QUEBEC-ONTARIO HIGH SPEED RAIL PROJECT: System Operations and Costs

Canadian Institute of Guided Ground Transport
Queen's University at Kingston, Ontario

Prepared for

The Quebec/Ontario High Speed Rail Project

by Boon, Jones and Associates, Inc.
on behalf of
Queen's University

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SYSTEM OPERATIONS AND COSTS

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EXECUTIVE SUMMARY

Scope of Study

This report sets out the results of our analysis with respect to Operating Strategy and Costing for the Quebec/Ontario High Speed Rail Project. These results include estimates of capital costs, revenues and operating and maintenance (O & M) costs. Consultations were held with experts from Sofrerail, Bombardier, Asea Brown Boveri (ABB) and VIA Rail to ensure that the assumptions were reasonable and the results consistent.

Two broad speed class/technology alternatives were analysed :

- medium-fast [200-250 kph] technologies incorporating body tilting; and
- very fast [300 kph+] technologies currently without body tilting.

To explore the effects of different maximum operating speeds, alignments and segmentation on system life-cycle costs and operating characteristics, eleven different scenarios were analysed. These included the 200 kph and 300 kph base cases (scenarios 1 and 5, respectively), three alternative cases for the 200 kph base case and six for the 300 kph base case, utilizing alignments via Dorval and via Mirabel, as summarized below in Table ES.1.

Table ES.1: Cases for Analysis

Scenario	Segments	Speed	Route	Trackage		Connect Air*
				London-Windsor	Montreal-Quebec	
1	Quebec-Windsor	200	Dorval	Single	Double	Yes
2	Montreal-Toronto	200	Dorval	--	--	Yes
3	Quebec-Toronto	200	Dorval	--	Double	Yes
4	Quebec-Windsor	250	Dorval	Single	Double	Yes
5	Quebec-Windsor	300	Mirabel	Single	Double	Yes
6	Montreal-Toronto	300	Mirabel	--	--	Yes
7	Quebec-Toronto	300	Mirabel	--	Double	Yes
8	Quebec-Windsor	350	Mirabel	Single	Double	Yes
9	Quebec-Windsor	300	Dorval	Single	Double	Yes
10	Montreal-Toronto	300	Dorval	--	--	Yes
11	Montreal-Toronto	300	Dorval	--	--	No

The shaded scenarios are the base cases for each option.

* passengers making direct connections between high speed rail (HSR) and air.

System Operation

Operating Plans for 2005 and 2025 were developed for each scenario for off-season weekdays with additional trains scheduled for off-season Fridays and on-season weekdays. These plans were based on:

- provision for four representative types of service: local, express, superexpress (Montreal-Toronto nonstop) and through trains;
- service design definitions, notably seating specification (282 seats, including 90 first class seats for the 200 kph technology, and 358 seats, including 108 first class seats for the 300 kph technology);
- travel times, based on Train Performance Calculator runs, plus defined station dwell times and schedule slack;
- assumptions concerning the distribution of traffic throughout the day, week and year; and
- the composite demand forecasts provided by the project management for 2005 and 2025.

Trip times and daily off-season frequencies (in each direction) are summarized in Table E.2 for the 200 kph and 300 kph base cases.

Table ES.2: Trip Times and Frequency: Base Cases

	Trip Times				Off-Season Frequencies (Day of the Week) [trains/seats]			
	200 kph		300 kph		200 kph		300 kph	
	Express	Local	Express	Local	2005	2025	2005	2025
Montreal-Quebec	1:34	1:45	1:12	1:24	14 3,948	18 5,076	13 4,654	17 6,086
Montreal-Toronto	3:13	3:25	2:38	2:56	21 5,922	28 7,896	20 7,160	26 9,308
Ottawa-Toronto	2:10	2:18	1:36	1:46	27 7,614	38 10,716	27 9,666	39 13,962
Toronto-London	0:58	1:11	0:41	0:58	16 4,512	22 6,204	15 5,370	20 7,160
Toronto-Windsor	1:56	2:09	1:24	1:39	8 2,256	11 3,102	8 2,864	10 3,580

Based on these Operating Plans, the initial fleet requirements for Quebec-Windsor are 56 trainsets for the 200 kph base case and 47 trainsets for the 300 kph base case (Table ES.3):

Table ES.3: Fleet Requirements: Base Cases

	200 kph		300 kph	
	Trainsets	Seats	Trainsets	Seats
2005	56	15,792	47	16,826
2025	79	22,278	66	23,628

Development of Operating and Maintenance Costs

Operations and Maintenance (O & M) costs were developed using a 'bottom up' approach, which incorporated:

- analysis of the material and labour inputs required to operate and maintain the representative technologies (obtained from European operators);
- current and projected Canadian labour productivity and cost data;
- estimates of workloads (trainset-kilometres, seat-km, passenger-km, etc.), derived from the Operating Plans; and
- an understanding of the relationship between O & M costs and system extent, utilization and operating environment.

The result was a set of cost estimates which reflect both the general characteristics of the representative technology and the specific conditions under which the technology would be applied.

Assumptions Concerning Labour

Two principles underpinned the development of labour costs in this report:

- As a rule, staff wages, salaries and benefits reflect pay levels currently prevailing in the Canadian railway industry; and
- Steps would be taken before 2005 to resolve current impediments to efficient HSR operations, notably multiple shopcraft bargaining units, the mileage basis of pay for the running trades and the labour-intensive telephone sales and reservation system.

The most important assumptions and principles underlying the derivation of labour quantities and costs are summarized in Table ES.4.

Table ES.4: Summary of Principles and Assumptions Concerning Labour Quantities and Costs

Category	Approach
Train crew	2-person crew; hourly basis of pay
Train control centre	Staffing based on time requirements (independent of technology)
On board services	Staffing based on number of seats, trip duration, service design
On board service support	One clerical/general employee per five on-train service employees
Station staff	2/3 of staffing assumed to be fixed, 1/3 varies with passenger throughput; baggage handling only available for connect-air passengers. Wage rate for redcaps 20% lower than current levels.
Telephone and counter ticket sales staff	50% of sales through third parties; 65% of the rest through automatic ticketing machines; assumptions concerning volume and duration of telephone and counter transactions.
Equipment Maintenance	Direct labour requirements per activity obtained from two technologies; assumption that multi-functional workforce would be in place by time HSR is deployed. Wage rate for cleaners 20% lower than current levels.
Infrastructure Maintenance	Labour requirements derived by analysis of: physical extent of system; severity of climatic conditions; rolling stock characteristics and level of system utilization. Contracting out of tamping, lining and levelling, rail grinding.
Administration	Management structure developed for a stand alone operator. Staffing requirements independent of technology and speed.

Results

The principal results of each scenario are summarized in Table ES.5.

Table ES.5: Summary of Results

Scenario	Total Capital to 2025 ($ Billions)	Operating Results for 2005				
		Net Revenue ($ Millions)	O & M Costs ($ Millions)	Rev/Cost Ratio	O & M Cost/seat-km (cents)	Employment (O & M)
1 Quebec-Windsor,200,Dorval	10.33	592	259	2.28	5.46	2,390
2 Montreal-Toronto,200,Dorval	5.92	365	158	2.31	5.31	1,413
3 Quebec-Toronto,200,Dorval	7.93	472	206	2.29	5.39	1,872
4 Quebec-Windsor,250,Dorval	11.17	712	285	2.50	5.25	2,622
5 Quebec-Windsor,300,Mirabel	11.42	757	303	2.50	5.11	2,714
6 Montreal-Toronto,300,Mirabel	6.66	471	186	2.53	4.89	1,615
7 Quebec-Toronto,300,Mirabel	8.70	606	241	2.52	5.00	2,128
8 Quebec-Windsor,350,Mirabel	11.48	825	321	2.57	5.13	2,749
9 Quebec-Windsor,300,Dorval	11.63	805	306	2.63	5.13	2,730
10 Montreal-Toronto,300,Dorval	6.68	511	188	2.72	4.87	1,620
11 Montreal-Tor.,300,Dorval*	5.87	471	178	2.65	5.04	1,519

* No Connect Air, no service to Pearson.

As a result of the projected growth in traffic between 2005 and 2025, significant improvements are anticipated in system productivity. These should translate into reductions in costs per unit of activity, leading to increases in operating profits and the ratio of net revenues to O & M costs, as illustrated in Table ES.6.

Table ES.6: Productivity and Cost Improvements: 2005-2025

Scenario	LABOUR PRODUCTIVITY Passenger-kms (000s) per Employee			UNIT COSTS O & M Costs/seat-km ($)			OPERATING PROFITABILITY Net passenger revenue/O & M costs		
	2005	2025	Change	2005	2025	Change	2005	2025	Change
1 QW,200,D	1,331	1,727	30%	5.46	4.74	-13%	2.28	3.03	33%
2 MT,200,D	1,423	1,848	30%	5.31	4.54	-15%	2.31	3.06	32%
3 QT,200,D	1,368	1,768	29%	5.39	4.66	-14	2.29	3.04	33%
4 QW,250,D	1,442	1,910	32%	5.25	4.58	-13%	2.50	3.26	30%
5 QW,300,M	1,471	1,928	31%	5.11	4.44	-13%	2.50	3.37	35%
6 MT,300,M	1,585	2,085	32%	4.89	4.19	-14%	2.53	3.42	35%
7 QT,300,M	1,518	1,996	32%	5.00	4.33	-13%	2.52	3.41	35%
8 QW,350,M	1,563	2,062	32%	5.13	4.44	-13%	2.57	3.37	31%
9 QW,300,D	1,521	1,981	30%	5.13	4.45	-13%	2.63	3.51	33%
10 MT,300,D	1,660	2,173	31%	4.87	4.24	-13%	2.72	3.68	35%
11 MT,300,D*	1,639	2,165	32%	5.04	4.35	-14%	2.65	3.64	37%

The shaded scenarios are the base cases for each option.

* No Connect Air, no service to Pearson.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Scope of Report

This Final Report, submitted by Boon, Jones and Associates, Inc. on behalf of Queen's University, describes the activities and findings of our team, with respect to Operating Strategy and Costing for the Quebec/Ontario High Speed Rail Project. It has been written as a succinct stand-alone document. For additional detail, the reader should consult the following reports, which provide documentation on specific tasks:

- *Labour Practices and Costs: Comparison of High Speed Rail and Conventional Rail Services* (Working Paper, February 1993).

- *Preliminary Operating Plan for High Speed Rail Service in the Quebec-Windsor Corridor* (Working Paper, March 1993).

- *Preliminary Technology Review: Final Report* (CIGGT Report No. 93-1, prepared for the Quebec-Ontario High Speed Rail Project by CIGGT, in association with Canarail, Inc., Swederail, LGL & Associates, J.H. Parker & Associates, June 1993).

1.2 Representative Technologies

In accordance with the Terms of Reference, two broad speed class/technology alternatives were analysed:

- medium-fast [200-250 kph] technologies incorporating body tilting; and

- very fast [300 kph+] technologies currently without body tilting.

To be considered in this investigation, high-speed rail (HSR) technologies had to be: currently in commercial service; capable of providing intercity trip times superior to those of existing modes; and potentially able to develop future generations of equipment capable of operating over the same infrastructure.

Based on these criteria, the two selected representative technologies were:

- the ABB X-2000, operated by Swedish State Railways; and

- the GEC-Alsthom TGV, operated by the French National Railways[1].

1.3 Final Composite Routes

The operating scenarios evaluated in this report pertain to the composite representative routes for 200-250 kph and 300+ kph which are defined in *Preliminary Routing Assessment and Costing Study: Interim Report No. 4: Development of Composite Representative Routes* (SNC-Lavalin and Delcan, February 1994). These are summarized in Table 1.1.

Table 1.1: Composite Representative Routes

Route Segment	Composite Representative Route	
	200-250 kph technology	300 + kph technology
Windsor-London	▸ Right of Way [ROW]: Existing ▸ Stations: - Windsor (suburban) - London (downtown)	▸ Right of Way [ROW]: Existing ▸ Stations: - Windsor (suburban) - London (suburban)
London-Toronto	▸ ROW: New 300 kph ▸ Stations: - Kitchener (suburban) - Pearson Airport - Toronto Union	▸ ROW: New 300 kph ▸ Stations: - Kitchener (suburban) - Pearson Airport - Toronto Union
Toronto-Ottawa/Hull	▸ ROW: - Toronto-Kingston: existing - Kingston-Smith Falls: new - Smith Falls-Ottawa: existing ▸ Stations: - East Toronto - Kingston (suburban) - Ottawa (VIA)	▸ ROW: - Toronto-Cobourg: existing - Cobourg-Smith Falls: new - Smith Falls-Ottawa: existing ▸ Stations: - East Toronto - Kingston (suburban) - Ottawa or Hull
Ottawa/Hull-Montreal	▸ ROW: Existing (M&O and Kingston subdivisions) ▸ Stations: - Dorval - Montreal (Central)	North Shore Option ▸ ROW: Existing with new sections ▸ Stations: - Mirabel Airport - Laval - Montreal (Central)
Montreal-Quebec	▸ ROW: Existing ▸ Stations: - Laval - Trois Rivières - Ancienne-Lorette - Quebec (Gare du Palais)	▸ ROW: Existing ▸ Stations: - Laval - Trois Rivières - Ancienne-Lorette - Quebec (Gare du Palais)

[1] A detailed description of the selection of representative technologies is available in *Preliminary Technology Review: Final Report.*

1.4 Sensitivity Analysis

To explore the effects of different maximum operating speeds, alignments and segmentation on system life-cycle costs and operating characteristics, eleven different scenarios were analysed. These included the 200 kph and 300 kph base cases (scenarios 1 and 5, respectively), three alternative cases for the 200 kph base case (scenarios 2-4, inclusive) and six for the 300 kph base case (scenarios 6-11, inclusive), as summarized below in Table 1.2.

Table 1.2: Cases for Analysis

Scenario	Segments	Speed	Route	Trackage		Connect Air
				London-Windsor	Montreal-Quebec	
1	Q-W	200	Dorval	Single	Double	Yes
2	M-T	200	Dorval	--	--	Yes
3	Q-T	200	Dorval	--	Double	Yes
4	Q-W	250	Dorval	Single	Double	Yes
5	Q-W	300	Mirabel	Single	Double	Yes
6	M-T	300	Mirabel	--	--	Yes
7	Q-T	300	Mirabel	--	Double	Yes
8	Q-W	350	Mirabel	Single	Double	Yes
9	Q-W	300	Dorval	Single	Double	Yes
10	M-T	300	Dorval	--	--	Yes
11	M-T	300	Dorval	--	--	No

Table 1.2 indicates that the base case assumes single track (strictly speaking, partial double track) between London-Windsor and full double track in the rest of the corridor, including Montreal-Quebec. In addition, the effects of using a partially double track configuration between Montreal and Quebec were studied. This analysis is reported upon in Appendix E.

2. SYSTEM OPERATION

2.1 Operating Scenarios

2.1.1 Train Service Categories

Following discussions with the government representatives, the project management team and other project consultants, scheduling for four representative types of service was developed:

- **Local** trains, which serve every station in a sector [i.e. Montreal-Quebec, Montreal-Ottawa-Toronto or Southwestern Ontario]. The first train in any hourly timeslot was assumed to be a local train;
- **Express** trains which serve only Quebec, Montreal, Ottawa, Toronto, London and/or Windsor;
- **Superexpress** trains which operate nonstop between Montreal and Toronto only;
- **Through** trains, allowing travel from one corridor sector to another without a change of train.[2]

In practice, a system operator would probably develop a more sophisticated timetable, incorporating skip-stop trains, in addition to local and express trains. Since the purpose of this analysis was to develop **representative** train frequencies for costing purposes, using the simplifed service definition summarized above is reasonable and appropriate[3]. What was important was to establish a schedule which would be sufficiently robust to be applicable to a variety of demand situations, given the overall annual link loadings.

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[2] In practice, such trains were rarely used although the schedules were set to allow trains to run through Toronto. For the 300 kph system, trains running through Montreal would follow the Laval bypass, and so would not serve Central Station, making the concept less attractive.

[3] In any event, the detailed annual, seasonal and time-of-day demand data for intermediate stations required to develop a practical skip-stop timetable were unavailable.

2.1.2 Service Design

In consultation with the clients, provision was made for two classes of service: first class and economy.

For the 200 kph technology, a 282-seat capacity was selected, based on the following consist configuration:

- two first class cars with 45 seats each;
- one economy car with 52 seats and accommodation for special needs passengers; and
- two economy cars with 70 seats each.

The 300 kph technology, with a total of 358 seats, was configured with:

- two first class cars with 38 seats each plus one first-class car with 32 seats;
- one 46-seat car with accommodation for special needs passengers; and
- three economy cars with 56 seats each, plus a fourth economy car with 36 seats and storage for food carts and baggage.

2.2 Travel Times

2.2.1 Approach

The generation of commercial travel times involved two iterative processes: one with the routing team, the other with the demand forecasting teams. The interaction with the routing consultant was to evaluate the cost effectiveness of modifying the permanent slow orders and optional stops associated with each alignment. The specification of scheduled travel time, as opposed to minimum run time, depends very much on market sensitivities to run time, service frequency, ticket price and service reliability. Consultations were held with the demand forecasters to ensure that the tradeoffs among these variables produced results which were acceptable from a market point of view. In particular, the allowances for slack were designed to provide adequate schedule adherence reliability without being excessively conservative.

Station-to-station trip times were estimated using CIGGT's Train Performance Calculator. The TPC program calculates station-to-station minimum run times, on the basis of the track geometry data, speed limits and train characteristics (e.g. acceleration/deceleration capabilities).

The difference between the Minimum Run Time, as generated by the TPC runs, and the projected scheduled run time consists of station dwell time plus slack time built into the schedule.

2.2.2 Results

Table 2.1 indicates station-to-station distances by route. Tables 2.2 and 2.3 indicate trip times by route/technology. The "duplicated track" on the Mirabel routing occurs because the Montreal-Laval trackage forms part of both the Quebec-Montreal and the Montreal-Ottawa routes.

Table 2.1: Station-to-Station Distances via Mirabel and via Dorval

	Via Mirabel (km)	Via Dorval (km)
Windsor-London	193	184
London-Kitchener	89	92
Kitchener-Pearson	68	68
Pearson-Toronto	24	24
Toronto-E. Toronto	35	35
E. Toronto-Kingston	224	222
Kingston-Ottawa/Hull	152	152
Ottawa/Hull-Mirabel or Dorval	144	156
Mirabel-Laval	33	0
Laval-Montreal or Dorval-Montreal	17	21
Montreal-Laval	17	17
Laval-Trois Rivieres	126	127
Trois Rivieres-Ancienne Lorette	115	116
Ancienne Lorette-Quebec	14	13
TOTAL	1,251	1,228
Duplicated track	(17)	0

Table 2.2 compares trip times for the 200-250 kph technology on the 200 kph representative route (via Dorval) and on the 300 kph representative route (via Mirabel)[4].

Table 2.2: Comparison of Travel Times: 200-250 kph

Route Segment	200 kph Maximum Speed		250 kph Maximum Speed	
	200 kph System/Route			
	Local	Express	Local	Express
Quebec-Montreal	1h 45m	1h 34m	1h 31m	1h 19m
Montreal-Ottawa	1h 2m	58m	54m	50m
Ottawa-Toronto	2h 18m	2h 10m	1h 57m	1h 48m
Montreal-Toronto	3h 25m	3h 13m	2h 56m	2h 43m
Montreal-Toronto Super Express		3h 5m		2h 34m
Toronto-Windsor	2h 9m	1h 56m	1h 49m	1h 33m
	200 kph on 300 kph Route, Montreal-Ottawa-Toronto			
	Local	Express	Local	Express
Montreal-Ottawa	1h 17m	1h 9m	1h 9m	1h 1m
Ottawa-Toronto	2h 17m	2h 9m	1h 57m	1h 48m
Montreal-Toronto	3h 39m	3h 23m	3h 11m	2h 54m
Montreal-Toronto Super Express		3h 18m		2h 48m

Average commercial speeds, defined as end-to-end distance divided by end-to-end trip time, ranged from 156-177 kph for the 200 kph local service to 207-237 kph for the 250 kph express service. Trip times are approximately 15 minutes longer between Montreal and Ottawa on the 300 kph route than on the 200 kph route because of the longer route and speed restrictions due to track geometry.

Table 2.3 compares trip times for the 300-350 kph technology on the 200 kph representative route (via Dorval) and on the 300 kph representative route (via Mirabel).

[4] These representative routes were described in Table 1.1.

Table 2.3: Comparison of Travel Times: 300-350 kph

Route Segment	300 kph Maximum Speed		350 kph Maximum Speed	
	300 kph System/Route			
	Local	Express	Local	Express
Quebec-Montreal	1h 24m	1h 12m	1h 17m	1h 5m
Montreal-Ottawa	1h 5m	57m	1h 0m	54m
Ottawa-Toronto	1h 46m	1h 36m	1h 36m	1h 27m
Montreal-Toronto	2h 56m	2h 38m	2h 41m	2h 26m
Montreal-Toronto Super Express		2h 32m		2h 19m
Toronto-Windsor	1h 39m	1h 24m	1h 27m	1h 14m
	300 kph on 200 kph Route, Montreal-Ottawa-Toronto			
	Local	Express	Local	Express
Montreal-Ottawa	50m	46m	47m	40m
Ottawa-Toronto	1h 46m	1h 35m	1h 36m	1h 27m
Montreal-Toronto	2h 41m	2h 26m	2h 28m	2h 12m
Montreal-Toronto Super Express		2h 18m		2h 4m

Average commercial speeds ranged from 194-227 kph for the 300 kph local service to 249-303 kph for the 350 kph express service. Trip times for the 300 kph technology on the 300 kph representative route between Montreal and Ottawa are slightly longer than for the 200 kph technology on the 200 kph representative route, because the 300 kph representative route is longer and subject to greater speed restrictions due to track geometry and an additional stop in Laval.

2.3 Train Schedules

2.3.1 Data Sources

The objective was to develop an Operating Plan and train schedules based on demand schedules incorporating time-of-day, -week and seasonal fluctuations. Given rules respecting minimum frequencies, this would allow the creation of a unique, optimized train schedule. Such information was only available from one of the three demand forecasters.

In the absence of such data, it was necessary to develop train schedules based on the best available data. A variety of data sources were used: VIA ridership records; consumer surveys; discussion with the government representatives and other Consultants on the Study Team; and corridor airline schedules. The object

of the analysis was to produce a demand profile as input to the development of a representative schedule for costing purposes.

2.3.2 Seasonal and Daily Traffic Factors

To estimate factors representative of seasonal and daily variations in traffic, the following procedure was used:

1. The year was divided into two periods: *off-season* and *on-season*. The off-season period is forty weeks per year, with ridership approximately 91 percent of the mean weekly annual ridership. The on-season period is twelve weeks per year, with ridership at approximately 130 percent of mean weekly ridership. The on-season period is not twelve contiguous weeks, but includes the summer period as well as the Christmas Holiday season and other times.

2. The off-season was then broken down by the day of the week as follows:

Monday	demand at 110 percent of the mean daily average
Tue-Thur	
Friday	demand at 125 percent of the mean daily average
Saturday	demand at 65 percent of the mean daily average
Sunday	demand at 80 percent of the mean daily average.

3. Next, each day was divided into three periods:

   - A morning peak of approximately three hours from 6h30 to 9h30;
   - An afternoon/evening peak of four hours from 14h30 to 18h30;
   - The off-peak period during mid-day and into the evening.

   For each of the sectors (and in some cases for the major origins and destinations or specific links within each sector) an estimate of the proportion of the total daily demand expected in the morning peak period in each direction and in the afternoon peak period in each direction was made.

4. During the on-season, the approximately 42 percent additional passengers are then distributed as follows:

Across the board increase	20 percent of the additional demand
Added to the off-peak hours	35 percent of the additional demand
Added to Saturdays	10 percent of the additional demand
Added to Sundays	15 percent of the additional demand
Added to Friday afternoon peak	7.5 percent of the additional demand
Added to Friday off-peak hours	7.5 percent of the additional demand
Not served	5 percent of the additional demand.

The final five percent of the additional on-season weekly demand is not served on the grounds that these passengers would contribute to superpeak conditions, requiring additional trainsets which run only ten to fifteen days per year and which would be in excess of required maintenance spares for the balance of the year.

2.3.3 Creation of the Operating Schedule

A four-step process was used to create the operating schedule:

1. First, a set of target load factors for the most heavily travelled link in any segment was established. (Note that in the Toronto-Ottawa-Montreal segment, it was necessary to consider the links east and west of Ottawa separately). The target load factors ranged from a low of 60 percent (off-peak periods of off-season days) to a high of 95 percent (peak afternoon periods on on-season Fridays). These were applied to the demand in each period to produce a *suggested* number of trains.

2. The suggested number of trains was the starting point for development of the schedule. The next step was to consider the effect of other factors including:

   - the forecast 2.5% annual rate of demand growth, for each year over the next twenty years;

   - the need to offer service frequency consistent with the forecast levels of demand, even where consequent load factor would be low in early years of operation;

   - the requirement to provide service throughout the operating day, which prevents concentrating trains in peak periods to the exclusion of off-peak hours;

- requirements for positioning of trainsets to cover departures early in each operating day;

- the client's requirement to provide service alternatives such as express trains, and through trains, in some markets and circumstances; and

- a desire to minimize day-of-week differences in train schedules.

Train departure patterns reflecting these factors were developed for each Corridor segment for a typical off-season weekday; additional departures were added for off-season Fridays and on-season weekdays.

3. No specific schedule was developed for a "typical on-season Friday". In fact, these are the twelve superpeak days of the year, and an HSR operator would operate as many trains as possible given fleet and infrastructure capacity.

   Also, specific schedules were not developed for weekend service. Instead, for on-season and off-season Saturdays and on-season and off-season Sundays, the service frequncy was set at the minimum frequency, or, where demand required additional capacity, at a frequency that resulted in an average load factor in the 65 to 70 percent range.

4. In creation of the schedule, the operating day was divided into a series of one-hour *timeslots* from 6h00 to 20h00. We started by offering hourly service throughout the day and then removed or added trains so that:

   - there was adequate coverage during peak periods;

   - minimum frequencies were met;

   - there were no long gaps without service during the operating day; and

   - load factors were in a reasonable range.

2.3.4 Representative Schedules

Table 2.4 indicates how ridership forecasts were translated into daily train requirements, taking the example of 300 kph technology in 2005 in the Quebec-Montreal segment (specifically the Trois-Rivières-Montreal link). For the off-season westbound direction, the peak daily requirements are for 5.1 trains to be dispatched [morning peak period demand/(target peak period load factor * seats per trainset)]. Table 2.5 shows a representative train schedule (for the 300 kph technology in 2005). Daily frequencies for the two technologies are shown in Table 2.6.

Relatively high levels of frequency (compared to most previous corridor studies) will be required to satisfy the projected demand, except in the London-Windsor segment. This is particularly true of the Ottawa-Toronto link. As a result of the projected traffic growth, significant increases in departures will be required by 2025, especially on the segments with the higher initial load factors (Ottawa-Toronto, Toronto-London).

Table 2.4: Development of Train Frequencies from Origin/Destination Demand Forecasts

OD DEMAND	Annual OD Demand ('000)	LINK QUE-TRV ('000)	LINK TRV-MTL ('000)		
Quebec-Trois Rivieres	68	68			
Quebec-Montreal	1,477	1,477	1,477		
Quebec-Ottawa	140	140	140		
Quebec-Toronto	189	189	189		
Trois Rivieres-Montreal	328		328		
Trois Rivieres-Ottawa	34		34		
Trois Rivieres-Toronto	23		23		
Quebec-Mirabel	4	4	4		
Quebec-Pearson	14	14	14		
TOTAL	2,276	1,891	2,208		
Mean daily demand in each direction*	3,118	2,590	3,025		
Proportion going beyond Montreal	17.7%				
Typical off-season weekday demand			2,931		
Typical off-season Friday demand			3,441		
Typical off-season Saturday demand			1,789		
Typical off-season Sunday demand			2,202		
Typical on-season weekday demand			3,771		
Typical on-season Friday demand			5,568		
TYPICAL WEEKDAY Trois Rivieres-Montreal Link		Off Season East Bound	Off Season West Bound	On Season East Bound	On Season West Bound
Total daily demand		2,931	2,931	3,771	3,771
Morning peak period demand		586	1,466	639	1,596
Afternoon peak period demand		1,612	586	1,756	640
Demand during balance of the day		733	879	1,376	1,535
Target peak period load factor		80.0%	80.0%	85.0%	85.0%
Target load factor balance of day		60.0%	60.0%	67.5%	67.5%
Seats per trainset		358	358	358	358
Peak period train requirements					
Morning		non-peak	5.1	non-peak	5.2
Afternoon		5.6	non-peak	5.8	non-peak
Balance of the day					
Actual peak period trains dispatched		6	5	6	6
Trains dispatched during balance of day		7	8	10	10
Load factor: peak period		75%	82%	82%	74%
Load factor: balance of day		53%	51%	56%	61%
Load factor: whole day		63%	63%	66%	66%

* All passenger counts below in units.

Table 2.5: Representative Daily Schedule: 300 kph

Eastbound -- Read from left to right

	Dep WIN	Arr LON	Arr KNR	Arr PER	Arr TOR	Dep TOR	Arr ETo	Arr KGN	Arr O/H	Dep O/H	Arr MIR	Arr LAV*	Arr MTL	Dep MTL	Arr LAV*	Arr 3Rv	Arr AnL	Arr QUE
Daily														07:10	07:22	07:54	08:24	08:34
Daily						06:00	06:14	07:07	07:46	07:51	08:28	08:42	08:56	08:40	08:52	09:24	09:54	10:04
Daily						07:00	07:14	08:07	08:46	08:51	09:28	09:42	09:56					
Daily						07:30			09:06									
Daily						07:15							09:47					
Daily	06:09	06:50	07:14	07:34	07:48	08:00	08:14	09:07	09:46	09:51	10:28	10:42	10:56	10:40	10:52	11:24	11:54	12:04
Daily		07:35	07:59	08:19	08:33													
Daily						08:20			09:56	10:01			10:58					
Daily						08:40	08:54	09:47	10:26									
Daily	07:09	07:50	08:14	08:34	08:48	09:00	09:14	10:07	10:46	10:51	11:28	11:42	11:56	11:40	11:52	12:24	12:54	13:04
Daily		08:13			09:03													
Daily			08:34	08:54	09:08													
Daily		08:35	08:59	09:19	09:33													
Daily	08:09	08:50	09:14	09:34	09:48	10:00	10:14	11:07	11:46	11:51	12:28	12:42	12:56					
Daily	09:09	09:50	10:14	10:34	10:48	11:00	11:14	12:07	12:46	12:51	13:28	13:42	13:56	13:40	13:52	14:24	14:54	15:04
Daily						12:00	12:14	13:07	13:46	13:51	14:28	14:42	14:56	14:40	14:52	15:24	15:54	16:04
Daily						12:30	12:44	13:37	14:16									
Daily		11:50	12:14	12:34	12:48	13:00	13:14	14:07	14:46	14:51	15:28	15:42	15:56	15:40	15:52	16:24	16:54	17:04
Daily														16:10				17:22
Daily	12:09	12:50	13:14	13:34	13:48	14:00	14:14	15:07	15:46	15:51	16:28	16:42	16:56	16:40	16:52	17:24	17:54	18:04
Daily		13:50	14:14	14:34	14:48	15:00	15:14	16:07	16:46	16:51	17:28	17:42	17:56	17:40	17:52	18:24	18:54	19:04
Daily														18:20				19:32
Daily	14:09	14:50	15:14	15:34	15:48	16:00	16:14	17:07	17:46	17:51	18:28	18:42	18:56	18:40	18:52	19:24	19:54	20:04
Daily						16:30	16:44	17:37	18:16									
Daily						16:45			18:21	18:26			19:23					
Daily						17:00	17:14	18:07	18:46	18:51	19:28	19:42	19:56					
Daily						17:15	17:29	18:22	19:01	19:06	19:43	19:57	► ►	► ►	► ►	20:34	21:04	21:14
Daily						17:30							20:02					
Daily						17:45			19:21									
Daily		16:50	17:14	17:34	17:48	18:00	18:14	19:07	19:46	19:51	20:28	20:42	20:56					
Daily						18:20			19:56	20:01			20:58					
Daily						18:40		19:43										
Daily	17:09	17:50	18:14	18:34	18:48	19:00	19:14	20:07	20:46	20:51	21:28	21:42	21:56					
Daily		18:20	18:44	19:04	19:18													
Daily						19:30		22:07	21:06									
Daily	19:09	19:50	20:14	20:34	20:48	21:00	21:14		22:46	22:51	23:28	23:42	23:56					

* Passengers travelling from the Montreal-Ottawa-Toronto segment to Quebec would change trains at Laval, rather than Montreal, e.g. if travelling on the 6 a.m. train from Toronto, they would detrain in Laval at 8.42, boarding the train for Quebec at 8.52.

► ► : through train

Table 2.6: Daily Frequencies: 2005 and 2025

200 kph

		2005		2025	
		Trains	Seats	Trains	Seats
Montreal-Quebec	Off-season	14	3,948	18	5,076
	On-season	17	4,794	23	6,486
Montreal-Toronto	Off-season	21	5,922	28	7,896
	On-season	24	6,768	35	9,870
Ottawa-Toronto	Off-season	27	7,614	38	10,716
	On-season	33	9,306	48	13,536
Toronto-London	Off-season	16	4,512	22	6,204
	On-season	19	5,358	29	8,178
Toronto-Windsor	Off-season	8	2,256	11	3,102
	On-season	9	2,538	14	3,948

300 kph

		2005		2025	
		Trains	Seats	Trains	Seats
Montreal-Quebec	Off-season	13	4,654	17	6,086
	On-season	16	5,728	22	7,876
Montreal-Toronto	Off-season	20	7,160	26	9,308
	On-season	23	8,234	33	11,814
Ottawa-Toronto	Off-season	27	9,666	39	13,962
	On-season	33	11,814	49	17,542
Toronto-London	Off-season	15	5,370	20	7,160
	On-season	18	6,444	27	9,666
Toronto-Windsor	Off-season	8	2,864	10	3,580
	On-season	9	3,222	13	4,654

2.4 Fleet size

2.4.1 Fleet Projections

The fleet requirement for 2005 for Quebec-Windsor is 56 trainsets for the 200 kph technology (15,792 seats) and 47 trainsets for the 300 kph technology (16,826 seats). By 2025, it will be necessary to acquire an additional 23 trainsets for the 200 kph technology and an additional 19 trainsets for the 300 kph technology. The composition of the fleet is indicated in Table 2.7.

Table 2.7: Fleet Requirements

	200 kph			300 kph		
	MOT	MQ	SWO	MOT	MQ	SWO
Basic Hourly Service	10	5	4	8	4	3
Extra Service: Half-Hour	8	3	1	8	1	1
Other Services	6 *	– ¶	5 §	5 *	1 ¶	4 §
Friday/seasonal	3	1	–	2	1	–
Basic Requirement	27	8	10	23	7	8
Guard trainsets	2	–	–	2	–	–
Scheduled Maintenance	4	1	1	3	1	1
Unscheduled Maintenance	3			2		
TOTAL 2005	36	9	11	30	8	9
Additional sets, 2005-2025	15	4	4	12	3	4
TOTAL 2025	51	13	15	42	11	13

* Ottawa-Toronto services
¶ Quebec-Toronto services
§ Kitchener and London trains.

2.4.2 Assumptions

An initial fleet size estimate was made on the following assumptions:

- under normal operations approximately one hour is needed between the arrival of a trainset at a terminal stations and its subsequent departure;
- turn times in Ottawa can be approximately half an hour reflecting a reduced cleaning requirement and the elimination of provisioning at Ottawa;
- the 3,000 km interval for Service Examinations must be respected at least in the early years of operation, even if this distance is accumulated in one day;
- service reliability is of such importance that a spare trainset must be kept at each major terminal ready to be used at any time;

On this basis, an **initial** approximation of fleet requirements was determined that would meet the weekday passenger demand during the twelve on-season weeks of the year, given the demand estimates and service design discussed above. It does not include maintenance spares, which are discussed below.

No additional trainsets are included in the fleet to serve the superpeaks — the fifteen or so days per year when demand is the greatest. On those days, additional service may still be offered by extending the peak service segment of the day earlier in the afternoon and later in the day and by ensuring that there is maximum availability of equipment through appropriate maintenance scheduling, as is done by SNCF in France.

From our analysis of maintenance requirements, it appears that nine 200 kph trainsets and seven 300 kph trainsets will be needed to ensure adequate fleet availability. This is a relatively high proportion of the total fleet (15-16 per cent), but that is inevitable given the relatively small fleet size and the modest demand peaking, which limits opportunities to schedule maintenance activities during low-demand periods.

There may well be opportunities to improve trainset utilization as operating experience increases, through optimization of maintenance procedures for the Canadian context and demand management techniques. However, improved utilization implies a decrease in the available time interval for some scheduled maintenance activities, and can be expected to lead to an increase in the number of incidents per trainset requiring unscheduled maintenance[5].

2.5 Power Demand and Energy Consumption

2.5.1 Electricity Prices

The base electricity prices are those published by Ontario Hydro for large-scale direct industrial customers. It is assumed that:

- half of consumption is during peak months and half is in off-peak months and that

NOTE ON ELECTRICITY PRICES

1. Power costs were based on the 1993 price schedules. Real price increases can be expected, especially in Ontario.

2. Note also that the total power demand on specific substations for the 200 kph system may be somewhat lower than the threshold required to receive the industrial power rate. We have assumed that the total power demand for the HSR system will be sufficient that the Operator will be able to buy at the industrial rate.

[5] The *rate* of occurrence (per trainset-operating hour) of events requiring unscheduled maintenance should remain uniform, unless the level of utilization rises well beyond the range of experience offshore, or unless elements of either technology prove to be unexpectedly vulnerable to Canadian conditions.

- 75 percent of consumption is during peak times (weekdays from 7 am to 11 pm) and 25 percent is during off peak times (weekends, and overnight).

This gives an average rate of 4.02 cents per kilowatt hour.

All power consumed in Quebec was costed at fifteen percent less than in Ontario. This reflects historical differences in electricity prices, which are expected to persist in the future.

2.5.2 Power Demand

For a typical acceleration from a stop to full speed, the following apply:

	X2000 200 kph	X2000 250 kph	TGV 8 TM* 300 kph	TGV 12 TM 350 kph
A Maximum power demand (mW)	7.0	7.0	10.8	16.7
B Average power demand (mW)	5.1	5.4	8.3	13.3
C Cruise power demand (mW)	2.1	3.7	6.4	9.7

A is the highest demand at any instant during the acceleration cycle.
B is the average over the acceleration cycle.
C is the average to maintain top speed over typical track. Note that while the total cruse power is higher for the 250 and 350 options, the total time drawing these power loads is less than at 200 and 300.
* Traction motors.

2.5.3 Energy Consumption

Electricity consumption was determined by applying the TPC-calculated power consumption per trainset-km to the total annual number of train runs (by train type, e.g. local, express, etc) and then multiplying by the distance applicable to each route.

At 300 kph, consumption ranged between 22.8 and 24.7 kilowatt-hours per train-km, depending on the route characteristics and the service type (local, express, superexpress). At 200 kph, consumption ranged from 10.9 to 13.0 kWh/train-km.

An allowance of 2.5 percent was added to account for power consumed during deadhead, terminal and other non-revenue-service train movements.

3. LABOUR AND MATERIALS QUANTITIES FOR OPERATIONS

3.1 Introduction

The following four chapters present the principles, assumptions and approaches which were followed to develop Operating and Maintenance costs. This chapter describes the estimation of labour and materials quantities for Operations activities. Chapter 4 covers the same ground for Maintenance activities. General administrative costs are addressed in chapter 5. Labour compensation and other labour issues are discussed in chapter 6.

3.2 Train Operating Costs

3.2.1 Train Crew

A two-person crew is assumed: engine-driver and conductor. Train crews are paid on an hourly basis with the time being the actual trip time plus one hour terminal time for trips in excess of 200 km and half hour for shorter trips.

These hours were grossed up by 20 per cent to provide for:

- short layovers;
- deadheading;
- train movements in the vicinity of terminals; and
- to ensure an adequately staffed spareboard[6].

With the growth in traffic, the extra time allowance was gradually reduced to 12.5 percent by the year 2025.

The total headcount is determined by dividing the total paid hours required by the available "productive" hours in a year per employee.

An allowance ($50 per person per night) was included for crews that are not returned to their home terminals. A meal allowance was also included rather

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[6] This will be a concern because, unlike VIA today, the HSR operator would be unable to draw upon trained crews from the freight railways for a spareboard because HSR would be a stand alone operating entity. And unlike the situation with on-board services, it would not be possible to operate a train with one less employee if required.

than allowing paid time-off to eat. Together these allowances account for less than five percent of total crew costs.

3.2.2 Train Control

Principles

Train control staffing is basically time-driven. In other words, staffing requirements are independent of the technologies under consideration and of traffic volumes (within the range of traffic which is forecast over the economic life of the two technologies).

Application

Train control for the MOT section requires a chief dispatcher and a power controller on duty 24 hours per day, plus one train controller, one crew controller and a terminal controller for Toronto and Montreal on duty two shifts per day. Including time not worked, a total of 24 people are required to provide this coverage.

When either of the end segments are added, we have included two positions which need to be staffed: one to handle the added train and power controlling function, and one dealing with the crew and terminal control function. Eight employees would be required to staff these two positions for one end segment. For the full corridor, at total of 40 employees would be required.

Despite growth in traffic, it is assumed that there would be no change in the train control labour requirements over time.

3.2.3 Administration

From analysis of required functional capabilities with reasonable span of control for individual managers, the transportation administration and supervision function for the MOT sector base in 2005 will require a total of 20 employees, As a result of traffic growth, we estimate that one additional professional employee and two additional support staff will be required by 2025.

On the same basis, we estimate that each of the other two segments will require four or five additional staff. Traffic growth will require one additional support employee per segment by the year 2025.

3.3 Customer Services

3.3.1 On Board Service Staff

On board staffing levels are a function of the number of seats in the trainset, the duration of the trip and the service design.

Average staffing levels for the 300 kph technology are[7]:

- Toronto-Montreal local trains, 2.5 persons
- Montreal-Ottawa trains, 2 persons
- Quebec-Toronto through trains, 3 persons
- Kitchener-Toronto trains, 0 persons.

Staffing requirements for the 200 kph technology were similar, there being little opportunity to cut back on such a skeleton staff, despite the lower number of seats in the five-car X-2000 trainset.

OBS staff are paid hourly, on the assumption that they average 160 hours work per four-week pay period. Following VIA practice, split shifts, long/short days, and seasonal work are incorporated in the calculation.

The basis for calculating total direct OBS staff hours and layover/meal costs is the same as for the train crew. The additional paid time allowance for OBS staff is 7.5 per cent.

3.3.2 On Board Service Materials

The cost allowance for minimal OBS supplies varies from 13 to 17 cents per passenger, depending on the mix of long-haul versus short-haul and first class versus economy passengers on the segment.

Most of the OBS supplies (notably drinks and meals) have not been included in the analysis, since the corresponding revenues have not been included in the revenue estimates provided by the Demand Consultants. The presumption is that pricing will result in, at worst, a break-even position from the perspective of the system operator.

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[7] These averages reflect the mix of peak and off-peak periods over the year. Thus the Quebec-Toronto through train requires one additional staff member, since it does not operate at off-peak hours of the day. Staffing for the Kitchener trains is low, because of the short trip duration and the small percentage of first class travellers.

3.3.3 On Board Service Support

An allowance was made for one clerical or general employee per five on-train service employees. These staff are required to provision trains, account for monies received by the OBS staff and issue liquor.

3.3.4 Stations

A staffing complement was defined for each station based on passenger throughput and functional requirements. Functional categories included baggage handlers and redcaps; passenger attendants; first class lounge attendants in major stations; security staff and janitors. Provision was made for baggage handlers only in stations and scenarios where connect air service was available, and then only for connect air passengers. In smaller stations, it was assumed that station employees would undertake a variety of duties, including assisting passengers with baggage.

To provide 7-day a week coverage during the hours that the system is open, 3.5 employees are required for each position.

Appendix Table C-2 summarizes the estimated number of positions and employees at each station for the 300 kph base case.

Station operating expenses were estimated based on the size of each station (m^2) and on its annual throughput.

The station staffing listed above is based on the passenger demand and train service requirements for the 300 kph full corridor case in the year 2005. One third of the total staffing allocated to each segment for other years and other demand scenarios is treated as being variable with passenger throughput relative to the 2005 base volume.

3.3.5 Advertising, Commissions, Credit Cards, Ticketing

Advertising

Following consultation with VIA representatives and client representatives, the advertising budget was set at two percent of gross passenger revenues (not including GST/PST) for the first year of operations, but thereafter was held constant. The rationale was that advertising expenses should be highest when the HSR operator was trying to build the market for the service. This ratio of advertising to sales is significantly lower than current practice and reflects the

fact that the HSR operation is projected to generate much larger revenues than conventional passenger rail.

Commissions

From discussions with transportation system operators, assigning half of all HSR tickets sales to travel agencies or other third parties appears reasonable. Third parties typically receive an 11 percent commission on gross sales. To account for this cash outflow, the estimated total revenue was reduced by 5.5 percent (11 percent commission on 50% of total sales).

Credit Cards

From discussion with operators, it is reasonable to expect that about 75% of the tickets sold directly by the HSR operator would be paid for by credit card. This applies both to tickets sold over the counter and those obtained from automatic ticketing machines. On that basis, about 37.5%[8] of total HSR ticket revenue would be subject to an average 2.5% charge levied by the financial institution issuing the credit card. To account for the credit card discount, 0.9 per cent (2.5 per cent of 37.5 per cent) was deducted from the gross revenue estimate.

Ticketing

Reservation transaction costs were estimated at $0.75/trip segment for all tickets, regardless of how the ticket was sold. A round-trip ticket counts as two segments, as does a one-way trip which crosses a segment boundary (from Quebec City to Ottawa, for example). A fifteen percent allowance for rebooked tickets was included.

When an airline style reservation system is used, most of the costs are expressed on a per-ticket basis. The annual fixed cost was estimated at $ 0.250 million for the MOT sector and $0.100 million each for the end points. We used a lower transaction fee than is currently paid by the airlines, since the complexity of the transactions for a Quebec-Windsor HSR system would be much less than for any existing airline reservation system.

Following a review of current practices in Canada and abroad, and discussions with transportation system operators, we have assumed that 65 percent of the tickets issued by the HSR operator would be sold through automatic ticketing machines. Including multiple passengers on a single ticket, round trips and

[8] That is, 75% of the half of ticket sales handled by the HSR operator.

multiple trips, an allowance of 64 machine transactions per 100 passengers using the machines would be required. An allowance of one dollar per transaction was included for operation and maintenance of the ticketing machines, including supplies and telecommunications.

The balance of this cost category is telecommunications costs for direct call-in information requests and ticket reservations. We have assumed that a large proportion of such calls would be handled by an interactive automated phone system, with a human attendant involved only on an exceptional basis.

3.3.6 Ticket Sales at Stations

As indicated above, less than one fifth of all tickets would be sold by station sales agents employed by the HSR operator.

We allowed .17 phone call per passenger (3 minutes duration), assuming 70 percent productivity in the determination of passenger requirements by Telephone Sales Staff. We also allowed 3.5 minutes of counter sales agent time for each counter transaction, assuming 65 percent productivity.

For the base 300 kph case, this yields the following staffing requirements:

- MOT 46 telephone and 38 counter staff
- MQ 14 telephone and 12 counter staff
- SWO 21 telephone and 18 counter staff.

Productivity for both employee groups is allowed to increase over time with increasing ticket sales. In other respects, staffing tracks the number of passengers handled over time or under different demand or technology scenarios. Note that we presume that the station staff would assist with counter ticket sales where appropriate, as at smaller stations.

3.3.7 Customer Services Administration

Based on an analysis of functional requirements and maintaining a reasonable span of control for executives and managers, we estimate that a total of 64 staff would be required for customer service professional, administrative, supervisory and general support activities for the MOT segment for the 300 kph base case. For the MQ and SWO segments, 19 and 21 additional staff would be required, respectively. The staffing breakdown for the 300 kph base case is illustrated in Table C-1.

4. LABOUR AND MATERIALS QUANTITIES FOR MAINTENANCE

4.1 Rolling Stock

4.1.1 Labour Requirements

Direct person hour requirements and frequencies for the various inspections and servicing activities were obtained for the two representative technologies. Given the fleetsize and annual utilization, this allowed us to determine a total direct maintenance manpower requirement for each sector. Different productivity assumptions were made ranging from 75 percent for unscheduled maintenance to 95 percent for activities scheduled up to a year in advance. Dividing by the number of hours per staff year gives the total staffing required. One foreman was added for every ten tradesmen; one helper for every twenty tradesmen; and one labourer/support staff for every ten tradesmen.

300 kph Technology

For the TGV, direct labour requirements are:

Unscheduled repair	16 hours per 1,600 train-km
Daily Brake Test	1 hour per trainset per day
Service Inspection	4 hours every 2,500 kms[9]
Running Gear Inspection	12 hours every 18 days
Motor Inspection	80 hours every 60 days
Minor Inspection	240 hours every quarter
Major Inspection	700 hours semi-annually
Full Inspection	1000 hours every 18 months

Maintenance activities on longer cycles subsume activities on shorter cycles. For example, the semi-annual Major Inspection takes the place of the quarterly Minor Inspection which would be scheduled for the same time period.

200 kph Technology

For the X-2000, the labour requirements for scheduled inspections, reprofilings and oil change range from 5 hrs every 4,500 km to 850 hrs every 1.2 million km, with an average direct labour requirement of seven hours per thousand trainset-km, compared to ten hours for the TGV. A daily service examination

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[9] The *maximum* interval between Service Inspection activities is 3,000 km. We have used an average of 2,500 km in estimating labour requirements.

has been added to the inspection requirements provided by ABB and Swederail. Data provided by ABB indicates that the initial experience with non-programmed maintenance has averaged 5.6 hours per thousand trainset-km.

4.1.2 Routine Maintenance Materials

Train materials, parts and supplies were based on the application of 0.6 percent of capital costs per trainset year and 0.004 percent of capital costs per thousand train km. From this were subtracted the annualized cost of materials used in overhauls (to avoid double counting). The capital cost base used for the calculation excludes the allowance of approximately 20 percent for engineering, project management, contingency and other "soft" costs included in the overall capital cost.

4.1.3 Cleaning

Cleaning follows the suggestions of the SNCF, except that we have reduced during-the-day trip cleaning, especially for shorter distance train runs.

It is assumed that cleaners are paid a base rate of 20 percent less than present and that these could be contract employees with a less attractive benefits package and less paid time not worked.

Supervision and quality control for cleaners would be provided by HSR operator staff earning at existing rates.

300 kph Technology

The adjusted SNCF standards for cleaning are as follows (for an 8-car TGV trainset):

Weekly per trainset	39 direct person hours
Daily per trainset used	20 direct person hours
Per trip	4 direct person hours

A lower productivity rate has been used for the per-trip cleaning, and adjustments have been made only in this component to account for short trips and shuttle train service. Following VIA practice, it is also assumed that garbage pick-up and other basic cleaning activities are undertaken by on-board service staff as part of their regular duties.

200 kph Technology

For the X-2000, the cleaning requirements per trainset are 80 percent of those applicable to the TGV. This reflects the difference in the seating capacity of the equipment and assumes comparable standards of cleaning.

4.1.4 Overhauls

TGV

The TGV uses two overhaul cycles: the "A" cycle occurs on an approximately 7 year cycle and is akin to an interior refit; the "B" cycle occurs on an approximately 14 year cycle and includes major mechanical work. The "B" overhaul subsumes the scheduled "A" work. Overhauls for the TGV are based on data from the SNCF, projecting an "A" overhaul to require 22,500 hours of direct labour and a "B" overhaul to require 67,500 hours. Ninety-five per cent productivity has been assumed. Labour has been costed in the same manner as for routine maintenance, including the addition of supervisors, helpers and labourers. Materials requirements have been estimated at 3.5 per cent of initial capital costs (net of contingencies, project management and other adders) for an "A" overhaul and 10.5 per cent for a "B" overhaul. Including a ten per cent plant allowance gives a cost estimate of $1.9 million for an "A" overhaul and $5.7 million for a "B" overhaul.

X-2000

For the X-2000, a seven year overhaul cycle has been used, combining both interior refits and mechanical work. Overhauls are estimated to cost 12.5 per cent of initial capital costs (net of contingencies, project management and other adders). Thus the cost of overhauls is estimated to be $2.9 million per trainset. Since actual operating data were unavailable, these assumptions were reviewed with both Swedish State Railways and ABB.

Contracting Out

Overhauls begin in the fifth year of operation and run on a seven year cycle. An examination of the overhaul requirements indicates that it is unlikely that there would be a sufficient volume of work for the HSR Operator to efficiently operate an overhaul shop. We have assumed that overhauls would be contracted out.

4.1.5 Equipment Maintenance Administration

The administrative component for the MOT 300 kph base case includes three executive staff, six managerial, 21 engineering and other professional and 26 clerical and other support staff.

Incremental shop management staffing of 7 employees is costed when the MQ sector is added and 9 employees when the SWO sector is added. The composition of the administrative workforce is shown in Table C.1.

4.2 Infrastructure Maintenance

4.2.1 Introduction

Infrastructure encompasses earthworks, track, structures, catenary and substations, signals and communications, stations and terminals, and maintenance and storage facilities.

Of these elements, the most significant in terms of technology- and site-specificity are earthworks, track and structures, catenary and substations, and signals and communications. The other elements are less directly related to technology and alignment, being driven largely by demand profile and consequent operating strategy and fleet size.

Basis of Estimates

The process used to develop estimates of infrastructure maintenance costs for the 200, 250, 300 and 350 kph alternatives is based on the notion that for infrastructure constructed to a given specification, there are four principal causal elements that affect the quantities of input factors (labour, materials, contracted services) required to maintain the required geometric and other standards for safe and comfortable operation. These causal elements are:

- the physical extent of the system (numbers of route-km, track-km, stations, maintenance facilities, etc);
- the severity of climatic conditions (number of degree-days, temperature extremes, levels of precipitation, etc);
- the speed of operation and rolling stock characteristics (static axle load, unsprung mass, presence or absence of steerable trucks, pantograph design) that affect consequent force levels exerted on

track and catenary with each axle pass or pantograph pass, respectively; and

- the level of utilization of the system (annual number of axle/pantograph passes).

The first, third and fourth elements have been calibrated against known data from Sweden (200 kph) and France (300 kph). The second element has been more challenging, largely because the relationships between climatic conditions and required levels of maintenance are complex, involving geotechnical conditions and quality control issues as well as differences in climate.

We have also taken into consideration the commonality of design standards as specified and/or as estimated for infrastructure for the two technology families. Where subsystems are uniform across the families and speed classes — for example, earthworks and subgrade, most of the track structure, the electrification design (although not the details of catenary tensioning) and signalling and train control — we have adopted as a starting point the maintenance practices and consequent input factor quantities that pertain to the representative system upon which the common specification was based (i.e., the TGV-A in most cases).

Where data for the U.S. North-East Corridor were available and relevant (as for frequency of track geometry car inspections) such practices have been specified. Adjustments reflecting the differences in required maintenance tolerances and imposed track forces for higher and/or lower speeds show up primarily in utilization-related input factor quantities and associated unit costs.

In developing our estimates, we began by characterizing the reference infrastructure (i.e. the *ligne à grande vitesse-Atlantique* or LGV-A) and the associated utilization level and input factors. We then adjusted the number of maintenance bases and track, catenary and signals and telecommunications maintenance teams to reflect the differences in the extent of the infrastructure in each segment of the Quebec City - Windsor Corridor.

This was done by proportioning each segment so that each base and team would be responsible for a similar length of track, electrification or signalling and telecommunications infrastructure. Note that the number of bases for the full corridor is not simply the sum of the number of bases for each segment: the segment boundary bases (Montreal, Toronto) would be double-counted. However, the number of maintenance *teams* are additive. The number of teams were tracked to the nearest quarter team through the calculations, then rounded to a whole number for purposes of reporting and costing.

There is substantial commonality with respect to scheduled visual and sensor-based inspections. The differences are largely in the estimated level of effort (labour, materials, contracted services) required to keep geometric defects within tolerance limits for acceptable passenger comfort. For all speed levels, the estimates reflect the presumption that the objective is year-round high-speed operation.

All else being equal, the magnitude of vertical and lateral forces exerted on track is proportional to the static axle load and the unsprung mass, and to the square of the speed of operation. The speed effect dominates the difference between the 200 kph and 300 kph services. The effect of the steerable trucks on the X-2000 is to reduce lateral forces during curve negotiation. This will increase rail life in curves and reduce requirements for rail grinding, and also wear related wheelset and suspension maintenance requirements. However, at the traffic levels forecast for the Quebec City-Windsor corridor, and with the geometric standards of the alignment, the absolute magnitude of the cost consequences of these benefits will be marginal.

From an infrastructure maintenance point of view, the causal aspects of utilization occur at the wheel-rail and pantograph-catenary interfaces. We have expressed annual utilization in terms of the annual number of axle and pantograph passes, relative to the number experienced on the reference infrastructure in a given year. The proportion for axle passes is quite low, ranging between 3.6% for 200 kph Toronto-Windsor to 17.4% for 300 kph Montreal-Ottawa-Toronto in the initial year, and growing slowly thereafter. The proportions for pantograph passes are higher, between 7.1% and 20.0%, reflecting the use of one pantograph per train, regardless of trainset size (1-8-1 vs 1-10-1 on the LGV-A) or consist configuration (single or double trainset).

4.2.2 Maintenance Organization

In developing these estimates, we have presumed that the infrastructure maintenance organization for a Canadian high-speed line would be part of the HSR Operator organization, following the SNCF model, rather than integrated into the track maintenance forces of CN and/or CP. We have also presumed that the French practice of contracting out tamping, lining and levelling, as well as rail grinding, and other selected activities, would be followed.

4.2.3 Maintenance Activities and Cycles

Following the SNCF approach, HSR employees would carry out inspections of track, earthworks, structures, electrification and signalling and communications

installations, execute small-scale point-of-failure maintenance and routine servicing, and supervise work being carried out by specialist contractors. All maintenance planning functions would be performed in-house by the operator's staff, as would all maintenance activities on safety-critical functions.

About one-third of fixed-facility maintenance activities (primarily inspections) would be carried out in daylight, with the balance being performed at night. The daily train schedule for each track incorporates one 90-minute block for daylight maintenance, which will be limited to surveys and visual inspections. Switches and other track appliances will also inspected in daylight. At night, there will be a 6-hour maintenance window, at least 4 hours of which will available without interruption. This follows SNCF practice, but it should be recognized that these nominal practices may require modification as determined by actual experience.

Gross materials requirements were estimated based on expected service life at a subsystem/major component level and anticipated level of replacement as a percentage of initial investment over that service life. The gross requirement was then adjusted for utilization, presuming that 50% of materials consumption would vary with utilization. Note that this applies to annual materials consumption only.

A significant proportion of infrastructure maintenance will be performed by outside contractors, including rail grinding, all production tamping, lining, and levelling, vegetation control and fence maintenance, and monthly track geometry car measurements. For all but tamping, lining and levelling, existing suppliers would be entirely capable of providing these services. As far as tamping, lining and levelling is concerned, the situation is less straightforward, largely because North American railroads typically undertake these activities with in-house staff and equipment. Existing contractors are not experienced in delivering work to the tolerances that a high-speed line requires.

The problem here is not equipment — the same suppliers that provide equipment for European high-speed operators and contractors all have North American subsidiaries — but rather experienced workers. We are of the opinion that whoever provides construction tamping, lining and levelling will have both a significant advantage and incentive to set up to continue to provide these services to the operator, and have estimated on that basis.

In addition to the annual activities described above, there are several large-scale programmed maintenance activities that are driven primarily by utilization, with secondary or limited effects from climate and site conditions. None of these

activities would affect the first decade of operations, and most are unlikely to begin until well beyond year 30, given the estimated levels of utilization.

Earthworks, Track and Structures

The key to achievement of earthworks, track and structures capable of sustaining safe and comfortable year-round operations will be rigorous monitoring of track conditions and timely and effective execution of preventative maintenance activities.

Walking inspections of the overall track will be made monthly, with switches inspected at two week intervals in summer and weekly in winter. Measurements of track geometry defects will be made weekly using revenue trainset(s) with accelerometer-equipped wheelset(s). Comprehensive measuremements of track geometry will be taken monthly using a track geometry car, as is done in the U.S. North-East Corridor. This is a shorter cycle than in France, where the measurements are done quarterly, but we believe that this is necessary, at least during the early years of operation, given the more severe climatic conditions that prevail in the Quebec City-Windsor Corridor. It may well be that climatic-related track degradation will stabilize (as appears to have happened in France). If so, these inspection cycles could be lengthened.

In the early years of operation of the Paris-Sud-Est high speed line in France, between 75% and 80% of the track length required tamping, lining and levelling each year. The requirements have since declined and stabilized at about 35% of the track being tamped each year. We have estimated tamping requirements (for all speeds) at 100% of track length in the first three years of operation, declining to 50% of track length in the 8th operating year.

Electrification

The electrification maintenance group within the high-speed maintenance organization must be self-sufficient and capable of dealing with major emergencies. Unlike the situation in France or Sweden, where substantial portions of the national rail network are electrified, the only other electrified operation in eastern Canada will be the Deux Montagnes commuter line in Montreal. The opportunities to redeploy maintenance staff from other segments to deal with a major emergency will be nil. Also, while maintenance crews from the provincial utilities would have most of the skills and certainly much of the heavy equipment required to deal with a major problem, it seems likely that at least some of the conditions that would create an emergency for the high-speed

operator — severe weather such as a tornado or an ice storm — would also tie up the utility repair crews and local contractors.

All routine maintenance to catenary and substations will be carried out by the staff of the Canadian high speed operator; these activities consist primarily of inspections, adjustments to the overhead catenary system (OCS) and cleaning of insulators. These activities will be highly mechanized to improve both efficiency and self-sufficiency of the maintenance teams. Each team will be equipped with an all-weather self-propelled on-track maintenance vehicle fitted with inspection and work baskets and a simplified in-cab signalling and train control system.

Other than visual inspections, the majority of the electrification maintenance will be performed at night. Limited coverage will be provided during the operating day to deal with off-track inspections (substations, autotransformer installations) and malfunctions. Preventative maintenance activities will include weekly daylight visual inspection of the catenary at switches and crossovers, sectioning points (phase breaks) and tensioning devices during passage of a revenue trainset. Monthly, the catenary will receive (in alternate months) either a daylight or a night inspection from a specialized observation car.

The dynamic behaviour of the catenary will checked be quarterly using video cameras mounted on a revenue trainset, and an annual record of pantograph movement and current collection values for the entire line will be made using an instrumented revenue trainset operating at the full rated speed. Catenary geometric characteristics will be measured annually using a specialized slow-speed vehicle.

Signalling and Telecommunications

Signalling and telecommunications (S&T) inspections and maintenance activities will be carried out by employees of the high-speed operator. With the move to electronic interlockings and additional computerization, these activities will emphasize diagnostic programs, site inspections and component replacement as prescribed by the supplier(s). Except for routine visual inspections, signalling and telecommunications maintenance will be carried out at night, with 24-hour on-call coverage for emergencies.

5. GENERAL ADMINISTRATION

5.1 Introduction

This chapter presents the General and Administrative (G & A) staffing complement of an HSR operator, describes the non-labour G & A budget, and identifies other Operating & Maintenance costs.

5.2 Personnel

The general administrative structure of the HSR operator is included in this category and includes all staff not otherwise accounted for. Based on analysis of functional requirements, we developed a management structure suitable for a stand-alone HSR operator. For the MOT segment in the 300 kph base case, a total of 135 employees would be required. Table C.1 presents the breakdown of these employees by functional category.

For the MQ segment, an additional 26 professional and support staff would be required, while for the SWO segment, 32 additional employees would be needed.

Note that the G & A staffing requirements are independent of technology and speed. While these factors will clearly affect staffing of some line functions, we see no causal basis for altering the G & A staffing. A small allowance for additional accounting, labour relations and similar staff was included to accommodate growth in the system (and the number of employees) over the 20 year evaluation period.

5.3 Other Costs

5.3.1 Non-Labour G & A Costs

This includes a small budget for external audit, public affairs, access to external computer and other systems, plus administrative expenses.

5.3.2 Insurance, Property Tax and Franchise Fees

Insurance included premiums or annual contributions to a self-insurance reserves for liability and property damage. It was assumed that this would cover all claims (in other words, there is no *claims* line item).

The allowance for Property tax is an estimate based on the taxes currently paid by VIA Rail.

After consultation with the client, no allowance was made for annual franchise fees. Information received from the Infrastructure Consultant indicated that there was no need to make provision for facility utilization fees. It was assumed that current levels of rent for Union and Central Station would continue to be paid.

6. LABOUR ISSUES

6.1 General Principles

The labour costs presented in this report are based upon the following general principles[10]:

- Staff wages, salaries and benefits reflect pay levels currently prevailing in the Canadian railway industry. On the basis of a review of this and other industries, it was determined that these pay and benefit levels were generally consistent with those of other large, national, unionized organizations, especially where split shifts, rotating shifts and assignment away from home are required.

- A number of constraints exist to efficient HSR operations under the current labour régime, the most important of which are: multiple shopcraft bargaining units, the mileage based system of pay for the running trades, the running trade crew size and the labour-intensive telephone sales and reservations system[11]. It was assumed that the current progress towards resolving these constraints would be sustained, so that they would not be an impediment to HSR operations by 2005.

6.2 Wages and Benefits

6.2.1 Wages

The following adjusted annual base wage rates were used:

Category	*$000*
Redcaps	26
Baggage handlers/attendants	29
Station attendants	33
Security guards	28
Ticket sellers	24

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[10] These are documented in greater detail in the working paper entitled *Labour Practices and Costs: Comparison of High Speed Rail and Conventional Rail Services* (February 1993).

[11] The first three of these are discussed in Blakney, J.F. et al., *Review of Institutional Options and Legislative and Labour Issues* (KPMG Peat Marwick Stevenson & Kellogg, May 1993). The TSO issue is one of high levels of labour content per reservations and sales transaction, as a result of a cumbersome and outdated computerised reservations system.

Category	*$000*
On-train service staff	31
Train conductors	55
Train drivers	60
Coach cleaners	24
Lead-hand cleaners	31
Shop labourers	31
Mechanical/electrical trades	39
Lead-hand tradesmen	40
Dispatchers	51
Infrastructure maintenance technicians	34
... equipment operators	36
... tradesmen	36
... foremen	40
Senior executive	250
Executive	90
Senior management	81
Management	71
Administrative/professional	55
Support	34

The following adjustments were made to existing VIA employment conditions and wage rates:

- Train crew were shifted from mileage-based compensation to annual wage;
- Wages for coach cleaners and redcaps were reduced by 20 per cent to reflect the fact that no specialized skills or training are required and that these could be higher turnover positions, perhaps contracted out; and
- Salaries for executive/management positions were reduced by five percent from the VIA average.

The other major difference included in the wage assumptions is that the annual wage subsumes all shift differentials, premiums for holiday work and all other so-called 'arbitraries'. This represents about a five percent across the board reduction in labour costs.

6.2.2 Benefits

Benefits and other labour adders were calculated directly for each wage category and include:

- Pension;
- UIC/CPP/QPP/Workers Compensation and other payroll taxes;
- Group life insurance; and
- Medical/dental/vision plan.

Benefits and payroll taxes range from about 16 percent burden for the most highly paid non-executive employees, to more than 22 percent of the lowest base wage.

Railroad employees have traditionally received a small annual allowance to cover costs of uniforms, adherence to grooming standards, and/or safety equipment. For example, a customer service agent, who is in direct and regular contact with the public, would receive $500 per year for uniforms and grooming, while a mechanic, who is not required to wear a uniform or meet grooming standards beyond those imposed for safety considerations, would receive a similar allowance for safety equipment.

Available productive hours are based on the following calculation:

Nominal working hours:	260 days x 8 hours	=	2,080
Less:			
Statutory Holidays	10 days x 8 hours	=	(80)
Vacation	15 days x 8 hours	=	(120)
Sick/Other Paid Leave	12 days x 8 hours	=	(96)
Training/Other Company	3 days x 8 hours	=	(24)
Total Available Productive Hours			1,760

7. CAPITAL COSTS

7.1 Introduction

The following costs were obtained from the Infrastructure Consultant: right-of-way; earthworks/subgrade; bridges; grade separations; other accommodations; track; power distribution system and stations. All other capital costs are discussed below.

7.2 Signals

The signal system costs are based on data provided through Canarail by the SNCF and its suppliers for the existing TVM 300 system and the new TVM 430 system. Costs were provided for the typical SNCF requirements for crossovers, stations and connections to the "conventional" railway network. The supplier provided sufficient detail to allow us to reduce the costs to reflect the lower need for sidings, crossovers and connections to the conventional railway system.

7.2.1 300 kph Technology

For the TVM 430 system, a three-part cost was given:

$0.478 million per double track route-km
$0.505 million per trainset
$6.523 million for a control desk.

The costs include engineering, project management and contingency.

In total, the signalling costs seem to be reasonable in comparison to other signalling costs we have reviewed.

7.2.2 200 kph Technology

Signal requirements for the lower-speed 200 kph technology are broadly similar to the base signalling system required for the 300 kph system. In our initial reviews a modified North American ATCS system was proposed. Since this is not an operating, proven technology, we were asked not to base the costing on this system. Instead, we have used the somewhat lower cost SNCF TVM 300 system to represent the cost of a suitable signalling system. This costs approximately $391,000 per route-km (double track) with the costs of the control

desks being the same as noted above. For the 250 kph scenario, the TVM 430 system was used.

For the short single track sections used between London and Windsor for all scenarios, the signalling cost per route-km was reduced by 25% to reflect the savings in having fewer kilometres of track to signal, but the increased costs of having to install the signal protection for high-speed turnouts between the single and double track sections.

7.3 Communications

The communications system requirements for the HSR system are independent of technology and design speed. Thus a single system was costed with the only differences being those of route-km and the number of drops required for stations and maintenance bases.

An all-inclusive price was provided through Canarail by the SNCF and its TGV suppliers which amounted to:

Basic communication circuits	$0.20 million per route km
Communications control centre	$2.96 million total
Station drop/concentrator	$0.87 million each
Maintenance base drop/concentrator	$0.54 million each

7.4 Maintenance Facilities

It was assumed that VIA's Montreal Maintenance Centre [MMC] and Toronto Maintenance Centre [TMC] could be used for the maintenance of the HSR equipment. The basis for this assumption, which was verified with VIA, was an assessment of the maintenance requirements for the HSR system, and the decreased maintenance requirements that VIA would face when the HSR is implemented. The shops are relatively new and were said to have been built to accommodate high-speed, electrified trainsets without major structural modifications.

Given that both Toronto and Montreal are terminal points for both the MOT sector trains and the endpoint sectors, a maintenance capability in both centres is required to ensure adequate train cycling and trainset availability.

For each shop, allowances of $50 million for structural modifications and $75 million allowance for new equipment and tooling were made. (Slightly lower allowances were made for the X-2000). Using costs developed by Canarail,

electrification and other modifications for 7 km of mainline access from the TMC to Union station and 3 km access from MMC to Central station were included at $500,000 per km[12]. An allowance of $250,000 per km for electrification and other modifications to the shop and related tracks was also included.

One new cleaning and provisioning compound (including allowance for at-station servicing) was included at Montreal and one at Toronto at a cost of $10 million each.

The majority of shop costs are included in the MOT base case. The shop capital costs allocated to the MQ and SWO sectors include a small amount for additional storage and servicing track at each shop, plus allowances for station servicing areas at Gare du Palais, London and Windsor.

Fifteen percent contingency and 10 percent engineering were added to the totals.

No allowance for the acquisition of the shops from VIA was not included in the capital costs on the grounds that these facilities were specifically funded by the federal government for the support of modern passenger services in the Corridor. Ten million dollars were added to the shop modification costs to account for disruption to VIA's maintenance activity during the conversion.

Also included in the maintenance facilities capital costs are a 400 m^2 control centre and a 3,500 m^2 administration building. These were costed at $3,000 per m^2, a 15 per cent premium over the Infrastructure Consultant's estimated cost of station construction.

Infrastructure maintenance facility capital costs include provision for specialized vehicles for each maintenance team (ranging from $100,000 for a signal maintenance team to $250,000 for a catenary maintenance team). Each maintenance base was allocated $3.85 million for heavy specialized equipment and $3.8 million for a building, track, access roads, and so on.

Four central maintenance depots are also included (two for the MOT sector and one each for the MQ and SWO sectors). The cost of each central depot was estimated as $5.0 millions, which includes a small work train and repair facilities.

Wherever possible, construction sites were used for maintenance facilities.

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[12] In the event of a Dorval routing, the Montreal access track requirements are much shorter.

7.5 Information Systems

This cost category includes two components: (i) ticketing machines and associated passenger control machinery and (ii) an integrated management/operations computer system. No significant capital costs are included for a reservation system as this system would be paid for on a usage basis.

Based on reports of other systems, $20 million has been allowed for the management system for the MOT base plus an incremental $7.5 million each for the two outer segments.

An installed estimate of $100,000 each was adopted for ticketing machines on the basis of discussions with a domestic supplier of such equipment. This also includes an allowance for two ticket validation machines for each ticket issuing machine. The distribution of ticketing machines is somewhat arbitrary. For the base 300 kph ridership, the following numbers were used:

MQ sector	18 machines
MOT sector	53 machines
SWO sector	24 machines.

7.6 Rolling Stock

The basis for determining the fleet requirements was discussed in section 2.4. For the 300 kph case, an all-inclusive price of $30 million per trainset was used. Allowing with changes in price levels, fleet size, and currency translation, this value is consistent with other prices that have been used for 8-car TGV trainsets. The $30 million value was confirmed in writing by Bombardier in March, 1994.

For the 350 kph case, four additional traction motors were specififed for each trainset to provide the acceleration required to meet the schedule. An allowance of $250,000 per traction motor (including associated control and power conditioning equipment) was added to the capital costs.

For the 200 kph technology, a base price of $4 million per locomotive and $2 million per car was quoted by ABB Canada as being a U.S. dollar price for imported equipment. Again these are consistent with the price of comparable equipment. We included a 40 percent increment to get to a base "partially made in Canada in Canadian dollars" price plus nine percent contingency, eight percent

program costs (engineering and so on) and 2.5 percent for spares to generate a price of $23.5 million per 5-car trainset.

7.7 Startup Costs

Startup costs include commissioning, capitalized administration and training. Each is discussed below.

7.7.1 Commissioning

Commissioning consists of the final testing and adjustment of the working components of the HSR system to ensure that everything works as a system. An allowance of two per cent of the capital costs for the track, signals, communications, rolling stock and information systems was made for commissioning. This is consistent with estimates for a number of HSR projects throughout the world. Commissioning begins a few years before the system opens, with the bulk of the costs being incurred in the last year of construction.

7.7.2 Administration

For the most part, the engineering, project management and other allowances estimated by the Infrastructure Consultant include what are known as "agency costs" or administrative expenses incurred by the HSR owner/operator during the construction of the system. Such costs include basic corporate management, accounting (payments to contractors), engineering (overseeing the construction) and so on.

In view of this, capitalized administration during the construction period has been estimated in the initial year of construction (1996) at five per cent of the 2005 expenses developed for the *executive* and *administration* categories in Section 5. Capitalized administrative expenses have been allowed to increase as construction proceeds so that the full number of executive and administrative employees are in place the year before each segment is open for operations.

The second component of capitalized administration includes the employment of the functional administrative staff (for example, the Chief of Transportation, maintenance supervisors, marketing professionals). Twenty per cent of these employees are put in place in the three year years before segment is open for operations, with the remainder being brought on in the next two years so that the entire administrative and supervisory staff is in place the year each segment opens.

Employment of the executive/administrative/supervisory staff in the years leading up to the opening of the system serves three purposes: to provide needed administrative services as the HSR system develops; to provide a training period for these employees; and to undertake start-up activities, such as developing the marketing program, establishing ticket pricing policies, and developing train schedules.

7.7.3 Training

Appropriate training of hourly-rated staff is a key element to the successful implementation of an HSR system. For the purposes of estimating training costs, we have divided the hourly rated employees into the following groups with an **average** training allowance per person:

Train crews	$115,000
Dispatchers	110,000
Customer services	6,000
Equipment maintenance	55,000
Infrastructure maintenance	85,000

All of the train crews and dispatchers will go through the pre-opening training, as will all customer service staff who fill front-line positions. A training allowance of five per cent was made for only seventy-five per cent of the equipment maintenance staff on the grounds there are no special skills or knowledge required for helpers and labourers. For infrastructure maintenance staff, only 60 per cent of the total staff are trained, again since labourers require no special knowledge that cannot be acquired on the job, and that a number of the specialized tradesmen require no additional specialized skills.

The training allowances reflect standard overseas practice and are based on the use of existing railway (VIA) staff.

Employee training starts in the year 2001 for the key staff and continues until each segment opens, with the bulk of the expenditures being undertaken during the two years immediately before each segment opens.

Training allowances were reduced by 25 per cent for Southwestern Ontario, on the grounds that the other sectors of the Corridor would already be in operation.

7.8 Ongoing Capital

Ongoing capital expenditures include the following classes of purchases:

- Additional new trainsets to meet growth in traffic;
- The overhaul of trainsets;
- The addition of ticketing machines to meet added demand;
- The replacement/upgrading of existing ticketing machines/information systems; and
- The replacement of equipment used by infrastructure maintenance crews.

7.9 Comparison of Capital Costs

Capital costs by scenario are compared in Tables 7.1a and 7.1b. (Capital costs for the Montreal-Quebec single track scenario are discussed in Appendix E.) The first eight items (from right-of-way to stations) were the responsibility of the Infrastructure Consultant; the remainder were developed as part of this report.

The salient features of Tables 71a and 71b are as follows:

- Total capital costs for the Quebec-Windsor scenarios range from $10.3 billion for 200 kph via Dorval to $11.6 billion for 300 kph via Dorval. The **magnitude** of capital costs depends primarily on speed and alignment.
- The capital cost **breakdown** is very stable across scenarios, regardless of speed class. For Quebec-Windsor, the shares of the initial capital costs are approximately 82 per cent for infrastructure costs (70 per cent for the items ranging for right-of-way to stations; 12 per cent for the items ranging from signals to information/ticketing systems), 15 per cent for rolling stock and 3 per cent for startup costs. The share of infrastructure costs is fractionally lower in the Montreal-Toronto scenarios, because higher traffic densities on this segment require higher investments in rolling stock than on the two end segments.

Table 7.1a: Capital Costs by Scenario
Millions of Dollars

Scenario	1	2	3	4	5	6
Corridor	Quebec-Windsor	Montreal-Toronto	Quebec-Toronto	Quebec-Windsor	Quebec-Windsor	Montreal-Toronto
Speed	200	200	200	250	300	300
Via Dorval/Mirabel	Dorval	Dorval	Dorval	Dorval	Mirabel	Mirabel
Right-of-Way	467	187	261	467	489	185
Earthworks/subgrade	1,654	927	1,290	1,654	1,891	1,142
Bridges	678	454	557	678	714	492
Grade separations	1,106	546	702	1,635	1,612	771
Other accommodations	148	93	105	148	160	105
Track	1,037	547	788	1,037	1,062	581
Power distribution system	921	474	700	921	902	486
Stations	475	418	456	475	388	332
Signals	483	252	391	585	590	314
Communications	270	136	210	270	272	139
Equipment Maintenance Facilities	176	148	160	176	197	169
Infrastructure Facilities	133	78	102	133	133	79
Information/ticketing systems	46	25	35	46	47	26
Rolling stock	1,429	867	1,124	1,546	1,530	960
Commissioning	102	61	81	107	106	64
Administrative allowance	93	62	75	93	93	62
Startup and training	61	37	50	69	68	41
TOTAL INITIAL CAPITAL	9,278	5,311	7,089	10,041	10,254	5,948
Additional Rolling Stock (2007-25)	422	234	351	468	450	270
Rolling Stock Overhauls (2007-25)	418	252	328	449	501	320
Other ongoing capital (2027-25)	207	119	158	210	211	121
TOTAL CAPITAL	10,325	5,916	7,926	11,167	11,415	6,659

Shaded cells represent base cases.

Table 7.1b: Capital Costs by Scenario
Millions of Dollars

Scenario	7	8	9	10	11
Corridor	Quebec-Toronto	Quebec-Windsor	Quebec-Windsor	Montreal-Toronto	Montreal-Toronto
Speed	300	350	300	300	300
Via Dorval/Mirabel	Mirabel	Mirabel	Dorval	Dorval	Dorval*
Right-of-Way	249	489	464	152	116
Earthworks/subgrade	1,481	1,891	1,832	1,044	958
Bridges	584	714	846	619	606
Grade separations	1,067	1,612	1,635	784	753
Other accommodations	115	160	159	102	30
Track	804	1,062	1,052	556	526
Power distribution system	678	902	907	464	446
Stations	361	388	475	418	83
Signals	486	590	585	305	293
Communications	214	272	270	136	130
Equipment Maintenance Facilities	182	197	193	165	165
Infrastructure Facilities	102	133	133	79	71
Information/ticketing systems	36	47	47	26	26
Rolling stock	1,230	1,581	1,530	930	840
Commissioning	84	107	107	64	52
Administrative allowance	75	93	93	62	61
Startup and training	56	68	68	42	39
TOTAL INITIAL CAPITAL	7,806	10,307	10,398	5,948	5,196
Additional Rolling Stock (2007-2025)	330	465	510	300	270
Rolling Stock Overhauls (2007-2025)	398	501	507	310	285
Other ongoing capital (2027-2025)	161	211	211	121	117
TOTAL CAPITAL	8,695	11,484	11,625	6,679	5,868

* No connect air; no service to Pearson

8. SYSTEM COSTS AND REVENUES

8.1 Introduction and Approach

This chapter presents system costs and revenues for the 200 kph and 300 kph base cases and stand alone cases, for the sensitivity analyses [250 kph and 350 kph] and for the Montreal-Toronto Reduced Cost Scenario.

In previous chapters, we have described the development of O & M costs and Capital costs. The first section of this chapter outlines the approaches which was taken to generate revenues and to allocate revenues and costs between Ontario and Quebec.

8.1.1 Development of Revenue Estimates

Ridership and revenue estimates were taken electronically from spreadsheets provided by Project Management. They were then assigned O/D by O/D into the three geographic sectors (Montreal-Quebec, Montreal-Ottawa-Toronto, Southwestern Ontario). For example, Montreal-Toronto traffic is assigned to the MOT sector, while Quebec-Toronto traffic is assigned to both MOT and MQ. Revenues for multi-sector trips were split between the sectors on the basis of the relative trip distances. Passenger-kms were determined by applying the actual distance for each O/D to the total passenger count.

Based on a series of discussions with the Project Manager and government representatives, concerning treatment of peak demand, no additional equipment was added to serve super-peak demand. As a consequence, approximately one per cent of the total annual traffic would not be served on super-peak days. Ridership and revenue were consequently reduced by one per cent across the board.

Gross revenues, as provided by Project Management, included PST for tickets sold in Quebec and GST for tickets sold in Ontario and Quebec, amounting to an average of ten per cent. These were backed out to derive net revenues.

8.1.2 Quebec/Ontario Allocations

Revenues and costs were allocated between Quebec and Ontario as follows.

Revenues

Revenues were allocated by project management in a two-stage process. Trips were allocated to a corridor segment and then revenues were allocated to Quebec

and Ontario. Revenue from trips within the Montreal-Quebec segment was attributed 100 per cent to Quebec. Revenue from trips within the Southwestern Ontario segment was attributed 100 per cent to Ontario. Trips within the Montreal-Ottawa-Toronto segment were examined O/D pair by O/D pair. Intraprovincial trips (Kingston-Toronto) were allocated 100 per cent to the province in which the trip occurred. The revenues from interprovincial trips were split 50/50 between Quebec and Ontario. Revenue from trips involving Ottawa/Hull was shared between Quebec and Ontario.

Capital Costs

The infrastructure costs were passed through without change from the Infrastructure Consultant. Rolling stock was not allocated between Quebec and Ontario, as another consultant is responsible for this activity. After discussions with client representatives, the main equipment maintenance facilities were allocated 50/50 between Quebec and Ontario, on the grounds that they could logically be located in either Quebec or Ontario. The same approach was taken with respect to the headquarters of the HSR operator.

O & M Costs

A functional approach was taken to allocate O & M costs between Quebec and Ontario. We looked at where crews were based, stations located, track gang locations, etc. Equipment maintenance shopping activities and headquarters O & M costs were allocated equally between Quebec and Ontario.

8.1.3 Contingencies

A contingency allowance (percentage) was established for each capital and operating cost element to account for uncertainty and for various cost items which were not explicitly addressed. For operating costs, these percentages range from 2.5 per cent for items which are relatively well estimated (such as power consumption) to 15 per cent for estimates which may be less reliable (e.g. infrastructure maintenance). On average, contingency accounts for 6.6 per cent of total operating costs.

For capital, the average contingency was 10 per cent. The contingency used for rolling stock was 9 per cent. Higher than average contingencies were used for Earthworks, grade separations, other accommodations, power distribution (discussed in the Final Report of the Infrastructure Consultant), signalling, communications and equipment maintenance facilities.

8.2 Results for 200 kph

8.2.1 Quebec-Windsor Corridor Base Case (Scenario 1)

In 2005, the 200 kph base case for the Quebec-Windsor corridor is projected to generate $592 million in net revenues, while operating and maintenance costs are forecast to be $259 million, for an operating profit of $333 and a net revenue/O & M costs ratio of 2.28. The initial capital cost of this scenario is $9.28 billion.

By 2025, the operating profit is projected to rise to $651 million, and the revenue/cost ratio to 3.03. Over this period, the O & M cost per trainset-km is projected to fall by 13 per cent, from $15.40 to $13.36.

The forecast breakdown of O & M costs in 2005 and 2025 is:

	2005	2025
▸ train operations	13 %	13 %
▸ customer services	27 %	27 %
▸ equipment maintenance	13 %	15 %
▸ infrastructure maintenance	24 %	24 %
▸ executive/administration	9 %	8 %
▸ other (insurance, property tax)	7 %	7 %
▸ contingency	7 %	7 %

The results for the Quebec-Windsor corridor are summarized in Tables 8.1 [capital costs], 8.2 [operations/revenues/costs] and 8.3 [operations cost breakdown]. Data on ridership breakdown, employment and cashflow breakdown are presented in Appendix D, tables D.1, D.2 and D.3.

Table 8.1: 200 kph, Quebec-Windsor Corridor: Capital Costs

06-Oct-94 **HSR STUDY COST DEVELOPMENT**

CAPITAL COST SUMMARY — **Composite (via Dorval) at 200 kph QW Corridor**

		Base Cost	Professional Services	Contin-gency	Total
201	Right-of-Way	380.64	40.92	45.56	467.12
202	Earthworks/subgrade	1,182.67	294.14	177.40	1,654.21
203	Bridges	528.90	95.80	52.89	677.59
204	Grade separations	803.50	156.35	145.96	1,105.80
205	Other accommodations	98.01	20.98	29.40	148.39
206	Track	860.49	131.55	44.68	1,036.72
207	Power distribution system	687.42	130.18	103.11	920.71
208	Stations	370.70	67.15	37.07	474.92
209	People movers (included in stations)	0.00	0.00	0.00	0.00
210	Signals	350.38	79.83	52.56	482.77
211	Communications	196.18	44.70	29.43	270.30
212	Equipment maintenance facilities	143.04	13.14	19.71	175.88
213	Infrastructure maintenance facilities	132.66	0.00	0.00	132.66
214	Information/ticketing systems	45.61	0.00	0.00	45.61
215	Rolling stock	1,204.94	105.83	117.97	1,428.74
216	Commissioning	0.00	102.33	0.00	102.33
217	Administration allowance	93.17	0.00	0.00	93.17
218	Startup and training	60.61	0.00	0.00	60.61
219	**TOTAL INITIAL CAPITAL COSTS**	7,138.91	1,282.89	855.74	9,277.55
220	**Additional fleet requirements**	*year 2009*	5 units		117.11
221		*year 2013*	5 units		117.11
222		*year 2017*	3 units		70.27
223		*year 2021*	5 units		117.11
224		*Total*	18 units		421.60
225	**Rolling Stock Overhauls**	*total, years 2005-2025*			424.41
226	**Infrastructure Renewal**	*total, years 2005-2025*			0.00
227	**Other ongoing capital**	*total, years 2005-2025*			207.23
228	*Cross check initial capital*				*(0.00)*

Table 8.2: 200 kph, Quebec-Windsor: Operations/Revenues/Costs

06-Oct-94 — HSR STUDY COST DEVELOPMENT

OPERATIONS/REVENUES/COSTSComposite (via Dorval) at 200 kph QW Corridor

			Year 2005	Year 2025		
	RIDERSHIP					
1	[A] Adjusted passengers (non-duplicated)	millions	10.0	15.3		
2	Average length of haul	kms	319	327		
3	Passenger kilometres	billion	3.2	5.0		
	OPERATION STATISTICS					
4	Route length	kilometres	1,228	1,228		
5	Train trips (one-way)	thousands	21.2	30.1		
6	Trainset kms	millions	16.8	24.0		
7	Seat kms	billions	4.7	6.8	*282*	*per trainset*
8	Trainsets in active fleet	units	60	79		
9	Average trainset utilization	k-km/year	280	304		
10	Average load factor		67%	74%		
11	Total energy consumption	gigaW-hrs	206	293		
12	Total employment		2,390	2,889		
	PASSENGER REVENUES					
13	Adjustusted revenues	$million	632.8	1,038.9		
14	Agency commissions	$million	(34.8)	(57.1)	*5.5%*	*of gross revenue*
15	Credit card discount	$million	(5.9)	(9.7)	*0.9%*	*of gross revenue*
16	Net Revenue	$million	592.1	972.0		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	$million	32.7	42.9	260	326
18	Customer services	$million	70.5	86.0	747	927
19	Equipment maintenance	$million	34.7	48.2	542	739
20	Infrastructure maintenance	$million	60.9	76.4	649	683
21	Executive/administration	$million	24.2	25.6	219	242
22	Insurance/taxes/other	$million	18.3	21.0	0	0
23	Contingency	$million	17.9	21.1	—	—
24	**Total O&M Costs**	$million	259.1	321.2	2,390	2,889
25	**OPERATING PROFIT**		333.0	650.8		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.28	3.03		
28	O&M cost per trainset-km	dollars	15.40	13.36		
29	O&M cost per seat-km	cents	5.46	4.74		
30	O&M cost per passenger	dollars	25.99	21.04		
31	O&M cost per passenger-km	cents	8.14	6.44		
32	Net revenue per passenger	dollars	59.39	63.66		
33	Net revenue per passenger km	cents	18.60	19.48		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	$million	256.1			
35	Construction of track	$million	6,763.6			
36	Construction of stations	$million	520.5			
37	Construction of maintenance facilities	$million	308.5			
38	Acqusition of rolling stock	$million	1,428.7			
39	**Total Initial Capital Costs**	$million	9,277.5	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	$million	1,046.7	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	$million	6.39			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	214.47	377.63	353.87	618.10
902	O and M Costs	99.30	159.83	121.80	199.43
903	Employment	938	1,452	1,142	1,747

Table 8.3: 200 kph, Quebec-Windsor: Operations Cost Breakdown

06-Oct-94 **HSR STUDY COST DEVELOPMENT**

OPERATIONS COST BREAKDOWN Composite (via Dorval) at 200 kph QW Corridor

		Cont Allow	Cost Estimate ($ million) 2005	Cost Estimate ($ million) 2025	Employment Estimate 2005	Employment Estimate 2025	Quebec Share 2005
	TRAIN OPERATIONS						
101	Train crew	5.0%	13.80	18.32	191	254	42%
102	Power – demand charges	2.5%	6.55	8.64	—	—	26%
103	Power – energy consumption	2.5%	7.98	11.37	—	—	21%
104	Control centre	5.0%	2.38	2.38	40	40	50%
105	Transportation administration/supervision	5.0%	1.98	2.22	29	33	49%
106	**Subtotal**		32.69	42.93	260	326	34%
	CUSTOMER SERVICES						
107	On-board service staff	10.0%	6.78	9.72	158	227	43%
108	On-board service supplies	5.0%	1.67	2.56	—	—	39%
109	On-board services ground support	10.0%	1.24	1.78	32	45	43%
110	Food/beverage for sale	0.0%	0.00	0.00	—	—	—
111	Station operations	10.0%	20.70	22.21	285	329	30%
112	ATM/Ticketing/Reservations transactions	5.0%	13.41	20.34	—	—	36%
113	Telephone/Counter Sales	5.0%	4.48	5.61	126	158	35%
114	Advertising and promotion expenses	5.0%	12.66	12.66	—	—	37%
115	Customer service administration/supervision	5.0%	9.60	11.09	146	167	49%
116	**Subtotal**		70.54	85.98	747	927	37%
	EQUIPMENT MAINTENANCE						
117	Routine maintenance – labour	5.0%	10.80	15.41	215	306	50%
118	Routine maintenance – material	5.0%	11.54	16.54	—	—	50%
119	Major maintenance [included in capital]	—	—	—	—	—	—
120	Cleaning	5.0%	7.87	10.58	255	345	42%
121	Maintenance administration/supervision	5.0%	4.51	5.66	72	89	50%
122	**Subtotal**		34.71	48.19	542	739	48%
	INFRASTRUCTURE MAINTENANCE						
123	Routine maintenance	15.0%	31.94	33.24	496	526	30%
124	Purchased services	15.0%	16.48	13.57	—	—	30%
125	Materials	10.0%	1.87	18.68	—	—	28%
126	Programmed replacement [occurs after 2025]	—	—	—	—	—	
127	Maintenance administration/supervision	5.0%	10.62	10.95	153	157	28%
128	**Subtotal**		60.91	76.45	649	683	29%
	EXECUTIVE/ADMINISTRATION						
129	Labour and related	5.0%	13.27	14.67	193	213	49%
130	Other	5.0%	10.90	10.90	—	—	50%
131	**Subtotal**		24.17	25.57	193	213	49%
	INSURANCE/TAXES/OTHER						
132	Insurance/claims	0.0%	11.50	14.38	—	—	29%
133	Property taxes	10.0%	6.75	6.65	—	—	83%
134	Franchise fees	10.0%	*nil*	nil	—	—	
135	**Subtotal**		18.25	21.03	0	0	49%
136	**CONTINGENCY**	7.4%	17.86	21.08	—	—	37%
137	**TOTAL**		259.13	321.23	2,390	2,889	38%
138	**Total: Quebec component**		99.30	121.80	938	1,142	
139	**Total: Ontario component**		159.83	199.43	1,452	1,747	
140	**[Major maintenance included in capital]**		0.00	26.23			
141	Routine equipment maintenance per trainset km	dollars	1.33	1.33			
142	Infrastructure maintenance per route km	$thousand	40.95	53.33			
143	Executive/administration as a percent of total		10.0%	8.5%			
144	Station/ticketing costs per passenger	Dollars	3.83	3.12			

8.2.2 MOT Stand Alone (Scenario 2)

The initial capital costs are $5.31 billion (43 per cent less than the base case. In 2005, the MOT Stand Alone case is projected to generate an operating profit of $207 millions (38 per cent less than the 200 kph base case) and a revenue/cost ratio of 2.31, compared to 2.28 for the Quebec-Windsor base case.

Although the traffic densities are highest in the MOT segment of the corridor, the fact that the fixed and semi-variable costs of HSR operation are not spread across the three segments largely offsets this advantage.
Executive/administrative costs are projected to account for almost 18 per cent of total O & M costs in 2005, compared to only 14 per cent for the Quebec-Windsor case.

The results for the MOT Stand Alone case are summarized in Table 8.4, while additional data are presented in Appendix D, Table D.4-D.8.

8.2.3 Quebec-Toronto Stand Alone (Scenario 3)

The initial capital costs of this scenario are $7.09 billion (24 per cent less than the 200 kph base case). In 2005, the Quebec-Toronto Stand Alone case is projected to generate an operating profit of $265 million (20 per cent less than the 200 kph base case) and a revenue/cost ratio of 2.29, compared to 2.28 for the Quebec-Windsor base case. The results for the Quebec-Toronto Stand Alone case are summarized in Table 8.5, while additional data are presented in Appendix D, Table D.9-D.13.

8.3 Results for 300 kph

8.3.1 Quebec-Windsor Corridor Base Case (Scenario 5)

In 2005, the 300 kph base case for the Quebec-Windsor corridor is projected to generate $757 million in net revenues [compared to $592 million for the 200 kph base case], while operating and maintenance costs are forecast to be $303 million [200: $259 million], for an operating profit of $454 million [200: $333 million] and a net revenue/O & M costs ratio of 2.50 [200: 2.28]. The initial capital cost of this scenario is $10.25 billion [200: $9.28 billion].

By 2025, the operating profit is projected to rise to $901 million [200: $651 million], and the revenue/cost ratio to 3.37 [200: 3.03]. Over this period, the O & M cost per train-km is projected to fall by 13 per cent, from $18.30 to $15.91, the same rate of improvement as was forecast for the 200 kph base case.

Table 8.4: 200 kph, MOT Stand Alone: Operations/Revenues/Costs

06-Oct-94 — HSR STUDY COST DEVELOPMENT

OPERATIONS/REVENUES/COSTSComposite (via Dorval) at 200 kph MOT Stand Alone

				Year 2005	Year 2025		
		RIDERSHIP					
1	[A]	Adjusted passengers (non-duplicated)	millions	5.6	8.6		
2		Average length of haul	kms	362	370		
3		Passenger kilometres	billion	2.0	3.2		
		OPERATION STATISTICS					
4		Route length	kilometres	610	610		
5		Train trips (one-way)	thousands	10.3	15.1		
6		Trainset kms	millions	10.6	15.4		
7		Seat kms	billions	3.0	4.3	*282 per trainset*	
8		Trainsets in active fleet	units	37	47		
9		Average trainset utilization	k-km/year	286	328		
10		Average load factor		67%	73%		
11		Total energy consumption	gigaW-hrs	128	187		
12		Total employment		1,413	1,732		
		PASSENGER REVENUES					
13		Adjustusted revenues	$million	390.6	647.4		
14		Agency commissions	$million	(21.5)	(35.6)	*5.5% of gross revenue*	
15		Credit card discount	$million	(3.7)	(6.1)	*0.9% of gross revenue*	
16		Net Revenue	$million	365.4	605.7		
		OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17		Train operations	$million	19.9	26.5	156	199
18		Customer services	$million	44.6	54.0	431	546
19		Equipment maintenance	$million	21.9	30.9	330	455
20		Infrastructure maintenance	$million	33.4	43.3	362	383
21		Executive/administration	$million	16.4	17.4	135	150
22		Insurance/taxes/other	$million	11.5	12.6	0	0
23		Contingency	$million	10.8	13.1	—	—
24		**Total O&M Costs**	$million	158.4	197.6	1,413	1,732
25		**OPERATING PROFIT**		207.1	408.0		
26		**COST/REVENUE RATIOS**					
27		Net revenue : O&M costs Ratio		2.31	3.06		
28		O&M cost per trainset-km	dollars	14.96	12.81		
29		O&M cost per seat-km	cents	5.31	4.54		
30		O&M cost per passenger	dollars	28.44	22.90		
31		O&M cost per passenger-km	cents	7.86	6.18		
32		Net revenue per passenger	dollars	65.62	70.19		
33		Net revenue per passenger km	cents	18.14	18.95		
		CAPITAL COSTS					
34		Startup/admin/training/other "soft" costs	$million	159.6			
35		Construction of track	$million	3,615.4			
36		Construction of stations	$million	443.5			
37		Construction of maintenance facilities	$million	225.8			
38		Acqusition of rolling stock	$million	866.6			
39		**Total Initial Capital Costs**	$million	5,310.9	*over the period 1995 to 2006*		
40		**Total Ongoing Capital Costs**	$million	605.7	*over the period 2007 to 2025*		
41		Initial capital per route-km (exduding RS)	$million	7.29			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	122.60	242.81	203.21	402.48
902	O and M Costs	52.69	105.67	64.24	133.41
903	Employment	488	926	606	1,126

Table 8.5: 200 kph, Quebec-Toronto Stand Alone: Operations/Revenues/Costs

06-Oct-94 — HSR STUDY COST DEVELOPMENT

OPERATIONS/REVENUES/COSTSComposite (via Dorval) at 200 kph QT Segment

			Year 2005	Year 2025		
	RIDERSHIP					
1 [A]	Adjusted passengers (non-duplicated)	millions	7.5	11.5		
2	Average length of haul	kms	344	351		
3	Passenger kilometres	billion	2.6	4.0		
	OPERATION STATISTICS					
4	Route length	kilometres	884	884		
5	Train trips (one-way)	thousands	15.4	22.0		
6	Trainset kms	millions	13.6	19.5		
7	Seat kms	billions	3.8	5.5	*282 per trainset*	
8	Trainsets in active fleet	units	47	63		
9	Average trainset utilization	k-km/year	289	310		
10	Average load factor		67%	73%		
11	Total energy consumption	gigaW-hrs	167	239		
12	Total employment		1,872	2,285		
	PASSENGER REVENUES					
13	Adjustusted revenues	$million	504.0	834.6		
14	Agency commissions	$million	(27.7)	(45.9)	*5.5% of gross revenue*	
15	Credit card discount	$million	(4.7)	(7.8)	*0.9% of gross revenue*	
16	Net Revenue	$million	471.5	780.9		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	$million	26.0	34.3	206	260
18	Customer services	$million	56.5	68.8	578	728
19	Equipment maintenance	$million	28.0	39.2	429	593
20	Infrastructure maintenance	$million	46.4	59.2	497	524
21	Executive/administration	$million	20.1	21.4	187	209
22	Insurance/taxes/other	$million	15.0	16.9	0	0
23	Contingency	$million	14.2	17.1	—	—
24	**Total O&M Costs**	$million	206.1	257.0	1,872	2,285
25	**OPERATING PROFIT**		265.4	523.9		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.29	3.04		
28	O&M cost per trainset-km	dollars	15.20	13.15		
29	O&M cost per seat-km	cents	5.39	4.66		
30	O&M cost per passenger	dollars	27.66	22.34		
31	O&M cost per passenger-km	cents	8.04	6.36		
32	Net revenue per passenger	dollars	63.28	67.88		
33	Net revenue per passenger km	cents	18.39	19.32		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	$million	206.6			
35	Construction of track	$million	5,004.4			
36	Construction of stations	$million	491.2			
37	Construction of maintenance facilities	$million	262.0			
38	Acqusition of rolling stock	$million	1,124.3			
39	**Total Initial Capital Costs**	$million	7,088.6	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	$million	837.7	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	$million	6.75			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	221.27	250.27	364.42	416.47
902	O and M Costs	97.23	108.91	118.95	138.06
903	Employment	915	957	1,110	1,175

The forecast breakdown of O & M costs for the 300 kph base case in 2005 and 2025 is as follows:

	2005	2025
▸ train operations	14 %	15 %
▸ customer services	26 %	26 %
▸ equipment maintenance	15 %	17 %
▸ infrastructure maintenance	24 %	24 %
▸ executive/administration	8 %	7 %
▸ other (insurance, property tax)	6 %	6 %
▸ contingency	7 %	7 %

This cost breakdown is very similar to that of the 200 kph base case. Because the fixed costs are spread over a larger traffic base, they account for a slightly smaller percentage of O & M costs.

The results for the 300 kph base case for the Quebec-Windsor corridor are summarized in Tables 8.6 [capital costs], 8.7 [operations/revenues/costs] and 8.8 [operations cost breakdown]. Data on ridership breakdown, employment and cashflow breakdown are presented in Appendix D, tables D.14, D.15 and D.16.

8.3.2 MOT Stand Alone via Mirabel (Scenario 6)

The initial capital costs of this scenario are $5.95 billion (42 per cent less than the 300 kph base case. In 2005, the MOT Stand Alone case is projected to generate an operating profit of $285 millions (37 per cent less than the base case) and a revenue/cost ratio of 2.53, compared to 2.50 for the Quebec-Windsor base case.

The results for the MOT Stand Alone case are summarized in Table 8.9, while additional data are presented in Appendix D, Table D.17-D.21.

Table 8.6: 300 kph, Quebec-Windsor Corridor: Capital Costs

~~06-Oct-94~~ **HSR STUDY COST DEVELOPMENT**

CAPITAL COST SUMMARY **Composite (via Mirabel) at 300 kph QW Corridor**

		Base Costs	*Professional Services*	Contin-gency	Total
201	Right-of-Way	398.18	42.80	47.67	488.65
202	Earthworks/subgrade	1,353.60	334.41	203.04	1,891.05
203	Bridges	557.05	100.90	55.70	713.66
204	Grade separations	1,203.91	227.98	180.59	1,612.48
205	Other accommodations	105.98	22.69	31.80	160.47
206	Track	881.78	134.58	45.76	1,062.11
207	Power distribution system	673.41	127.52	101.01	901.94
208	Stations	303.20	54.92	30.32	388.44
209	People movers (included in stations)	0.00	0.00	0.00	0.00
210	Signals	427.95	97.51	64.19	589.65
211	Communications	197.07	44.90	29.56	271.53
212	Equipment maintenance facilities	160.04	14.84	22.26	197.13
213	Infrastructure maintenance facilities	133.47	0.00	0.00	133.47
214	Information/ticketing systems	46.90	0.00	0.00	46.90
215	Rolling stock	1,290.34	113.33	126.33	1,530.00
216	Commissioning	0.00	105.63	0.00	105.63
217	Administration allowance	93.16	0.00	0.00	93.16
218	Startup and training	67.58	0.00	0.00	67.58
219	**TOTAL INITIAL CAPITAL COSTS**	7,893.63	1,422.02	938.22	10,253.87
220	**Additional fleet requirements**	*year 2009*	4 units		120.00
221		*year 2013*	4 units		120.00
222		*year 2017*	4 units		120.00
223		*year 2021*	3 units		90.00
224		*Total*	15 units		450.00
225	**Rolling Stock Overhauls**	*total, years 2005-2025*			509.34
226	**Infrastructure Renewal**	*total, years 2005-2025*			0.00
227	**Other ongoing capital**	*total, years 2005-2025*			210.67
228	*Cross check initial capital*				*(0.00)*

Table 8.7: 300 kph, Quebec-Windsor: Operations/Revenues/Costs

06-Oct-94 HSR STUDY COST DEVELOPMENT

OPERATIONS/REVENUES/COSTSComposite (via Mirabel) at 300 kph QW Corridor

			Year 2005	Year 2025		
	RIDERSHIP					
1	[A] Adjusted passengers (non-duplicated)	millions	11.8	18.5		
2	Average length of haul	kms	340	345		
3	Passenger kilometres	billion	4.0	6.4		
	OPERATION STATISTICS					
4	Route length	kilometres	1,234	1,234		
5	Train trips (one-way)	thousands	20.1	29.5		
6	Trainset kms	millions	16.5	23.9		
7	Seat kms	billions	5.9	8.5	*358 per trainset*	
8	Trainsets in active fleet	units	50	66		
9	Average trainset utilization	k-km/year	331	361		
10	Average load factor		67%	75%		
11	Total energy consumption	gigaW-hrs	403	579		
12	Total employment		2,714	3,320		
	PASSENGER REVENUES					
13	Adjustusted revenues	$million	808.9	1,368.1		
14	Agency commissions	$million	(44.5)	(75.2)	*5.5% of gross revenue*	
15	Credit card discount	$million	(7.6)	(12.8)	*0.9% of gross revenue*	
16	Net Revenue	$million	756.9	1,280.0		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	$million	43.3	58.0	229	287
18	Customer services	$million	78.5	97.3	794	1,006
19	Equipment maintenance	$million	45.4	63.7	711	981
20	Infrastructure maintenance	$million	72.4	89.6	787	832
21	Executive/administration	$million	24.2	25.6	219	243
22	Insurance/taxes/other	$million	18.3	21.3	0	0
23	Contingency	$million	20.8	23.8	—	—
24	**Total O&M Costs**	$million	302.8	379.4	2,714	3,320
25	**OPERATING PROFIT**		454.0	900.6		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.50	3.37		
28	O&M cost per trainset-km	dollars	18.30	15.91		
29	O&M cost per seat-km	cents	5.11	4.44		
30	O&M cost per passenger	dollars	25.76	20.46		
31	O&M cost per passenger-km	cents	7.58	5.93		
32	Net revenue per passenger	dollars	64.39	69.03		
33	Net revenue per passenger km	cents	18.96	20.00		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	$million	266.4			
35	Construction of track	$million	7,691.5			
36	Construction of stations	$million	435.3			
37	Construction of maintenance facilities	$million	330.6			
38	Acqusition of rolling stock	$million	1,530.0			
39	**Total Initial Capital Costs**	$million	10,253.9	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	$million	1,161.3	*over the period 2007 to 2025*		
41	Initial capital per route-km (exduding RS)	$million	7.07			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	273.02	483.83	462.99	817.02
902	O and M Costs	122.27	180.57	152.01	227.43
903	Employment	1,121	1,593	1,366	1,954

Table 8.8: 300 kph, Quebec-Windsor: Operations Cost Breakdown

06-Oct-94 HSR STUDY COST DEVELOPMENT

OPERATIONS COST BREAKDOWN Composite (via Mirabel) at 300 kph QW Corridor

		Cont Allow	Cost Estimate ($ million) 2005	2025	Employment Estimate 2005	2025	Quebec Share 2005
	TRAIN OPERATIONS						
101	Train crew	5.0%	11.58	15.50	161	215	41%
102	Power–demand charges	2.5%	11.96	15.71	—	—	30%
103	Power–energy consumption	2.5%	15.45	22.22	—	—	28%
104	Control centre	5.0%	2.38	2.38	40	40	50%
105	Transportation administration/supervision	5.0%	1.98	2.23	29	33	49%
106	**Subtotal**		43.35	58.04	229	287	34%
	CUSTOMER SERVICES						
107	On-board service staff	10.0%	7.13	10.28	166	240	43%
108	On-board service supplies	5.0%	2.02	3.18	—	—	39%
109	On-board services ground support	10.0%	1.31	1.89	33	48	43%
110	Food/beverage for sale	0.0%	0.00	0.00	—	—	—
111	Station operations	10.0%	21.22	23.16	300	357	30%
112	ATM/Ticketing/Reservations transactions	5.0%	15.72	24.57	—	—	36%
113	Telephone/Counter Sales	5.0%	5.28	6.81	149	192	35%
114	Advertising and promotion expenses	5.0%	16.18	16.18	—	—	37%
115	Customer service administration/supervision	5.0%	9.60	11.19	146	169	49%
116	**Subtotal**		78.46	97.27	794	1,006	37%
	EQUIPMENT MAINTENANCE						
117	Routine maintenance–labour	5.0%	15.19	21.69	302	431	50%
118	Routine maintenance–material	5.0%	15.38	22.24	—	—	50%
119	Major maintenance [included in capital]	—	—	—	—	—	—
120	Cleaning	5.0%	10.35	14.12	337	461	42%
121	Maintenance administration/supervision	5.0%	4.51	5.70	72	89	50%
122	**Subtotal**		45.43	63.75	711	981	48%
	INFRASTRUCTURE MAINTENANCE						
123	Routine maintenance	15.0%	38.72	40.48	634	675	37%
124	Purchased services	15.0%	20.87	16.21	—	—	37%
125	Materials	10.0%	2.20	21.99	—	—	36%
126	Programmed replacement [occurs after 2025]	—	—	—	—	—	
127	Maintenance administration/supervision	5.0%	10.62	10.97	153	158	35%
128	**Subtotal**		72.42	89.65	787	832	37%
	EXECUTIVE/ADMINISTRATION						
129	Labour and related	5.0%	13.27	14.73	193	214	49%
130	Other	5.0%	10.90	10.90	—	—	50%
131	**Subtotal**		24.17	25.63	193	214	49%
	INSURANCE/TAXES/OTHER						
132	Insurance/claims	0.0%	11.50	14.61	—	—	37%
133	Property taxes	10.0%	6.75	6.65	—	—	83%
134	Franchise fees	10.0%	*nil*	nil	—	—	
135	**Subtotal**		18.25	21.26	0	0	54%
136	**CONTINGENCY**	7.4%	20.76	23.85	—	—	40%
137	**TOTAL**		302.83	379.45	2,714	3,320	40%
138	**Total: Quebec component**		122.27	152.01	1,121	1,366	
139	**Total: Ontario component**		180.57	227.43	1,593	1,954	
140	**[Major maintenance included in capital]**		0.00	17.81			
141	Routine equipment maintenance per trainset km	dollars	1.85	1.84			
142	Infrastructure maintenance per route km	$thousand	50.06	63.75			
143	Executive/administration as a percent of total		8.6%	7.2%			
144	Station/ticketing costs per passenger	Dollars	3.56	2.91			

Table 8.9: 300 kph, MOT Stand Alone: Operations/Revenues/Costs

06-Oct-94 **HSR STUDY COST DEVELOPMENT**

OPERATIONS/REVENUES/COSTSComposite (via Mirabel) at 300 kph MOT [stand-alone]

			Year 2005	Year 2025		
	RIDERSHIP					
1	Passengers	*millions*	6.58	10.56		
2	Average length of haul	*kms*	390	396		
3	Passenger kilometres	*billion*	2.56	4.18		
	OPERATION STATISTICS					
4	Route length	*kilometres*	629	629		
5	Train trips (one-way)	*thousands*	9.64	14.82		
6	Trainset kms	*millions*	10.61	15.64		
7	Seat kms	*billions*	3.80	5.60	*358*	*per trainset*
8	Trainsets in active fleet	*units*	32	41		
9	Average trainset utilization	*k-km/year*	331	382		
10	Load factor		68%	75%		
11	Total energy consumption	*gigaW-hrs*	254	375		
12	Total employment		1,615	2,005		
	PASSENGER REVENUES					
13	Gross Revenues	*$million*	502.54	858.44		
14	Agency commissions	*$million*	(27.64)	(47.21)	*5.5%*	*of gross revenue*
15	Credit card discount	*$million*	(4.71)	(8.05)	*0.9%*	*of gross revenue*
16	**Net Revenue**	*$million*	470.19	803.18		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	*$million*	26.79	36.35	140	179
18	Customer services	*$million*	49.38	60.90	460	596
19	Equipment maintenance	*$million*	29.06	41.29	443	614
20	Infrastructure maintenance	*$million*	39.96	50.91	438	466
21	Executive/administration	*$million*	16.35	17.44	135	151
22	Insurance/taxes/other	*$million*	11.50	12.71	0	0
23	Contingency	*$million*	12.51	15.25	—	—
24	**Total O&M Costs**	*$million*	185.55	234.85	1,615	2,005
25	**OPERATING PROFIT**		284.63	568.33		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.53	3.42		
28	O&M cost per trainset-km	*dollars*	17.49	15.01		
29	O&M cost per seat-km	*cents*	4.89	4.19		
30	O&M cost per passenger	*dollars*	28.18	22.24		
31	O&M cost per passenger-km	*cents*	7.23	5.62		
32	Net revenue per passenger	*dollars*	71.41	76.05		
33	Net revenue per passenger km	*cents*	18.33	19.21		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	*$million*	167.33			
35	Construction of track	*$million*	4,215.47			
36	Construction of stations	*$million*	357.84			
37	Construction of maintenance facilities	*$million*	247.50			
38	Acquisition of rolling stock	*$million*	960.00			
39	**Total Initial Capital Costs**	*$million*	5,948.15	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	*$million*	711.22	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	*$million*	7.93			

8.3.3 Quebec-Toronto Stand Alone (Scenario 7)

The initial capital costs of this scenario are $7.81 billion (24 per cent less than the 300 kph base case). In 2005, the Quebec-Toronto Stand Alone case is projected to generate an operating profit of $366 million (19 per cent less than the 300 kph base case) and a revenue/cost ratio of 2.52, compared to 2.50 for the Quebec-Windsor base case.

The results for the Quebec-Toronto Stand Alone case are summarized in Table 8.10, while additional data are presented in Appendix D, Table D.22-D.26.

8.4 Sensitivity Analysis

8.4.1 250 kph and 350 kph (Scenarios 4 and 8)

250 kph (Scenario 4)

The 250 kph scenario (see Table 8.11) is projected to produce significant improvements in trip time compared to the 200 kph base case: 14 minutes for Montreal-Quebec, 29 minutes for Montreal-Toronto and 20 minutes for Toronto-Windsor, giving rise to a 15 per cent increase in projected ridership. Because O & M costs are forecast to increase by only 10 per cent (only train operations costs increase proportionately with ridership), both operating profits and net revenue: O & M cost ratio improve. Capital costs are projected to be eight per cent higher than for the 200 kph base case, the increases primarily affecting grade separation, signalling and rolling stock. Additional details on the results of the 250 kph scenario are provided in Appendix D, Tables D.27 and D.28.

Table 8.11: Summary of Results of the 250 kph Scenario

	Units	200 kph Scenario		250 kph Scenario	
		2005	2025	2005	2025
Capital Costs [Initial/Ongoing]	$ Billions	9.28	1.05	10.04	1.12
Net revenues	$ Millions	592	972	712	1,151
O & M costs	$ Millions	259	321	285	353
Operating Profit	$ Millions	333	651	427	799
Net revenue/O & M cost ratio		2.28	3.03	2.50	3.26
O & M cost/seat-km	Cents	5.46	4.74	5.25	4.58

Table 8.10: 300 kph, Quebec-Toronto Stand Alone: Operations/Revenues/Costs

06-Oct-94 **HSR STUDY COST DEVELOPMENT**

OPERATIONS/REVENUES/COSTSComposite (via Mirabel) at 300 kph QT Segment

			Year 2005	Year 2025		
	RIDERSHIP					
1 [A]	Adjusted passengers (non-duplicated)	millions	8.8	13.9		
2	Average length of haul	kms	369	375		
3	Passenger kilometres	billion	3.2	5.2		
	OPERATION STATISTICS					
4	Route length	kilometres	885	885		
5	Train trips (one-way)	thousands	14.5	21.4		
6	Trainset kms	millions	13.4	19.5		
7	Seat kms	billions	4.8	7.0	*358 per trainset*	
8	Trainsets in active fleet	units	40	52		
9	Average trainset utilization	k-km/year	336	375		
10	Average load factor		67%	75%		
11	Total energy consumption	gigaW-hrs	325	471		
12	Total employment		2,128	2,615		
	PASSENGER REVENUES					
13	Adjustusted revenues	$million	647.7	1,102.0		
14	Agency commissions	$million	(35.6)	(60.6)	*5.5% of gross revenue*	
15	Credit card discount	$million	(6.1)	(10.3)	*0.9% of gross revenue*	
16	Net Revenue	$million	606.0	1,031.0		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	$million	34.5	46.4	183	230
18	Customer services	$million	62.7	77.6	616	789
19	Equipment maintenance	$million	36.8	51.7	570	782
20	Infrastructure maintenance	$million	55.0	68.9	600	635
21	Executive/administration	$million	20.1	21.4	187	209
22	Insurance/taxes/other	$million	15.0	17.0	0	0
23	Contingency	$million	16.4	19.8	—	—
24	**Total O&M Costs**	$million	240.5	302.8	2,128	2,615
25	**OPERATING PROFIT**		365.5	728.3		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.52	3.41		
28	O&M cost per trainset-km	dollars	17.90	15.51		
29	O&M cost per seat-km	cents	5.00	4.33		
30	O&M cost per passenger	dollars	27.43	21.74		
31	O&M cost per passenger-km	cents	7.43	5.80		
32	Net revenue per passenger	dollars	69.14	74.04		
33	Net revenue per passenger km	cents	18.73	19.75		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	$million	215.1			
35	Construction of track	$million	5,679.4			
36	Construction of stations	$million	397.5			
37	Construction of maintenance facilities	$million	283.8			
38	Acqusition of rolling stock	$million	1,230.0			
39	**Total Initial Capital Costs**	$million	7,805.8	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	$million	888.8	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	$million	7.43			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	279.94	326.05	474.40	556.63
902	O and M Costs	119.40	121.06	147.86	154.91
903	Employment	1,092	1,037	1,321	1,294

350 kph (Scenario 8)

The 350 kph scenario appears slightly more financially attractive than the 300 kph base case (see Table 8.12). The only additional capital is for rolling stock. Revenue is projected to increase by 9 per cent from the 300 kph base case, while O & M costs are projected to rise by 6 per cent. The main factor here is a 21 per cent increase in the cost of train operations, a result which is largely driven by higher energy consumption (+27 per cent per seat-km, compared to 300 kph). The net revenue: O & M cost ratio is slightly improved compared to the 300 kph base case. Additional details on the results of the 350 kph scenario are provided in Appendix D, Tables D.29 and D.30.

Table 8.12: Summary of Results of the 350 kph Scenario

	Units	300 kph Scenario		350 kph Scenario	
		2005	2025	2005	2025
Capital Costs [Initial/ongoing]	$ Billions	10.25	1.16	10.31	1.18
Net revenues	$ Millions	757	1,280	825	1,360
O & M costs	$ Millions	303	379	321	404
Operating Profit	$ Millions	454	901	503	956
Net revenue/O & M cost ratio		2.50	3.37	2.57	3.37
O & M cost/seat-km	cents	5.11	4.44	5.13	4.44

8.4.2 300 kph via Dorval (Scenarios 9 and 10)

Two scenarios were costed for 300 kph technology operating over the Dorval routing: a full corridor scenario and a Montreal-Ottawa-Toronto scenario. The Dorval routing is approximately 20 km shorter between Montreal and Toronto.

Table 8.13: Summary of Results for 300 kph via Mirabel and via Dorval: 2005

	Units	Quebec-Windsor		Montreal-Ottawa-Toronto	
		via Dorval	via Mirabel	via Dorval	via Mirabel
Initial Capital Costs	$ Billions	10.40	10.25	5.95	5.95
Net revenues	$ Millions	805	757	511	470
O & M costs	$ Millions	306	303	188	186
Operating Profit	$ Millions	499	454	323	285
Net revenue/O & M cost ratio		2.63	2.50	2.72	2.53
O & M cost/seat-km	cents	5.13	5.11	4.87	4.89

Table 8.13 provides a comparative summary between the results of the Mirabel and Dorval routings for Quebec-Windsor and MOT for the year 2005. The Dorval routing requires higher initial capital costs: the costs of a people mover at Dorval station, a massive structure at Hudson and more complex grade separations more than compensate for the savings due to the shorter route. In terms of operating results, the Dorval routing is more attractive: revenues are higher, because of shorter trip times, while O & M costs are comparable to those on the Mirabel routing. Tables D.31 and D.32 provide additional information.

8.4.3 Reduced Cost Scenario (Scenario 11)

A Reduced Cost Scenario was developed for Montreal-Ottawa-Toronto at 300 kph. This followed a South shore routing between Montreal and Ottawa, did not extend to Pearson, and did not include connect air service.

The initial capital cost of the Reduced Cost Scenario is estimated to be $5.20 billion, a saving of $750 million (14 per cent) over the regular 300 kph MOT via Dorval scenario. In 2005, the Reduced Cost Scenario case is projected to generate an operating profit of $471 million ($28 million or 6 per cent less than the regular 300 kph MOT via Dorval case) and a revenue/cost ratio of 2.65, compared to 2.72 for the regular MOT via Dorval case.

The results for the Reduced Cost Scenario are summarized in Table 8.14, while additional data are presented in Appendix D, Table D.31-D.35.

Table 8.14: 300 kph, Reduced Cost Scenario: Operations/Revenues/Costs

06-Oct-94 HSR STUDY COST DEVELOPMENT

OPERATIONS/REVENUES/COSTSReduced (via Dorval) at 300 kph MOT Stand Alone

			Year 2005	Year 2025		
	RIDERSHIP					
1 [A]	Adjusted passengers (non-duplicated)	millions	6.6	10.6		
2	Average length of haul	kms	378	385		
3	Passenger kilometres	billion	2.5	4.1		
	OPERATION STATISTICS					
4	Route length	kilometres	586	586		
5	Train trips (one-way)	thousands	9.6	14.4		
6	Trainset kms	millions	9.9	14.3		
7	Seat kms	billions	3.5	5.1	*358 per trainset*	
8	Trainsets in active fleet	units	28	37		
9	Average trainset utilization	k-km/year	353	387		
10	Average load factor		70%	80%		
11	Total energy consumption	gigaW-hrs	237	343		
12	Total employment		1,519	1,889		
	PASSENGER REVENUES					
13	Adjustusted revenues	$million	503.8	868.6		
14	Agency commissions	$million	(27.7)	(47.8)	*5.5% of gross revenue*	
15	Credit card discount	$million	(4.7)	(8.1)	*0.9% of gross revenue*	
16	Net Revenue	$million	471.4	812.7		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	$million	26.2	35.2	136	173
18	Customer services	$million	48.3	59.8	435	566
19	Equipment maintenance	$million	27.0	38.2	407	568
20	Infrastructure maintenance	$million	36.9	45.5	407	431
21	Executive/administration	$million	16.4	17.5	135	151
22	Insurance/taxes/other	$million	11.5	12.7	0	0
23	Contingency	$million	11.9	14.3	—	—
24	**Total O&M Costs**	$million	178.2	223.1	1,519	1,889
25	**OPERATING PROFIT**		293.2	589.6		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.65	3.64		
28	O&M cost per trainset-km	dollars	18.03	15.57		
29	O&M cost per seat-km	cents	5.04	4.35		
30	O&M cost per passenger	dollars	27.10	20.98		
31	O&M cost per passenger-km	cents	7.17	5.45		
32	Net revenue per passenger	dollars	71.70	76.42		
33	Net revenue per passenger km	cents	18.97	19.87		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	$million	152.4			
35	Construction of track	$million	3,859.2			
36	Construction of stations	$million	108.9			
37	Construction of maintenance facilities	$million	235.7			
38	Acqusition of rolling stock	$million	840.0			
39	**Total Initial Capital Costs**	$million	5,196.1	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	$million	665.7	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	$million	7.44			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	158.16	313.25	272.67	540.03
902	O and M Costs	58.05	120.13	70.93	152.16
903	Employment	526	993	655	1,235

8.5 Summary of Results

The principal results of each scenario are summarized in Table 8.15 for 2005.

Table 8.15: Summary of Results: 2005

	Description	Initial Capital ($ Billions)	Net Revenue ($ Millions)	O & M Costs ($ Millions)	Rev/Cost Ratio	O & M Cost/seat-km (cents)	Employment (O & M)
1	QW,200,Dor	9.28	592	259	2.28	5.46	2,419
2	MT,200,Dor	5.31	365	158	2.31	5.31	1,413
3	QT,200,Dor	7.09	472	206	2.29	5.39	1,872
4	QW,250,Dor	9.41	712	285	2.50	5.25	2,646
5	QW,300,Mir	10.25	757	303	2.50	5.11	2,733
6	MT,300,Mir	5.95	471	186	2.53	4.89	1,615
7	QT,300,Mir	7.81	606	241	2.52	5.00	2,128
8	QW,350,Mir	10.31	825	321	2.57	5.13	2,767
9	QW,300,Dor	10.40	805	306	2.63	5.13	2,749
10	MT,300,Dor	5.95	511	188	2.72	4.87	1,620
11	MT,300,Dor*	5.20	471	178	2.65	5.04	1,519

The shaded scenarios are the base cases for each option.

* No Connect Air, no service to Pearson.

As a result of the projected growth in traffic between 2005 and 2025, significant improvements are anticipated in system productivity. These should translate into reductions in costs per unit of activity, leading to increases in operating profits and the ratio of net revenues to O & M costs, as illustrated in Table 8.16.

Table 8.16: Productivity and Cost Improvements: 2005-2025

Scenario	LABOUR PRODUCTIVITY Passenger-kms per Employee			UNIT COSTS O & M Costs/seat-km ($)			OPERATING PROFITABILITY Net passenger revenue/O & M costs		
	2005	2025	Change	2005	2025	Change	2005	2025	Change
1 QW,200,D	1,315	1,727	31%	5.46	4.74	-13%	2.28	3.03	33%
2 MT,200,D	1,423	1,848	30%	5.31	4.54	-15%	2.31	3.06	32%
3 QT,200,D	1,368	1,768	29%	5.39	4.66	-14	2.29	3.04	33%
4 QW,250,D	1,429	1,910	34%	5.25	4.58	-13%	2.50	3.26	30%
5 QW,300,M	1,460	1,928	32%	5.11	4.44	-13%	2.50	3.37	35%
6 MT,300,M	1,585	2,085	32%	4.89	4.19	-14%	2.53	3.42	35%
7 QT,300,M	1,518	1,996	32%	5.00	4.33	-13%	2.52	3.41	35%
8 QW,350,M	1,554	2,062	33%	5.13	4.44	-13%	2.57	3.37	31%
9 QW,300,D	1,510	1,981	31%	5.13	4.45	-13%	2.63	3.51	33%
10 MT,300,D	1,660	2,173	31%	4.87	4.24	-13%	2.72	3.68	35%
11 MT,300,D*	1,639	2,165	32%	5.04	4.35	-14%	2.65	3.64	37%

The shaded scenarios are the base cases for each option.

* No Connect Air, no service to Pearson.

Quebec/Ontario revenue and cost allocations are shown in Table 8.17 for 2005.

Table 8.17: Quebec/Ontario Revenue and O & M Cost Allocations: 2005
Million Dollars

Scenario	Revenues				O & M Costs			
	Quebec	%	Ontario	%	Quebec	%	Ontario	%
1 QW,200,D	214	36%	378	64%	99	38%	159	62%
2 MT,200,D	123	34%	243	66%	53	33%	106	67%
3 QT,200,D	221	47%	250	53%	97	47%	109	53%
4 QW,250,D	257	36%	455	64%	108	38%	177	62%
5 QW,300,M	273	36%	484	64%	122	40%	180	60%
6 MT,300,M	158	34%	312	66%	69	37%	116	63%
7 QT,300,M	280	46%	326	54%	119	50%	121	50%
8 QW,350,M	298	36%	527	64%	129	40%	193	60%
9 QW,300,D	290	36%	515	64%	115	38%	189	62%
10 MT,300,D	171	34%	339	66%	60	32%	128	68%
11 MT,300,D*	158	34%	313	66%	58	33%	120	67%

* No Connect Air, no service to Pearson

APPENDIX A: TRIP TIMES

Table A.1: Station to Station Times: 300kph, Eastbound

Table A.2: Station to Station Times: 200kph, Eastbound

Table A.3: Trip Times, 300kph, Eastbound

Table A.4: Trip Times, 200kph, Eastbound

Table A.1: Station to Station Times: 300kph, Eastbound

Train type		Local	Express	SuperEx	Through	Local	Express	SuperEx	Through
Route		CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb
Speed		300	300	300	300	350	350	350	350
Windsor	*Dp*								
London	*Ar*	00:41	--	--	00:41	00:35	--	--	00:35
Kitchener	*Ar*	00:24	--	--	00:24	00:21	--	--	00:21
Pearson	*Ar*	00:20	--	--	00:20	00:18	--	--	00:18
Toronto	*Ar*	00:14	01:24	01:24	00:14	00:13	01:14	01:14	00:13
Toronto	*Dp*	00:12	00:12	00:12	00:05	00:12	00:12	00:12	00:05
East Toronto	*Ar*	00:14	--	--	00:14	00:14	--	--	00:14
Kingston	*Ar*	00:53	--	--	00:53	00:48	--	--	00:48
Dummy Station	*Ar*	--	--	--	--	--	--	--	--
Ott/Hull CBD	*Ar*	00:39	01:36	--	00:39	00:34	01:27	--	00:34
Ott/Hull CBD	*Dp*	00:05	00:05	--	00:05	00:05	00:05	--	00:05
Mirabel	*Ar*	00:37	--	--	00:37	00:33	--	--	00:33
Laval	*Ar*	00:14	--	--	00:14	00:13	--	--	00:13
Montreal	*Ar*	00:14	00:57	02:32	--	00:14	00:54	02:19	--
Montreal	*Dp*	*NA*	00:12	00:12	--	*NA*	00:09	00:12	--
Laval	*Ar*	00:12	--	--	00:05	00:12	--	--	00:05
Trois Rivieres	*Ar*	00:32	--	--	00:32	00:29	--	--	00:29
Anc Lor	Ar	00:30	--	--	00:30	00:26	--	--	00:26
Quebec	Ar	00:10	01:12	01:12	00:10	00:10	01:05	01:05	00:10

Table A.2: Station to Station Times: 200kph, Eastbound

Train type / *Route* / *Speed*		Local CMP-Dor 200	Express CMP-Dor 200	SuperEx CMP-Dor 200	Through CMP-Dor 200	Local CMP-Dor 250	Express CMP-Dor 250	SuperEx CMP-Dor 250	Through CMP-Dor 250
Windsor	*Dp*								
London	*Ar*	00:58	--	--	00:58	00:48	--	--	00:48
Kitchener	*Ar*	00:33	--	--	00:33	00:27	--	--	00:27
Pearson	*Ar*	00:24	--	--	00:24	00:21	--	--	00:21
Toronto	*Ar*	00:14	01:56	01:56	00:14	00:13	01:33	01:33	00:13
Toronto	*Dp*	00:12	00:12	00:12	00:05	00:12	00:12	00:12	00:05
East Toronto	*Ar*	00:13	--	--	00:13	00:13	--	--	00:13
Kingston	*Ar*	01:13	--	--	01:13	01:01	--	--	01:01
Dummy Station	*Ar*	--	--	--	--	--	--	--	--
Ott/Hull CBD	*Ar*	00:52	02:10	--	00:52	00:43	01:48	--	00:43
Ott/Hull CBD	*Dp*	00:05	00:05	--	00:05	00:05	00:05	--	00:05
Dorval	*Ar*	00:52	--	--	00:52	00:44	--	--	00:44
Dummy Station	*Ar*	--	--	--	--	--	--	--	--
Montreal	*Ar*	00:10	00:58	03:05	00:10	00:10	00:50	02:34	00:10
Montreal	*Dp*	00:12	00:12	00:12	00:05	00:12	00:12	00:12	00:05
Laval	*Ar*	00:11	--	--	00:11	00:11	--	--	00:11
Trois Rivieres	*Ar*	00:44	--	--	00:44	00:37	--	--	00:37
Anc Lor	Ar	00:41	--	--	00:41	00:34	--	--	00:34
Quebec	Ar	00:09	01:34	01:34	00:09	00:09	01:19	01:19	00:09

Table A.3: Trip Times, 300kph, Eastbound

Train type		Local	Express	SuperEx	Through	Local	Express	SuperEx	Through
Route		CMP-Dor	CMP-Dor	CMP-Dor	CMP-Dor	CMP-Dor	CMP-Dor	CMP-Dor	CMP-Dor
Speed		200	200	200	200	250	250	250	250
Windsor	*Dp*	00:39	00:52	00:52	00:46	00:59	01:15	01:15	01:06
London	*Ar*	01:37	--	--	01:44	01:47	--		01:54
Kitchener	*Ar*	02:10	--	--	02:17	02:14	--		02:21
Pearson	*Ar*	02:34	--	--	02:41	02:35	--		02:42
Toronto	*Ar*	02:48	02:48	02:48	02:55	02:48	02:48	02:48	02:55
Toronto	*Dp*	03:00	03:00	03:00	03:00	03:00	03:00	03:00	03:00
East Toronto	*Ar*	03:13	--	--	03:13	03:13	--	--	03:13
Kingston	*Ar*	04:26	--	--	04:26	04:14	--	--	04:14
Dummy Station	*Ar*	--	--	--	--	--	--	--	--
Ott/Hull CBD	*Ar*	05:18	05:10	--	05:18	04:57	04:48	--	04:57
Ott/Hull CBD	*Dp*	05:23	05:15	--	05:23	05:02	04:53	--	05:02
Dorval	*Ar*	06:15	--	--	06:15	05:46	--	--	05:46
Dummy Station	*Ar*	--	--	--	--	--	--	--	--
Montreal	*Ar*	06:25	06:13	06:05	06:25	05:56	05:43	05:34	05:56
Montreal	*Dp*	06:37	06:25	06:17	06:30	06:08	05:55	05:46	06:01
Laval	*Ar*	06:48	--	--	06:41	06:19	--	--	06:12
Trois Rivieres	*Ar*	07:32	--	--	07:25	06:56	--	--	06:49
Anc Lor	Ar	08:13	--	--	08:06	07:30	--	--	07:23
Quebec	Ar	08:22	07:59	07:51	08:15	07:39	07:14	07:05	07:32

Table A.4: Trip Times, 200kph, Eastbound

Train type		Local	Express	SuperEx	Through	Local	Express	SuperEx	Through
Route		CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb	CMP-Mirb
Speed		300	300	300	300	350	350	350	350
Windsor	*Dp*	01:09	01:24	01:24	01:16	01:21	01:34	01:34	01:28
London	*Ar*	01:50	--	--	01:57	01:56	--		02:03
Kitchener	*Ar*	02:14	--	--	02:21	02:17	--		02:24
Pearson	*Ar*	02:34	--	--	02:41	02:35	--		02:42
Toronto	*Ar*	02:48	02:48	02:48	02:55	02:48	02:48	02:48	02:55
Toronto	*Dp*	03:00	03:00	03:00	03:00	03:00	03:00	03:00	03:00
East Toronto	*Ar*	03:14	--	--	03:14	03:14	--	--	03:14
Kingston	*Ar*	04:07	--	--	04:07	04:02	--	--	04:02
Dummy Station	*Ar*	--	--	--	--	--	--	--	--
Ott/Hull CBD	*Ar*	04:46	04:36	--	04:46	04:36	04:27	--	04:36
Ott/Hull CBD	*Dp*	04:51	04:41	--	04:51	04:41	04:32	--	04:41
Mirabel	*Ar*	05:28	--	--	05:28	05:14	--	--	05:14
Laval	*Ar*	05:42	--	--	05:42	05:27	--	--	05:27
Montreal	*Ar*	05:56	05:38	05:32	--	05:41	05:26	05:19	--
Montreal	*Dp*	05:40	05:50	05:44	--	05:25	05:35	05:31	--
Laval	*Ar*	05:52	--	--	--	05:37	--	--	--
Trois Rivieres	*Ar*	06:24	--	--	06:19	06:06	--	--	06:01
Anc Lor	Ar	06:54	--	--	06:49	06:32	--	--	06:27
Quebec	Ar	07:04	07:02	06:56	06:59	06:42	06:40	06:36	06:37

APPENDIX B: SCHEDULES

Table B.1: 2005 Operating Plan: 300 kph: Montreal-Quebec

Table B.2: 2005 Operating Plan: 300 kph: Montreal-Ottawa-Toronto

Table B.3: 2005 Operating Plan: 300 kph: Southwestern Ontario

Table B.1: 2005 Operating Plan: 300 kph: Montreal-Quebec

Weekday Departures Montreal-Quebec Segment *Composite Forecasts*

Timeslot	WESTBOUND		EASTBOUND	
Start				
06:00 AM				
	Que-Laval-(Toronto)			
07:00 AM	Quebec-Montreal (L)		Montreal-Quebec (L)	
	Quebec-Montreal (X)			
08:00 AM	Quebec-Montreal (L)		Montreal-Quebec (L)	
	Quebec-Montreal (X)			
09:00 AM	Quebec-Montreal (L)		(Toronto)-Laval-Quebec (	On-season only
10:00 AM	Quebec-Montreal (L)		Montreal-Quebec (L)	
11:00 AM	Quebec-Montreal (L)	On-season only	Montreal-Quebec (L)	
12:00 PM	Quebec-Montreal (L)		Montreal-Quebec (L)	On-season only
01:00 PM	Quebec-Montreal (L)		Montreal-Quebec (L)	
02:00 PM	Quebec-Montreal (L)	On-season only	Montreal-Quebec (L)	
03:00 PM	Quebec-Montreal (L)		Montreal-Quebec (L)	
			Montreal-Quebec (X)	Fridays/On-season only
04:00 PM	Quebec-Montreal (L)		Montreal-Quebec (L)	
			Montreal-Quebec (X)	
05:00 PM	Quebec-Montreal (L)		Montreal-Quebec (L)	
			Montreal-Quebec (X)	
06:00 PM	Quebec-Montreal (L)	Fridays/Seasonal to Toronto	Montreal-Quebec (L)	
			Montreal-Quebec (X)	Possible seasonal extra
07:00 PM	Quebec-Montreal (L)		(Toronto)-Laval-Quebec	
08:00 PM	Quebec-Montreal (L)	Possible extra	Montreal-Quebec (L)	Possible extra
09:00 PM				
10:00 PM				
End				

Table B.2: 2005 Operating Plan: 300 kph: Montreal-Ottawa-Toronto

Weekday Departures Montreal-Ott/Hull-Trnto Ontario Segment

Composite Forecasts

Timeslot	WESTBOUND		EASTBOUND	
Start				
06:00 AM	Mtl-Ott/Hull-Trnto (L)			
	Ott/Hull-Trnto (L)	Seasonal only	Trnto-Ott/Hull-Mtl (L)	
07:00 AM	Mtl-Ott/Hull-Trnto (L)		Trnto-Ott/Hull (X)	Seasonal only
	Mtl-Ott/Hull-Trnto (SX)		Trnto-Ott/Hull-Mtl (L)	
	Ott/Hull-Trnto (X)		Trnto-Ott/Hull-Mtl (SX)	
	(Que)-Laval-O/H-Trnto		Trnto-Ott/Hull (X)	
08:00 AM	Mtl-Ott/Hull-Trnto (L)		Trnto-O/H-Laval-(Que)	Seasonal only
	Mtl-Ott/Hull-Trnto (X)		Trnto-Ott/Hull-Mtl (L)	
	Kingston-Toronto		Trnto-Ott/Hull-Mtl (X)	
	Ott/Hull-Trnto (L)		Trnto-Ott/Hull (L)	
09:00 AM	Mtl-Ott/Hull-Trnto (L)			
	Ott/Hull-Trnto (L)		Trnto-Ott/Hull-Mtl (L)	
	Mtl-Ott/Hull-Trnto (X)	Seasonal only		
10:00 AM	Mtl-Ott/Hull-Trnto (L)		Trnto-Ott/Hull-Mtl (X)	Seasonal only
11:00 AM	Mtl-Ott/Hull-Trnto (L)		Trnto-Ott/Hull-Mtl (L)	
	Ott/Hull-Trnto (L)	Seasonal only	Trnto-Ott/Hull-Mtl (L)	
12:00 PM	Mtl-Ott/Hull-Trnto (L)		Trnto-Ott/Hull (L)	Seasonal only
			Trnto-Ott/Hull-Mtl (L)	
01:00 PM	Mtl-Ott/Hull-Trnto (L)		Trnto-Ott/Hull (L)	
			Trnto-Ott/Hull-Mtl (L)	
02:00 PM	Mtl-Ott/Hull-Trnto (L)			
	Ott/Hull-Trnto (L)		Trnto-Ott/Hull-Mtl (L)	
03:00 PM	Mtl-Ott/Hull-Trnto (L)		Trnto-Ott-Hull (L)	Friday/seasonal only
	Mtl-Ott/Hull-Trnto (X)	Friday/Seasonal	Trnto-Ott/Hull-Mtl (L)	
			Trnto-Ott/Hull-Mtl (X)	Friday/Seasonal
04:00 PM	Mtl-Ott/Hull-Trnto (L)			
	Mtl-Ott/Hull-Trnto (X)		Trnto-Ott/Hull-Mtl (L)	
	Ott/Hull-Trnto (L)		Trnto-Ott-Hull (L)	
			Trnto-Ott/Hull-Mtl (X)	
05:00 PM	Mtl-Ott/Hull-Trnto (L)			
	Mtl-Ott/Hull-Trnto (SX)		Trnto-Ott/Hull-Mtl (L)	
	Ott/Hull-Trnto (X)	Friday/Seasonal only	Trnto-Ott/Hull-Mtl (SX)	
			Trnto-O/H-Laval-(Que)	
			Trnto-Ott-Hull (X)	
06:00 PM	Mtl-Ott/Hull-Trnto (L)			
	Mtl-Ott/Hull-Trnto (X)		Trnto-Ott/Hull-Mtl (L)	
	Ott/Hull-Trnto (L)		Trnto-Ott-Hull (X)	
			Trnto-Kingston	
07:00 PM	Mtl-Ott/Hull-Trnto (L)		Trnto-Ott/Hull-Mtl (X)	
	(Que)-Laval-O/H-Trnto	Seasonal only	Trnto-Ott/Hull-Mtl (L)	
	Ott/Hull-Trnto (X)	Friday/seasonal only	Trnto-Ott/Hull(L)	
08:00 PM	Mtl-Ott/Hull-Trnto (L)	Possible extra		
			Trnto-Ott/Hull-Mtl (L)	Possible extra
09:00 PM	Ott/Hull-Trnto (L)	Or run in 8 pm slot	Trnto-Ott/Hull(L)	Friday/seasonal only
			Trnto-Ott/Hull(L)	Or run in 8 pm slot
End	*Airport extension not shown*		*Airport extension not shown*	

Table B.3: 2005 Operating Plan: 300 kph: Southwestern Ontario

Weekday Departures Southwestern Ontario Segment *Composite Forecasts*

Timeslot	WESTBOUND		EASTBOUND	
Start				
06:00 AM				
07:00 AM	Toronto-Windsor (L)		Windsor-Toronto (L)	
08:00 AM	Toronto-London (L)		London-Toronto (L)	
			Windsor-Toronto (L)	
			London-Toronto (L)	
			Kitchener-Toronto	
09:00 AM	Toronto-London (L)	Seasonal only	Windsor-Toronto (L)	
10:00 AM	Toronto-Windsor (L)		London-Toronto (L)	
11:00 AM	Toronto-London (L)		Windsor-Toronto (L)	
12:00 PM	Toronto-Windsor (L)		London-Toronto (L)	Seasonal only
			Windsor-Toronto (L)	
01:00 PM	Toronto-London (L)		London-Toronto (L)	
02:00 PM	Toronto-Windsor (L)		Windsor-Toronto (L)	
03:00 PM	Toronto-Windsor (L)	Seasonal only	London-Toronto (L)	
			Windsor-Toronto (L)	
04:00 PM	Toronto-Windsor (L)			
	Toronto-London (L)			
05:00 PM	Toronto-Windsor (L)		Windsor-Toronto (L)	
	Toronto-London (L)		London-Toronto (L)	
06:00 PM	Toronto-Windsor (L)		London-Toronto (L)	
	Toronto-Kitchener		Windsor-Toronto (L)	Seasonal only
	Toronto-London (X)	Fridays/Seasonal only		
07:00 PM	Toronto-Windsor (L)		Windsor-Toronto (L)	
	Toronto-London (L)			
08:00 PM	Toronto-London (L)		London-Toronto (L)	Fridays/Seasonal only
09:00 PM				
10:00 PM				
End				

Note: One additional trip needed in each direction between Toronto and Kitchener or London during on-season
This allowance included in the costing and in the fleet buildup

APPENDIX C: STAFFING

Table C.1: Executive, Professional and Administrative Staff (300 kph)

Table C.2: Station Staffing, Quebec-Windsor

Table C.1: Executive, Professional and Administrative Staff

	Exec	Mgt	Adm Prof	Supp Staff	Hourly Rated	Total
MOT SECTOR						
Corporate/executive	4	0	3	5	0	12
Legal/Audit	1	1	3	3	0	8
Public Affairs	0	1	2	1	0	4
Government Affairs	0	1	2	1	0	4
Human/resources	1	6	8	6	0	21
Finance/accounting	1	6	17	17	0	41
Property/security/risk	0	3	4	2	0	9
General admin	2	3	9	14	0	28
Engineering support	0	1	4	3	0	8
Subtotal General	9	22	52	52	0	135
Transportation general	1	4	2	1	0	8
Control centre	0	1	0	1	24	26
Train crews	0	1	6	3	99	109
Subtotal Transportation	1	6	8	5	123	143
Equipment general	1	0	5	2	0	8
Equipment maintenance	2	6	16	24	199	247
Trainset cleaning	0	0	0	0	196	196
Subtotal Equipment	3	6	21	26	394	450
Infrastructure general	1	3	9	4	0	17
Infrastrructure maintenance	0	25	28	24	344	421
Subtotal Infrastructure	1	28	37	28	344	438
Marketing general	2	6	11	7	0	26
On-board services	0	3	9	8	140	160
Station operations	0	4	7	4	159	174
Ticket sales	1	5	15	8	84	113
Subtotal Customer Service	1	12	31	20	382	446
TOTAL	17	80	160	138	1,243	1,638

	Exec	Mgt	Adm Prof	Supp Staff	Hourly Rated	Total
MQ SECTOR						
Corporate/executive	0	0	0	0	0	0
Legal/Audit	0	0	1	0	0	1
Public Affairs	0	0	1	0	0	1
Government Affairs	0	0	1	0	0	1
Human/resources	0	0	4	3	0	7
Finance/accounting	0	0	3	3	0	6
Property/security/risk	0	0	2	1	0	3
General admin	0	0	1	4	0	5
Engineering support	0	0	1	1	0	2
Subtotal General	0	0	14	12	0	26
Transportation general	0	0	0	0	0	0
Control centre	0	0	0	1	8	9
Train crews	0	0	2	1	29	32
Subtotal Transportation	0	0	2	2	36	40
Equipment general	0	0	0	0	0	0
Equipment maintenance	0	0	4	3	47	54
Trainset cleaning	0	0	0	0	66	66
Subtotal Equipment	0	0	4	3	114	121
Infrastructure general	0	0	3	0	0	3
Infrastrructure maintenance	0	7	9	6	137	159
Subtotal Infrastructure	0	7	12	6	137	162
Marketing general	0	0	5	2	0	7
On-board services	0	0	2	4	32	38
Station operations	0	1	3	2	63	69
Ticket sales	0	0	3	4	26	33
Subtotal Customer Service	0	1	8	10	120	139
TOTAL	0	8	45	35	407	495

	Exec	Mgt	Adm Prof	Supp Staff	Hourly Rated	Total
SWO SECTOR						
Corporate/executive	0	0	0	0	0	0
Legal/Audit	0	0	1	0	0	1
Public Affairs	0	0	1	0	0	1
Government Affairs	0	0	1	0	0	1
Human/resources	0	0	4	3	0	7
Finance/accounting	0	0	3	5	0	8
Property/security/risk	0	0	2	2	0	4
General admin	0	0	2	5	0	7
Engineering support	0	0	2	1	0	3
Subtotal General	0	0	16	16	0	32
Transportation general	0	0	0	0	0	0
Control centre	0	0	0	1	8	9
Train crews	0	0	2	2	33	37
Subtotal Transportation	0	0	2	3	41	46
Equipment general	0	0	0	0	0	0
Equipment maintenance	0	0	5	4	56	65
Trainset cleaning	0	0	0	0	75	75
Subtotal Equipment	0	0	5	4	131	140
Infrastructure general	0	0	3	0	0	3
Infrastrructure maintenance	0	10	12	9	154	184
Subtotal Infrastructure	0	10	15	9	154	187
Marketing general	0	0	7	2	0	9
On-board services	0	0	2	3	28	33
Station operations	0	1	5	2	79	87
Ticket sales	0	0	3	5	39	47
Subtotal Customer Service	0	1	10	10	147	168
TOTAL	0	11	55	44	472	581

	Exec	Mgt	Adm Prof	Supp Staff	Hourly Rated	Total
FULL CORRIDOR						
Corporate/executive	4	0	3	5	0	12
Legal/Audit	1	1	5	3	0	10
Public Affairs	0	1	4	1	0	6
Government Affairs	0	1	4	1	0	6
Human/resources	1	6	16	12	0	35
Finance/accounting	1	6	23	25	0	55
Property/security/risk	0	3	8	5	0	16
General admin	2	3	12	23	0	40
Engineering support	0	1	7	5	0	13
Subtotal General	9	22	82	80	0	193
Transportation general	1	4	2	1	0	8
Control centre	0	1	0	3	40	44
Train crews	0	1	10	6	161	178
Subtotal Transportation	1	6	12	10	200	229
Equipment general	1	0	5	2	0	8
Equipment maintenance	2	6	25	31	302	366
Trainset cleaning	0	0	0	0	337	337
Subtotal Equipment	3	6	30	33	639	711
Infrastructure general	1	3	15	4	0	23
Infrastrructure maintenance	0	42	49	39	634	764
Subtotal Infrastructure	1	45	64	43	634	787
Marketing general	2	6	23	11	0	42
On-board services	0	3	13	15	200	231
Station operations	0	6	15	8	300	329
Ticket sales	1	5	21	17	149	193
Subtotal Customer Service	1	14	49	40	648	752
TOTAL	17	99	260	217	2,121	2,714

Table C.2: Station Staffing, Quebec-Windsor

	Rent ($ Millions)	Total staff	Baggage	Attend	1st Class	Security	Info	Redcaps	Janitors	Total Cost ($mlns)
Gare du Palais		35	3.0	8.0	3.0	6.0	3.0	6	6	1.17
Ancienne Lorette		6		3.0				3		0.20
Trois Rivieres		6		3.0				3		0.20
Laval (MQ)		5	2.0	1.5				1.5		0.16
Central (MQ)		11		4.5			1.5	4.5		0.36
Central	3.8	33	4.5	12.0	4.0		3.0	9		1.15
Laval/Dorval		6	2.0	3.0					1	0.22
Mirabel		0								0.00
Ottawa/Hull		49	5.0	12.0	4.0	6.0	3.0	10.5	8	1.61
Kingston		11	1.5	6.0				2	1	0.37
East TO		6		3.0				3		0.20
Union	4.2	35	3.0	12.0	5.0		3.0	12		1.21
Pearson (MOT)		20	4.5	4.5			3.0	6.0	2	0.66
Union (SWO)		11		6.0			1.5	3		0.38
Pearson (SWO)		8	2.0	3.0				3.0		0.26
Kitchener/Waterloo		7		4.5					2	0.25
London		28	3.0	7.5	2.0	2.0	3.0	4.5	6	0.96
Windsor		26	3.0	6.0	2.0	3.0	1.5	4.5	6	0.86
MQ	0.0	63	5	20	3	6	5	18	6	2.08
MOT	8.0	159	21	53	13	6	12	43	12	5.42
SWO	0.0	79	8	27	4	5	6	15	14	2.71

Notes

Station labour based on initial 300 kph ridership for 2005. All others scaled.
Baggage handlers eliminated if Connect Air removed.
Pearson staffing reduced if Connect Air removed.
Does not include counter ticket sales staff/station masters or support staff.
Allocation of Pearson (MOT) staffing depend on allocation of Union-Pearson segment.

APPENDIX D: COSTS

Table D.1: 200 kph, Quebec-Windsor Corridor: Ridership Breakdown

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

RIDERSHIP BREAKDOWN **Composite (via Dorval) at 200 kph QW Corridor**

			Year 2005	*Year 2025*		
	RIDERSHIP					
301	Ridership within the segment	*millions*	na	na		
302	Ridership between segments	*millions*	na	na		
303	Airport traffic	*millions*	na	na		
304 [A]	**Total potential passengers**	*million*	10.07	15.42		
305	Passengers not served at peak	*million*	(0.10)	(0.15)	1.0%	*of passengers*
306	Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307	**Net passengers**	*million*	9.97	15.27		
	PASSENGER REVENUES					
308	Initial transportation revenue estimate	*$million*	693.67	1,138.81		
309	PST/GST	*$million*	(54.44)	(89.46)	7.8%	*of revenues*
310	Revenue estimate net of taxes	*$million*	639.23	1,049.35		
311	First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312	Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313	Revenues foregone at peak	*$million*	(6.39)	(10.49)	1.0%	*of revenues*
314	**Final Gross Revenue**	*$million*	632.83	1,038.85		
	PASSENGER KILOMETRES					
315	Ridership within segments	*billions*	2.86	4.50		
316	Ridership between segments	*billions*	0.35	0.55		
317	Airport traffic	*billions*	above	above		
318	Total		3.21	5.04		
319	Passenger-km foregone at peak	*billions*	(0.03)	(0.05)	1.0%	*of passenger-km*
320	Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321	**Total passenger kms**	*billions*	3.18	4.99		
322	**Average Length of Haul**	*kms*	319	327		

Table D.2: 200 kph, Quebec-Windsor Corridor: Employment Data

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

EMPLOYMENT DATA — **Composite (via Dorval) at 200 kph QW Corridor**

		Average Wage	*Total Year 2005*	*Total Year 2025*	*Quebec Year 2005*	*Quebec Year 2025*
401	Train Crew	57,500	191	254	79	102
402	Dispatchers	50,600	40	40	20	20
403	Managerial/admin/professional	58,324	529	583	216	241
404	Station staff	35,939	71	82	24	28
405	Mechanical trades/skilled	39,402	243	335	116	160
406	Maintenance trades/skilled	36,349	406	432	102	107
407	**Total "skilled"**	47,796	1,480	1,726	557	658
408	OBS Staff	31,453	174	249	74	103
409	Sales Staff	29,007	126	158	45	57
410	Other customer service	29,986	16	23	7	9
411	Support staff	34,206	64	76	41	49
412	Station labour (various)	24,881	214	247	72	84
413	Equipment maintenance unskilled	30,603	17	25	9	12
414	Track maintenance unskilled	30,603	90	94	45	47
415	Cleaners	24,270	210	291	89	122
416	**Total "unskilled"**	27,984	910	1,163	381	484
417	**Total "unallocated"**		29	0	(0)	(0)
418	**Grand total employment**	40,238	2,419	2,889	938	1,142
419	**Ontario Total "skilled"**		923	1,068		
420	**Ontario Total "unskilled"**		529	679		
421	**Ontario Total "unallocated"**		29	0		
422	**Ontario Grand total employment**		1,481	1,747		
423	**Quebec Total "skilled"**		557	658		
424	**Quebec Total "unskilled"**		381	484		
425	**Quebec Total "unallocated"**		0	0		
426	**Quebec Grand total employment**		938	1,142		

Table D.3: 200 kph, Quebec-Windsor Corridor: Cash Flow Breakdown

01-Aug-94 — **HSR STUDY COST DEVELOPMENT**

TOTAL CASHFLOW — **Composite (via Dorval) at 200 kph QW Corridor**

		Total Year 2005	Total Year 2025	Quebec Year 2005	Quebec Year 2025
501	[A] **RIDERSHIP**	10.0	15.3	*NA*	*NA*
502	**ADJUSTED GROSS REVENUE**	632.8	1,038.9	229.2	378.2
503	Payments to Travel Agencies	34.8	57.1	12.6	20.8
504	Payments to Credit Card Companies	5.9	9.7	2.1	3.5
505	**Revenue Available to HSR Operator**	592.1	972.0	214.5	353.9
	OPERATING EMPLOYMENT				
904	Total employment	2,390	2,889	938	1,142
905	"Skilled" employment	1,480	1,726	557	658
906	"Unskilled" employment	910	1,163	381	484
907	Employment in Ontario	1,452	1,747		
908	Employment in Quebec	938	1,142	938	1,142
	OPERATING COSTS				
	Labour				
506	Bare wage bill skilled	70.7	82.5	27.3	32.1
507	Bare wage bill unskilled	25.5	32.5	10.8	13.7
508	Payroll taxes	8.1	9.7	3.2	3.8
509	Provisions for pension plan	7.2	8.6	2.9	3.4
	Purchased materials/services				
510	Electricity	14.5	20.0	3.4	4.5
511	Advertising/promotion	12.7	12.7	4.7	4.7
512	Infrastructure maintenance services	16.5	13.6	4.3	4.7
513	Infrastructure materials/supplies	1.9	18.7	0.5	5.2
514	Rolling stock materials/supplies	11.5	16.5	5.8	8.3
515	Telecommunications/computer services	13.4	20.3	4.8	7.4
516	Insurance services/franchise fees etc	11.5	14.4	3.3	4.3
517	Food/related sundries	1.7	2.6	0.7	1.0
518	**Unscheduled materials/services**	46.1	48.1	21.2	20.8
519	**Allowance for contingencies**	17.9	21.1	6.6	7.9
520	**TOTAL OPERATING COSTS**	259.1	321.2	99.3	121.8
521	**OPERATING PROFIT**	333.0	650.8	*NA*	*NA*
909	**COST REVENUE RATIO**	2.28	3.03	*NA*	*NA*
522	Operating costs (Ontario)	159.8	199.4		
523	Operating costs (Quebec)	99.3	121.8		

	CAPITAL COSTS	Initial	Ongoing	Total
524	Total spent in Quebec	2,203.27	103.61	2,306.89
525	Total spent in Ontario	4,196.77	103.61	4,300.38
526	Total spent in the rest of Canada	268.02	0.00	268.02
527	Total spend in the rest of the World	1,180.02	0.00	1,180.02
528	Geographical allocation pending	1,428.74	808.06	2,236.80
529	Residual unallocated to region	0.73	0.00	0.73
530	**Total Capital Costs**	9,277.55	1,015.28	10,292.83
531	Total spent on skilled labour	2,454.68	0.00	2,454.68
532	Total spent on unskilled labour	623.49	0.00	623.49
533	Total spent on material	4,667.67	1,015.28	5,682.95
534	Total spent on plant	1,531.64	0.00	1,531.64
535	Residual unallocated to spending category	0.07	0.00	0.07
536	**Total Capital Costs**	9,277.55	1,015.28	10,292.83

	TOTAL CASH FLOW (excluding revenues)	
537	Total spent in Quebec	*[This line defined only for year-by-year tables]*
538	Total spent in Ontario	*[This line defined only for year-by-year tables]*
539	Total spent in the rest of Canada	*[This line defined only for year-by-year tables]*
540	Total spend in the rest of the World	*[This line defined only for year-by-year tables]*
541	Geographical allocation pending	*[This line defined only for year-by-year tables]*
542	Residual unallocated to region	*[This line defined only for year-by-year tables]*
543	**Total**	*[This line defined only for year-by-year tables]*
910	**NET CASH FLOW**	*[This line defined only for year-by-year tables]*

Table D.4: 200 kph, MOT Stand Alone: Capital Costs

06-Oct-94 **HSR STUDY COST DEVELOPMENT**

CAPITAL COST SUMMARY — Composite (via Dorval) at 300 kph MOT Stand Alone

			Professional Services	*Contingency*	Total
201	Right-of-Way	124.23	13.35	14.87	152.46
202	Earthworks/subgrade	746.34	186.02	111.95	1,044.32
203	Bridges	483.47	87.57	48.35	619.39
204	Grade separations	584.75	110.88	88.57	784.20
205	Other accommodations	67.53	14.46	20.26	102.24
206	Track	461.25	70.38	23.93	555.56
207	Power distribution system	346.61	65.64	51.99	464.24
208	Stations	326.50	59.14	32.65	418.29
209	People movers (included in stations)	0.00	0.00	0.00	0.00
210	Signals	221.17	50.39	33.18	304.73
211	Communications	98.36	22.41	14.75	135.53
212	Equipment maintenance facilities	133.94	12.44	18.66	165.04
213	Infrastructure maintenance facilities	78.59	0.00	0.00	78.59
214	Information/ticketing systems	25.85	0.00	0.00	25.85
215	Rolling stock	784.32	68.89	76.79	930.00
216	Commissioning	0.00	63.60	0.00	63.60
217	Administration allowance	62.29	0.00	0.00	62.29
218	Startup and training	41.50	0.00	0.00	41.50
219	**TOTAL INITIAL CAPITAL COSTS**	4,586.71	825.17	535.94	5,947.83
220	**Additional fleet requirements**	*year 2009*	4 units		60.00
221		*year 2013*	5 units		90.00
222		*year 2017*	2 units		60.00
223		*year 2021*	5 units		90.00
224		*Total*	16 units		300.00
225	**Rolling Stock Overhauls**	*total, years 2005-2025*			309.88
226	**Infrastructure Renewal**	*total, years 2005-2025*			0.00
227	**Other ongoing capital**	*total, years 2005-2025*			120.79
228	*Cross check initial capital*				*0.00*

Table D.5: 200 kph, MOT Stand Alone: Operations Costs Breakdown

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

OPERATIONS COST BREAKDOWN Composite (via Dorval) at 200 kph MOT Stand Alone

		Cont Allow	Cost Estimate ($ million) 2005	2025	Employment Estimate 2005	2025	Quebec Share 2005
	TRAIN OPERATIONS						
101	Train crew	5.0%	8.06	10.97	112	152	38%
102	Power - demand charges	2.5%	3.87	5.02	--	--	10%
103	Power - energy consumption	2.5%	5.07	7.39	--	--	10%
104	Control centre	5.0%	1.44	1.44	24	24	50%
105	Transportation administration/supervision	5.0%	1.47	1.67	20	23	50%
106	**Subtotal**		19.92	26.50	156	199	27%
	CUSTOMER SERVICES						
107	On-board service staff	10.0%	4.46	6.56	104	153	38%
108	On-board service supplies	5.0%	0.88	1.36	--	--	38%
109	On-board services ground support	10.0%	0.82	1.20	21	31	38%
110	Food/beverage for sale	0.0%	0.00	0.00	--	--	--
111	Station operations	10.0%	14.65	15.43	148	171	24%
112	ATM/Ticketing/Reservations transactions	5.0%	7.33	11.24	--	--	34%
113	Telephone/Counter Sales	5.0%	2.41	3.06	68	86	34%
114	Advertising and promotion expenses	5.0%	7.81	7.81	--	--	34%
115	Customer service administration/supervision	5.0%	6.20	7.29	90	106	50%
116	**Subtotal**		44.56	53.95	431	546	34%
	EQUIPMENT MAINTENANCE						
117	Routine maintenance - labour	5.0%	6.76	9.78	134	194	50%
118	Routine maintenance - material	5.0%	7.31	10.74	--	--	50%
119	Major maintenance [included in capital]	--	--	--	--	--	--
120	Cleaning	5.0%	4.29	5.83	140	191	38%
121	Maintenance administration/supervision	5.0%	3.55	4.51	56	70	50%
122	**Subtotal**		21.90	30.86	330	455	48%
	INFRASTRUCTURE MAINTENANCE						
123	Routine maintenance	15.0%	17.20	17.96	268	285	13%
124	Purchased services	15.0%	8.48	6.95	--	--	13%
125	Materials	10.0%	1.16	11.59	--	--	13%
126	Programmed replacement [occurs after 2025]	--	--	--	--	--	
127	Maintenance administration/supervision	5.0%	6.53	6.77	94	97	23%
128	**Subtotal**		33.36	43.28	362	383	15%
	EXECUTIVE/ADMINISTRATION						
129	Labour and related	5.0%	9.85	10.89	135	150	50%
130	Other	5.0%	6.50	6.50	--	--	50%
131	**Subtotal**		16.35	17.39	135	150	50%
	INSURANCE/TAXES/OTHER						
132	Insurance/claims	0.0%	6.00	7.10	--	--	13%
133	Property taxes	10.0%	5.50	5.50	--	--	84%
134	Franchise fees	10.0%	*nil*	nil	--	--	
135	**Subtotal**		11.50	12.60	0	0	47%
136	**CONTINGENCY**	7.3%	10.75	13.07	--	--	30%
137	**TOTAL**		158.36	197.64	1,413	1,732	33%
138	**Total: Quebec component**		52.69	64.24	488	606	
139	**Total: Ontario component**		105.67	133.41	926	1,126	
140	**[Major maintenance included in capital]**		0.00	15.93			
141	Routine equipment maintenance per trainset km	dollars	1.33	1.33			
142	Infrastructure maintenance per route km	$thousand	44.01	59.87			
143	Executive/administration as a percent of total		11.1%	9.4%			
144	Station/ticketing costs per passenger	Dollars	4.34	3.41			

Table D.6: 200 kph, MOT Stand Alone: Ridership Breakdown

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

RIDERSHIP BREAKDOWN — **Composite (via Dorval) at 200 kph MOT Stand Alone**

			Year 2005	*Year 2025*		
	RIDERSHIP					
301	Ridership within the segment	*millions*	na	na		
302	Ridership between segments	*millions*	na	na		
303	Airport traffic	*millions*	na	na		
304 [A]	**Total potential passengers**	*million*	5.62	8.72		
305	Passengers not served at peak	*million*	(0.06)	(0.09)	1.0%	*of passengers*
306	Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307	**Net passengers**	*million*	5.57	8.63		
	PASSENGER REVENUES					
308	Initial transportation revenue estimate	*$million*	427.72	708.96		
309	PST/GST	*$million*	(33.22)	(55.06)	7.8%	*of revenues*
310	Revenue estimate net of taxes	*$million*	394.50	653.90		
311	First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312	Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313	Revenues foregone at peak	*$million*	(3.94)	(6.54)	1.0%	*of revenues*
314	**Final Gross Revenue**	*$million*	390.55	647.36		
	PASSENGER KILOMETRES					
315	Ridership within segments	*billions*	1.95	3.10		
316	Ridership between segments	*billions*	0.09	0.13		
317	Airport traffic	*billions*	above	above		
318	Total		2.03	3.23		
319	Passenger-km foregone at peak	*billions*	(0.02)	(0.03)	1.0%	*of passenger-km*
320	Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321	**Total passenger kms**	*billions*	2.01	3.20		
322	**Average Length of Haul**	*kms*	362	370		

Table D.7: 200 kph, MOT Stand Alone: Employment Data

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

EMPLOYMENT DATA — **Composite (via Dorval) at 200 kph MOT Stand Alone**

		Average Wage	Total Year 2005	Total Year 2025	Quebec Year 2005	Quebec Year 2025
401	Train Crew	57,500	112	152	42	55
402	Dispatchers	50,600	24	24	12	12
403	Managerial/admin/professional	58,324	367	413	158	180
404	Station staff	35,939	37	43	9	10
405	Mechanical trades/skilled	39,402	151	212	62	89
406	Maintenance trades/skilled	36,349	219	233	11	12
407	**Total "skilled"**	48,690	910	1,076	294	359
408	OBS Staff	31,453	114	168	43	61
409	Sales Staff	29,007	68	86	23	30
410	Other customer service	29,986	10	15	4	6
411	Support staff	34,206	28	33	14	16
412	Station labour (various)	24,881	111	128	27	31
413	Equipment maintenance unskilled	30,603	11	16	5	8
414	Track maintenance unskilled	30,603	49	52	25	26
415	Cleaners	24,270	113	158	53	69
416	**Total "unskilled"**	28,090	504	656	194	247
417	**Total "unallocated"**		0	0	(0)	0
418	**Grand total employment**	41,349	1,413	1,732	488	606
419	**Ontario Total "skilled"**		616	717		
420	**Ontario Total "unskilled"**		310	409		
421	**Ontario Total "unallocated"**		0	0		
422	**Ontario Grand total employment**		926	1,126		
423	**Quebec Total "skilled"**		294	359		
424	**Quebec Total "unskilled"**		194	247		
425	**Quebec Total "unallocated"**		0	0		
426	**Quebec Grand total employment**		488	606		

Table D.8: 200 kph, MOT Stand Alone: Cash Flow Breakdown

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

TOTAL CASHFLOW — **Composite (via Dorval) at 200 kph MOT Stand Alone**

		Total Year 2005	Total Year 2025	Quebec Year 2005	Quebec Year 2025
501	[A] **RIDERSHIP**	5.6	8.6	*NA*	*NA*
502	**ADJUSTED GROSS REVENUE**	390.6	647.4	131.0	217.2
503	Payments to Travel Agencies	21.5	35.6	7.2	11.9
504	Payments to Credit Card Companies	3.7	6.1	1.2	2.0
505	**Revenue Available to HSR Operator**	365.4	605.7	122.6	203.2
	OPERATING EMPLOYMENT				
904	Total employment	1,413	1,732	488	606
905	"Skilled" employment	910	1,076	294	359
906	"Unskilled" employment	504	656	194	247
907	Employment in Ontario	926	1,126		
908	Employment in Quebec	488	606	488	606
	OPERATING COSTS				
	Labour				
506	Bare wage bill skilled	44.3	52.4	15.4	18.6
507	Bare wage bill unskilled	14.1	18.5	5.5	7.0
508	Payroll taxes	4.8	5.9	1.7	2.1
509	Provisions for pension plan	4.4	5.3	1.6	1.9
	Purchased materials/services				
510	Electricity	8.9	12.4	0.9	1.2
511	Advertising/promotion	7.8	7.8	2.7	2.7
512	Infrastructure maintenance services	8.5	7.0	1.1	0.9
513	Infrastructure materials/supplies	1.2	11.6	0.2	1.6
514	Rolling stock materials/supplies	7.3	10.7	3.7	5.4
515	Telecommunications/computer services	7.3	11.2	2.5	3.9
516	Insurance services/franchise fees etc	6.0	7.1	0.8	0.9
517	Food/related sundries	0.9	1.4	0.3	0.5
518	**Unscheduled materials/services**	32.0	33.3	13.1	13.7
519	**Allowance for contingencies**	10.8	13.1	3.3	3.9
520	**TOTAL OPERATING COSTS**	158.4	197.6	52.7	64.2
521	**OPERATING PROFIT**	207.1	408.0	*NA*	*NA*
909	**COST REVENUE RATIO**	2.31	3.06	*NA*	*NA*
522	Operating costs (Ontario)	105.7	133.4		
523	Operating costs (Quebec)	52.7	64.2		

		Initial	Ongoing	Total
	CAPITAL COSTS			
524	Total spent in Quebec	1,043.66	59.50	1,103.16
525	Total spent in Ontario	2,579.87	59.50	2,639.37
526	Total spent in the rest of Canada	141.63	0.00	141.63
527	Total spend in the rest of the World	678.49	0.00	678.49
528	Geographical allocation pending	866.61	463.76	1,330.37
529	Residual unallocated to region	0.67	0.00	0.67
530	**Total Capital Costs**	5,310.93	582.76	5,893.69
531	Total spent on skilled labour	1,425.31	0.00	1,425.31
532	Total spent on unskilled labour	359.50	0.00	359.50
533	Total spent on material	2,639.79	582.76	3,222.54
534	Total spent on plant	886.33	0.00	886.33
535	Residual unallocated to spending category	0.00	0.00	0.00
536	**Total Capital Costs**	5,310.93	582.76	5,893.69

	TOTAL CASH FLOW (excluding revenues)	
537	Total spent in Quebec	*[This line defined only for year-by-year tables]*
538	Total spent in Ontario	*[This line defined only for year-by-year tables]*
539	Total spent in the rest of Canada	*[This line defined only for year-by-year tables]*
540	Total spend in the rest of the World	*[This line defined only for year-by-year tables]*
541	Geographical allocation pending	*[This line defined only for year-by-year tables]*
542	Residual unallocated to region	*[This line defined only for year-by-year tables]*
543	**Total**	*[This line defined only for year-by-year tables]*
910	**NET CASH FLOW**	*[This line defined only for year-by-year tables]*

Table D.9: 200 kph, Quebec-Toronto Stand Alone: Capital Costs

06-Oct-94 HSR STUDY COST DEVELOPMENT

CAPITAL COST SUMMARY — Composite (via Dorval) at 200 kph QT Segment

		Base Cost	Professional Services	Contin-gency	Total
201	Right-of-Way	212.60	22.85	25.45	260.91
202	Earthworks/subgrade	924.15	227.53	138.62	1,290.30
203	Bridges	434.92	78.78	43.49	557.19
204	Grade separations	506.46	99.32	96.69	702.47
205	Other accommodations	69.18	14.81	20.75	104.74
206	Track	654.24	99.97	33.97	788.18
207	Power distribution system	522.40	98.93	78.36	699.69
208	Stations	356.00	64.48	35.60	456.08
209	People movers (included in stations)	0.00	0.00	0.00	0.00
210	Signals	284.05	64.72	42.61	391.38
211	Communications	152.09	34.65	22.81	209.55
212	Equipment maintenance facilities	130.49	11.99	17.98	160.46
213	Infrastructure maintenance facilities	101.56	0.00	0.00	101.56
214	Information/ticketing systems	35.16	0.00	0.00	35.16
215	Rolling stock	948.15	83.28	92.83	1,124.26
216	Commissioning	0.00	81.42	0.00	81.42
217	Administration allowance	75.27	0.00	0.00	75.27
218	Startup and training	49.95	0.00	0.00	49.95
219	**TOTAL INITIAL CAPITAL COSTS**	5,456.66	982.73	649.16	7,088.55
220	**Additional fleet requirements**	*year 2009*	5 units		93.69
221		*year 2013*	5 units		93.69
222		*year 2017*	3 units		70.27
223		*year 2021*	5 units		93.69
224		*Total*	18 units		351.33
225	**Rolling Stock Overhauls**	*total, years 2005-2025*			334.47
226	**Infrastructure Renewal**	*total, years 2005-2025*			0.00
227	**Other ongoing capital**	*total, years 2005-2025*			158.49
228	*Cross check initial capital*				*0.00*

Table D.10: 200 kph, Quebec-Toronto Stand Alone: Operations Costs Breakdown

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

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OPERATIONS COST BREAKDOWN Composite (via Dorval) at 200 kph QT Segment

		Cont Allow	Cost Estimate ($ million) 2005	2025	Employment Estimate 2005	2025	Quebec Share 2005
	TRAIN OPERATIONS						
101	Train crew	5.0%	10.85	14.51	150	201	53%
102	Power - demand charges	2.5%	5.15	6.73	--	--	32%
103	Power - energy consumption	2.5%	6.42	9.23	--	--	26%
104	Control centre	5.0%	1.91	1.91	32	32	62%
105	Transportation administration/supervision	5.0%	1.70	1.94	24	27	57%
106	**Subtotal**		26.02	34.32	206	260	43%
	CUSTOMER SERVICES						
107	On-board service staff	10.0%	5.73	8.30	133	193	50%
108	On-board service supplies	5.0%	1.23	1.90	--	--	54%
109	On-board services ground support	10.0%	1.05	1.52	27	39	50%
110	Food/beverage for sale	0.0%	0.00	0.00	--	--	--
111	Station operations	10.0%	17.33	18.47	210	243	36%
112	ATM/Ticketing/Reservations transactions	5.0%	10.02	15.31	--	--	51%
113	Telephone/Counter Sales	5.0%	3.29	4.16	93	117	51%
114	Advertising and promotion expenses	5.0%	10.08	10.08	--	--	48%
115	Customer service administration/supervision	5.0%	7.76	9.09	116	135	60%
116	**Subtotal**		56.49	68.84	578	728	47%
	EQUIPMENT MAINTENANCE						
117	Routine maintenance - labour	5.0%	8.67	12.49	172	248	50%
118	Routine maintenance - material	5.0%	9.34	13.49	--	--	50%
119	Major maintenance [included in capital]	--	--	--	--	--	--
120	Cleaning	5.0%	5.97	8.17	194	266	54%
121	Maintenance administration/supervision	5.0%	3.97	5.06	63	79	50%
122	**Subtotal**		27.95	39.21	429	593	51%
	INFRASTRUCTURE MAINTENANCE						
123	Routine maintenance	15.0%	24.35	25.37	378	401	39%
124	Purchased services	15.0%	12.28	10.07	--	--	40%
125	Materials	10.0%	1.53	15.26	--	--	34%
126	Programmed replacement [occurs after 2025]	--	--	--	--	--	
127	Maintenance administration/supervision	5.0%	8.28	8.52	119	123	36%
128	**Subtotal**		46.43	59.22	497	524	39%
	EXECUTIVE/ADMINISTRATION						
129	Labour and related	5.0%	11.40	12.69	161	180	57%
130	Other	5.0%	8.70	8.70	--	--	63%
131	**Subtotal**		20.10	21.39	161	180	59%
	INSURANCE/TAXES/OTHER						
132	Insurance/claims	0.0%	8.50	10.41	--	--	39%
133	Property taxes	10.0%	6.50	6.50	--	--	86%
134	Franchise fees	10.0%	*nil*	nil	--	--	
135	**Subtotal**		15.00	16.91	0	0	59%
136	**CONTINGENCY**	7.4%	14.16	17.12	--	--	46%
137	**TOTAL**		206.15	257.01	1,872	2,285	47%
138	**Total: Quebec component**		97.23	118.95	915	1,110	
139	**Total: Ontario component**		108.91	138.06	957	1,175	
140	**[Major maintenance included in capital]**		0.00	20.61			
141	Routine equipment maintenance per trainset km	dollars	1.33	1.33			
142	Infrastructure maintenance per route km	$thousand	43.18	57.38			
143	Executive/administration as a percent of total		10.5%	8.9%			
144	Station/ticketing costs per passenger	Dollars	4.07	3.27			

Table D.11: 200 kph, Quebec-Toronto Stand Alone: Ridership Breakdown

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

RIDERSHIP BREAKDOWN — **Composite (via Dorval) at 200 kph QT Segment**

			Year 2005	Year 2025		
	RIDERSHIP					
301	Ridership within the segment	*millions*	na	na		
302	Ridership between segments	*millions*	na	na		
303	Airport traffic	*millions*	na	na		
304 [A]	**Total potential passengers**	*million*	7.53	11.62		
305	Passengers not served at peak	*million*	(0.08)	(0.12)	1.0%	*of passengers*
306	Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307	**Net passengers**	*million*	7.45	11.50		
	PASSENGER REVENUES					
308	Initial transportation revenue estimate	*$million*	554.72	918.53		
309	PST/GST	*$million*	(45.64)	(75.49)	8.2%	*of revenues*
310	Revenue estimate net of taxes	*$million*	509.08	843.04		
311	First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312	Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313	Revenues foregone at peak	*$million*	(5.09)	(8.43)	1.0%	*of revenues*
314	**Final Gross Revenue**	*$million*	503.99	834.61		
	PASSENGER KILOMETRES					
315	Ridership within segments	*billions*	2.36	3.73		
316	Ridership between segments	*billions*	0.23	0.35		
317	Airport traffic	*billions*	above	above		
318	Total		2.59	4.08		
319	Passenger-km foregone at peak	*billions*	(0.03)	(0.04)	1.0%	*of passenger-km*
320	Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321	**Total passenger kms**	*billions*	2.56	4.04		
322	**Average Length of Haul**	*kms*	344	351		

Table D.12: 200 kph, Quebec-Toronto Stand Alone: Employment Data

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

EMPLOYMENT DATA — **Composite (via Dorval) at 200 kph QT Segment**

		Average Wage	*Total Year 2005*	*Total Year 2025*	*Quebec Year 2005*	*Quebec Year 2025*
401	Train Crew	57,500	150	201	80	102
402	Dispatchers	50,600	32	32	20	20
403	Managerial/admin/professional	58,324	428	477	212	236
404	Station staff	35,939	52	61	24	28
405	Mechanical trades/skilled	39,402	204	282	97	133
406	Maintenance trades/skilled	36,349	309	328	102	107
407	**Total "skilled"**	47,952	1,175	1,381	534	626
408	OBS Staff	31,453	147	213	74	103
409	Sales Staff	29,007	93	117	47	60
410	Other customer service	29,986	13	19	7	9
411	Support staff	34,206	55	66	41	49
412	Station labour (various)	24,881	157	182	72	84
413	Equipment maintenance unskilled	30,603	14	20	7	10
414	Track maintenance unskilled	30,603	69	73	45	47
415	Cleaners	24,270	149	213	88	121
416	**Total "unskilled"**	28,200	697	904	381	484
417	**Total "unallocated"**		0	0	(0)	0
418	**Grand total employment**	40,598	1,872	2,285	915	1,110
419	**Ontario Total "skilled"**		642	754		
420	**Ontario Total "unskilled"**		316	421		
421	**Ontario Total "unallocated"**		0	0		
422	**Ontario Grand total employment**		957	1,175		
423	**Quebec Total "skilled"**		534	626		
424	**Quebec Total "unskilled"**		381	484		
425	**Quebec Total "unallocated"**		0	0		
426	**Quebec Grand total employment**		915	1,110		

Table D.13: 200 kph, Quebec-Toronto Stand Alone: Cash Flow Breakdown

01-Aug-94 **HSR STUDY COST DEVELOPMENT**

TOTAL CASHFLOW — **Composite (via Dorval) at 200 kph QT Segment**

		Total Year 2005	Total Year 2025	Quebec Year 2005	Quebec Year 2025
501	[A] **RIDERSHIP**	7.5	11.5	*NA*	*NA*
502	**ADJUSTED GROSS REVENUE**	504.0	834.6	236.5	389.5
503	Payments to Travel Agencies	27.7	45.9	13.0	21.4
504	Payments to Credit Card Companies	4.7	7.8	2.2	3.7
505	**Revenue Available to HSR Operator**	471.5	780.9	221.3	364.4
	OPERATING EMPLOYMENT				
904	Total employment	1,872	2,285	915	1,110
905	"Skilled" employment	1,175	1,381	534	626
906	"Unskilled" employment	697	904	381	484
907	Employment in Ontario	957	1,175		
908	Employment in Quebec	915	1,110	915	1,110
	OPERATING COSTS				
	Labour				
506	Bare wage bill skilled	56.3	66.2	26.3	30.8
507	Bare wage bill unskilled	19.7	25.5	10.8	13.7
508	Payroll taxes	6.4	7.7	3.1	3.7
509	Provisions for pension plan	5.7	6.9	2.8	3.3
	Purchased materials/services				
510	Electricity	11.6	16.0	3.3	4.4
511	Advertising/promotion	10.1	10.1	4.8	4.8
512	Infrastructure maintenance services	12.3	10.1	4.3	4.7
513	Infrastructure materials/supplies	1.5	15.3	0.5	5.2
514	Rolling stock materials/supplies	9.3	13.5	4.7	6.7
515	Telecommunications/computer services	10.0	15.3	5.1	7.8
516	Insurance services/franchise fees etc	8.5	10.4	3.3	4.3
517	Food/related sundries	1.2	1.9	0.7	1.0
518	**Unscheduled materials/services**	39.4	41.1	21.1	20.7
519	**Allowance for contingencies**	14.2	17.1	6.5	7.7
520	**TOTAL OPERATING COSTS**	206.1	257.0	97.2	118.9
521	**OPERATING PROFIT**	265.4	523.9	*NA*	*NA*
909	**COST REVENUE RATIO**	2.29	3.04	*NA*	*NA*
522	Operating costs (Ontario)	108.9	138.1		
523	Operating costs (Quebec)	97.2	118.9		

	CAPITAL COSTS	Initial	Ongoing	Total
524	Total spent in Quebec	2,033.57	79.24	2,112.81
525	Total spent in Ontario	2,814.70	79.24	2,893.94
526	Total spent in the rest of Canada	204.05	0.00	204.05
527	Total spend in the rest of the World	911.32	0.00	911.32
528	Geographical allocation pending	1,124.26	655.82	1,780.07
529	Residual unallocated to region	0.67	0.00	0.67
530	**Total Capital Costs**	7,088.55	814.30	7,902.86
531	Total spent on skilled labour	1,887.11	0.00	1,887.11
532	Total spent on unskilled labour	473.68	0.00	473.68
533	Total spent on material	3,545.91	814.30	4,360.22
534	Total spent on plant	1,181.86	0.00	1,181.86
535	Residual unallocated to spending category	0.00	0.00	0.00
536	**Total Capital Costs**	7,088.55	814.30	7,902.86

	TOTAL CASH FLOW (excluding revenues)	
537	Total spent in Quebec	*[This line defined only for year-by-year tables]*
538	Total spent in Ontario	*[This line defined only for year-by-year tables]*
539	Total spent in the rest of Canada	*[This line defined only for year-by-year tables]*
540	Total spend in the rest of the World	*[This line defined only for year-by-year tables]*
541	Geographical allocation pending	*[This line defined only for year-by-year tables]*
542	Residual unallocated to region	*[This line defined only for year-by-year tables]*
543	**Total**	*[This line defined only for year-by-year tables]*
910	**NET CASH FLOW**	*[This line defined only for year-by-year tables]*

Table D.14: 300 kph, Quebec-Windsor Corridor: Ridership Breakdown

25-Jul-04 **HSR STUDY COST DEVELOPMENT**

RIDERSHIP BREAKDOWN — **Composite (via Mirabel) at 300 kph QW Corridor**

			Year 2005	Year 2025		
	RIDERSHIP					
301	Ridership within the segment	*millions*	na	na		
302	Ridership between segments	*millions*	na	na		
303	Airport traffic	*millions*	na	na		
304 [A]	**Total potential passengers**	*million*	11.87	18.73		
305	Passengers not served at peak	*million*	(0.12)	(0.19)	1.0%	*of passengers*
306	Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307	**Net passengers**	*million*	11.75	18.54		
	PASSENGER REVENUES					
308	Initial transportation revenue estimate	*$million*	886.65	1,499.58		
309	PST/GST	*$million*	(69.55)	(117.68)	7.8%	*of revenues*
310	Revenue estimate net of taxes	*$million*	817.10	1,381.90		
311	First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312	Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313	Revenues foregone at peak	*$million*	(8.17)	(13.82)	1.0%	*of revenues*
314	**Final Gross Revenue**	*$million*	808.93	1,368.08		
	PASSENGER KILOMETRES					
315	Ridership within segments	*billions*	3.54	5.69		
316	Ridership between segments	*billions*	0.49	0.78		
317	Airport traffic	*billions*	above	above		
318	Total		4.03	6.47		
319	Passenger-km foregone at peak	*billions*	(0.04)	(0.06)	1.0%	*of passenger-km*
320	Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321	**Total passenger kms**	*billions*	3.99	6.40		
322	**Average Length of Haul**	*kms*	340	345		

Table D.15: 300 kph, Quebec-Windsor Corridor: Employment Data

25-Jul-94 **HSR STUDY COST DEVELOPMENT**

EMPLOYMENT DATA **Composite (via Mirabel) at 300 kph QW Corridor**

		Average Wage	*Total Year 2005*	*Total Year 2025*	*Quebec Year 2005*	*Quebec Year 2025*
401	Train Crew	57,500	161	215	66	85
402	Dispatchers	50,600	40	40	20	20
403	Managerial/admin/professional	58,324	529	586	227	254
404	Station staff	35,939	75	89	25	30
405	Mechanical trades/skilled	39,402	331	460	158	220
406	Maintenance trades/skilled	36,349	527	562	184	195
407	**Total "skilled"**	46,317	1,661	1,951	680	803
408	OBS Staff	31,453	183	264	78	108
409	Sales Staff	29,007	149	192	52	68
410	Other customer service	29,986	17	24	7	10
411	Support staff	34,206	64	76	41	50
412	Station labour (various)	24,881	225	268	76	90
413	Equipment maintenance unskilled	30,603	24	35	12	17
414	Track maintenance unskilled	30,603	108	113	53	56
415	Cleaners	24,270	284	397	122	164
416	**Total "unskilled"**	27,803	1,053	1,368	441	562
417	**Total "unallocated"**		19	0	0	(0)
418	**Grand total employment**	39,125	2,733	3,320	1,121	1,366
419	**Ontario Total "skilled"**		981	1,148		
420	**Ontario Total "unskilled"**		612	806		
421	**Ontario Total "unallocated"**		19	0		
422	**Ontario Grand total employment**		1,612	1,954		
423	**Quebec Total "skilled"**		[illegible]	803		
424	**Quebec Total "unskilled"**		[illegible]	562		
425	**Quebec Total "unallocated"**		[illegible]	0		
426	**Quebec Grand total employment**		121	1,366		

Table D.16: 300 kph, Quebec-Windsor Corridor: Cash Flow Breakdown

01-Aug-94 — **HSR STUDY COST DEVELOPMENT**

TOTAL CASHFLOW — **Composite (via Mirabel) at 300 kph QW Corridor**

		Total Year 2005	Total Year 2025	Quebec Year 2005	Quebec Year 2025
501	[A] **RIDERSHIP**	11.8	18.5	*NA*	*NA*
502	**ADJUSTED GROSS REVENUE**	808.9	1,368.1	291.8	494.8
503	Payments to Travel Agencies	44.5	75.2	16.0	27.2
504	Payments to Credit Card Companies	7.6	12.8	2.7	4.6
505	**Revenue Available to HSR Operator**	756.9	1,280.0	273.0	463.0
	OPERATING EMPLOYMENT				
904	Total employment	2,714	3,320	1,121	1,366
905	"Skilled" employment	1,661	1,951	680	803
906	"Unskilled" employment	1,053	1,368	441	562
907	Employment in Ontario	1,593	1,954		
908	Employment in Quebec	1,121	1,366	1,121	1,366
	OPERATING COSTS				
	Labour				
506	Bare wage bill skilled	76.9	90.3	31.9	37.5
507	Bare wage bill unskilled	29.3	38.0	12.4	15.8
508	Payroll taxes	9.0	11.0	3.8	4.5
509	Provisions for pension plan	8.0	9.6	3.3	4.0
	Purchased materials/services				
510	Electricity	27.4	37.9	7.8	10.7
511	Advertising/promotion	16.2	16.2	5.9	5.9
512	Infrastructure maintenance services	20.9	16.2	6.7	7.0
513	Infrastructure materials/supplies	2.2	22.0	0.8	8.0
514	Rolling stock materials/supplies	15.4	22.2	7.7	11.1
515	Telecommunications/computer services	15.7	24.6	5.7	8.8
516	Insurance services/franchise fees etc	11.5	14.6	4.2	5.4
517	Food/related sundries	2.0	3.2	0.8	1.2
518	**Unscheduled materials/services**	47.6	49.8	23.0	22.0
519	**Allowance for contingencies**	20.8	23.8	8.3	9.9
520	**TOTAL OPERATING COSTS**	302.8	379.4	122.3	152.0
521	**OPERATING PROFIT**	454.0	900.6	*NA*	*NA*
909	**COST REVENUE RATIO**	2.50	3.37	*NA*	*NA*
522	Operating costs (Ontario)	180.6	227.4		
523	Operating costs (Quebec)	122.3	152.0		

	CAPITAL COSTS	Initial	Ongoing	Total
524	Total spent in Quebec	2,467.65	105.33	2,572.98
525	Total spent in Ontario	4,646.09	105.33	4,751.42
526	Total spent in the rest of Canada	275.90	0.00	275.90
527	Total spend in the rest of the World	1,333.46	0.00	1,333.46
528	Geographical allocation pending	1,530.00	918.80	2,448.80
529	Residual unallocated to region	0.77	(0.00)	0.77
530	**Total Capital Costs**	10,253.87	1,129.47	11,383.34
531	Total spent on skilled labour	2,782.87	0.00	2,782.87
532	Total spent on unskilled labour	724.93	0.00	724.93
533	Total spent on material	5,016.43	1,129.47	6,145.90
534	Total spent on plant	1,729.63	0.00	1,729.63
535	Residual unallocated to spending category	0.01	0.00	0.01
536	**Total Capital Costs**	10,253.87	1,129.47	11,383.34

	TOTAL CASH FLOW (excluding revenues)	
537	Total spent in Quebec	*[This line defined only for year-by-year tables]*
538	Total spent in Ontario	*[This line defined only for year-by-year tables]*
539	Total spent in the rest of Canada	*[This line defined only for year-by-year tables]*
540	Total spend in the rest of the World	*[This line defined only for year-by-year tables]*
541	Geographical allocation pending	*[This line defined only for year-by-year tables]*
542	Residual unallocated to region	*[This line defined only for year-by-year tables]*
543	**Total**	*[This line defined only for year-by-year tables]*
910	**NET CASH FLOW**	*[This line defined only for year-by-year tables]*

Table D.17: 300 kph, MOT Stand Alone: Capital Costs

06-Oct-94 HSR STUDY COST DEVELOPMENT

CAPITAL COST SUMMARY **Composite (via Mirabel) at 300 kph MOT Stand Alone**

		Base Cost	*Professional Services*	Contin-*gency*	Total
201	Right-of-Way	150.58	16.19	18.03	184.80
202	Earthworks/subgrade	819.73	199.45	122.96	1,142.14
203	Bridges	384.06	69.57	38.41	492.04
204	Grade separations	575.84	109.05	86.38	771.26
205	Other accommodations	69.54	14.89	20.86	105.28
206	Track	482.25	73.52	25.01	580.77
207	Power distribution system	362.64	68.67	54.40	485.71
208	Stations	259.00	46.91	25.90	331.81
209	People movers (included in stations)	0.00	0.00	0.00	0.00
210	Signals	227.98	51.94	34.20	314.11
211	Communications	101.15	23.05	15.17	139.36
212	Equipment maintenance facilities	136.94	12.74	19.11	168.79
213	Infrastructure maintenance facilities	78.72	0.00	0.00	78.72
214	Information/ticketing systems	26.03	0.00	0.00	26.03
215	Rolling stock	809.62	71.11	79.27	960.00
216	Commissioning	0.00	63.81	0.00	63.81
217	Administration allowance	62.16	0.00	0.00	62.16
218	Startup and training	41.36	0.00	0.00	41.36
219	**TOTAL INITIAL CAPITAL COSTS**	4,587.59	820.88	539.68	5,948.15
220	**Additional fleet requirements**	*year 2009*	3 units		60.00
221		*year 2013*	5 units		90.00
222		*year 2017*	2 units		60.00
223		*year 2021*	3 units		60.00
224		*Total*	13 units		270.00
225	**Rolling Stock Overhauls**	*total, years 2005-2025*			320.11
226	**Infrastructure Renewal**	*total, years 2005-2025*			0.00
227	**Other ongoing capital**	*total, years 2005-2025*			121.11
228	*Cross check initial capital*				*0.00*

06-Oct-94

HSR STUDY COST DEVELOPMENT

OPERATIONS COST BREAKDOWN Composite (via Mirabel) at 300 kph MOT [stand-alone]

		Cont Allow	Cost Estimate ($ million) 2005	Cost Estimate ($ million) 2025	Employment Estimate 2005	Employment Estimate 2025	Quebec Share 2005
	TRAIN OPERATIONS						
101	Train crew	5.0%	6.89	9.48	96	131	38%
102	Power – demand charges	2.5%	7.13	9.20	—	—	21%
103	Power – energy consumption	2.5%	9.86	14.54	—	—	21%
104	Control centre	5.0%	1.44	1.44	24	24	50%
105	Transportation administration/supervision	5.0%	1.47	1.68	20	23	50%
106	**Subtotal**		26.79	36.35	140	179	29%
	CUSTOMER SERVICES						
107	On-board service staff	10.0%	4.78	7.09	111	165	38%
108	On-board service supplies	5.0%	1.06	1.70	—	—	38%
109	On-board services ground support	10.0%	0.88	1.30	22	33	38%
110	Food/beverage for sale	0.0%	0.00	0.00	—	—	—
111	Station operations	10.0%	14.91	15.93	156	185	24%
112	ATM/Ticketing/Reservations transactions	5.0%	8.65	13.72	—	—	34%
113	Telephone/Counter Sales	5.0%	2.86	3.75	81	106	34%
114	Advertising and promotion expenses	5.0%	10.05	10.05	—	—	34%
115	Customer service administration/supervision	5.0%	6.20	7.37	90	107	50%
116	**Subtotal**		49.38	60.90	460	596	34%
	EQUIPMENT MAINTENANCE						
117	Routine maintenance – labour	5.0%	9.72	13.95	193	277	50%
118	Routine maintenance – material	5.0%	9.87	14.67	—	—	50%
119	Major maintenance [included in capital]	—	—	—	—	—	—
120	Cleaning	5.0%	5.93	8.13	194	266	38%
121	Maintenance administration/supervision	5.0%	3.55	4.55	56	70	50%
122	**Subtotal**		29.06	41.29	443	614	48%
	INFRASTRUCTURE MAINTENANCE						
123	Routine maintenance	15.0%	21.00	22.06	344	368	29%
124	Purchased services	15.0%	11.08	8.56	—	—	29%
125	Materials	10.0%	1.35	13.50	—	—	29%
126	Programmed replacement [occurs after 2025]	—	—	—	—	—	—
127	Maintenance administration/supervision	5.0%	6.53	6.78	94	98	34%
128	**Subtotal**		39.96	50.91	438	466	30%
	EXECUTIVE/ADMINISTRATION						
129	Labour and related	5.0%	9.85	10.94	135	151	50%
130	Other	5.0%	6.50	6.50	—	—	50%
131	**Subtotal**		16.35	17.44	135	151	50%
	INSURANCE/TAXES/OTHER						
132	Insurance/claims	0.0%	6.00	7.21	—	—	29%
133	Property taxes	10.0%	5.50	5.50	—	—	84%
134	Franchise fees	10.0%	*nil*	*nil*	—	—	
135	**Subtotal**		11.50	12.71	0	0	55%
136	**CONTINGENCY**	7.2%	12.51	15.25	—	—	36%
137	**TOTAL**		185.55	234.85	1,615	2,005	37%
138	**Total: Quebec component**		69.12	86.05	618	762	
139	**Total: Ontario component**		116.43	148.80	998	1,243	
140	**[Major maintenance included in capital]**		0.00	11.36			
141	Routine equipment maintenance per trainset km	*dollars*	1.85	1.83			
142	Infrastructure maintenance per route km	*$thousand*	53.12	70.10			
143	Executive/administration as a percent of total		9.4%	7.9%			
144	Station/ticketing costs per passenger	*Dollars*	3.06	3.16			
145							

Table D.18: 300 kph, MOT Stand Alone: Operations Costs Breakdown

Table D.19: 300 kph, MOT Stand Alone: Ridership Breakdown

25-Jul-94 **HSR STUDY COST DEVELOPMENT**

RIDERSHIP BREAKDOWN — **Composite (via Mirabel) at 300 kph MOT Stand Alone**

			Year 2005	*Year 2025*		
	RIDERSHIP					
301	Ridership within the segment	*millions*	na	na		
302	Ridership between segments	*millions*	na	na		
303	Airport traffic	*millions*	na	na		
304 [A]	**Total potential passengers**	*million*	6.65	10.67		
305	Passengers not served at peak	*million*	(0.07)	(0.11)	1.0%	*of passengers*
306	Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307	**Net passengers**	*million*	6.59	10.56		
	PASSENGER REVENUES					
308	Initial transportation revenue estimate	*$million*	550.35	940.12		
309	PST/GST	*$million*	(42.74)	(73.01)	7.8%	*of revenues*
310	Revenue estimate net of taxes	*$million*	507.61	867.11		
311	First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312	Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313	Revenues foregone at peak	*$million*	(5.08)	(8.67)	1.0%	*of revenues*
314	**Final Gross Revenue**	*$million*	502.54	858.44		
	PASSENGER KILOMETRES					
315	Ridership within segments	*billions*	2.50	4.07		
316	Ridership between segments	*billions*	0.10	0.15		
317	Airport traffic	*billions*	above	above		
318	Total		2.59	4.22		
319	Passenger-km foregone at peak	*billions*	(0.03)	(0.04)	1.0%	*of passenger-km*
320	Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321	**Total passenger kms**	*billions*	2.56	4.18		
322	**Average Length of Haul**	*kms*	390	396		

Table D.20: 300 kph, MOT Stand Alone: Employment Data

25-Jul-94 **HSR STUDY COST DEVELOPMENT**

EMPLOYMENT DATA — **Composite (via Mirabel) at 300 kph MOT Stand Alone**

		Average Wage	*Total Year 2005*	*Total Year 2025*	*Quebec Year 2005*	*Quebec Year 2025*
401	Train Crew	57,500	96	131	36	47
402	Dispatchers	50,600	24	24	12	12
403	Managerial/admin/professional	58,324	367	415	169	192
404	Station staff	35,939	39	46	9	11
405	Mechanical trades/skilled	39,402	211	297	89	128
406	Maintenance trades/skilled	36,349	285	305	70	75
407	**Total "skilled"**	47,175	1,022	1,219	386	466
408	OBS Staff	31,453	123	182	47	66
409	Sales Staff	29,007	81	106	28	36
410	Other customer service	29,986	11	17	4	6
411	Support staff	34,206	28	33	14	16
412	Station labour (various)	24,881	117	139	28	34
413	Equipment maintenance unskilled	30,603	15	22	8	11
414	Track maintenance unskilled	30,603	59	63	30	32
415	Cleaners	24,270	160	225	74	96
416	**Total "unskilled"**	27,881	593	786	232	297
417	**Total "unallocated"**		0	0	0	0
418	**Grand total employment**	40,088	1,615	2,005	618	762
419	**Ontario Total "skilled"**		636	753		
420	**Ontario Total "unskilled"**		361	489		
421	**Ontario Total "unallocated"**		0	0		
422	**Ontario Grand total employment**		998	1,243		
423	**Quebec Total "skilled"**		386	466		
424	**Quebec Total "unskilled"**		232	297		
425	**Quebec Total "unallocated"**		0	0		
426	**Quebec Grand total employment**		618	762		

Table D.21: 300 kph, MOT Stand Alone: Cash Flow Breakdown

25-Jul-04 **HSR STUDY COST DEVELOPMENT**

TOTAL CASHFLOW — **Composite (via Mirabel) at 300 kph MOT Stand Alone**

		Total Year 2005	*Total Year 2025*	*Quebec Year 2005*	*Quebec Year 2025*
501	**[A] RIDERSHIP**	6.6	10.6	*NA*	*NA*
502	**ADJUSTED GROSS REVENUE**	502.5	858.4	168.6	288.0
503	Payments to Travel Agencies	27.6	47.2	9.3	15.8
504	Payments to Credit Card Companies	4.7	8.0	1.6	2.7
505	**Revenue Available to HSR Operator**	470.2	803.2	157.8	269.5
	OPERATING EMPLOYMENT				
904	Total employment	1,615	2,005	618	762
905	"Skilled" employment	1,022	1,219	386	466
906	"Unskilled" employment	593	786	232	297
907	Employment in Ontario	998	1,243		
908	Employment in Quebec	618	762	618	762
	OPERATING COSTS				
	Labour				
506	Bare wage bill skilled	48.2	57.4	18.9	22.7
507	Bare wage bill unskilled	16.5	21.9	6.5	8.3
508	Payroll taxes	5.4	6.7	2.1	2.6
509	Provisions for pension plan	4.9	6.0	1.9	2.3
	Purchased materials/services				
510	Electricity	17.0	23.7	3.6	4.9
511	Advertising/promotion	10.1	10.1	3.5	3.5
512	Infrastructure maintenance services	11.1	8.6	3.2	2.5
513	Infrastructure materials/supplies	1.3	13.5	0.4	3.9
514	Rolling stock materials/supplies	9.9	14.7	4.9	7.3
515	Telecommunications/computer services	8.7	13.7	3.0	4.7
516	Insurance services/franchise fees etc	6.0	7.2	1.7	2.1
517	Food/related sundries	1.1	1.7	0.4	0.6
518	**Unscheduled materials/services**	32.9	34.4	14.5	15.1
519	**Allowance for contingencies**	12.5	15.3	4.5	5.5
520	**TOTAL OPERATING COSTS**	185.6	234.8	69.1	86.1
521	**OPERATING PROFIT**	284.6	568.3	*NA*	*NA*
909	**COST REVENUE RATIO**	2.53	3.42	*NA*	*NA*
522	Operating costs (Ontario)	116.4	148.8		
523	Operating costs (Quebec)	69.1	86.1		

	CAPITAL COSTS	**Initial**	**Ongoing**	**Total**
524	Total spent in Quebec	1,230.46	60.55	1,291.02
525	Total spent in Ontario	2,821.77	60.55	2,882.33
526	Total spent in the rest of Canada	151.36	0.00	151.36
527	Total spend in the rest of the World	783.79	0.00	783.79
528	Geographical allocation pending	960.00	561.70	1,521.70
529	Residual unallocated to region	0.76	0.00	0.76
530	**Total Capital Costs**	5,948.15	682.81	6,630.95
531	Total spent on skilled labour	1,625.91	0.00	1,625.91
532	Total spent on unskilled labour	421.14	0.00	421.14
533	Total spent on material	2,880.86	682.81	3,563.66
534	Total spent on plant	1,020.25	0.00	1,020.25
535	Residual unallocated to spending category	(0.00)	0.00	(0.00)
536	**Total Capital Costs**	5,948.15	682.81	6,630.95

	TOTAL CASH FLOW (excluding revenues)	
537	Total spent in Quebec	*[This line defined only for year-by-year tables]*
538	Total spent in Ontario	*[This line defined only for year-by-year tables]*
539	Total spent in the rest of Canada	*[This line defined only for year-by-year tables]*
540	Total spend in the rest of the World	*[This line defined only for year-by-year tables]*
541	Geographical allocation pending	*[This line defined only for year-by-year tables]*
542	Residual unallocated to region	*[This line defined only for year-by-year tables]*
543	**Total**	*[This line defined only for year-by-year tables]*
910	**NET CASH FLOW**	*[This line defined only for year-by-year tables]*

Table D.22: 300 kph, Quebec-Toronto Stand Alone: Capital Costs

01-Aug-94 HSR STUDY COST DEVELOPMENT

CAPITAL COST SUMMARY **Composite (via Mirabel) at 300 kph QT Segment**

		Base Cost	Professional Services	Contin-gency	Total
201	Right-of-Way	203.17	21.84	24.32	249.33
202	Earthworks/subgrade	1,062.88	258.96	159.43	1,481.27
203	Bridges	456.13	82.62	45.61	584.37
204	Grade separations	796.33	150.80	119.45	1,066.58
205	Other accommodations	76.08	16.29	22.83	115.20
206	Track	667.75	101.83	34.64	804.22
207	Power distribution system	506.17	95.85	75.92	677.94
208	Stations	282.00	51.08	28.20	361.28
209	People movers (included in stations)	0.00	0.00	0.00	0.00
210	Signals	352.82	80.39	52.92	486.14
211	Communications	155.58	35.45	23.34	214.37
212	Equipment maintenance facilities	147.49	13.69	20.53	181.71
213	Infrastructure maintenance facilities	102.13	0.00	0.00	102.13
214	Information/ticketing systems	36.17	0.00	0.00	36.17
215	Rolling stock	1,037.33	91.11	101.56	1,230.00
216	Commissioning	0.00	84.18	0.00	84.18
217	Administration allowance	75.26	0.00	0.00	75.26
218	Startup and training	55.70	0.00	0.00	55.70
219	**TOTAL INITIAL CAPITAL COSTS**	6,012.99	1,084.10	708.75	7,805.85
220	**Additional fleet requirements**	*year 2009*	3 units		60.00
221		*year 2013*	5 units		120.00
222		*year 2017*	3 units		90.00
223		*year 2021*	3 units		60.00
224		*Total*	14 units		330.00
225	**Rolling Stock Overhauls**	*total, years 2005-2025*			406.49
226	**Infrastructure Renewal**	*total, years 2005-2025*			0.00
227	**Other ongoing capital**	*total, years 2005-2025*			160.99
228	*Cross check initial capital*				*0.00*

Table D.23: 300 kph, Quebec-Toronto Stand Alone: Operations Costs Breakdown

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

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OPERATIONS COST BREAKDOWN Composite (via Mirabel) at 300 kph QT Segment

		Cont Allow	Cost Estimate ($ million) 2005	2025	Employment Estimate 2005	2025	Quebec Share 2005
	TRAIN OPERATIONS						
101	Train crew	5.0%	9.16	12.34	127	171	52%
102	Power - demand charges	2.5%	9.43	12.26	--	--	37%
103	Power - energy consumption	2.5%	12.32	17.90	--	--	35%
104	Control centre	5.0%	1.91	1.91	32	32	62%
105	Transportation administration/supervision	5.0%	1.70	1.94	24	27	57%
106	**Subtotal**		34.52	46.36	183	230	42%
	CUSTOMER SERVICES						
107	On-board service staff	10.0%	6.07	8.85	142	206	50%
108	On-board service supplies	5.0%	1.47	2.34	--	--	54%
109	On-board services ground support	10.0%	1.11	1.62	28	41	50%
110	Food/beverage for sale	0.0%	0.00	0.00	--	--	--
111	Station operations	10.0%	17.70	19.15	221	263	36%
112	ATM/Ticketing/Reservations transactions	5.0%	11.74	18.45	--	--	50%
113	Telephone/Counter Sales	5.0%	3.88	5.04	109	142	50%
114	Advertising and promotion expenses	5.0%	12.95	12.95	--	--	47%
115	Customer service administration/supervision	5.0%	7.76	9.17	116	136	60%
116	**Subtotal**		62.69	77.57	616	789	47%
	EQUIPMENT MAINTENANCE						
117	Routine maintenance - labour	5.0%	12.31	17.51	245	348	50%
118	Routine maintenance - material	5.0%	12.50	18.27	--	--	50%
119	Major maintenance [included in capital]	--	--	--	--	--	--
120	Cleaning	5.0%	8.03	10.86	262	355	54%
121	Maintenance administration/supervision	5.0%	3.97	5.08	63	79	50%
122	**Subtotal**		36.81	51.71	570	782	51%
	INFRASTRUCTURE MAINTENANCE						
123	Routine maintenance	15.0%	29.35	30.73	481	512	49%
124	Purchased services	15.0%	15.57	12.03	--	--	49%
125	Materials	10.0%	1.76	17.56	--	--	45%
126	Programmed replacement [occurs after 2025]	--	--	--	--	--	
127	Maintenance administration/supervision	5.0%	8.28	8.54	119	123	45%
128	**Subtotal**		54.96	68.85	600	635	49%
	EXECUTIVE/ADMINISTRATION						
129	Labour and related	5.0%	11.40	12.71	161	180	57%
130	Other	5.0%	8.70	8.70	--	--	63%
131	**Subtotal**		20.10	21.41	161	180	59%
	INSURANCE/TAXES/OTHER						
132	Insurance/claims	0.0%	8.50	10.54	--	--	50%
133	Property taxes	10.0%	6.50	6.50	--	--	86%
134	Franchise fees	10.0%	*nil*	nil	--	--	
135	**Subtotal**		15.00	17.04	0	0	66%
136	**CONTINGENCY**	7.3%	16.38	19.83	--	--	50%
137	**TOTAL**		240.46	302.77	2,128	2,615	50%
138	**Total: Quebec component**		119.40	147.86	1,092	1,321	
139	**Total: Ontario component**		121.06	154.91	1,037	1,294	
140	**[Major maintenance included in capital]**		0.00	14.40			
141	Routine equipment maintenance per trainset km	dollars	1.85	1.83			
142	Infrastructure maintenance per route km	$thousand	52.75	68.17			
143	Executive/administration as a percent of total		9.0%	7.6%			
144	Station/ticketing costs per passenger	Dollars	3.76	3.03			

Table D.24: 300 kph, Quebec-Toronto Stand Alone: Ridership Breakdown

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

RIDERSHIP BREAKDOWN — **Composite (via Mirabel) at 300 kph QT Segment**

			Year 2005	*Year 2025*		
	RIDERSHIP					
301	Ridership within the segment	*millions*	na	na		
302	Ridership between segments	*millions*	na	na		
303	Airport traffic	*millions*	na	na		
304 [A]	**Total potential passengers**	*million*	8.85	14.07		
305	Passengers not served at peak	*million*	(0.09)	(0.14)	1.0%	*of passengers*
306	Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307	**Net passengers**	*million*	8.77	13.93		
	PASSENGER REVENUES					
308	Initial transportation revenue estimate	*$million*	712.69	1,212.47		
309	PST/GST	*$million*	(58.46)	(99.38)	8.2%	*of revenues*
310	Revenue estimate net of taxes	*$million*	654.23	1,113.09		
311	First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312	Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313	Revenues foregone at peak	*$million*	(6.54)	(11.13)	1.0%	*of revenues*
314	**Final Gross Revenue**	*$million*	647.69	1,101.96		
	PASSENGER KILOMETRES					
315	Ridership within segments	*billions*	2.95	4.77		
316	Ridership between segments	*billions*	0.31	0.50		
317	Airport traffic	*billions*	above	above		
318	Total		3.27	5.27		
319	Passenger-km foregone at peak	*billions*	(0.03)	(0.05)	1.0%	*of passenger-km*
320	Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321	**Total passenger kms**	*billions*	3.23	5.22		
322	**Average Length of Haul**	*kms*	369	375		

Table D.25: 300 kph, Quebec-Toronto Stand Alone: Employment Data

26-Jul-94 **HSR STUDY COST DEVELOPMENT**

EMPLOYMENT DATA — **Composite (via Mirabel) at 300 kph QT Segment**

		Average Wage	*Total Year 2005*	*Total Year 2025*	*Quebec Year 2005*	*Quebec Year 2025*
401	Train Crew	57,500	127	171	67	85
402	Dispatchers	50,600	32	32	20	20
403	Managerial/admin/professional	58,324	428	479	223	248
404	Station staff	35,939	55	66	25	30
405	Mechanical trades/skilled	39,402	278	383	132	181
406	Maintenance trades/skilled	36,349	399	425	184	195
407	**Total "skilled"**	46,489	1,318	1,556	650	760
408	OBS Staff	31,453	156	227	78	108
409	Sales Staff	29,007	109	142	55	71
410	Other customer service	29,986	14	21	7	10
411	Support staff	34,206	55	66	41	49
412	Station labour (various)	24,881	165	197	76	90
413	Equipment maintenance unskilled	30,603	20	28	10	14
414	Track maintenance unskilled	30,603	82	87	53	56
415	Cleaners	24,270	209	292	123	163
416	**Total "unskilled"**	27,984	810	1,060	442	561
417	**Total "unallocated"**		0	0	(0)	0
418	**Grand total employment**	39,444	2,128	2,615	1,092	1,321
419	**Ontario Total "skilled"**		668	796		
420	**Ontario Total "unskilled"**		368	498		
421	**Ontario Total "unallocated"**		0	0		
422	**Ontario Grand total employment**		1,037	1,294		
423	**Quebec Total "skilled"**		650	760		
424	**Quebec Total "unskilled"**		442	561		
425	**Quebec Total "unallocated"**		0	0		
426	**Quebec Grand total employment**		1,092	1,321		

Table D.26: 300 kph, Quebec-Toronto Stand Alone: Cash Flow Breakdown

01-Aug-04 — **HSR STUDY COST DEVELOPMENT**

TOTAL CASHFLOW — **Composite (via Mirabel) at 300 kph QT Segment**

		Total Year 2005	Total Year 2025	Quebec Year 2005	Quebec Year 2025
501	[A] **RIDERSHIP**	8.8	13.9	*NA*	*NA*
502	**ADJUSTED GROSS REVENUE**	647.7	1,102.0	299.2	507.0
503	Payments to Travel Agencies	35.6	60.6	16.5	27.9
504	Payments to Credit Card Companies	6.1	10.3	2.8	4.8
505	**Revenue Available to HSR Operator**	606.0	1,031.0	279.9	474.4
	OPERATING EMPLOYMENT				
904	Total employment	2,128	2,615	1,092	1,321
905	"Skilled" employment	1,318	1,556	650	760
906	"Unskilled" employment	810	1,060	442	561
907	Employment in Ontario	1,037	1,294		
908	Employment in Quebec	1,092	1,321	1,092	1,321
	OPERATING COSTS				
	Labour				
506	Bare wage bill skilled	61.3	72.3	30.6	35.7
507	Bare wage bill unskilled	22.7	29.6	12.4	15.8
508	Payroll taxes	7.1	8.7	3.6	4.4
509	Provisions for pension plan	6.3	7.6	3.2	3.9
	Purchased materials/services				
510	Electricity	21.7	30.2	7.7	10.5
511	Advertising/promotion	13.0	13.0	6.1	6.1
512	Infrastructure maintenance services	15.6	12.0	6.7	7.0
513	Infrastructure materials/supplies	1.8	17.6	0.8	8.0
514	Rolling stock materials/supplies	12.5	18.3	6.2	9.1
515	Telecommunications/computer services	11.7	18.5	5.9	9.2
516	Insurance services/franchise fees etc	8.5	10.5	4.2	5.4
517	Food/related sundries	1.5	2.3	0.8	1.2
518	**Unscheduled materials/services**	40.5	42.4	22.9	21.8
519	**Allowance for contingencies**	16.4	19.8	8.2	9.7
520	**TOTAL OPERATING COSTS**	240.5	302.8	119.4	147.9
521	**OPERATING PROFIT**	365.5	728.3	*NA*	*NA*
909	**COST REVENUE RATIO**	2.52	3.41	*NA*	*NA*
522	Operating costs (Ontario)	121.1	154.9		
523	Operating costs (Quebec)	119.4	147.9		

	CAPITAL COSTS	**Initial**	**Ongoing**	**Total**
524	Total spent in Quebec	2,288.94	80.49	2,369.43
525	Total spent in Ontario	3,051.35	80.49	3,131.85
526	Total spent in the rest of Canada	209.37	0.00	209.37
527	Total spend in the rest of the World	1,025.43	0.00	1,025.43
528	Geographical allocation pending	1,230.00	699.36	1,929.36
529	Residual unallocated to region	0.76	0.00	0.76
530	**Total Capital Costs**	7,805.85	860.35	8,666.19
531	Total spent on skilled labour	2,124.04	0.00	2,124.04
532	Total spent on unskilled labour	547.52	0.00	547.52
533	Total spent on material	3,806.61	860.35	4,666.95
534	Total spent on plant	1,327.68	0.00	1,327.68
535	Residual unallocated to spending category	0.00	0.00	0.00
536	**Total Capital Costs**	7,805.85	860.35	8,666.19

	TOTAL CASH FLOW (excluding revenues)	
537	Total spent in Quebec	*[This line defined only for year-by-year tables]*
538	Total spent in Ontario	*[This line defined only for year-by-year tables]*
539	Total spent in the rest of Canada	*[This line defined only for year-by-year tables]*
540	Total spend in the rest of the World	*[This line defined only for year-by-year tables]*
541	Geographical allocation pending	*[This line defined only for year-by-year tables]*
542	Residual unallocated to region	*[This line defined only for year-by-year tables]*
543	**Total**	*[This line defined only for year-by-year tables]*
910	**NET CASH FLOW**	*[This line defined only for year-by-year tables]*

Table D.27: 250 kph, Quebec-Windsor Corridor: Ridership Breakdown

06-Oct-94 HSR STUDY COST DEVELOPMENT

RIDERSHIP BREAKDOWN **Composite (via Dorval) at 250 kph QW Corridor**

				Year 2005	Year 2025		
		RIDERSHIP					
301		Ridership within the segment	*millions*	na	na		
302		Ridership between segments	*millions*	na	na		
303		Airport traffic	*millions*	na	na		
304	[A]	**Total potential passengers**	*million*	11.58	17.96		
305		Passengers not served at peak	*million*	(0.12)	(0.18)	1.0%	*of passengers*
306		Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307		**Net passengers**	*million*	11.46	17.78		
		PASSENGER REVENUES					
308		Initial transportation revenue estimate	*$million*	833.93	1,348.87		
309		PST/GST	*$million*	(65.42)	(105.83)	7.8%	*of revenues*
310		Revenue estimate net of taxes	*$million*	768.51	1,243.03		
311		First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312		Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313		Revenues foregone at peak	*$million*	(7.69)	(12.43)	1.0%	*of revenues*
314		**Final Gross Revenue**	*$million*	760.82	1,230.60		
		PASSENGER KILOMETRES					
315		Ridership within segments	*billions*	3.36	5.36		
316		Ridership between segments	*billions*	0.46	0.73		
317		Airport traffic	*billions*	above	above		
318		Total		3.82	6.09		
319		Passenger-km foregone at peak	*billions*	(0.04)	(0.06)	1.0%	*of passenger-km*
320		Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321		**Total passenger kms**	*billions*	3.78	6.03		
322		**Average Length of Haul**	*kms*	330	339		

Table D.28: 250 kph, Quebec-Windsor Corridor: Operations/Revenues/Costs

06-Oct-94 **HSR STUDY COST DEVELOPMENT**

OPERATIONS/REVENUES/COSTSComposite (via Dorval) at 250 kph QW Corridor

			Year 2005	Year 2025		
	RIDERSHIP					
1	[A] Adjusted passengers (non-duplicated)	millions	11.5	17.8		
2	Average length of haul	kms	330	339		
3	Passenger kilometres	billion	3.8	6.0		
	OPERATION STATISTICS					
4	Route length	kilometres	1,228	1,228		
5	Train trips (one-way)	thousands	24.2	34.1		
6	Trainset kms	millions	19.3	27.3		
7	Seat kms	billions	5.4	7.7	*282 per trainset*	
8	Trainsets in active fleet	units	65	86		
9	Average trainset utilization	k-km/year	297	318		
10	Average load factor		70%	78%		
11	Total energy consumption	gigaW-hrs	320	452		
12	Total employment		2,622	3,157		
	PASSENGER REVENUES					
13	Adjustusted revenues	$million	760.8	1,230.6		
14	Agency commissions	$million	(41.8)	(67.7)	*5.5% of gross revenue*	
15	Credit card discount	$million	(7.1)	(11.5)	*0.9% of gross revenue*	
16	Net Revenue	$million	711.8	1,151.4		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	$million	39.3	51.7	264	328
18	Customer services	$million	76.7	94.2	784	980
19	Equipment maintenance	$million	38.9	53.5	598	809
20	Infrastructure maintenance	$million	68.3	84.1	784	826
21	Executive/administration	$million	24.2	25.5	219	241
22	Insurance/taxes/other	$million	18.3	21.1	0	0
23	Contingency	$million	19.7	22.8	—	—
24	**Total O&M Costs**	$million	285.2	352.9	2,622	3,157
25	**OPERATING PROFIT**		426.7	798.5		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.50	3.26		
28	O&M cost per trainset-km	dollars	14.79	12.92		
29	O&M cost per seat-km	cents	5.25	4.58		
30	O&M cost per passenger	dollars	24.88	19.85		
31	O&M cost per passenger-km	cents	7.54	5.85		
32	Net revenue per passenger	dollars	62.10	64.75		
33	Net revenue per passenger km	cents	18.82	19.09		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	$million	269.2			
35	Construction of track	$million	7,395.1			
36	Construction of stations	$million	521.3			
37	Construction of maintenance facilities	$million	309.3			
38	Acqusition of rolling stock	$million	1,545.9			
39	**Total Initial Capital Costs**	$million	10,040.6	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	$million	1,126.8	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	$million	6.92			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	257.02	454.83	415.90	735.49
902	O and M Costs	107.69	177.49	132.66	220.25
903	Employment	1,019	1,603	1,247	1,910

Table D.29: 350 kph, Quebec-Windsor Corridor: Ridership Breakdown

06-Oct-94 HSR STUDY COST DEVELOPMENT

RIDERSHIP BREAKDOWN — Composite (via Mirabel) at 350 kph QW Corridor

				Year 2005	Year 2025		
		RIDERSHIP					
301		Ridership within the segment	*millions*	na	na		
302		Ridership between segments	*millions*	na	na		
303		Airport traffic	*millions*	na	na		
304	[A]	**Total potential passengers**	*million*	12.64	20.10		
305		Passengers not served at peak	*million*	(0.13)	(0.20)	1.0%	*of passengers*
306		Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307		**Net passengers**	*million*	12.51	19.90		
		PASSENGER REVENUES					
308		Initial transportation revenue estimate	*$million*	965.92	1,592.96		
309		PST/GST	*$million*	(75.78)	(124.91)	7.8%	*of revenues*
310		Revenue estimate net of taxes	*$million*	890.15	1,468.05		
311		First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312		Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313		Revenues foregone at peak	*$million*	(8.90)	(14.68)	1.0%	*of revenues*
314		**Final Gross Revenue**	*$million*	881.25	1,453.37		
		PASSENGER KILOMETRES					
315		Ridership within segments	*billions*	3.81	6.19		
316		Ridership between segments	*billions*	0.53	0.84		
317		Airport traffic	*billions*	above	above		
318		Total		4.34	7.03		
319		Passenger-km foregone at peak	*billions*	(0.04)	(0.07)	1.0%	*of passenger-km*
320		Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321		**Total passenger kms**	*billions*	4.30	6.96		
322		**Average Length of Haul**	*kms*	344	350		

Table D.30: 350 kph, Quebec-Windsor Corridor: Operations/Revenues/Costs

01-Aug-94 HSR STUDY COST DEVELOPMENT

OPERATIONS/REVENUES/COSTSComposite (via Mirabel) at 350 kph QW Corridor

			Year 2005	Year 2025		
	RIDERSHIP					
1	[A] Adjusted passengers (non-duplicated)	millions	12.5	19.9		
2	Average length of haul	kms	344	350		
3	Passenger kilometres	billion	4.3	7.0		
	OPERATION STATISTICS					
4	Route length	kilometres	1,234	1,234		
5	Train trips (one-way)	thousands	21.4	31.5		
6	Trainset kms	millions	17.5	25.4		
7	Seat kms	billions	6.3	9.1	*358 per trainset*	
8	Trainsets in active fleet	units	50	66		
9	Average trainset utilization	k-km/year	350	385		
10	Average load factor		69%	76%		
11	Total energy consumption	gigaW-hrs	541	783		
12	Total employment		2,749	3,375		
	PASSENGER REVENUES					
13	Adjustusted revenues	$million	881.2	1,453.4		
14	Agency commissions	$million	(48.5)	(79.9)	*5.5% of gross revenue*	
15	Credit card discount	$million	(8.3)	(13.6)	*0.9% of gross revenue*	
16	Net Revenue	$million	824.5	1,359.8		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	$million	52.4	70.9	228	287
18	Customer services	$million	81.5	101.7	809	1,033
19	Equipment maintenance	$million	48.2	67.7	732	1,008
20	Infrastructure maintenance	$million	75.1	91.7	787	833
21	Executive/administration	$million	24.2	25.7	219	244
22	Insurance/taxes/other	$million	18.3	21.3	0	0
23	Contingency	$million	21.7	24.8	—	—
24	**Total O&M Costs**	$million	321.4	403.8	2,749	3,375
25	**OPERATING PROFIT**		503.2	956.0		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.57	3.37		
28	O&M cost per trainset-km	dollars	18.35	15.89		
29	O&M cost per seat-km	cents	5.13	4.44		
30	O&M cost per passenger	dollars	25.69	20.29		
31	O&M cost per passenger-km	cents	7.48	5.80		
32	Net revenue per passenger	dollars	65.91	68.33		
33	Net revenue per passenger km	cents	19.19	19.53		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	$million	268.1			
35	Construction of track	$million	7,691.5			
36	Construction of stations	$million	435.7			
37	Construction of maintenance facilities	$million	330.6			
38	Acqusition of rolling stock	$million	1,581.0			
39	**Total Initial Capital Costs**	$million	10,307.0	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	$million	1,176.8	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	$million	7.07			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	297.55	526.96	489.25	870.56
902	O and M Costs	128.80	192.55	160.50	243.34
903	Employment	1,136	1,612	1,388	1,987

Table D.31: 300 kph, Quebec-Windsor Corridor via Dorval: Operations/Revenues/ Costs

06-Oct-94 **HSR STUDY COST DEVELOPMENT**

OPERATIONS/REVENUES/COSTSComposite (via Dorval) at 300 kph QW Corridor

			Year 2005	*Year 2025*		
	RIDERSHIP					
1	[A] Adjusted passengers (non-duplicated)	millions	12.3	19.7		
2	Average length of haul	kms	336	342		
3	Passenger kilometres	billion	4.2	6.7		
	OPERATION STATISTICS					
4	Route length	kilometres	1,228	1,228		
5	Train trips (one-way)	thousands	20.8	31.3		
6	Trainset kms	millions	16.7	24.4		
7	Seat kms	billions	6.0	8.7	*358 per trainset*	
8	Trainsets in active fleet	units	50	68		
9	Average trainset utilization	k-km/year	333	359		
10	Average load factor		70%	77%		
11	Total energy consumption	gigaW-hrs	406	592		
12	Total employment		2,730	3,397		
	PASSENGER REVENUES					
13	Adjustusted revenues	$million	860.8	1,456.1		
14	Agency commissions	$million	(47.3)	(80.1)	*5.5% of gross revenue*	
15	Credit card discount	$million	(8.1)	(13.7)	*0.9% of gross revenue*	
16	Net Revenue	$million	805.4	1,362.4		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	$million	44.1	59.8	233	299
18	Customer services	$million	81.0	101.4	812	1,042
19	Equipment maintenance	$million	45.5	65.3	708	1,008
20	Infrastructure maintenance	$million	72.2	90.3	784	832
21	Executive/administration	$million	24.2	25.8	219	246
22	Insurance/taxes/other	$million	18.3	21.3	0	0
23	Contingency	$million	20.9	24.3	—	—
24	**Total O&M Costs**	$million	306.2	388.4	2,730	3,397
25	**OPERATING PROFIT**		499.2	974.0		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.63	3.51		
28	O&M cost per trainset-km	dollars	18.37	15.92		
29	O&M cost per seat-km	cents	5.13	4.45		
30	O&M cost per passenger	dollars	24.81	19.75		
31	O&M cost per passenger-km	cents	7.38	5.77		
32	Net revenue per passenger	dollars	65.28	69.27		
33	Net revenue per passenger km	cents	19.40	20.23		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	$million	268.3			
35	Construction of track	$million	7,751.0			
36	Construction of stations	$million	521.7			
37	Construction of maintenance facilities	$million	326.8			
38	Acqusition of rolling stock	$million	1,530.0			
39	**Total Initial Capital Costs**	$million	10,397.9	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	$million	1,227.5	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	$million	7.22			

		2005 Que	*2005 Ont*	*2025 Que*	2025 Ont
901	Net Revenues	290.18	515.23	488.73	873.65
902	O and M Costs	114.50	188.78	143.64	240.71
903	Employment	1,063	1,667	1,328	2,069

Table D.32: 300 kph, MOT via Dorval: Operations/Revenues/ Costs

06-Oct-94 HSR STUDY COST DEVELOPMENT

OPERATIONS/REVENUES/COSTSComposite (via Dorval) at 300 kph MOT [stand-alone]

			Year 2005	Year 2025		
	RIDERSHIP					
1	Passengers	*millions*	7.09	11.52		
2	Average length of haul	*kms*	379	385		
3	Passenger kilometres	*billion*	2.69	4.43		
	OPERATION STATISTICS					
4	Route length	*kilometres*	610	610		
5	Train trips (one-way)	*thousands*	10.32	15.64		
6	Trainset kms	*millions*	10.78	15.82		
7	Seat kms	*billions*	3.86	5.66	*358 per trainset*	
8	Trainsets in active fleet	*units*	31	41		
9	Average trainset utilization	*k-km/year*	348	386		
10	Load factor		70%	78%		
11	Total energy consumption	*gigaW-hrs*	258	379		
12	Total employment		1,620	2,039		
	PASSENGER REVENUES					
13	Gross Revenues	*$million*	545.63	942.66		
14	Agency commissions	*$million*	(30.01)	(51.85)	*5.5% of gross revenue*	
15	Credit card discount	*$million*	(5.12)	(8.84)	*0.9% of gross revenue*	
16	**Net Revenue**	*$million*	510.50	881.98		
	OPERATIONS AND MAINTENANCE COSTS				*[Total employment]*	
17	Train operations	*$million*	27.59	37.47	144	186
18	Customer services	*$million*	51.57	64.21	475	623
19	Equipment maintenance	*$million*	28.98	41.66	434	619
20	Infrastructure maintenance	*$million*	39.29	50.75	432	459
21	Executive/administration	*$million*	16.35	17.52	135	152
22	Insurance/taxes/other	*$million*	11.50	12.75	0	0
23	Contingency	*$million*	12.55	15.47	—	—
24	**Total O&M Costs**	*$million*	187.85	239.82	1,620	2,039
25	**OPERATING PROFIT**		322.66	642.15		
26	**COST/REVENUE RATIOS**					
27	Net revenue : O&M costs Ratio		2.72	3.68		
28	O&M cost per trainset-km	*dollars*	17.43	15.16		
29	O&M cost per seat-km	*cents*	4.87	4.24		
30	O&M cost per passenger	*dollars*	26.49	20.81		
31	O&M cost per passenger-km	*cents*	7.00	5.41		
32	Net revenue per passenger	*dollars*	71.98	76.54		
33	Net revenue per passenger km	*cents*	19.01	19.89		
	CAPITAL COSTS					
34	Startup/admin/training/other "soft" costs	*$million*	167.40			
35	Construction of track	*$million*	4,162.67			
36	Construction of stations	*$million*	444.14			
37	Construction of maintenance facilities	*$million*	243.63			
38	Acquisition of rolling stock	*$million*	930.00			
39	**Total Initial Capital Costs**	*$million*	5,947.83	*over the period 1995 to 2006*		
40	**Total Ongoing Capital Costs**	*$million*	730.68	*over the period 2007 to 2025*		
41	Initial capital per route-km (excluding RS)	*$million*	8.23			

Table D.33: 300 kph, MOT Reduced Cost Scenario: Capital Costs

06-Oct-94 HSR STUDY COST DEVELOPMENT

CAPITAL COST SUMMARY **Reduced (via Dorval) at 300 kph MOT Stand Alone**

			Professional Services	*Contingency*	Total
201	Right-of-Way		94.76	10.19	11.34	116.29
202	Earthworks/subgrade		687.23	168.12	103.08	958.44
203	Bridges		472.91	85.66	47.29	605.87
204	Grade separations		561.51	106.48	85.08	753.07
205	Other accommodations		20.05	4.29	6.02	30.36
206	Track		436.50	66.62	22.65	525.76
207	Power distribution system		332.85	63.03	49.93	445.81
208	Stations		65.00	11.77	6.50	83.27
209	People movers (included in stations)		0.00	0.00	0.00	0.00
210	Signals		212.85	48.50	31.93	293.28
211	Communications		94.56	21.55	14.18	130.30
212	Equipment maintenance facilities		133.94	12.44	18.66	165.04
213	Infrastructure maintenance facilities		70.66	0.00	0.00	70.66
214	Information/ticketing systems		25.63	0.00	0.00	25.63
215	Rolling stock		708.42	62.22	69.36	840.00
216	Commissioning		0.00	52.20	0.00	52.20
217	Administration allowance		61.25	0.00	0.00	61.25
218	Startup and training		38.91	0.00	0.00	38.91
219	**TOTAL INITIAL CAPITAL COSTS**		4,017.05	713.06	466.02	5,196.13
220	**Additional fleet requirements**	*year 2009*	4 units			60.00
221		*year 2013*	5 units			90.00
222		*year 2017*	2 units			60.00
223		*year 2021*	4 units			60.00
224		*Total*	15 units			270.00
225	**Rolling Stock Overhauls**	*total, years 2005-2025*				284.50
226	**Infrastructure Renewal**	*total, years 2005-2025*				0.00
227	**Other ongoing capital**	*total, years 2005-2025*				111.17
228	*Cross check initial capital*					*0.00*

Table D.34: 300 kph, MOT Reduced Cost Scenario: Operations Costs Breakdown

06-Oct-94 HSR STUDY COST DEVELOPMENT

OPERATIONS COST BREAKDOWN Reduced (via Dorval) at 300 kph MOT Stand Alone

		Cont Allow	Cost Estimate ($ million) 2005	2025	Employment Estimate 2005	2025	Quebec Share 2005
	TRAIN OPERATIONS						
101	Train crew	5.0%	6.62	9.10	92	126	37%
102	Power – demand charges	2.5%	7.28	9.35	—	—	10%
103	Power – energy consumption	2.5%	9.37	13.59	—	—	10%
104	Control centre	5.0%	1.44	1.44	24	24	50%
105	Transportation administration/supervision	5.0%	1.47	1.68	20	23	50%
106	**Subtotal**		26.18	35.16	136	173	21%
	CUSTOMER SERVICES						
107	On-board service staff	10.0%	4.61	6.81	107	159	37%
108	On-board service supplies	5.0%	1.05	1.71	—	—	37%
109	On-board services ground support	10.0%	0.84	1.25	21	32	37%
110	Food/beverage for sale	0.0%	0.00	0.00	—	—	—
111	Station operations	10.0%	14.05	14.97	136	162	28%
112	ATM/Ticketing/Reservations transactions	5.0%	8.63	13.80	—	—	34%
113	Telephone/Counter Sales	5.0%	2.85	3.77	80	106	34%
114	Advertising and promotion expenses	5.0%	10.08	10.08	—	—	34%
115	Customer service administration/supervision	5.0%	6.20	7.38	90	107	50%
116	**Subtotal**		48.31	59.75	435	566	35%
	EQUIPMENT MAINTENANCE						
117	Routine maintenance – labour	5.0%	8.82	12.71	175	253	50%
118	Routine maintenance – material	5.0%	9.26	13.45	—	—	50%
119	Major maintenance [included in capital]	—	—	—	—	—	—
120	Cleaning	5.0%	5.37	7.52	175	246	37%
121	Maintenance administration/supervision	5.0%	3.55	4.49	56	69	50%
122	**Subtotal**		27.00	38.17	407	568	47%
	INFRASTRUCTURE MAINTENANCE						
123	Routine maintenance	15.0%	19.63	20.57	322	343	14%
124	Purchased services	15.0%	10.31	7.97	—	—	14%
125	Materials	10.0%	1.08	10.82	—	—	14%
126	Programmed replacement [occurs after 2025]	—	—	—	—	—	
127	Maintenance administration/supervision	5.0%	5.91	6.13	85	88	23%
128	**Subtotal**		36.93	45.49	407	431	15%
	EXECUTIVE/ADMINISTRATION						
129	Labour and related	5.0%	9.85	10.96	135	151	50%
130	Other	5.0%	6.50	6.50	—	—	50%
131	**Subtotal**		16.35	17.46	135	151	50%
	INSURANCE/TAXES/OTHER						
132	Insurance/claims	0.0%	6.00	7.24	—	—	14%
133	Property taxes	10.0%	5.50	5.50	—	—	84%
134	Franchise fees	10.0%	*nil*	nil	—	—	
135	**Subtotal**		11.50	12.74	0	0	47%
136	**CONTINGENCY**	7.2%	11.90	14.32	—	—	30%
137	**TOTAL**		178.18	223.09	1,519	1,889	33%
138	**Total: Quebec component**		58.05	70.93	526	655	
139	**Total: Ontario component**		120.13	152.16	993	1,235	
140	**[Major maintenance included in capital]**		0.00	9.85			
141	Routine equipment maintenance per trainset km	dollars	1.83	1.83			
142	Infrastructure maintenance per route km	$thousand	52.96	67.18			
143	Executive/administration as a percent of total		9.8%	8.4%			
144	Station/ticketing costs per passenger	Dollars	3.84	3.03			

Table D.35: 300 kph, MOT Reduced Cost Scenario: Ridership Breakdown

06-Oct-94 HSR STUDY COST DEVELOPMENT

RIDERSHIP BREAKDOWN **Reduced (via Dorval) at 300 kph MOT Stand Alone**

				Year 2005	Year 2025		
		RIDERSHIP					
301		Ridership within the segment	*millions*	na	na		
302		Ridership between segments	*millions*	na	na		
303		Airport traffic	*millions*	na	na		
304	[A]	**Total potential passengers**	*million*	6.64	10.74		
305		Passengers not served at peak	*million*	(0.07)	(0.11)	1.0%	*of passengers*
306		Allowance for additional passengers	*million*	0.00	0.00	0.0%	*of passengers*
307		**Net passengers**	*million*	6.57	10.64		
		PASSENGER REVENUES					
308		Initial transportation revenue estimate	*$million*	551.78	951.26		
309		PST/GST	*$million*	(42.85)	(73.88)	7.8%	*of revenues*
310		Revenue estimate net of taxes	*$million*	508.93	877.38		
311		First Class premium	*$million*	0.00	0.00	0.0%	*of revenues*
312		Food/beverage sales	*$million*	0.00	0.00	0.00	*per passenger*
313		Revenues foregone at peak	*$million*	(5.09)	(8.77)	1.0%	*of revenues*
314		**Final Gross Revenue**	*$million*	503.84	868.61		
		PASSENGER KILOMETRES					
315		Ridership within segments	*billions*	2.41	3.97		
316		Ridership between segments	*billions*	0.10	0.16		
317		Airport traffic	*billions*	above	above		
318		Total		2.51	4.13		
319		Passenger-km foregone at peak	*billions*	(0.03)	(0.04)	1.0%	*of passenger-km*
320		Allowance for additional passenger-kms	*billions*	0.00	0.00	0.0%	*of passengers-km*
321		**Total passenger kms**	*billions*	2.49	4.09		
322		**Average Length of Haul**	*kms*	378	385		

Table D.36: 300 kph, MOT Reduced Cost Scenario: Employment Data

06-Oct-94 HSR STUDY COST DEVELOPMENT

EMPLOYMENT DATA — **Reduced (via Dorval) at 300 kph MOT Stand Alone**

		Average Wage	*Total Year 2005*	*Total Year 2025*	*Quebec Year 2005*	*Quebec Year 2025*
401	Train Crew	57,500	92	126	34	43
402	Dispatchers	50,600	24	24	12	12
403	Managerial/admin/professional	58,324	359	406	157	179
404	Station staff	35,347	34	41	9	11
405	Mechanical trades/skilled	39,402	193	272	81	116
406	Maintenance trades/skilled	36,349	266	284	17	18
407	**Total "skilled"**	47,437	968	1,152	310	380
408	OBS Staff	31,453	118	175	44	59
409	Sales Staff	29,007	80	106	28	37
410	Other customer service	29,986	11	16	4	5
411	Support staff	34,206	27	32	14	16
412	Station labour (various)	24,471	102	122	28	34
413	Equipment maintenance unskilled	30,603	14	20	7	10
414	Track maintenance unskilled	30,603	56	59	28	30
415	Cleaners	24,270	144	207	65	84
416	**Total "unskilled"**	27,931	552	737	217	275
417	**Total "unallocated"**		0	0	0	0
418	**Grand total employment**	40,355	1,519	1,889	526	655
419	**Ontario Total "skilled"**		658	773		
420	**Ontario Total "unskilled"**		335	462		
421	**Ontario Total "unallocated"**		0	0		
422	**Ontario Grand total employment**		993	1,235		
423	**Quebec Total "skilled"**		310	380		
424	**Quebec Total "unskilled"**		217	275		
425	**Quebec Total "unallocated"**		0	0		
426	**Quebec Grand total employment**		526	655		

Table D.37: 300 kph, MOT Reduced Cost Scenario: Cash Flow Breakdown

06-Oct-94 HSR STUDY COST DEVELOPMENT

TOTAL CASHFLOW — **Reduced (via Dorval) at 300 kph MOT Stand Alone**

		Total Year 2005	*Total Year 2025*	*Quebec Year 2005*	*Quebec Year 2025*
501	**[A] RIDERSHIP**	6.6	10.6	*NA*	*NA*
502	**ADJUSTED GROSS REVENUE**	503.8	868.6	169.0	291.4
503	Payments to Travel Agencies	27.7	47.8	9.3	16.0
504	Payments to Credit Card Companies	4.7	8.1	1.6	2.7
505	**Revenue Available to HSR Operator**	471.4	812.7	158.2	272.7
	OPERATING EMPLOYMENT				
904	Total employment	1,519	1,889	526	655
905	"Skilled" employment	968	1,152	310	380
906	"Unskilled" employment	552	737	217	275
907	Employment in Ontario	993	1,235		
908	Employment in Quebec	526	655	526	655
	OPERATING COSTS				
	Labour				
506	Bare wage bill skilled	45.9	54.6	15.8	19.2
507	Bare wage bill unskilled	15.4	20.6	6.1	7.7
508	Payroll taxes	5.1	6.3	1.8	2.2
509	Provisions for pension plan	4.6	5.6	1.6	2.0
	Purchased materials/services				
510	Electricity	16.7	22.9	1.6	2.2
511	Advertising/promotion	10.1	10.1	3.5	3.5
512	Infrastructure maintenance services	10.3	8.0	1.4	1.1
513	Infrastructure materials/supplies	1.1	10.8	0.2	1.5
514	Rolling stock materials/supplies	9.3	13.5	4.6	6.7
515	Telecommunications/computer services	8.6	13.8	3.0	4.7
516	Insurance services/franchise fees etc	6.0	7.2	0.8	1.0
517	Food/related sundries	1.1	1.7	0.4	0.6
518	**Unscheduled materials/services**	32.2	33.6	13.6	14.2
519	**Allowance for contingencies**	11.9	14.3	3.6	4.3
520	**TOTAL OPERATING COSTS**	178.2	223.1	58.1	70.9
521	**OPERATING PROFIT**	293.2	589.6	*NA*	*NA*
909	**COST REVENUE RATIO**	2.65	3.64	*NA*	*NA*
522	Operating costs (Ontario)	120.1	152.2		
523	Operating costs (Quebec)	58.1	70.9		

	CAPITAL COSTS	**Initial**	**Ongoing**	**Total**
524	Total spent in Quebec	830.20	55.59	885.78
525	Total spent in Ontario	2,713.09	55.59	2,768.67
526	Total spent in the rest of Canada	136.59	0.00	136.59
527	Total spend in the rest of the World	675.51	0.00	675.51
528	Geographical allocation pending	840.00	527.60	1,367.60
529	Residual unallocated to region	0.74	0.00	0.74
530	**Total Capital Costs**	5,196.13	638.78	5,834.91
531	Total spent on skilled labour	1,424.37	0.00	1,424.37
532	Total spent on unskilled labour	363.77	0.00	363.77
533	Total spent on material	2,529.00	638.78	3,167.78
534	Total spent on plant	878.99	0.00	878.99
535	Residual unallocated to spending category	(0.00)	0.00	(0.00)
536	**Total Capital Costs**	5,196.13	638.78	5,834.91

	TOTAL CASH FLOW (excluding revenues)	
537	Total spent in Quebec	*[This line defined only for year-by-year tables]*
538	Total spent in Ontario	*[This line defined only for year-by-year tables]*
539	Total spent in the rest of Canada	*[This line defined only for year-by-year tables]*
540	Total spend in the rest of the World	*[This line defined only for year-by-year tables]*
541	Geographical allocation pending	*[This line defined only for year-by-year tables]*
542	Residual unallocated to region	*[This line defined only for year-by-year tables]*
543	**Total**	*[This line defined only for year-by-year tables]*
910	**NET CASH FLOW**	*[This line defined only for year-by-year tables]*

APPENDIX E: IMPLICATIONS OF USING A SINGLE TRACK BETWEEN MONTREAL AND QUEBEC CITY

E.1 Introduction

E.1.1 Rationale for Studying 'Single Track'

The operating plan was reviewed to assess the implications of utilizing a partially double track system [hereafter referred to as 'single track']. The objective was to explore the trade offs between reductions in capital costs versus the loss in revenues arising from longer trip times, and to quantify the impact of the change in operating plans on O & M costs.

The 300 kph technology operating on the Montreal-Quebec segment was chosen to test the impact of a single track configuration. Montreal-Quebec was selected because the forecast link loads are lower than on the Montreal-Ottawa-Toronto segment. For a preliminary analysis of single track versus double track, the results would be similar regardless of the technology which was assumed. This appendix illustrates the impacts of single track using the 300 kph technology.

E.1.2 Description of Single Track Configuration

The 300 kph base case assumes full double track the entire distance of the route (with additional trackage at stations). The single track configuration is as follows:

Montreal-Laval	Double track
Laval-Trois Rivières	Single track with three 8 km passing sidings
Around Trois-Rivières	Double track
Trois-Rivières-Ancienne-Lorette	Single track with three 8 km passing sidings
Ancienne-Lorette-Quebec	Double track

In summary, 41 per cent of the route would be double tracked (30 per cent between Laval and Ancienne-Lorette).

E.2 Implications for Ridership and Revenues

E.2.1 Trip Times

The following approach was taken to develop trip times for this scenario:

- Three minutes of slack were added to all trains, to reflect the fact that a single track operating plan is inherently less robust than a double track operating plan;

- Based on Train Performance Calculator runs, each time a train takes the siding, it is delayed about five minutes.

- Depending on the day and the time of day, each train would be delayed for taking the siding once, twice, or not at all. Most of the delay takes place during the morning and evening peak periods when trains are operating at half hour headways in the dominant direction. By adjusting the schedule, it is generally possible to ensure that the trains that require two delays are in the inferior direction at the edge of the peak period. Some trains can be scheduled with no meet delays (e.g. any meets occur on a double track portion of the route). Trains during the off peak periods are generally not subject to much delay.

- By 2025, assuming that the track configuration and the train sizes are held constant, approximately two minutes average additional delay should be added to the 2005 delay times to account for the extra traffic and meets. The operating plan still requires no train to be delayed more than twice, but there are very few trains that operate without delay. The increase in delay is projected to affect peak period trains more than off peak, adding about a minute (on average) to all trains.

- The alternative is to use some 10-car trains and extend the double track so that the 2005 trip times can be maintained. In the absence of such an approach, additional double tracking would be required after fifteen years of operation between Laval and Trois-Rivières.

In summary, the following average increases in trip times are projected:

2005		5.7 minutes[13]	
2025		8.0 minutes	No change in track/train size
	or	5.7 minutes	Add track and/or lengthen trains

For the purposes of this analysis, an eight minute average trip time increase by 2025 was assumed.

[13] An average of 6 minutes on normal days (160), 4 minutes on weekends (104 days) and 7 minutes on Fridays or peak period days (100).

E.2.2 Ridership

On the basis of the increases in trip times described above, Project Management provided forecasts of ridership and gross revenues for 2005 and 2025. The projections from the Composite Forecasts were used for the purposes of this analysis. The comparison between double track and single track was as follows:

Table E.1: Comparison of Projected Ridership in the MQ Segment (Thousands)

	Double Track	Single Track	Difference
2005			
MQ - MQ	1,877	1,780	-5.2%
MQ - MOT	399	391	-2.0%
2025			
MQ - MQ	2,913	2,701	-7.3%
MQ - MOT	647	630	-2.6%

These ridership projections translated into a decrease in gross (and net) revenues of 5.6 per cent in 2005, rising to 7.4 per cent by 2025.

E.3 Implications for Costs

E.3.1 Capital Costs

Table E.2 compares initial and ongoing capital costs for the single track and double track scenarios.

Table E.2: Comparison of Capital Costs in the MQ Segment

	Double Track	Single Track	Difference
Startup/admin/training/other "soft" costs	47	43	-8.0%
Construction of track	1,464	1,216	-16.9%
Construction of stations	39	39	-0.1%
Construction of maintenance facilities	36	36	-0.9%
Acquisition of rolling stock	270	240	-11.1%
Total Initial Capital Costs	1,857	1,575	-15.2%
Total Ongoing Capital Costs	177	138	-22.2%
Initial capital per route-km (excluding RS)	6.21	5.23	-15.9%

The difference in initial capital cost requirements is almost 16 per cent. Track construction costs are the main difference. Track construction costs would not

be reduced in the same proportion as track-kilometres (-34 per cent), because of the impact of the costs of nonvariable items such as grade separations and structures.

The reduction in demand projections would necessitate a slightly smaller fleet, both initially and to 2025.

E.3.2 Operating and Maintenance Costs

Key operating statistics for single track and double track are compared in Table E.3. The reductions in workload and employment are roughly commensurate with the projected decreases in ridership. Because it would be possible to eliminate one trainset which under the double track operating plan achieved relatively low utilization, trainset utilization is projected to increase somewhat under the single track scenario.

Table E.3: Comparison of Operating Statistics

	2005 DT	2005 ST	2005 DIF	2025 DT	2025 ST	2025 DIF
RIDERSHIP						
Passengers (millions)	2.25	2.15	-4.6%	3.52	3.30	-6.4%
Passenger kilometres (billions)	0.55	0.52	-4.9%	0.86	0.80	-6.9%
OPERATION STATISTICS						
Train trips (one-way) (thousands)	4.52	4.33	-4.1%	6.14	5.72	-6.9%
Trainset kms (millions)	2.45	2.35	-4.0%	3.31	3.08	-7.0%
Seat kms (billions)	0.88	0.84	-4.0%	1.19	1.10	-7.0%
Trainsets in active fleet	8	7	-12.5%	11	9	-18.2%
Average trainset utilization ('000 km)	306	336	9.7%	301	343	13.7%
Load factor	63%	62%	-1.0%	73%	73%	0.0%
Total energy consumption (gigaW-hrs)	62	60	-2.2%	83	79	-4.9%
Total employment	495	471	-4.8%	584	544	-6.8%

Revenue and O & M cost projections for 2005 and 2025 are shown in Table E.4. This indicates that the projected drop in O & M costs is slightly less than the projected drop in revenues, so that operating profits are projected to be approximately $4 million lower for the single track scenario in 2005, rising to $10 million lower by 2025.

The behaviour of O & M costs varies by functional area. It was assumed that executive/administration and insurance/taxes/other costs would not vary over

such a small range of activity. Train operation costs remained almost constant (crew and energy costs increased slightly per train run, but the number of train runs decreased). Equipment maintenance costs varied almost linearly with volume. The single track configuration is less expensive to maintain, although the decrease in costs is less than proportionate to the change in track-kilometres because certain activities are independent of the track configuration (for example, ROW activities, signalling/communications maintenance).

Table E.4: Comparison of Revenues and O & M Costs
(Millions of Dollars unless specified)

	2005 DT	2005 ST	2005 DIF	2025 DT	2025 ST	2025 DIF
PASSENGER REVENUES						
Gross Revenues	123.4	116.5	-5.6%	207.1	191.7	-7.4%
Net Revenue	115.4	109.0	-5.6%	193.8	179.4	-7.4%
OPERATIONS AND MAINTENANCE COSTS						
Train operations	6.7	6.7	0.2%	8.6	8.4	-1.7%
Customer services	12.2	11.9	-2.7%	15.2	14.6	-4.2%
Equipment maintenance	7.1	6.7	-5.7%	9.4	8.6	-9.3%
Infrastructure maintenance	15.0	13.6	-9.5%	17.9	16.0	-10.6%
Executive/administration	3.7	3.7	0.0%	4.0	3.9	-0.7%
Insurance/taxes/other	7.2	7.2	0.0%	8.3	8.2	-0.9%
Contingency	3.7	3.5	-6.5%	4.4	4.1	-7.7%
Total O&M Costs	52.0	49.6	-4.6%	63.9	59.9	-6.2%
OPERATING PROFIT	63.5	59.4	-6.4%	129.9	119.4	-8.0%
COST/REVENUE RATIOS						
Net revenue : O&M costs Ratio	2.22	2.20	-1.1%	3.03	2.99	-1.3%
O&M cost per trainset-km (dollars)	21.20	21.07	-0.6%	19.28	19.43	0.8%
O&M cost per seat-km (cents)	5.92	5.88	-0.6%	5.39	5.43	0.8%
O&M cost per passenger (dollars)	23.06	23.06	0.0%	18.13	18.17	0.2%
O&M cost per passenger-km (cents)	9.47	9.51	0.3%	7.43	7.48	0.8%
Net revenue per passenger (dollars)	51.24	50.68	-1.1%	54.98	54.39	-1.1%
Net revenue per passenger km (cents)	21.04	20.89	-0.7%	22.52	22.40	-0.5%

Cost/revenue ratios are little affected by the track configuration.

Overall, it appears that the change in capital costs would overwhelm the change in annual operating profits.

E.4 Limitations of the Analysis

The results of this analysis cannot be regarded as definitive, because they do not include an assessment of:

- the 'robustness' of a partially double track system (i.e. the consequences of a delay in a single train on the overall schedule), or
- the market response to such a system.

The impact of, say, a half hour delay in a single train depends upon where and when such a delay occurs: on a single track segment or on a double track one, during the peak or during the off peak. It would also depend on assumptions concering strategies to minimize the impact of the disruption, for example the creation of a double train following a delay to reduce the number of meets.

To model the impact of delays on the schedule would require the use of a delay simulation model. This was not possible within the scope of this assignment.