger facilities and station trackage.

8.4.3 National Capital Region

As discussed for the other two Technology/ROW scenarios, access to the region in this scenario is also achieved by using the CN Smiths Falls Subdivision as far as Federal Junction. The implications of HSR in this corridor are as described in Section 4.4.3 for the tilting technology scenario. The same improvements to alignment and the necessary elevated structure at Federal Junction would also be required.

Approximately 3 km north of the junction the route leaves the CN Beachburg Subdivision and joins the CP Ellwood Subdivision at the existing diamond crossing in Confederation Heights. Between the crossing and the Ottawa River, the HSR tracks in the CP Subdivision are obliged to follow the curvilinear alignment which is constrained by the Carleton University property, the Dows Lake tunnel and the fully developed industrial and residential areas north and south of the Queensway. This section includes nine curves with radii between 450 and 1000 metres. A

new single track tunnel duplicating the Dows Lake tunnel and a new bridge carrying HSR tracks over the Ottawa River would be required east of the existing Prince of Wales Bridge.

North of the river, the CP ROW curves east into the site of the existing Hull Station which would be redeveloped as the major HSR station serving the National Capital Region. From the station, new HSR tracks would be constructed on the north side of the ROW in the CP Lachute Subdivision, which would be used to pass through Hull and then swing east through Gatineau. The HSR tracks would leave the CP ROW and the urban area in the vicinity of Lac Beauchamp Park.

8.4.4 Montréal

The route enters the Montréal urban area from the west in the CP Lachute Subdivision, immediately south of Mirabel Airport. HSR tracks would share the CP ROW for a distance of 32 km through to the junction with the CP Trois-Rivières Subdivision in Laval.

A direct access to Mirabel Airport was also developed as an alternative routing to the CP ROW. This routing, which permits the use of the provision made for an underground station in the existing airport terminal, requires an additional 6 km of alignment.

For this scenario, the HSR route enters the Montréal urban area following the CP Trois-Rivières Subdivision up to Saint-Martin Junction. In this section, the minimum curve radius is 2000 metres. From Saint-Martin Junction up to Rivières-des-Prairies, the CP Lachute Subdivision would be used where the minimum curve radius is 1000 m. East of Rivière-des-Prairies, the HSR tracks would follow the CP Lachute Subdivision up to approximately Henri-Bourassa Boulevard where a tunnel is introduced to join the CN Mont Royal Subdivision for access to Central Station. In this section, the minimum curve radius is 900 m. The route from Central Station eastward to Québec would be as described in Section 6.4.4 for the existing ROW scenario, i.e. returning north to the Saint-Martin junction in Laval and then leaving the urban area along the CP Trois-Rivières Subdivision, acquired for HSR service.

8.4.5 Québec

The HSR route enters the Québec urban area in the CP Trois-Rivières Subdivision at Ancienne-Lorette. HSR tacks would remain in this subdivision as far as Allenby Junction where the CP

ROW meets the CN Bridge Subdivision. Up to this point the minimum curve radius is 1200 m. Between Allenby Junction and Gare du Palais, the HSR tracks would be constructed in the CN Bridge Subdivision ROW. This ROW is severely constrained by adjacent development, hence major expropriation would be required to improve the existing 1200 m and 350 m radius curves. HSR tracks would pass through the CN Limilou Yards and cross the Rivière St. Charles to enter the existing Gare du Palais.

8.4.6 Access to Toronto and Montréal Airports

Montréal

In Montréal, the Dorval Airport can be linked to the representative route for 200-250 kph HSR service which uses the existing CN rail corridor at Dorval Station. Access to the terminal buildings would have to be achieved by some form of people mover or shuttle bus service. Diversion from the rail corridor to pass under or close to the terminal buildings would require an extensive, costly underground alignment beneath fully developed communities and across airport property.

The routing for the 200-250 kph scenario precludes any direct access to Mirabel Airport unless the Montréal urban area is accessed from Lachute as in the representative route for the "Over 300 kph, existing ROW" scenario. Clearly, this alternative access would then eliminate any direct link to Dorval Airport.

For both over 300 kph scenarios, access to the Montréal urban area is from the northwest along the CP Lachute Subdivision immediately south of Mirabel Airport property. Consequently a diversion of the route into the airport property has been investigated. This diversion has an additional length of 6 km and requires 4 km of underground construction to link to the provisions for a future underground station incorporated in the original airport terminal construction. From the east, the route would approach the terminal in a ROW parallel and adjacent to the existing main access road to the terminal.

Toronto

Access to Lester B. Pearson Airport in Toronto is possible from the over 300 kph new right-of-way only, as the representative routes for both technologies using existing rail right-of-way through the Greater Toronto Area would follow the lakeshore corridor. This corridor passes

through fully developed urban area approximately 15 km to the south of the airport and thus precludes a convenient.

The over 300 kph route would pass 2 km, north-west of the Pearson Airport property before entering the CN Weston sub-division which then continues in a south-easterly direction through the Malton GO station and into Metro Toronto. The GO station and the highway ROW are located approximately 3.2 km and 2.3km from the airport terminal area respectively. Either of these locations could be linked to the terminals by a high frequency people mover shuttle with a travel time under 5 minutes. The alternative of direct access to the terminal area by high speed rail would require a major 8km long tunnel under airport property and the surrounding industrial area. Neither of the above access methods has been included in the cost estimate for the new corridor scenario.

9 ENVIRONMENTAL IMPACT - OVER 300 KPH NON-TILTING TECHNOLOGY IN NEW CORRIDOR

This chapter provides a selective overview of the potential natural and socio-economic environmental impacts to sensitive features directly affected by the over 300 kph non-tilting technology in a new corridor.

9.1 Windsor to Toronto

9.1.1 Natural Environment

i) **Provincially Significant Features**

- Affects two Class 1-3 wetlands (4.3 km; Puslinch Lake Wetland and Galt Creek Swamp). Located between Kitchener and Guelph and are within 3.4 km of each other.

- Affects four (3.4 km) areas of Natural and Scientific Interest (ANSIs)

  - the Galt Moraine (earth science) located east of Kitchener; an ANSI located between Kitchener and Milton; and unidentified ANSI located west of Brampton near Campbellville; and an ANSI located north of Ajax;

- Affects 12 (9.0 km) Environmentally Sensitive Areas (ESAs)

  - Medina Bush and Sunova Swamp between London and Woodstock;
  - between Kitchener and Milton the line impacts Galt Creek Swamp, Waterloo ESA #35 and Hilton Falls; and
  - from Claireville to the east limit of the section, the route affects seven ESAs associated with the valleys of major watercourses flowing to Lake Ontario

- Crosses two features declared to be of Provincial Interest (Niagara Escarpment -5.5 km in vicinity of Hilton Falls/Kelso Conservation Areas; Phase II Rouge Valley Park).

ii) **Ecological Reserves/Wildlife Management Areas**

- Affects two waterfowl staging and reproduction areas;

  - Lake St. Clair/Baptiste Creek area (2.7 km);
  - Galt Creek Swamp area east of Kitchener (1.5 km).

- Affects two deer yards:

  - Galt Creek area east of Kitchener (2.3 km);
  - near Campbellville in association with the Hilton Falls ESA (1.5 km).

iii) **Significant Fisheries/Aquatic Habitat**

- Crosses a total of 187 watercourses;

- Crosses 249 warm water streams. These are typically less significant in terms of fisheries and aquatic habitat;

- Crosses 16 identified cold water streams:

  - North Branch Creek east of London, and Washington Creek west of Kitchener;
  - Aberfoyle Creek and Bronte Creek along with two of its tributaries south of Guelph;
  - Sixteen Mile Creek near Milton; and
  - from Claireville to the east limit of the study area, East Dufferin Creek and seven other cold water streams north of Whitby and Oshawa are crossed.

- Crosses eight migratory streams; all but one, the Credit River near Churchville, are small streams and are located just north of Ajax, Whitby and Oshawa;

- Crosses one spawning/nursery area just west of Kitchener on Washington Creek (headwaters of Nith River).

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 300 Km/h New ROW

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0-20 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	0.0	0	0.0	0	0.0
20-40 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	13	0.0	0	0.0	0	0.0
40-60 Km	0	0.0	0	0.0	0	0.0	1	2.7	0	0.0	0	0.0	0	0.0	11	0.0	0	0.0	0	0.0
60-80 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	12	0.0	0	0.0	0	0.0
80-100 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	7	0.0	0	0.0	0	0.0
100-120 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	16	0.0	0	0.0	0	0.0
120-140 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	12	0.0	0	0.0	0	0.0
140-160 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	17	0.0	0	0.0	0	0.0
160-180 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	12	0.0	0	0.0	0	0.0
180-200 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	13	0.0	0	0.0	0	0.0
200-220 Km	0	0.0	0	0.0	2	2.4	0	0.0	0	0.0	0	0.0	0	0.0	11	0.0	0	0.0	0	0.0
220-240 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.0	17	0.0	0	0.0	0	0.0
240-260 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	16	0.0	0	0.0	1	0.5
260-280 Km	0	0.0	1	0.6	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	8	0.0	0	0.0	0	0.0
280-300 Km	2	4.3	1	1.0	1	2.1	1	1.5	1	2.3	0	0.0	3	0.0	4	0.0	0	0.0	0	0.0
300-320 Km	0	0.0	1	1.5	1	0.9	0	0.0	1	1.5	1	5.3	1	0.0	16	0.0	0	0.0	0	0.0
320-340 Km	0	0.0	0	0.0	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	12	0.0	1	0.0	0	0.0
340-360 Km	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
360-380 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
380-400 Km	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	15	0.0	1	0.0	0	0.0
400-420 Km	0	0.0	1	0.3	4	1.5	0	0.0	0	0.0	0	0.0	9	0.0	28	0.0	6	0.0	0	0.0
420-440 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0
Total	2	4.3	4	3.4	12	9.0	2	4.2	2	3.8	1	5.3	16	0.0	249	0.0	8	0.0	1	0.5

Station Commencing: 0+000

Station Ending: 420+339

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 300 Km/h New ROW

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Settlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0-20 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	2	2.0
20-40 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	4	4.0
40-60 Km	0	0.0	0	0.0	1	1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
60-80 Km	0	0.0	0	0.0	1	12.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
80-100 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	2.0
100-120 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0
120-140 Km	0	0.0	0	0.0	1	8.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
140-160 Km	0	0.0	0	0.0	1	20.0	0	.0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
160-180 Km	0	0.0	0	0.0	2	7.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	3.0
180-200 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	13.0
200-220 Km	0	0.0	0	0.0	1	5.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	2.0
220-240 Km	0	0.0	0	0.0	1	3.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	3.0
240-260 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.0
260-280 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.1	0	0.0	0	0.0	1	2.0	0	0.0
280-300 Km	0	0.0	1	1.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.0	0	0.0
300-320 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.8	2	1.3	0	0.0	1	1.0	3	3.0
320-340 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0	0	0.0	1	1.0	2	6.0
340-360 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.1	1	1.0	1	2.0	1	1.0
360-380 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	5.0	0	0.0
380-400 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	1	1.0	1	3.0
400-420 Km	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	2	1.7	1	0.4	0	0.0	0	0.0	1	1.0
420-440 Km	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	2	1.7	8	58.8	0	0.0	0	0.0	0	0.0	6	5.0	5	2.8	1	1.0	7	14.0	31	47.0

Station Commencing: 0+000

Station Ending: 420+339

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 300 Km/h New ROW

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0-20 Km	4	8.1	1	0.0	2	9.0	0	0.0	0	0.0	1	9.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
20-40 Km	7	15.9	0	0.0	2	20.0	2	11.8	0	0.0	2	8.2	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6
40-60 Km	4	19.4	5	1.2	4	18.1	1	1.6	1	4.5	1	14.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
60-80 Km	1	20.0	6	4.0	6	18.3	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6
80-100 Km	4	10.6	4	1.0	10	7.7	0	0.0	1	15.2	2	4.8	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7
100-120 Km	2	14.3	0	0.0	3	20.0	0	0.0	1	10.2	2	9.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
120-140 Km	3	12.9	2	0.7	2	20.0	0	0.0	2	9.5	3	10.5	0	0.0	0	0.0	0	0.0	0	0.0	2	2.8
140-160 Km	6	11.0	0	0.0	2	20.0	0	0.0	1	6.9	1	13.1	0	0.0	0	0.0	0	0.0	0	0.0	2	2.2
160-180 Km	2	18.0	1	0.3	5	15.5	0	0.0	1	4.5	1	15.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
180-200 Km	2	20.0	1	0.5	4	18.3	0	0.0	0	0.0	2	19.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
200-220 Km	2	20.0	0	0.0	3	18.6	0	0.0	1	12.5	1	4.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
220-240 Km	2	20.0	0	0.0	6	12.5	1	10.9	1	9.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
240-260 Km	1	20.0	0	0.0	6	9.2	1	0.7	1	5.9	1	13.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
260-280 Km	4	19.9	0	0.0	0	0.0	1	13.8	1	1.3	1	3.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
280-300 Km	3	5.0	0	0.0	0	0.0	2	2.6	0	0.0	2	17.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
300-320 Km	8	10.5	0	0.0	1	0.1	1	1.4	0	0.0	2	18.6	0	0.0	0	0.0	0	0.0	2	0.5	0	0.0
320-340 Km	7	19.2	1	0.6	0	0.0	1	2.9	0	0.0	2	17.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
340-360 Km	3	18.6	1	0.3	0	0.0	0	0.0	0	0.0	1	15.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
360-380 Km	2	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
380-400 Km	3	19.8	1	0.1	0	0.0	0	0.0	1	4.8	1	13.1	1	6.0	0	0.0	0	0.0	0	0.0	0	0.0
400-420 Km	7	19.2	3	1.1	4	1.0	0	0.0	1	4.9	1	15.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
420-440 Km	1	0.4	0	0.0	1	0.2	1	0.4	1	0.4	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	78	342.5	26	9.6	61	208.4	11	46.0	14	89.7	29	242.9	1	6.0	0	0.0	0	0.0	2	0.5	7	6.9

Station Commencing: 0+000

Station Ending: 420+339

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9a

SECTION : WINDSOR TO TORONTO

TECHNOLOGY : 300 Km/h New ROW

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
	nb	km	nb	km
0-20 Km	0	0.0	0	0.0
20-40 Km	0	0.0	0	0.0
40-60 Km	0	0.0	0	0.0
60-80 Km	0	0.0	0	0.0
80-100 Km	0	0.0	0	0.0
100-120 Km	0	0.0	0	0.0
120-140 Km	0	0.0	0	0.0
140-160 Km	0	0.0	0	0.0
160-180 Km	0	0.0	0	0.0
180-200 Km	0	0.0	0	0.0
200-220 Km	0	0.0	0	0.0
220-240 Km	0	0.0	0	0.0
240-260 Km	0	0.0	0	0.0
260-280 Km	0	0.0	0	0.0
280-300 Km	0	0.0	0	0.0
300-320 Km	0	0.0	0	0.0
320-340 Km	0	0.0	0	0.0
340-360 Km	0	0.0	0	0.0
360-380 Km	0	0.0	0	0.0
380-400 Km	0	0.0	1	1.1
400-420 Km	0	0.0	0	0.0
420-440 Km	0	0.0	0	0.0
Total	0	0.0	1	1.1

Station Commencing: 0+000

Station Ending: 420+339

iv) **Floodplain/Geotechnical Hazards**

- Crosses eight sections (58.8 km) of deep silty clay with alluvium at river crossings which may constitute an erosion/instability problem or where cut may not be suitable for reuse as fill. Most extensive areas are from Tilbury to Chatham (12.5 km including Baptiste Creek and Jeannette's Creek) and from West Lorne to London (36.1 km).

- Crosses two sections of wetland (peat and muck) soils (1.7 km).

9.1.2 Socio-Economic Environment

i) **Major Parks/Historic Sites**

- Crosses future phases of Rouge Valley Park (length undetermined).

ii) **Major Tourism/Recreation/Conservation Areas**

- Affects six recreational areas (5.0 km) encroaching on two and passing through four.

- Affects five Conservation Areas, encroaching on four, severing one (Claireville).

iii) **Urban Perimeters**

- Passes through Hamlet of Claireville (1.0 km).

- Three major urban concentrations, that require access, have been deleted from the data matrix; 11.0 km through Windsor, 8.0 km through Cambridge and 12.0 km through Vaughan and Markham.

iv) **Rural Communities**

- Affects no small rural settlements west of Kitchener.

- Passes close (within 500 m) to seven communities over a distance of 15.0 km, primarily between Kitchener and Hamilton and southern areas of York Region.

- Comes close (within 250 m) to 31 clusters of residences over a distance of 47.0 km. Major areas of concentration are south of London and from Guelph to Brampton.

v) **Agriculture**

- Crosses 342.5 km of the best (Class 1 and 2) agricultural soils (81 % of total route). Areas across north end of GTA should be discounted as non-agricultural (40 km).

- Approximately 75% of route between Windsor and Kitchener traverses Class 1 and 2 soils; concentration of Class 1 and 2 soils drops to 57% from Kitchener to Guelph Junction north of Hamilton. From Toronto to Oshawa, approximately 97% of the route traverses Class 1 and 2 soils.

- Affects 26 areas (9.6 km) of speciality crop operations, primarily in segment from Tilbury to Chatham (includes approximately 12 fields (mostly tobacco) in Tilbury East, Raleigh and Harwich Townships). Remainder are isolated operations, primarily west of London and east of Toronto.

- Crosses 208.4 km of artificially drained areas. Area of highest tile system and drain concentrations is from Windsor to the east side of London (approximately 70% of the route crosses tile system and about 176 drains are severed). Represents a new direct impact.

- Creates awkward severance over 242.9 km (major areas occur between Tilbury and Rodney and from a point southwest of London to Kitchener). Kitchener to Markham currently affected by Highway 401 corridor and urban development. The route then swings north, severing lots to Brougham (on Pickering Airport site), then runs generally parallel to agricultural lot lines to east limit of study area.

- Also creates 89.7 km of severance with moderate degree of impact (category LL2 - perpendicular to lot lines near back of farm). Areas of concentration are Chatham to southwest of London and east of London to west of Kitchener.

vi) **Federal Reserves**

- Crosses federally owned Pickering Airport Site (6.0 km), some of which may be declared surplus to Transport Canada needs. May affect airside facilities and landside auxiliary uses.

vii) **Major Natural Resource Areas**

- Crosses portions of oil/gas pools in three locations from west of Tilbury to Chatham (1.9 km) and four locations from Rodney to Dutton (5.0 km).

- Minor effect on aggregate resources (2 locations, 0.5 km).

viii) **Waste Management Sites**

- Severs one candidate site (M6) near Markham in York Region (1.1 km).

9.2 Toronto to Ottawa

This option encounters similar constraints to those in the existing Lakeshore rail corridor due to its proximity and the incidence of north-south linear features. In addition, it is common with the existing rail corridor options between Smiths Falls and Richmond.

9.2.1 Natural Environment

i) **Provincially Significant Features**

- Encroaches on seven areas (23.3 km) of Class 1-3 wetlands primarily after turning northward east of Kingston (includes Rideau River System and Marlborough Regional Forest/Wetland Complex).

- Affects one ANSI (0.2 km near Newtonville) and 53.3 km of ESAs.

- Primary area of concern is extensive Shrike habitat area identified in the Belleville area (between 135 km and 160 km). This is considered as a major nesting area approximately 60% of identified Shrike nests in Ontario are located in this particular area. As a result of further discussions with MNR Kemptville staff (D. Cuddy), we have concluded that the corridor near Napanee will actually pass to the south of the cited shrike habitat which is apparently quite extensive (runs essentially the full width of Lennox-Addington County with a southern limit of Selby). Future field work will likely be necessary to confirm this and determine the potential for proximity effects.

ii) **Ecological Reserves/Wildlife Areas**

- Affects 60.0 km of nature reserves/management areas.

iii) **Significant Fisheries/Aquatic Habitat**

- Crosses a total of 187 watercourses.

- Crosses at least fifteen identified cold water or salmonoid migration watercourses (1.7 km). Many crossings are at or near headwaters of salmonoid producing streams.

- Crosses 2.2 km warm water streams.

iv) **Significant Forests**

- Encroaches on 85.0 km of sensitive area (includes Shrike habitat and Marlborough Regional Forest/Wetland Complex).

9.2.2 Socio-Economic Environment

i) **Major Tourism Areas**

- Encroaches on two Conservation Areas (0.2 km Port Hope; 0.5 km Grafton).

ii) **Urban Perimeters**

- Passes through 4.8 km of defined settlement area.

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9b

SECTION : TORONTO TO OTTAWA

TECHNOLOGY : 300 Km/h on NEW R.O.W.

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0
0020-0040	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0040-0060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5	2	0.1	0	0.0	0	0.0
0060-0080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0100-0120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	0	0.0	0	0.0
0120-0140	0	0.0	0	0.0	1	5.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0
0140-0160	1	1.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0
0180-0200	2	2.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0
0220-0240	1	3.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0
0240-0260	2	2.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0
0260-0280	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	2	4.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0
0300-0320	1	9.4	0	0.0	1	16.0	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	1	7.8	0	0.0	0	0.0	1	20.0	0	0.0	1	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	1	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	10	23.3	1	0.2	5	49.3	0	0.0	0	0.0	3	60.0	5	1.7	11	2.3	0	0.0	0	0.0

Station Commencing: -1+460

Station Ending: 314+930 (to Richmond)

353+720 (to Ottawa)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9b

SECTION : TORONTO TO OTTAWA

TECHNOLOGY : 300 Km/h on NEW R.O.W.

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Settlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.5	0	0.0	1	0.4
0020-0040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5
0040-0060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	1	3.2	0	0.0	1	0.5
0060-0080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	1	1.0	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	2.5
0100-0120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.8
0120-0140	1	5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
0140-0160	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.0	0	0.0	1	1.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	6.1	0	0.0
0340-0360	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	5	85.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.7	4	8.7	2	6.1	15	8.4

Station Commencing: -1+460

Station Ending: 314+930 (to Richmond)

353+720 (to Ottawa)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9b

SECTION : TORONTO TO OTTAWA

TECHNOLOGY : 300 Km/h on NEW R.O.W.

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	2	18.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0020-0040	3	9.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0040-0060	1	18.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0060-0080	1	10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	2	15.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0100-0120	1	1.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0120-0140	1	19.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0140-0160	2	5.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	2	7.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	2	1.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	3	11.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	2	8.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	2	16.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	25	143.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	3.0	0	0.0

Station Commencing: -1+460

Station Ending: 314+930 (to Richmond)

353+720 (to Ottawa)

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : TORONTO TO OTTAWA
TECHNOLOGY : 300 Km/h on NEW R.O.W.

TABLE 9b

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
0000-0020	0	0.0	0	0.0
0020-0040	0	0.0	0	0.0
0040-0060	0	0.0	0	0.0
0060-0080	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0
0100-0120	0	0.0	0	0.0
0120-0140	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: -1+460
Station Ending: 314+930 (to Richmond)
353+720 (to Ottawa)

iii) Rural Communities

- Comes close (within 500 m) to defined urban perimeters over 6.1 km of route length (Richmond and Barrhaven).

- Comes close (within 250 km) to undefined rural residential clusters over 7.4 km of route length.

iv) Agriculture

- Traverses Class 1 and 2 soils over approximately 36% of route length (143.8 km). Concentrated primarily in Oshawa to Trenton area.

v) Major Natural Resource Areas

- Encroaches on two areas of aggregate resources (2.0 km) near Leeds/Morton.

9.3 Ottawa to Montréal

9.3.1 Natural Environment

This option, located on the north shore of the Ottawa River in Québec, exhibits very limited potential to create adverse effects on natural components; these include Provincially Significant Features, Significant Fisheries/Aquatic Habitat and Floodplain/Geotechnical Hazards.

i) Provincially Significant Features

- Affects one provincially significant wetland at 96 km mark (0.8 km).

ii) Significant Fisheries/Aquatic Habitat

- Crosses a total of seven watercourses;

- Crosses exclusively warm water watercourses (4.5 km), including Gatineau River (250 m) and Rivière Rouge (100 m).

iii) **Floodplain/Geotechnical Hazards**

- Traverses three areas presenting geotechnical hazards in the Thurso/Plaisance areas (4.1 km wetland soils).

9.3.2 Socio Economic Environment

Socio-economic constraints are more prevalent than natural ares on this route segment and include Major Parks/Historic Sties, Urban Perimeters, Rural Communities and Agriculture.

i) **Major Parks/Historic Sites**

- Affects 3.4 km of Major Park area (lac Leamy in Hull and lac Beauchamp in Templeton);
- Affects three historic sites (0.2 km at North Nation Mills; 0.3 km at Calumet; 1.4 km at Ogdensburg).

ii) **Urban Perimeters**

- Passes through 1.3 km of defined urban settlement area (0.5 km Angers; 0.8 km Scholastique).

iii) **Rural Communities**

- Comes close (within 500 m) to Masson urban perimeter over a length of 0.8 km;
- Comes close (within 250 m) to two clusters of rural residential area (1.7 km).

iv) **Agriculture**

- Route traverses Class 1 and 2 soils (primarily Class 2) over approximately 15% of its length (57.8 km). Concentrated in the area between Hull and Plaisance. Considered the tradeoff in avoiding rural communities of Angers, Masson, Thurso and Lachute on existing right-of-way.

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9c

SECTION : OTTAWA TO MONTREAL

TECHNOLOGY : 300 Km/h on NEW R.O.W.

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	Res	km	nb	km	nb	km	nb	km	nb	km
0000-0020	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0
0020-0040	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0040-0060	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0060-0080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0
0100-0120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0
0120-0140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.5	0	0.0	0	0.0

Station Commencing: 0000+000

Station Ending: 0400+000

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW
SECTION : OTTAWA TO MONTREAL
TECHNOLOGY : 300 Km/h on NEW R.O.W.

TABLE 9c

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Settlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	0	0.0	0	0.0	0	0.0	2	3.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0020-0040	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	1	0.8	0	0.0
0040-0060	0	0.0	0	0.0	3	3.6	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0060-0080	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	1	1.5
0100-0120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0120-0140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.8	0	0.0	1	0.2
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	0	0.0	4	4.1	2	3.4	0	0.0	2	0.5	0	0.0	0	0.0	2	1.3	1	0.8	2	1.7

Station Commencing: 0000+000
Station Ending: 0400+000

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SECTION : OTTAWA TO MONTREAL
TECHNOLOGY : 300 Km/h on NEW R.O.W.

TABLE 9c

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
0000-0020	4	9.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0020-0040	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0040-0060	2	10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0060-0080	1	1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0100-0120	2	6.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0120-0140	4	11.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	14	57.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

Station Commencing: 0000+000
Station Ending: 0400+000

QUEBEC - ONTARIO H.S.R. STUDY : ROUTING AND INFRASTRUCTURE ANALYSIS - ENVIRONMENTAL OVERVIEW

TABLE 9c

SECTION : OTTAWA TO MONTREAL

TECHNOLOGY : 300 Km/h on NEW R.O.W.

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
0000-0020	0	0.0	0	0.0
0020-0040	0	0.0	0	0.0
0040-0060	0	0.0	0	0.0
0060-0080	0	0.0	0	0.0
0080-0100	0	0.0	0	0.0
0100-0120	0	0.0	0	0.0
0120-0140	0	0.0	0	0.0
0140-0160	0	0.0	0	0.0
0160-0180	0	0.0	0	0.0
0180-0200	0	0.0	0	0.0
0200-0220	0	0.0	0	0.0
0220-0240	0	0.0	0	0.0
0240-0260	0	0.0	0	0.0
0260-0280	0	0.0	0	0.0
0280-0300	0	0.0	0	0.0
0300-0320	0	0.0	0	0.0
0320-0340	0	0.0	0	0.0
0340-0360	0	0.0	0	0.0
0360-0380	0	0.0	0	0.0
0380-0400	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 0000+000

Station Ending: 0400+000

9.4 Montréal to Québec

9.4.1 Natural Environment

The over 300 kph non-tilting technology on a new right-of-way does not cross any Provincially Significant Features, Significant Forests or Ecological Reserves/Wildlife Management Areas (refer to Table 9d). However, it does exhibit the potential to affect Significant Fisheries/Aquatic Habitat and Floodplain/Geotechnical Hazard elements.

i) Significant Fisheries/Aquatic Habitat

- Crosses six spawning areas of concern (1.3 km) where aquatic habitats and fisheries for specific species are particularly sensitive (refer to Section 5.4.1 for specifics) :

  - Mille-Iles River (100 m);
  - L'Assomption River (2 spawning areas, 600 m);
  - Sainte-Anne and Batiscan Rivers (500 m); and
  - Jacques-Cartier River (100 m).

- 119 streams (< 30 m) and 32 rivers. Two most important in terms of their potential availability and utilization by aquatic fauna are :

  - Des Prairies (200-300 m width);
  - Batiscan River (> 300 m width).

ii) Floodplain/Geotechnical Hazards

- Crosses 10.8 km of geotechnically hazardous elements, namely seven wetlands totalling 8.1 km, the largest (2.9 km) being located east of L'Assomption River, and ten areas of erosion (2.7 km) along the sensitive clayey banks of rivers subjected to accelerated erosion processes and bank instability, such as L'Assomption River.

9.4.2 Socio-Economic Environment

This option does not affect any Major Parks/Historic Sites, Major Tourist/Recreation and Conservation Areas, Federal Reserves, Major Natural Resource Areas or Waste Management Sites. However, it encroaches on three socio-economic elements that are very highly or highly sensitive because of their high concentration of population or intensive activity: Urban Perimeters, Rural Communities and Agriculture (refer to Table 9d).

i) Urban Perimeters

- Passes inside seventeen small urban and suburban areas totalling 7.8 km. The most important urban settlement affected is a suburban area (600 m) located near Cap-de-la-Madeleine.

ii) Rural Communities

- Comes close (within 500 m) to thirteen urban areas representing 8.6 km that could be affected by noise problems, in particular two small zones (1.9 km) east of Vaucluse (L'Assomption River);
- Runs through the limits of three very small rural communities representing 0.5 km;
- Comes close (within 250 m) to four clusters of residences totalling 3.6 km, the most important being located east of Mascouche.

iii) Agriculture

- Affects 76.9 km of Class 1 and 2 soils (the best agricultural soils in Québec), located on land zoned for agricultural purposes (most extensive (36.4 km) between Berthierville and Trois-Rivières-Ouest);
- Encroaches on 18.7 km of specialty crops on land protected by agricultural zoning (most extensive between L'Épiphanie and Berthierville (14.0 km));
- Affects 17.5 km of areas with high incidence of tile drainage, mainly concentrated west of Maskinongé (6.0 km);

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TABLE 9d

Station	Provincially Significant Features						Ecological Reserves/Wildlife Areas						Significant Fisheries/Aquatic Habitat							
	Wetlands (Class 1-3)		ANSI's		ESA's		Waterfowl Staging & Reproduction		Deer Yards		Nature Reserves/ Mgmt Areas		Cold/Cool Water		Warm Water		Migratory		Spawning/ Nursery Areas	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
00-20	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
20-40	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
40-60	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
60-80	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.6
80-100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
100-120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
120-140	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
140-160	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
160-180	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
180-200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.5
200-220	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
220-240	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
240-260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
260-280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
280-300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	151	0.0	0	0.0	6	1.3

Station Commencing: 6+300 (Central Station)
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TABLE 9d

Station	Sig. Forests (Woodlots)		Floodplain/Geotech. Hazards				Major Parks/Historic sites						Major Tourism Areas				Urban Perim.		Rural Communities			
			Wetland Areas		Areas of Erosion		Provincial		National		Historic Sites/ Historic Areas		Recreation Areas		Conservation Areas		New/Exist. ROW Required in Settlement Areas		500m Prox. to Exist. Urban Perimeter		250m Prox. to Residences in Non-Urban	
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
00-20	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
20-40	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.0	1	0.7	1	1.6
40-60	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.9	4	2.9	0	0.0
60-80	0	0.0	1	2.9	2	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	2.1	2	1.9	1	0.2
80-100	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.5	0	0.0	1	1.0
100-120	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
120-140	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
140-160	0	0.0	0	0.0	1	1.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	1.4	2	1.6	0	0.0
160-180	0	0.0	4	4.3	2	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	0	0.0
180-200	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
200-220	0	0.0	2	0.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	2	1.0
220-240	0	0.0	0	0.0	2	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.9	0	0.0
240-260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	1	0.6	2	0.3
260-280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
280-300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	0.0	7	8.1	10	2.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	17	7.8	13	8.6	7	4.1

Station Commencing: 6+300 (Central Station)
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TABLE 9d

Station	Agriculture												Federal Reserves				Major Natural Resource Areas					
	Class 1-2 Soils		Specialty Crops		Artificial Drainage Systems		Orientation to Lot Lines						Military Base		Indian Reserve		Harvestable Woodlots		Aggregate Resource Areas		Oil/Gas Pools	
							LL1		LL2		LL3											
Km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km	nb	km
00-20	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
20-40	0	0.0	0	0.0	0	0.0	0	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
40-60	0	9.9	0	1.3	0	2.5	0	0.0	0	6.1	0	8.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
60-80	0	4.4	0	6.8	0	0.6	0	0.0	0	12.4	0	7.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
80-100	0	5.6	0	7.6	0	2.2	0	4.0	0	2.6	0	9.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
100-120	0	20.0	0	0.0	0	6.0	0	1.5	0	5.9	0	12.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
120-140	0	16.4	0	0.0	0	0.0	0	0.0	0	6.0	0	14.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
140-160	0	0.0	0	0.5	0	0.0	0	3.2	0	0.0	0	3.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
160-180	0	0.0	0	0.4	0	0.0	0	0.0	0	12.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
180-200	0	5.9	0	0.1	0	5.6	0	5.4	0	11.2	0	3.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
200-220	0	4.3	0	0.9	0	0.0	0	0.0	0	13.3	0	4.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
220-240	0	1.4	0	1.0	0	0.6	0	0.0	0	9.2	0	10.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
240-260	0	9.0	0	0.1	0	0.0	0	0.0	0	10.2	0	8.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
260-280	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
280-300	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	0	76.9	0	18.7	0	17.5	0	14.9	0	89.7	0	82.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

Station Commencing: 6+300 (Central Station)
Station Ending: 279+930(Gare du Palais)

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TABLE 9d

Station	Waste Management Sites			
	Existing Sites		Candidate Sites	
Km	nb	km	nb	km
00-20	0	0.0	0	0.0
20-40	0	0.0	0	0.0
40-60	0	0.0	0	0.0
60-80	0	0.0	0	0.0
80-100	0	0.0	0	0.0
100-120	0	0.0	0	0.0
120-140	0	0.0	0	0.0
140-160	0	0.0	0	0.0
160-180	0	0.0	0	0.0
180-200	0	0.0	0	0.0
200-220	0	0.0	0	0.0
220-240	0	0.0	0	0.0
240-260	0	0.0	0	0.0
260-280	0	0.0	0	0.0
280-300	0	0.0	0	0.0
Total	0	0.0	0	0.0

Station Commencing: 6+300 (Central Station)
Station Ending: 279+930(Gare du Palais)

- Affects 82.7 km (LL3 category) where non-viable or unmanageable severance or remainder parcels may be created, particularly between Berthierville and Trois-Rivières-Ouest (26.6 km);

- Perpendicular to lot lines located behind farms (LL2 category) on 89.7 km (56.7 km between Cap-de-la-Madeleine and Québec Airport).

10 ELECTRIFICATION SYSTEM CHARACTERISTICS

10.1 CATENARY SYSTEM DESIGN

The electrical design of the catenary for the 2 x 25 kV system will require a feeder to be run above the 25 kV catenary structures for the length of the 2 x 25 kV sections. In addition, a metallic ground/return-neutral conductor will be connected directly to each catenary post and bonded to the tracks through impedance bonds at distances for 1500-2000 metres. The method of connection and the actual spacing will be determined by the signalling system design and the spacing will be determined by the signalling system design and the spacing of the auto-transformer stations. If the auto-transformer spacing is such that track bonding need only take place at the auto-transformer locations then this conductor will become an overhead ground conductor only.

10.2 TRACKWORK DESIGN AND OPERATION

The initial trackwork design is assumed to be at least double track throughout with strategically spaced track crossovers and switches. This will make it possible to isolate sections of track for maintenance or following an incident causing loss of a traction unit, while still operating traffic along the opposite track. It is assumed that such track switches will be electrically operated and will be able to be operated remotely via the main signalling control and dispatch system.

With the provision of track switches, electrical catenary switches will also be required to similarly isolate the catenary connections to any section of track which is removed from traffic.

For maintenance and garaging areas, where track switches are manually operated, manually operated electrical switches would be provided.

10.3 MAIN SUBSTATION DESIGN

It is assumed that the design will consist of two incoming lines at either 120, 230 or 315 kV each equipped with a line circuit breaker and with utility metering systems. These two lines will normally be operated with one in service and one on standby with an automatic transfer

equipment for use if the normal supply fails. A transfer time of about 5 seconds would be envisaged.

The high voltage side of the station would then consist of two busses separated by a tie breaker with two transformers stepping down to 50/25 kV, connected via automatic motorised disconnects, one to each bus. Similarly the 50/25 kV bus would consist of two sections and a tie breaker and also be connected respectively, to each transformer through an automatic motorised disconnect.

For normal operation, both transformers would be in operation, paralleled on the high side and separated on the lower voltage side. Normally it would be expected to operate these single phase transformers on separate phase pairs with the phase pairs selected to balance the load over the utility's power network.

Each transformer would be equipped with an on-load tap changer and automatic voltage control to adjust for variations in the utilities high voltage network but not to correct for the variable voltage changes in the catenary voltage. This will keep the catenary open circuit (no-load) voltage constant allowing for the most efficient operation of the catenary power system.

The 50/25 kV side of each main transformer will be provided with a two pole 2 x 25 kV connection and a third neutral grounded connection giving 50 kV (nominal) between the two poles and 25 kV to ground for each pole. These will be switched in two pole ganged circuit breakers to feed the track circuits with one pole of each breaker feeding the catenary and the other pole feeding the high level feeder for the same section of track.

Normally, each infeed station will feed two tracks in both directions requiring two catenary breaks and four catenary and feeder circuits per station. Main substations will be concrete structure, generally 30m long and 15m wide with oil transformers and high voltage switches located outdoor.

10.4 AUTO-TRANSFORMER PARALLELISM STATION

The auto-transformer paralleling stations along the route have the function of re-enforcing the power supply to the catenary from the second 25 kV feeder while, at the same time, diverting the traction return current from the track and from the ground. The return traction current will then flow back to the feeder station via the 25 kV feeder. The traction current therefore flows

normally in the 25 kV catenary and back along the 25 kV feeder with little flow back in the centre point track/ground circuit. The traction circuit therefore effectively has a 50 kV driving voltage while maintaining only a 25 kV voltage for the traction units.

The station consists of two auto-transformers, one per track with two pole current breakers/circuit interruptors for the two tracks and a paralleling bus which provides electrical support from one track to the other. This connection also supports the power supply on either side of track break if a section of track is out of service at a pair of track sectioning stations see section 10.7.

10.5 PHASE BREAK STATION

At the mid point between two utility infeed stations, a double auto-transformer paralleling and phase break station will be required. This will break the supplies from the two utility feeds but will provide an interlocked, never paralleled, transfer of power, should either utility feeder station not be available for any reason.

The phase break will consist of a dead section between two section breaks spaced to ensure that no pair of pantographs can bridge both section breaks. However, it would be possible for a train to stop inside the phase break and normally open disconnects are provided to energize this break in an emergency.

10.6 TRACK CROSSOVER SECTIONING STATION

These stations are located at each track switch or track crossover to provide the same electrical isolation on the catenary as is provided by the tack switch on the track.

The track section consists of motorised or manually operated disconnects which parallel section breaks in the catenary. These breaks are usually provided on the switched side of a track switch and provide a means of isolating electrically the track which has been isolated mechanically by the track switch.

10.7 2 X 25 KV TO 1 X 25 KV INTERFACE STATION

The interface station between the two types of supply system is a special form of auto-transformer station which will terminate the 2 x 25 kV section at the auto-transformer and

provide single pole switching to feed the 1 x 25 kV system. The neutral bus will similarly terminate the grounded return conductor and the track at the neutrals of the two auto-transformer.

10.8 CONTROL PRINCIPLES

An electrical power control centre is recommended for each traffic control centre. The electrical control centre would have direct control of all circuit breakers, circuit switches and disconnects and be able to restore power after a catenary fault or re-switch the network to take account of the loss of any utility power feed.

The control centre would also store and display analogy and billing data to control and record the power costs and any control interface necessary with the supplying power utilities. The centre would also store statistical performance and fault data which would be used to predict and control maintenance activity. It should also control and dispatch repair teams in an emergency and be responsible for electrical system safety.

11 SUMMARY OF QUANTITIES OF MAJOR INFRASTRUCTURE COMPONENTS

In order to provide a general overview of the infrastructure required, the quantities of major infrastructure components for the different scenarios are shown in Tables 11.1, 11.2 and 11.3. These quantities were broken down into further sub-items, where appropriate, for input to the capital cost model.

The detailed derivation of these quantities and the sub-items is tabulated for each technology ROW scenario in Appendix B.

Summary of Quantities of Major Infrastructure Components
200 - 250 kph Tilting Technology in Existing Rail Corridors
Table 11.1

Item Description	Unit	Windsor to Toronto	Toronto to Montréal	Montréal to Québec
Route Length	km	360	616	273
Land Acquisition (Railways)	ha	477	1,008	284
Land Acquisition (Private)	ha	787	778	858
Station Location Considered	No.	3	7	4
Embankment Constructed from Cut Material (Soft & Hard)	1,000m^3	2,937	6,713	1,422
Embankment Constructed from Borrow Material	1,000m^3	677	644	2,653
Disposal of Unsuitable Material	1,000m^3	4,420	6,003	434
Major Watercourse Crossings	No.	110	269	32
Small River Crossings	No.	24	17	90
Large River Crossings	Lin.m	1,055	2,180	440
Modification to Existing Bridges	Lin.m	280	1,350	2,290
Rail Crossings	No.	16	8	4
Highway Grade Separations	No.	36	88	24
Modification of Existing Grade Separations	No.	68	106	24
Viaduct Structure	Lin.m	4,200	3,250	0
Tunnels	Lin.m	3,250	2,050	4,817
Rail	Tonnes	89,780	154,421	68,270
Ties	No.	1,152,000	1,981,654	876,200
Ballast	1,000m^3	1,565	2,692	1,191
Electrification - Catenary	km	733	1,261	558

Summary of Quantities of Major Infrastructure Components
Over 300 kph Non-Tilting Technology in Existing Rail Corridors
Table 11.2

Item Description	Unit	Windsor to Toronto	Toronto to Montréal	Montréal to Québec
Route Length	km	365	585	271
Land Acquisition (Railways)	ha	512	569	232
Land Acquisition (Private)	ha	1,380	1,527	1,074
Station Location Considered	No.	3	8	4
Embankment Constructed from Cut Material (Soft & Hard)	$1,000m^3$	3,500	10,233	1,374
Embankment Constructed from Borrow Material	$1,000m^3$	3,827	3,084	2,627
Disposal of Unsuitable Material	$1,000m^3$	4,987	5,907	476
Major Watercourse Crossings	No.	123	269	28
Small River Crossings	No.	24	18	82
Large River Crossings	Lin.m	1,280	4,575	645
Modification to Existing Bridges	Lin.m	220	510	1,500
Rail Crossings	No.	19	20	5
Highway Grade Separations	No.	126	247	96
Modification of Existing Grade Separations	No.	59	71	25
Viaduct Structure	Lin.m	4,200	3,100	0
Tunnels	Lin.m	3,250	3,807	4,817
Rail	Tonnes	90,890	147,055	67,880
Ties	No.	1,261,800	2,041,625	942,300
Ballast	$1,000m^3$	1,572	2,545	1,176
Electrification - Catenary	km	742	1,201	555

Summary of Quantities of Major Infrastructure Components
Over 300 kph Non-Tilting Technology in New Corridors
Table 11.3

Item Description	Unit	Windsor to Toronto	Toronto to Montréal	Montréal to Québec
Route Length	km	375	614	273
Land Acquisition (Railways)	ha	64	155	0
Land Acquisition (Private)	ha	2,263	2,453	1,247
Station Location Considered	No.	4	8	4
Embankment Constructed from Cut Material (Soft & Hard)	$1,000m^3$	7,174	25,947	1,633
Embankment Constructed from Borrow Material	$1,000m^3$	4,234	1,068	2,890
Disposal of Unsuitable Material	$1,000m^3$	983	5,905	690
Major Watercourse Crossings	No.	156	297	30
Small River Crossings	No.	65	19	92
Large River Crossings	Lin.m	1,070	6,055	1,860
Modification to Existing Bridges	Lin.m	0	510	550
Rail Crossings	No.	20	14	7
Highway Grade Separations	No.	165	244	91
Modification of Existing Grade Separations	No.	43	53	20
Viaduct Structure	Lin.m	1,650	5,700	0
Tunnels	Lin.m	2,400	20,757	4,817
Rail	Tonnes	93,710	153,960	68,270
Ties	No.	1,301,200	2,137,600	947,800
Ballast	$1,000m^3$	1,621	2,665	1,183
Electrification - Catenary	km	765	1,257	558