Final Report

Projections of Ridership and Passenger Revenue for High Speed Rail Alternatives Operating Between Windsor and Quebec City

Prepared for

The Steering Committee for the Quebec/Ontario High Speed Rail Study
Transurb Inc./IBI Group/Monenco-AGRA
Project Manager

Prepared by

Charles River Associates Incorporated
200 Clarendon Street
Boston, Massachusetts 02116

October 1994

CRA No. 159.00

Table of Contents

Executive Summary

INTRODUCTION

This report presents ridership and passenger revenue forecasts for proposed alternative high speed rail (HSR) systems between Windsor and Québec City in Canada. Charles River Associates (CRA) was one of three firms selected to undertake such forecasts on behalf of a Steering Committee formed by the Canadian federal government and the provincial governments of Ontario and Québec. To achieve uniformity in various input data, HSR service options, and other necessary assumptions, certain information was compiled by others and supplied to each firm. As a result, at times, CRA relied on information we did not develop independently. This included using increases in travel growth on existing modes in the absence of HSR based on time series analysis rather than those projected by a panel of Canadian experts. While this raised our ridership forecasts above what we would forecast independently, our basic mode choice methodology for forecasting HSR demand was not affected. Also, the differences between the HSR ridership forecasts in 2005 resulting from the different growth forecasts of travel on the existing modes in the absence of HSR were not large (about 8 percent). Chapter 2 of this report describes the approach and forecasting models we used to make HSR ridership projections in this corridor.

HSR ALTERNATIVES

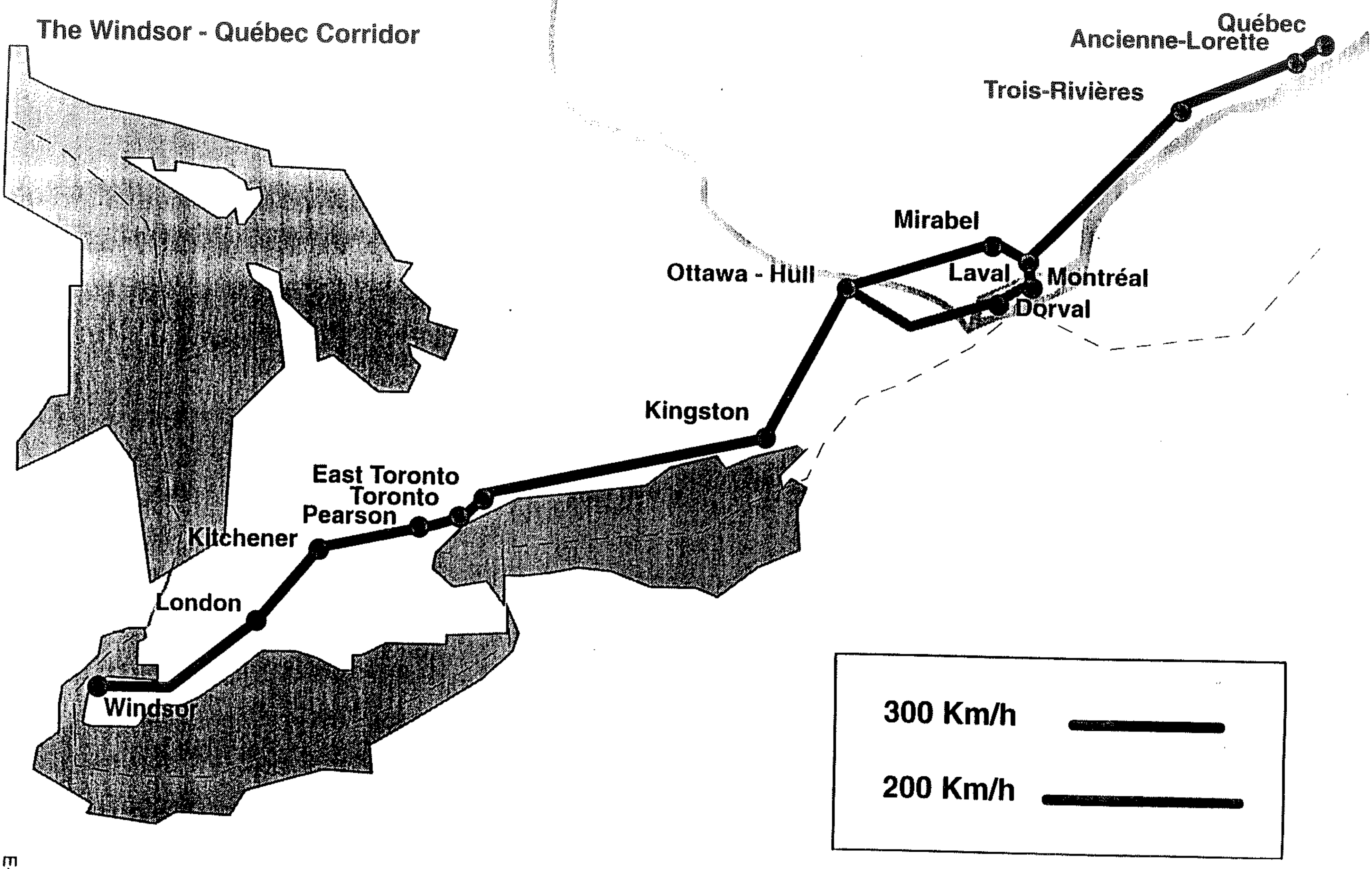
The objective of this study was to project HSR ridership and passenger revenue for travel between various origin-destination (O/D) pairs and alignment options for the years 2005 and 2025. The HSR alternatives considered in this analysis differed in their speeds, alignment, and terminal locations. For the complete or full corridor, HSR service would connect Windsor, Toronto, Montréal, and Québec City with each other and with various intermediate stops. For these alternatives it was assumed that existing VIA intercity rail service would no longer operate. For this full corridor service, two alignments were investigated — denoted as the 200 kph and 300 kph options. Figure E-1 shows the basic HSR alignment that connects Windsor with Québec City.

Two other shortened corridors were also considered in this study. The first assumed that HSR service would operate only between Toronto and Québec City, while the second assumed service between Toronto and Montréal only. It was specified for both of these shortened corridors that where HSR did not operate, service would continue to be provided by VIA with timed transfers to the HSR system.

For the full Windsor to Québec City corridor, a conveniently located HSR station was provided at Pearson International Airport in Toronto, while in Montréal, only

Figure E-1

The Windsor - Québec Corridor



SOURCE: Ministère [illegible] Transports [illegible] Québec

Executive Summary

Dorval International Airport was served in the 200 kph service, and only Mirabel International Airport was served in the 300 kph alternative. For the two shortened alignments, it was assumed that there would not be an HSR station in Toronto's Pearson Airport for the forecasts provided in this report.

HSR RIDERSHIP AND REVENUE FORECASTS

Based on early ridership estimates generated in this study, an HSR operating plan was developed by the Canadian Institute for Guided Ground Transportation (CIGGT) which provided HSR travel times and frequencies on an O/D basis. Given the information supplied for the full corridor, including the forecasts of travel on the existing modes in the absence of HSR that we were directed to use, we forecast 10.2 million HSR riders in the year 2005 for the 200 kph alternative. At the revenue-maximizing fares we developed for this alternative, this forecast yielded C$713.7 million[1] (1992 dollars) in annual passenger revenue. The forecasts of HSR passengers and revenues for all the alternatives for the years 2005 and 2025 are shown in Table E-1. (HSR revenues shown in Table E-1 should be considered gross passenger revenues, since reductions due to agency commissions and the like have not been included in the analysis.) For the shorter Montréal–Toronto service, the table shows the projection of 5.6 million HSR trips in the year 2005 given the 200 kph alignment and technology. (As described in more detail later in this report, there is more than a speed difference between the 200 kph and 300 kph technologies.) HSR ridership and revenue in Table E-1 have been computed based on revenue-maximizing fares that could be charged to business and nonbusiness travelers.

For the 200 kph alternative, the largest number of HSR trips was projected for the Toronto-Ottawa city pair, followed next by the Toronto-Montréal city pair. For the Toronto-Ottawa city pair, the number of trips results from the much improved HSR service offered, compared to the service available on the other intercity modes. For the Toronto-Montréal city pair, the result is due to the large number of trips currently made between these two cities. Chapter 4 presents more detailed information about the various forecasts produced, along with certain sensitivity analyses that were undertaken.

[1]Unless otherwise stated, all cost/price information in this report is given in 1992 Canadian dollars.

Executive Summary

Table E-1. **Total Annual HSR Ridership and Revenue Projections by Year and Scenario**

Year	Technology	HSR Service	HSR Passengers	Passenger Revenue (1992 dollars)
2005	200 kph	Québec-Windsor	10,208,000	$713,696,000
		Québec-Toronto Only	7,374,000	519,914,000
		Montréal-Toronto Only	5,634,000	406,090,000
	300 kph	Québec-Windsor	10,586,000	798,329,000
		Québec-Toronto Only	7,507,000	573,923,000
		Montréal-Toronto Only	5,755,000	452,298,000
2025	200 kph	Québec-Windsor	14,690,000	1,131,932,000
		Québec-Toronto Only	10,597,000	819,560,000
		Montréal-Toronto Only	8,127,000	641,682,000
	300 kph	Québec-Windsor	15,175,000	1,270,928,000
		Québec-Toronto Only	10,715,000	907,437,000
		Montréal-Toronto Only	8,273,000	719,166,000

Source: Charles River Associates, 1994.

PROJECTIONS OF HSR RIDERSHIP BY SOURCE

Table E-2 shows the number and percent of HSR trips projected for the year 2005 by previous mode, as well as induced ridership for the full corridor alternatives. The largest number of diverted trips for this alternative comes from the automobile market segment, while more than 25 percent of the HSR trips are made by previous air travelers. The majority of air traveler diversions are from local air travelers – that is, travelers whose origins and destinations are within the HSR corridor.

As a point of comparison, Table E-3 presents similar information for the shortened Toronto–Montréal HSR services. Since the only HSR airport station in the 200 kph alternative is at Dorval Airport in Montréal (the HSR station at Pearson International Airport is not included in this alternative), the number of former connect air travelers using HSR in 2005 declines significantly from 935,000 to 175,000. An even more dramatic decrease is observed for the 300 kph alternative, which includes only the Mirabel Airport Station in Montréal in the shortened Toronto-Montréal HSR service configuration. In terms of market segments, the largest number of trips diverted still comes from auto, but at a smaller percentage compared to an HSR system for the full corridor. In these alternatives, former local air travelers represent a relatively large segment of intercity travelers diverted to the HSR system. In each instance, about 13 to 14 percent of the HSR trips are induced riders.

Table E-2. HSR Passengers in 2005 by Source (Full Corridor)

	200 kph Alternative		300 kph Alternative	
Source	**HSR Trips**	**Percent**	**HSR Trips**	**Percent**
Local Air	1,656,656	16.2	1,965,458	18.6
Connect Air	935,931	9.2	755,028	7.1
Rail	1,696,973	16.6	1,705,655	16.1
Bus	1,146,783	11.2	1,109,065	10.5
Auto	3,376,924	33.1	3,601,460	34.0
Subtotal	8,813,267		9,136,667	
Induced	1,395,008	13.7	1,449,458	13.7
Total	10,208,275	100.0	10,586,125	100.0

SOURCE: Charles River Associates, 1994.

Table E-3. HSR Passengers in 2005 by Source (Toronto–Montréal HSR Service Only)

	200 kph Alternative		300 kph Alternative	
Source	**HSR Trips**	**Percent**	**HSR Trips**	**Percent**
Local Air	1,384,090	24.4	1,625,159	28.2
Connect Air	174,522	3.1	11,903	0.2
Rail	1,158,855	20.4	1,161,471	20.2
Bus	676,521	11.9	634,779	11.0
Auto	1,508,244	26.5	1,569,947	27.3
Subtotal	4,902,232		5,003,259	
Induced	780,679	13.7	751,385	13.1
Total	5,682,911	100.0	5,754,644	100.0

SOURCE: Charles River Associates, 1994.

SENSITIVITY ANALYSIS OF HSR RIDERSHIP AND REVENUE

As part of this study, we carried out a series of sensitivity analyses of the HSR ridership and revenue forecasts to various input factors and assumptions. These analyses illustrate how the forecasts vary as certain conditions change. The results of the sensitivity analyses for the 200 kph option are summarized in Table E-4.

The largest change in both HSR ridership and revenue occurs for the two shortened alignments. For example, with HSR service only between Toronto and Montréal, HSR ridership in the year 2005 for the 200 kph option decreases by 45 percent compared to the full Windsor–Québec City corridor (the "base"). With the HSR system operating only between Toronto and Québec City, HSR ridership decreases by about 28 percent.

The four other sensitivity analyses in Table E-4 are for the full corridor and pertain to changes in HSR frequency, fare, speed, and routing. In terms of HSR ridership, the largest changes occur when the HSR fares or speeds increase. Note, however, that a uniform increase in HSR fares leads to a decrease in HSR revenue, since the base HSR fares are revenue-maximizing fares. Although not presented in the table, a uniform decrease in HSR fares would also result in a reduction in HSR revenue, for the same reason. Therefore, increases in HSR revenue only occur when HSR speeds increase over the base case. As shown in Table E-4, HSR operating at 250 kph on the 200 kph alignment is expected to result in a 12 percent increase in HSR revenue. An HSR routing via Mirabel Airport increases travel times on this longer route, decreases connect air ridership and, therefore, decreases ridership and revenue by 6 percent, as shown in Table E-4.

Executive Summary

Table E-4. Sensitivity of HSR Ridership and Revenue in the Year 2005 to Various Input Assumptions

Factor	Sensitivity Analysis	200 kph Alternative		300 kph Alternative	
		HSR Ridership Change	HSR Revenue Change	HSR Ridership Change	HSR Revenue Change
Base	N/A	0	0	0	0
HSR Service	Toronto–Québec only	-28%	-27%	-29%	-28%
HSR Service	Toronto–Montréal only	-45%	-43%	-46%	-43%
HSR Frequency	3 additional trains/day	+4%	+4%	+4%	+4%
HSR Fare	10% fare increase	-9%	-1%	-9%	-1%
HSR Speed	50 kph increase	+9%	+12%	+5%	+6%
HSR Routing	North Shore (Mirabel)/ South Shore (Dorval)	-6%	-6%	+6%	+7%

SOURCE: Charles River Associates, 1994.

SUMMARY OF FORECASTING METHODOLOGY

The approach we used to develop forecasts of HSR ridership in this study can be described as a three-step process:

- estimate future travel by each existing mode and market segment/trip purpose between the cities to be served by the proposed HSR system;
- estimate the diversion from .each existing mode to HSR for each market segment; and
- estimate induced travel on the HSR mode.

The total travel market is broken down into a number of mutually exclusive and readily definable mode and trip purpose market segments that exhibit distinct patterns of travel behavior. Overall ridership forecasts are prepared by summing across all the market segments. This approach avoids forecasting arbitrary diversions of travel from existing modes that result from the application of multinomial choice models, including nested choice models.[2] Our binary choice market segment approach provides complete flexibility to forecast the great variations in the substitutability of the new mode for the various current modes. These variations result from significant differences in the tradeoffs among time, cost, and comfort made by travelers in different market segments.

In the Québec–Windsor corridor, we first estimated total O/D volumes on *each* of the existing modes (local air, connect air, auto, rail, and bus) in the absence of HSR for the base year, 1992, and each forecast year of interest (2005 and 2025). Based on the revealed preference surveys conducted by Consumer Contact Limited (CCL) and the expansion weights CCL provided, we developed the share of trips made by business and nonbusiness travelers for each O/D.[3] Then, using the new mode choice models we developed from the local air, connect air, auto, rail, and bus stated preference survey data,[4] we estimated HSR's share of these markets for different groups of travelers, given the anticipated price and service levels on the competing modes.[5] In the third step we estimated induced demand. This three-step forecasting process is shown under the "Forecasting" heading on the right-hand side of Figure E-2.

A three-step approach is standard practice in forecasting intercity travel demand. Usually, however, the models that predict the market share for a new mode assume that travelers will divert from the existing modes to the new mode in direct proportion to the shares of trips on the existing modes. In this study, we developed ten separate two-mode market segment choice models, each comparing the attractiveness of HSR with one of the existing modes of travel (five modes of travel, including local air and connect air as separate "modes," and two trip purposes for each mode). Consequently, intercity travelers' preferences for a new

[2]Christopher V. Forinash and Frank S. Koppelman, "Application and Interpretation of Nested Logit Models of Intercity Mode Choice," *Transportation Research Record* 1413, 1993.

[3]Additional details concerning the three waves of revealed preference surveys can be found in: Consumer Contact Limited, "HSR Corridor Study: Travel Intercept Surveys," Draft Final Report, March 1993.

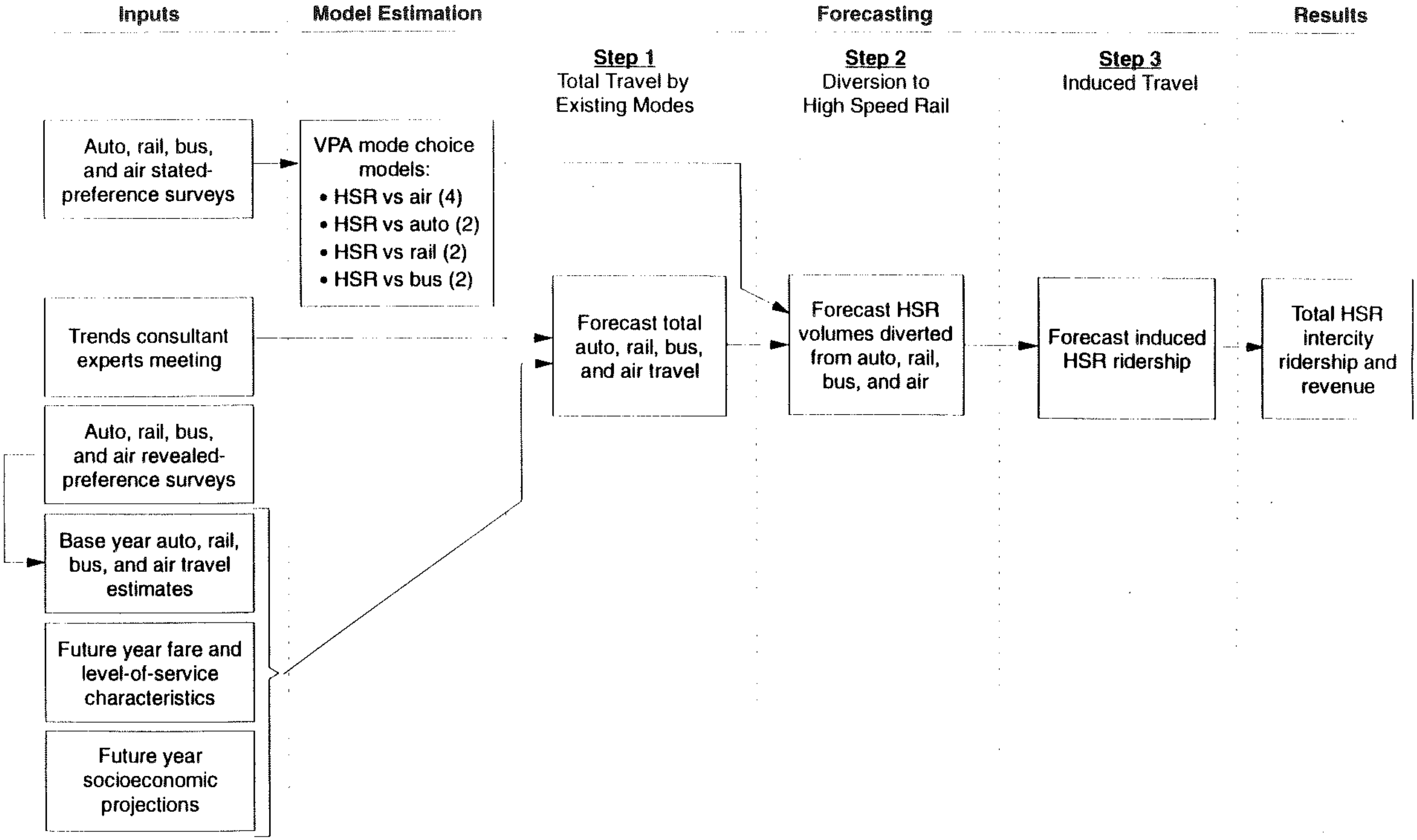
[4]Additional details concerning the stated preference surveys can be found in: Market Facts of Canada Limited, "Québec/Ontario High Speed Rail Project Data Gathering: Stated Preference Surveys," Technical Report, April 29, 1993.

[5]The specification of how level of service on existing modes will change over time is given in: KPMG Peat Marwick Stevenson & Kellogg, "Reference Scenario: Trends in Intercity Passenger Transportation and Government Support," prepared for the Québec/Ontario High Speed Rail Project, April 5, 1993.

mode vary not only by trip purpose, but also by the intercity mode they currently use.

Figure E-2

Flow Chart of Intercity High Speed Rail Ridership and Passenger Revenue Forecasting Process



SOURCE: Charles River Associates, 1994.

FORECASTING HSR MARKET SHARES

The core of the HSR ridership forecasting process is the estimation and application of each market segment mode choice model. Customer preferences and the total size of each market determine the travel volumes diverted to HSR. The mechanism for forecasting future market shares is to develop detailed relationships between the market shares and the travel times, costs, and comfort levels of HSR and each competing mode. These relationships are called mode choice models.

Ten Market Segments

We developed ten separate binary logit market segment mode choice models, which involved modeling the mode preference behavior of business and nonbusiness travelers (separately) on existing modes within the Québec–Windsor corridor:

- local air travelers making trips entirely within the corridor,
- connecting air travelers making trips with one end outside the corridor and transferring between planes at a hub airport within the corridor,
- auto travelers,
- conventional rail travelers, and
- intercity bus travelers.

The general form of the models is as follows:

$$S_{OD}^{m,HSR} = f(time_{OD}^{m,HSR}, cost_{OD}^{m,HSR}, frequency_{OD}^{m,HSR}, constant^{m,HSR})$$

where

$S_{OD}^{m,HSR}$ = share of existing mode m trips between O and D that will divert to HSR;

$time_{OD}^{m,HSR}$ = access, egress, and line-haul travel time components for mode m and for HSR;

$cost_{OD}^{m,HSR}$ = access, egress, and line-haul travel cost components for mode m and for HSR;

$frequency_{OD}^{m,HSR}$ = measures of the frequency and terminal processing times for mode m and for HSR; and

$constant^{m,HSR}$ = effect of other unquantified characteristics of HSR relative to mode m.

As discussed above, our market segmentation approach to mode choice modeling is based on our prior experience that intercity air, auto, rail and bus travelers behave very differently in terms of modal preferences and valuation of modal characteristics such as times and cost. We expect travelers with the highest values of time to travel by air and the lowest values of time to travel by bus, other things being equal (including trip purpose). We also expect business travelers in general to value time more than nonbusiness travelers, other things being equal.

We hypothesize that these different mode choice behaviors within each of these travel market segments make it necessary to examine each segment separately. We believe that combining the modal preference data for all of these market segments into one mode choice model would overgeneralize the mode choice process and cause us to overlook basic differences in people's behavior. This applies both to one "simultaneous" multinomial mode choice model and to a "nested" mode choice model that incorporates values and preferences from "lower level" choices into "higher level" choices in the assumed choice sequence.[6] Since the mode choice models described below demonstrated significant differences in the behavior of the different market segments, we retained and used our separate market segment models for this study.

Our segmentation of the market by the *revealed* preferences of travelers to use their current intercity travel modes allowed a survey data collection strategy that obtained information on travelers' behaviors and values while they were traveling on each mode for different trip purposes between cities in the corridor. These intercept surveys also provided us with information on the desired market segments when the travelers' reasons for travel were freshest in their minds

[6]Daniel Brand, Thomas E. Parody, Poh Ser Hsu, and Kevin F. Tierney. "Forecasting High-Speed Rail Ridership," *Transportation Research Record* 1341, 1992.

Executive Summary

Value Perception Analysis

The technique used to collect data on traveler valuations of the various characteristics of HSR as described in the context of their use of existing modes (i.e., air, rail, bus, and auto) is called Value Perception Analysis. VPA is a survey technique that infers how people's stated preferences for existing or potential products and services are affected by differing features or attributes of those products. This procedure has been applied successfully to a wide variety of transportation and other marketing research problems. With this methodology it is possible to estimate the share of trips that would be made on a *new* mode and to assess how individuals trade off various attributes of the new and existing mode(s) (e.g., access time versus cost, in-vehicle time versus waiting time, etc.).

VPA is a *stated preference* survey research procedure that measures travelers' perceptions and preferences for *new* modes. The surveys designed for this study asked (pre)qualified respondents to *rank* a number of transportation alternatives, including two involving their current mode (air, auto, bus, or rail) and two involving the *new* HSR mode. Each alternative was characterized by its technology (name) and specific values of its service characteristics: frequency of service, access and egress time (for nonauto modes), line-haul (in-vehicle) travel time, and trip cost. The respondents were asked to rank the alternatives from the most attractive to the least attractive. Respondents therefore had to make a series of choices among alternatives that involved *tradeoffs* among different components of time, cost, and mode.

The VPA approach allows design of alternatives so that no two travel characteristics vary together for all respondents, and we can estimate the effects of each service characteristic from a relatively small number of responses because each VPA alternative is an observation reflecting a choice of mode with a different set of attributes.

In summary, VPA provides several advantages for this study. First, it can be used to predict shares for new modes. Second, it can be used to study tradeoffs among characteristics that usually vary together. Third, it provides a considerable amount of information per respondent (in effect, multiple observations) so that it is possible to obtain statistically robust results with modest sample sizes.

Model Development and Evaluation

In developing the mode choice models for each of the ten market segments, we tested a variety of explanatory variables, including separate line-haul (in-vehicle)

Executive Summary

time, access and egress time, wait time (calculated as half of the headway), and travel cost (or fare) variables. In addition, we examined various combinations of variables. We also tested alternative combinations of travel time, including defining travel time by using differential weights for line-haul time, access/egress time, and wait time.

Specifically, a linear utility function was estimated of the form:

$$\mu = \alpha + \sum_{n=1}^{N} \beta_n X_n + \varepsilon$$

where

μ = utility,

α = modal constant,

$\beta_1 - \beta_N$ = coefficients for N level of service variables,

$X_1 - X_N$ = values for the N level of service variables, and

ε = disturbance term.

A separate model was estimated for each of the ten market segments by applying a standard logit transformation to the utility values. The transformation can be expressed as follows:

$$Share_{HSR_{mkt\ seg}} = \frac{e^{\mu_{HSR_{mkt\ seg}}}}{e^{\mu_{HSR_{mkt\ seg}}} + e^{\mu_{existing\ mode_{mkt\ seg}}}}$$

Table E-5 presents the *values of time* of travelers in each market segment, calculated from the estimated mode choice models for the various components of travel time, including the terminal transfer penalty and values for the modal constants. As expected, the values of time for local and connect air travelers are generally much higher than for auto travelers, which in turn are much higher than for current rail and bus users. Line-haul time savings on HSR are more important to air travelers than they are to auto, rail, and bus travelers across all market segments. Finally, the values of line-haul time for nonbusiness travelers are lower than for business travelers traveling on a comparable mode.

Executive Summary

Table E-5. Implied Values of Time, Terminal Transfer Penalty, and Modal Constants from the HSR Mode Choice Models (1992 Canadian Dollars)

Trip Purpose	Current Mode	Line-haul Time	Access/ Egress Time	Wait Time	Transfer	HSR Constant
Business	Air local	$53.79	$82.42	$75.31	–	-$8.97
	Air connect	$48.68	–	$105.00	$23.33	-$35.00
	Auto	$36.50	$54.74	$24.33	–	-$74.66
	Rail	$14.27	$48.22	$36.89	–	$11.42
	Bus	$12.28	$32.28	$45.27	–	$18.43
Nonbusiness	Air local	$33.22	$57.52	$49.83	–	-$5.54
	Air connect	$34.83	–	$105.00	$11.67	-$35.00
	Auto	$25.00	$37.50	$16.67	–	-$83.83
	Rail	$9.67	$29.70	$25.60	–	$11.61
	Bus	$6.69	$17.19	$31.02	–	$12.71

SOURCE: Charles River Associates, 1994.

The relationship among the values of time for line-haul (in-vehicle) time, access/egress time, and wait time (defined as half the headway on common carrier modes) varies by market segment. In studies of *urban* fixed-route and schedule (i.e., common carrier) transit travel competing with auto, the value of access and egress time is commonly observed to be greater than the value of line-haul time. This result was observed for every market segment in this intercity corridor. Similarly, the value of wait time was lower than line-haul time for all market segments except for auto. However, values for wait time could have been higher if we defined wait time as one-quarter of the headway — without changing the forecasts. (The model ultimately uses headway in its calculations of future market shares.)

The values of the HSR modal constants in Table E-5 strongly support our findings from other HSR studies that local air and HSR are much more similar in the effect of unobserved attributes on ridership compared to other modes. That is, controlling for all the conventional level of service attributes included in the model (cost, line-haul time, access/egress time, and wait time), travelers perceive the (local) air and HSR "fixed route and schedule" common carrier modes to be relatively similar (e.g., the $8.97 air business constant is worth ten minutes of line-haul time, and the $5.54 air nonbusiness constant is also worth ten minutes of line-haul time). Auto, on the other hand, is valued quite highly relative to HSR if all the travel times and costs are held equal. Of course, HSR is capable of much shorter travel times than auto over longer distances. Nevertheless, the HSR constants in the auto mode choice models mean that certain attributes of auto (privacy, flexibility, etc.) are valued very high relative to HSR.

Comparing the value of the HSR constants in the auto models to each other, the HSR constant in the business model is smaller than the nonbusiness model. This means that business auto travelers value auto (all else being held equal) somewhat less than nonbusiness travelers. This is consistent with the expected finding that nonbusiness travelers value the privacy, flexibility, and added space in the auto (e.g., to carry extra luggage, children, etc.) more than business travelers. In travel time terms, the auto business constant is worth 2.0 hours ($74.66 ÷ $36.50 per hour) of line-haul travel time, while the auto nonbusiness constant is worth 3.4 hours ($83.83 ÷ $25.00 per hour), a finding that is consistent with all our other studies.

In summary, the ten mode choice models estimated in this study are intended to relate traveler preferences for their current mode and HSR to the level of service values of each competing mode and to the attributes inherent in the modes themselves. The values of time and the modal constants in the models have high face validity (reasonableness) and conform very well to the findings in our several previous HSR ridership studies, as well as to values of time reported in the literature.

These mode choice models were used to estimate HSR market shares in each market segment, given the anticipated service levels on the competing modes. These market shares were then applied to the future-year forecasts of travel by air, auto, rail, and bus that we were directed to use, to determine the number of travelers (riders) diverted from these modes.

Induced travel was then estimated using the attribute values in the mode choice models to measure the attractiveness of the new mode to travelers in the corridor. Diverted and induced travel in the intercity travel markets by O/D were used to produce the total HSR intercity ridership forecasts.

ORGANIZATION OF THIS REPORT

The remainder of this report is organized into four chapters. Chapter 1 describes the two basic HSR scenarios.

Executive Summary

Chapter 2 describes the development of the diversion and induced demand models used to produce the HSR ridership and passenger revenue forecasts. The chapter builds on the summary discussion of methodology in this executive summary and provides detailed descriptions of the techniques and data used to estimate the ridership forecasting models for each market segment.

Chapter 3 describes the procedures used to derive the passenger revenue-maximizing HSR fares that were subsequently assumed in our forecasts of HSR ridership and revenue for the various alternatives considered. These revenue-maximizing fares were assumed in the base case runs for the various sensitivity analyses performed.

Chapter 4 provides the detailed tables containing the ridership and passenger revenue forecasts for the years 2005 and 2025, including cross-tabulations of ridership estimates for all market segments. Chapter 4 also provides sensitivity analyses of ridership and revenue to certain changes in various forecasting inputs and assumptions.

1
Characteristics of the HSR Alternatives

OVERVIEW

The executive summary presented the ridership and passenger revenue forecasts for several high speed rail (HSR) alternatives, which are intended to reflect the range of potential options for HSR service in the Québec City–Windsor corridor. The alternatives vary in terms of different alignments, speeds, station locations, and connectivity to air service at Toronto and Montréal. Although the alignments (and thus travel times) for the two principal routes differ, they generally share the same station locations in the major cities.

The following sections describe the common characteristics of the alternatives. Chapter 4 provides detailed tables of all the input times and costs for HSR between all stations on the two basic alternatives, and supplements in considerable detail the descriptions in this chapter.

HSR CHARACTERISTICS

HSR Alignment and Stations

Figure 1-1 shows the basic full HSR alignment from Windsor to Québec City, along with intermediate station stops. For both alternatives on the full alignment, HSR stations would include Windsor, London, Kitchener, Pearson, Toronto, Kingston, Ottawa, Montréal, Laval, Trois-Rivières, Ancienne Lorette, and Québec City. For these alternatives it was assumed that existing VIA intercity rail service would no longer operate.

Two other shortened corridors were also considered in this study. The first assumed that HSR service would operate only between Toronto and Québec City, while the second assumed service only between Toronto and Montréal. It was specified for both of these shortened corridors that where HSR did not operate, service would continue to be provided by VIA with timed transfers to the HSR system.

For the full Windsor to Québec City corridor, a conveniently located HSR station was provided at Pearson International Airport in Toronto, while in Montréal, only Dorval International Airport was served in the 200 kph alternative, and only Mirabel International Airport was served in the 300 kph alternative. For the two

Characteristics of the HSR Alternatives

shortened alignments, an airport HSR station at Toronto's Pearson Airport was not provided.

Access to and from HSR Stations

For each of the HSR stations, we assumed modes of local access similar to those currently used to access the nearest airport. All of the airports currently rely on passengers driving and parking, being dropped off, renting a car, taking a taxi or limousine, or using a bus, shuttle van, or service. The proportions of air passengers using each mode to reach specific airports in the HSR corridor can be obtained from the air intercept (or revealed preference) surveys conducted during the course of the study. Overall, approximately 25 percent of the air passengers arrive/leave in a car that is parked at the airport, 30 percent are dropped off/picked up, 10 percent arrive/leave by rental car, 29 percent use taxi/limousine service, and the remainder use buses and airport/hotel shuttle vans. Business travelers are more likely to use rental cars and taxis, and are less likely to be picked up or dropped off.

HSR Station Characteristics

Table 1-1 shows the terminal processing times assumed in this study for the HSR and other common carrier modes. Terminal processing time is the time required by an intercity traveler to traverse through these terminals. As depicted in the table, terminal processing times are higher when the origin and/or destination of an intercity trip is in Montréal or Toronto, and are lower for all other cities.

Table 1-1. Terminal Processing Time in Each City

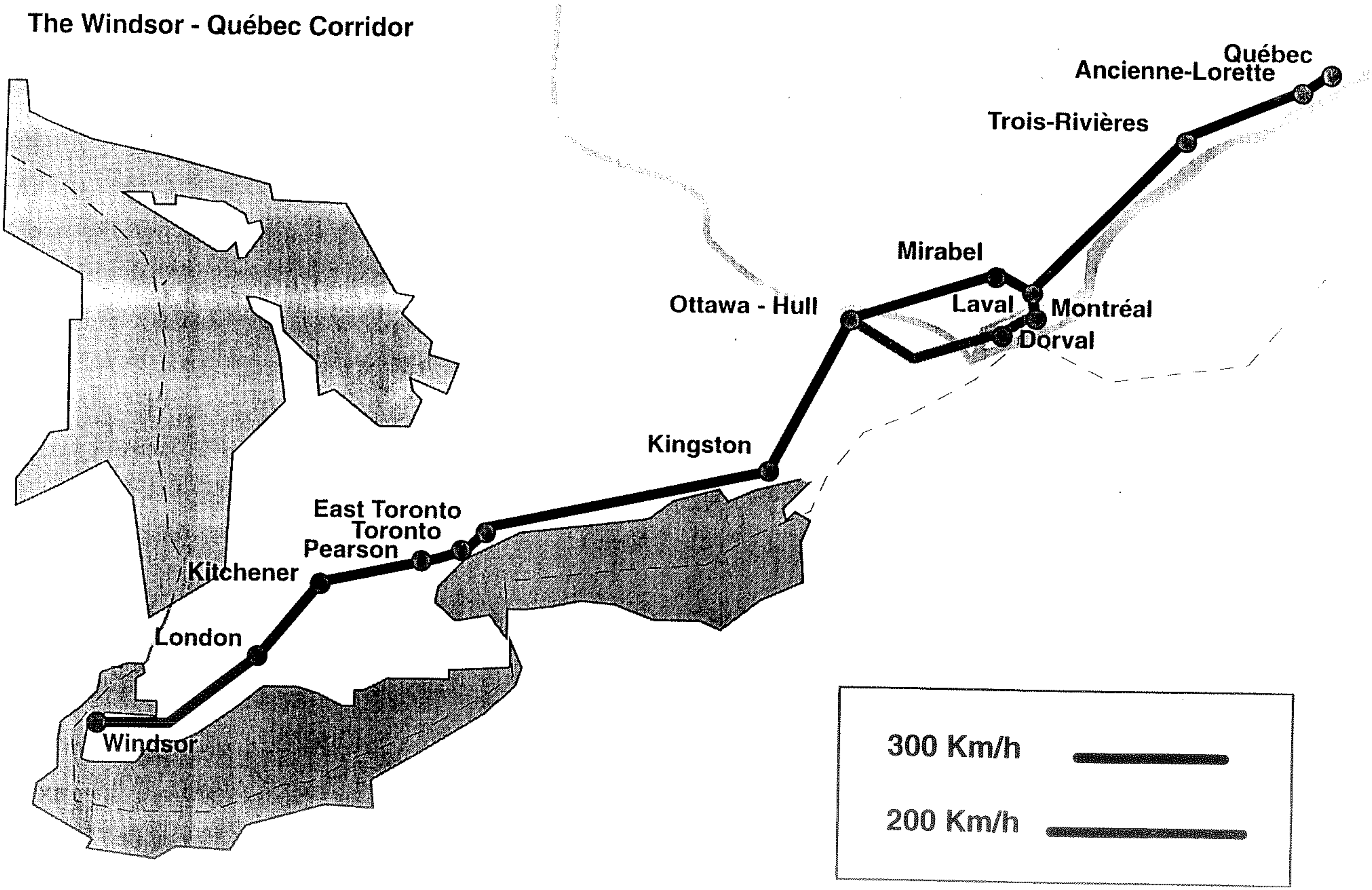
Mode	Processing Time (minutes)	
	Montréal or Toronto	Other Cities
Air	15	10
Rail/HSR	10	8
Bus	7	7

Note: Terminal processing time reflects time in the terminal and includes the time to walk to the check-in area, the ticket and baggage processing time, and the time to walk to the departure lounge. This time does not include the waiting time after reaching the departure area.

SOURCE: IBI, 1993.

Figure 1-1

The Windsor - Québec Corridor



SOURCE: Ministère des Transports du Québec

Characteristics of the HSR Alternatives

HSR Frequency

The number of HSR trains assumed to be operating daily varies between the 200 kph and 300 kph alternatives and by O/D pair. In general, frequencies varied from a low of 11 trains per day to a high of 25 trains per day. The precise number is related to stopping patterns and the use of either short turnaround or through trains. Chapter 4 shows the HSR frequencies used between each O/D pair for the 200 kph and 300 kph alternatives.

HSR Fare Policies

In the early phases of the study, HSR fares were assumed to be 60 percent of the business and nonbusiness air fares, respectively. While useful for many of the initial analyses undertaken, such an assumption resulted in anomalies for an essentially linear, ground-based HSR system. That is, air fares in the corridor do not vary by distance, but rather by the volume and competition in the air travel O/D market. Thus, HSR fares equal to 60 percent of air fares resulted in some shorter trips having higher fares than contiguous longer trips. This may be possible with air, but is not workable for a linear ground-based rail system making on-line intermediate stops. Consequently, to eliminate or minimize "hidden-city" (higher intermediate) fares while maximizing passenger revenue, a detailed analysis of fare pricing optimization and revenue maximizing was undertaken, which is described in Chapter 3.

2
Forecasting Methodology and Estimation of Ridership Forecasting Models

This chapter describes the three-step forecasting methodology used to project HSR ridership and revenue for the alternative HSR systems. A summary and flowchart of the overall methodology was presented in the executive summary. This chapter extends that description by presenting information on the future growth rates of air, auto, rail, and bus intercity travel in the absence of HSR that we were directed to use, along with the mode choice models we estimated. This chapter also describes the methodology for forecasting induced travel on the HSR system.

FORECASTING INTERCITY TRAVEL BY MODE

The first step in the three-step ridership forecasting process was to forecast intercity air, auto, bus, and rail travel between the superzones being used in Ontario and Québec.

At an expert panel meeting arranged by KPMG in Montréal on March 5, 1993, as part of the overall study, attended by CRA, it was the opinion that a standard time-series econometric analysis of historical intercity travel in the Windsor–Québec corridor would not be the most appropriate method to project future travel by mode in the corridor. The meeting also produced some projections of the annual rates of growth by mode in the absence of HSR between 1992–2005 and 1992–2025. However, the Steering Committee for the study chose to use air and auto rates of growth derived from a CIGGT trend analysis also conducted as part of the overall study. As Table 2-1 shows, the rates which CRA was instructed to use are higher than those produced by the expert panel.

Table 2-1. Annual Rates of Growth for Existing Modes in the Corridor in the Absence of HSR

Mode	Rates Used in Forecasts		Rates Projected by Expert Panel	
	1992–2005	1992–2025	1992–2005	1992–2025
Air	2.95%	2.72%	2.3%	2.2%
Rail	0%	0%	0%	0%
Bus	0%	0%	0%	0%
Auto	2.19%	2.13%	1%	1%

Because the forecasts of HSR ridership are created by multiplying the predicted share of HSR by the forecast future volume for each existing mode, any increases in the growth of existing modal volumes will be reflected directly in the forecasts of HSR ridership. That is, if the forecast of total travel on existing modes is increased by 10 percent, for example, the forecast of HSR ridership will likewise increase by 10 percent, even if all other factors are held constant. The actual effect of the differences in annual rates of growth in Table 2-1 is to increase the HSR ridership forecasts by approximately 8 percent in 2005.

FORECASTING DIVERSION TO HSR

This section describes the development of the models used in the second major step of the three-step HSR ridership forecasting process. This step forecasts the diversion of air, auto, rail and bus trips to HSR, given the anticipated service levels on the competing modes.

In this discussion of forecasting intercity travel, we describe our market segmentation approach for mode choice modeling, including a discussion of the data used for model estimation. We then describe the mode choice models estimated for the ten major intercity travel market segments. We also present extensive "reasonableness checks" on the forecasting procedures by comparing the estimated models to each other, and to the values of time and demand elasticities reported by others.

Market Segmentation

The executive summary outlined our market segmentation approach to HSR mode choice modeling. Prior experience indicates that intercity air, auto, bus, and rail travelers behave very differently in terms of modal preferences and valuation of modal characteristics such as times and cost. Similar differences have also been observed between business and nonbusiness travelers. Consequently, for purposes of this study, we specified ten market segments for mode choice model estimation.

We hypothesize there are different mode choice behaviors within each of these travel market segments that make it necessary to examine each segment separately. We believe that combining the modal preference data for all of these market segments into one mode choice model would overgeneralize the mode choice process and cause us to overlook basic differences in behavior. If our

Forecasting Methodology and Estimation of Ridership Forecasting Models

choice process and cause us to overlook basic differences in behavior. If our empirical analyses (the mode choice models) had allowed us to reject the differences between the choice behaviors exhibited by the different market segments, we could have combined the data and models for those market segments. Since our mode choice models demonstrated significant differences in the behavior of the different market segments, we could not reject the hypothesis of different behaviors. Therefore, as will be shown, we kept our separate market segment models.

Based on our previous experience in intercity HSR ridership forecasting, we formulated a number of hypotheses about the differences in travel behavior among these market segments. First, as noted in the executive summary, people's existing choice of travel mode is the result of differences in their values of time, among other factors. We expect travelers with high values of time to travel by air, other things being equal (including trip purpose). We also expect business travelers in general to value time more than nonbusiness travelers, other things being equal.

Indeed, people's selection of their current intercity travel modes reveals a great deal about their preferences for the various features of those modes. We segmented the market by the *revealed* preferences of travelers to use air, auto, bus, and rail for their intercity travel in Canada. We obtained information on travelers' behavior and values while they were traveling by air, auto, rail, and bus for different trip purposes between cities in the HSR corridor. The intercept surveys provided us with information on the desired market segments when the travelers' reasons for travel were freshest in their minds.

We expect individuals to elect to travel by auto primarily because they prefer such characteristics as the auto's flexibility, privacy, comfort, luggage-carrying ability, and the ability to make multiple stops. If this hypothesis is true, then on a percentage basis auto travelers will be less likely to switch to HSR than air travelers. Since model accuracy increases as travel units and behavior become more homogenous, deriving separate models for each of the market segments listed above has been found necessary in other studies, as well as in this study. The general form of the models is shown below:

$$S_{OD}^{m,HSR} = f(time_{OD}^{m,HSR}, cost_{OD}^{m,HSR}, frequency_{OD}^{m,HSR}, constant^{m,HSR})$$

where

Forecasting Methodology and Estimation of Ridership Forecasting Models

$S_{OD}^{m,HSR}$ = share of existing mode m trips between O and D that will divert to HSR;

$time_{OD}^{m,HSR}$ = access, egress, and line-haul travel time components for mode m and for HSR;

$cost_{OD}^{m,HSR}$ = access, egress, and line-haul travel cost components for mode m and for HSR;

$frequency_{OD}^{m,HSR}$ = measures of the frequency and terminal processing times for mode m and for HSR; and

$constant^{m,HSR}$ = effect of other unquantified characteristics of HSR relative to mode m.

Mode Choice Model Estimation Dataset

To project HSR ridership and revenue for the alternatives examined, information was obtained on the number of intercity trips made by mode and by trip purpose between various superzone pairs. Data on volumes and trip purpose were obtained from large-scale revealed preference surveys[7] conducted at three periods during 1992 — summer, fall, and winter — and then factored to represent travel over an entire year. To our knowledge, this is the first instance where such an attempt has been made to capture seasonal effects explicitly.

Using stated preference surveys designed by CRA, information was obtained on how intercity travelers for the market segments described above make tradeoffs between conventional level of service factors and modes they could use for their trips. Additional details concerning the stated preference surveys can be found in: Market Facts of Canada Limited, "Québec/Ontario High Speed Rail Project Data Gathering: Stated Preference Surveys," Technical Report, April 29, 1993. In particular, the technique used to collect data on traveler valuations of the various times and costs of HSR, described in the context of their use of existing modes, is called Value Perception Analysis (VPA).

[7]Additional details concerning the three waves of revealed preference surveys can be found in: Consumer Contact Limited, "HSR Corridor Study: Travel Intercept Surveys," Draft Final Report, March 1993.

Forecasting Methodology and Estimation of Ridership Forecasting Models

VPA is a survey technique that infers how people's stated preferences for existing or potential products and services are affected by differing features or attributes of those products. This procedure has been applied successfully to a wide variety of transportation and other marketing research problems. With this methodology it is possible to estimate the share of trips that would be made on a *new* mode and to assess how individuals trade off various attributes of the new and existing mode(s) (e.g., access time versus cost, in-vehicle time versus waiting time).

VPA is a *stated preference* survey research procedure that measures travelers' perceptions and preferences for *new* modes. The surveys designed for this study asked (pre)qualified respondents to *rank* a number of transportation alternatives, including two involving their current mode and two involving the *new* mode. Each alternative was characterized by its technology (name) and its service characteristics: frequency of service, access and egress time (for nonauto modes), line-haul (in-vehicle) travel time, and trip cost. The respondents were asked to rank the alternatives from the most attractive to the least attractive. Respondents therefore had to make a series of choices among alternatives that involved *tradeoffs* among different components of time, cost, and mode. We forced choices between alternatives in which neither clearly dominated in terms of speed, comfort, or cost. Dominance of any alternative reduces the information obtained from the survey, since when all characteristics of an alternative are superior, it is far more difficult to allocate causality among the improved attributes.

Intercity HSR ridership is influenced by many factors. Even if we could *observe* HSR ridership in North America (i.e., if it were not a new mode), the many factors that affect it typically change at the same time. Therefore, direct observation of the effects of changes in individual explanatory variables is not possible. Consequently, multivariate statistical techniques must be used to measure the influence of different explanatory variables on the "dependent" variable of interest (i.e., HSR ridership).

VPA has many advantages over revealed preference survey methods. In addition to its ability to predict shares for new modes, it allows for a survey design that minimizes the sample size needed to estimate an accurate model. For example, access time and cost often vary together in actual settings (for example, air travel is both more expensive and involves more access time than auto). Line-haul time for a mode almost always varies together with its fare or operating cost. Under the revealed preference approach, it can be very difficult to estimate relationships among the attributes without (and often even with) a very large sample.

Forecasting Methodology and Estimation of Ridership Forecasting Models

In contrast, the VPA approach allows the design of alternatives so that no two travel characteristics vary together for all respondents. We can estimate the effects of each service characteristic from a relatively small number of responses. Each VPA choice is an observation reflecting a choice of mode with a different set of attributes. In the case of four alternatives, each respondent in effect provides three data points instead of one. The effective sample size, therefore, can be up to three times the number of sampled individuals.

In summary, VPA provides several advantages for this study. First, it can be used to predict shares for new modes. Second, it can be used to study tradeoffs among characteristics that usually vary together. Third, it provides a considerable amount of information per respondent (in effect, multiple observations), so it is possible to obtain statistically robust results with modest sample sizes.

Estimated Mode Choice Models

To estimate the mode choice models for each of the ten market segments, we tested a variety of explanatory variables, including separate line-haul (in-vehicle) time, access and egress time, wait time (calculated as half of the headway), travel cost (or fare) variables, and (for connecting air passengers) transferring to HSR in the same or different airport terminals. In addition, we examined various combinations of variables. We also tested alternative combinations of travel time, including defining travel time by using differential weights for line-haul time, access/egress time, and wait time. In this phase of our work, the VPA responses were weighted by the O/D volumes, to ensure that the resultant models fairly represent the observed flows by mode.

A separate HSR *constant* was also estimated for each model, to measure the preference for HSR based on existing perceptions while controlling for the effects of all the other variables explicitly included in each model. A value of exactly zero for the modal constant would imply that, if all times and costs in the model were *equal*, travelers would be indifferent between their current mode and HSR (i.e., 50 percent would choose one mode and 50 percent would choose the other). A negative (positive) value of the HSR constant implies that, all else being equal, the share of individuals in the market segment in question who would prefer HSR is less (more) than 50 percent.

Specifically, a linear utility function was estimated of the form:

Forecasting Methodology and Estimation of Ridership Forecasting Models

$$\mu = \alpha + \sum_{n=1}^{N} \beta_n X_n + \varepsilon$$

where

μ	= utility,
α	= modal constant,
$\beta_1 - \beta_N$	= coefficients for N level of service variables,
$X_1 - X_N$	= values for the N level of service variables, and
ε	= disturbance term.

A separate model was estimated for each of the ten market segments by applying a standard logit transformation to the utility values. The transformation can be expressed as follows:

$$Share_{HSR_{mkt\,seg}} = \frac{e^{\mu_{HSR_{mkt.\,seg.}}}}{e^{\mu_{HSR_{mkt.\,seg.}}} + e^{\mu_{existing\,mode_{mkt.\,seg.}}}}$$

Tables 2-1 to 2-5 show the coefficients and t-statistics for the estimated local air, connect air, auto, conventional rail, and intercity bus models, respectively. As can be seen from the tables, all of the level of service coefficients and modal constants are statistically significant.[8]

[8]In the case of the level of service coefficients in the nonbusiness auto model in Table 2-3, the coefficients are significant using a one tail test, since the hypothesis being rejected is that they are positive. In other words, we have found that they are significantly different from and less than zero.

CRA

Forecasting Methodology and Estimation of Ridership Forecasting Models

Table 2-1. Coefficients for the Estimated Local Air Models

Variable	Business	Nonbusiness
Modal constant	-0.1874 (-4.31)	-0.1240 (-3.05)
Line-haul time	-1.1243 (-4.31)	-0.7442 (-3.05)
Access/egress time	-1.7225 (-3.01)	-1.2882 (-2.49)
Wait time	-1.5740 (-4.31)	-1.1163 (-3.05)
Cost	-0.0209 (-3.32)	-0.0224 (-3.61)

Note: *t*-statistics are in parentheses.

SOURCE: Charles River Associates, 1994.

Table 2-2. Coefficients for the Estimated Connect Air Models

Variable	Business	Nonbusiness
Modal constant	-0.4089 (-2.53)	-0.3323 (-2.13)
Line-haul time	-0.5687 (-3.61)	-0.3307 (-2.40)
Wait time	-1.2267 (-2.53)	-0.9969 (-2.13)
Cost	-0.0117 (-2.53)	-0.0095 (-2.13)
Transfer	-0.2726 (-2.53)	-0.1108 (-2.13)

Notes: *t*-statistics are in parentheses.
Transfer is defined as transfer in same terminal, or transfer in different terminal.

SOURCE: Charles River Associates, 1994.

Forecasting Methodology and Estimation of Ridership Forecasting Models

Table 2-3. Coefficients for the Estimated Auto Models

Variable	Business	Nonbusiness
Modal constant	-0.8437 (-6.20)	-1.1927 (-4.46)
Line-haul time	-0.4124 (-2.60)	-0.3557 (-1.78)
Access/egress time	-0.6186 (-2.60)	-0.5336 (-1.78)
Wait time	-0.2749 (-2.60)	-0.2371 (-1.78)
Cost	-0.0113 (-2.34)	-0.0142 (-1.78)

Note: *t*-statistics are in parentheses.

SOURCE: Charles River Associates, 1994.

Forecasting Methodology and Estimation of Ridership Forecasting Models

Table 2-4. Coefficients for the Estimated Conventional Rail Models

Variable	Business	Nonbusiness
Modal constant	0.7985 (4.12)	1.0968 (6.33)
Line-haul time	-0.9947 (-4.12)	-0.9140 (-6.33)
Access/Egress time	-3.3611 (-4.06)	-2.8062 (-5.38)
Wait time	-2.5711 (-2.58)	-2.4195 (-3.27)
Cost	-0.0697 (-2.43)	-0.0945 (-4.17)

Note: *t*-statistics are in parentheses.

SOURCE: Charles River Associates, 1994.

Table 2-5. Coefficients for the Estimated Bus Models

Variable	Business	Nonbusiness
Modal constant	2.1099 (5.75)	1.3596 (6.33)
Line-haul time	-1.4066 (-5.75)	-0.7156 (-6.33)
Access/Egress time	-3.6958 (-4.69)	-1.8398 (-3.55)
Wait time	-5.1831 (-4.32)	-3.3190 (-4.78)
Cost	-0.1145 (-3.57)	-0.1070 (-5.09)

Note: *t*-statistics are in parentheses.

SOURCE: Charles River Associates, 1994.

Table 2-6 presents the *values of time* of travelers in each market segment calculated from the estimated mode choice models for the various components of travel time (and the terminal transfer penalty for connecting air passengers). As expected, the values of line-haul time for air travelers are higher than for auto

Forecasting Methodology and Estimation of Ridership Forecasting Models

travelers, and both are much higher than for rail and bus travelers. Line-haul time savings on HSR are more important to air travelers than auto travelers, and much more important in both cases than they are to conventional rail and bus travelers. This means that current bus and rail travelers are relatively much more sensitive to price differences between modes than they are to time differences.

Also, as expected, the values of line-haul time for business travelers are higher than for nonbusiness travelers traveling on the same mode. The value of business line-haul time is consistently about 50 percent higher than the value of nonbusiness line-haul time. The only exception to this relationship is for bus travelers, where the nonbusiness value of line-haul time is closer to half the value of business travelers' time. This is consistent with our prior hypothesis that the most price-sensitive intercity travelers use the cheapest mode (bus) for their travel.

Table 2-6. Implied Values of Time and the Terminal Transfer Penalty From the HSR Mode Choice Models (1992 Canadian Dollars)

Trip Purpose	Current Mode	Line-haul Time	Access/ Egress Time	Wait Time	Transfer
Business	Air local	$53.79	$82.42	$75.31	–
	Air connect	$48.68	–	$105.00	$23.33
	Auto	$36.50	$54.74	$24.33	–
	Rail	$14.27	$48.22	$36.89	–
	Bus	$12.28	$32.28	$45.27	–
Nonbusiness	Air local	$33.22	$57.52	$49.83	–
	Air connect	$34.83	–	$105.00	$11.67
	Auto	$25.00	$37.50	$16.67	–
	Rail	$9.67	$29.70	$25.60	–
	Bus	$6.69	$17.19	$31.02	–

SOURCE: Charles River Associates, 1994.

The relationship among the values of time for line-haul (in-vehicle) time, access/egress time, and wait time (defined as half the air, rail, bus, or HSR headway) varies by market segment. In studies of *urban* fixed-route and schedule (common carrier) transit travel competing with auto, the value of access and

Forecasting Methodology and Estimation of Ridership Forecasting Models

egress time is commonly observed to be greater than the value of line-haul time. As can be seen in Table 2-6, this result was observed for every market segment in this study. The value of wait time (defined as half the headway) was also higher than line-haul time in every instance, except the auto market segments. Even this value would have been higher than line-haul time if we defined wait time as one-quarter of the headway (*h*/4) — without changing the forecasts. The model uses headway in its calculations of future market shares. The value of wait time shown in Table 2-6 depends on its definition; we use half the headway (*h*/2) as the commonly used definition, although for longer headways, the average wait time is likely to be shorter (e.g., for two-hour headways, the average wait time might be one-half hour or *h*/4). Changing the wait time definition to *h*/4 (which does not affect the forecasts) would increase the value of wait time relative to line-haul time shown in the table.

The values of the HSR modal constants in Table 2-7 strongly support our findings in other HSR studies that air and HSR are much more similar in the effect of unobserved attributes of each mode on ridership than are auto and HSR. That is, controlling for all the conventional level of service attributes included in the model (cost, line-haul time, access/egress time, and wait time), travelers favor air slightly, but perceive the air and HSR "fixed route and schedule" common carrier modes to be relatively similar (e.g., the $8.97 local air business HSR constant is worth ten minutes of line-haul time, and the $5.54 local air nonbusiness HSR constant is also worth ten minutes of line-haul time). Auto, on the other hand, is valued quite highly relative to HSR if all the travel times and costs are held equal ($74.66 for business travelers and $83.83 for nonbusiness travelers). In travel time terms the difference is even greater, with the auto business constant worth 2 hours ($74.66 ÷ $36.50 per hour) and the auto nonbusiness constant worth 3.4 hours ($83.83 ÷ $25.00 per hour), a finding that is consistent with all our other studies. Of course, HSR is capable of shorter travel times than auto over longer distances. Nevertheless, the HSR constants in the auto mode split models mean that certain attributes of auto (privacy, flexibility, etc.) are valued very highly relative to HSR (and the other common carrier modes).

Forecasting Methodology and Estimation of Ridership Forecasting Models

Table 2-7. Implied Values of the Modal Constants From the HSR Mode Choice Models (1992 Canadian Dollars)

Current Mode	Business	Nonbusiness
Air local	-$8.97	-$5.54
Air connect	-$35.00	-$35.00
Auto	-$74.66	-$83.83
Rail	$11.42	$11.61
Bus	$18.43	$12.71

Note: Values are equal to the fare advantage of HSR over the existing mode, keeping all times and costs equal for the competing modes.

SOURCE: Charles River Associates, 1994.

The importance of these privacy and flexibility attributes to auto travelers is indicated not only by the high dollar values of the HSR constants in the auto models, but also by the fact that the HSR constant in the auto nonbusiness model is larger than in the auto business model. This means that auto nonbusiness travelers are willing to pay more for the privacy and flexibility attributes of auto travel than business travelers. This is consistent with the hypothesis that business travelers are (relatively) more interested in the activities at their destinations than in what happens along the way.

The HSR modal constants in the conventional rail and bus models are relatively large, particularly in travel time terms, and are the only modes whose users currently perceive HSR as inherently more attractive than their current modes in terms of the attributes incorporated in the modal constant (comfort, privacy, etc.). Conventional rail is perceived as closer to HSR than bus. The equivalent line-haul travel time values of the HSR constants are 0.8 hours ($11.42 ÷ $14.27 per hour) for conventional rail business travelers and 1.2 hours ($11.61 ÷ $9.67 per hour) for nonbusiness travelers. For intercity bus travelers, the equivalent travel time values of the HSR constants are 1.5 hours ($18.43 ÷ $12.28 per hour) and 1.9 hours ($12.71 ÷ $6.69 per hour) for business and nonbusiness travelers, respectively.

Finally, the HSR modal constants in the connecting air models are large and negative in dollar terms, and measure the disutility of transferring from one line-haul mode to another in this corridor. Their $35.00 value for both business and

Forecasting Methodology and Estimation of Ridership Forecasting Models

nonbusiness air travelers represents a significant transfer penalty worth about 0.7 hours of line-haul time for business travelers and one hour for nonbusiness travelers.

HSR demand elasticities with respect to HSR fare, line-haul time, access/egress, and wait times are not constant in these binary logit models.[9] Instead, they vary by O/D pair as a function of the values of the independent variables (i.e., the travel times and costs), and as a function of the resulting mode share, which also varies by O/D pair. Table 2-8 presents HSR demand elasticities for all ten market segments with respect to HSR fare, line-haul time, and frequency. In these logit models, demand elasticities are not constant. Instead, they vary by O/D pair as a function of the values of the independent variables (i.e., the travel times and costs), and as a function of the resulting mode share, which also varies by O/D pair. The demand elasticities in Table 2-8 are calculated for the Windsor–Québec alignment using the 300 kph speed option.

Table 2-8. Demand Elasticities by Market Segment

	Trip Purpose					
	Business			Nonbusiness		
Current Mode	HSR Fare	HSR Line Haul Time	HSR Frequency	HSR Fare	HSR Line Haul Time	HSR Frequency
Air Local	-0.8	-1.0	0.3	-0.8	-0.8	0.2
Air Connect	-0.6	-0.6	0.3	-0.4	-0.4	0.2
Rail	-0.4	-0.1	0.1	-0.5	-0.1	0.1
Bus	-2.3	-0.5	0.8	-1.3	-0.2	0.4
Auto	-0.7	-0.5	0.1	-0.7	-0.4	0.1

Values for all modes are calculated using the revenue-maximizing HSR fares for the 300 kph option.

SOURCE: Charles River Associates, 1994.

The following subsections discuss all the findings and values in Tables 2-1 through 2-8 for each of the market segments.

[9] The demand elasticity shows the percent change in modal travel resulting from a 1-percent change in the named causal variable.

Forecasting Methodology and Estimation of Ridership Forecasting Models

Local Air Business Mode Choice Model

For the local air business model shown in Table 2-1, all the system variable coefficients are significant and have the expected signs. Both HSR mode constants are also significant. The cost and travel time coefficients are negative, implying that increases in the travel time or cost of an alternative will reduce that alternative's desirability. As discussed above, the small modal constants suggest that air business travelers feel HSR and air are both common carrier modes and are relatively similar when controlling for the traditional time and cost attributes included in the survey data. However, the HSR modal constants are negative, indicating that when all the travel times and costs are equal, air is slightly preferred to HSR. (Of course, this result is prior to the start of any HSR service with its attendant high level of marketing and, presumably, positive publicity.)

As expected, local air business travelers are very sensitive to line-haul time. As noted in Table 2-8, the elasticity on line-haul time for this market segment is -1.0. Similarly, the value of time implied by the model is about $54 an hour (Table 2-6). This range is equal to about 1.33 times the average hourly household income rate of the business travelers in the air intercept survey, a result that falls squarely in the range reported in a Federal Aviation Administration (FAA) comprehensive literature review of air travel demand models.[10] The FAA range of 1.0 to 1.5 times the average wage is based on 17 models of air business travel demand.

The value of access/egress time for air business travelers in Table 2-6 is C$82 per hour. This value, which also reflects the premium air travelers place on time, is similar to the airport access value of time for business travelers of approximately $60 per hour (in 1992 US dollars) reported in a San Francisco airport access survey, and is quite consistent with the range of values reported in a Boston airport access survey.[11]

The value of wait time is about C$75 per hour for air business travelers. In general, it is difficult to validate values of wait time, since little is known about the value of air/HSR waiting time. Also, as discussed above, since we define wait

[10]Federal Aviation Administration, US DOT, "Economic Value for Evaluation of Federal Aviation Administration Investment and Regulatory Programs," Washington, DC, June 1989.

[11]Harvey, G., "Study of Airport Access Mode Choice," *Journal of Transportation Engineering*, Vol. 112, No. 5, ASCE, September 1986.

Forecasting Methodology and Estimation of Ridership Forecasting Models

time as one-half the headway, our values of wait time equal the value of the headway times two. Our values are consistent with a study of the value of the *second* hour of waiting time for connecting business passengers at hub airports, which reported values as high as US$100 per hour. Our own value of the first hour of connect wait time from our connect air VPA survey described below was C$105 for business travelers.

The estimated HSR modal constant in Table 2-7 indicates that if cost and travel times are equal, air business travelers have a slight preference to continue using air. An HSR fare reduction of about $9 for this market segment is needed to make this group of travelers feel indifferent between the two modes.

Local Air Nonbusiness Mode Choice Model

In the mode choice model for local air nonbusiness travelers presented in Table 2-1, all level of service variables have the correct signs and all are statistically significant. The modal constants are also significant.

As expected, individuals traveling by air for nonbusiness purposes are less sensitive than business travelers to line-haul time (relative to the cost involved in saving travel time). Table 2-6 shows their implied value of line-haul time to be about $33. This value is approximately equal to the average hourly household income of nonbusiness travelers in our air traveler intercept survey, and is within the range reported in the 1989 FAA study cited previously.

The value of access/egress time for local air nonbusiness trips is about C$58 per hour, as shown in Table 2-6. This is somewhat higher than the US$35 per hour (inflation adjusted) value obtained in the airport access mode choice study in San Francisco, but within the Boston airport access survey's reported range of values.[12]

The somewhat lower values of wait time and the HSR modal constant for nonbusiness air travelers relative to business air travelers are consistent with the differences between the values of line-haul and access/egress time in the two models (just over one-third lower values in each case). This is consistent with the

[12] Harvey, G., op. cit.

usual case in which business travelers are willing to pay more for most things than nonbusiness travelers.

Connect Air Business Mode Choice Model

The connect air market segments refer to business and nonbusiness travelers making trips with one end outside the corridor and transferring between planes at a hub airport within the corridor.[13] Connecting flights made entirely within the corridor (Québec City to Toronto to London, for example) were considered "local" air trips in our analysis and were characterized by correspondingly longer travel times.

In the mode choice model for connect air business travelers presented in Table 2-2, all level of service variables have the correct signs and all are statistically significant. The modal constants are also significant. The value of line-haul time is slightly lower than for local air business travelers, shown in Table 2-6. This is probably because nonstop air travelers have higher values of time than connecting air travelers, and are represented heavily in the local air data but are not represented at all in the connect air data. This reasoning must be tempered by the often limited choices available to local air travelers flying between the smaller cities in the Québec–Windsor corridor.

The value of wait time is much higher than for local travelers. This higher value for connect air business travelers is for the second (connecting) wait time, while for local travelers the lower value is for the first wait time. While the literature is certainly sparse on values of connect wait times, the consensus is that such values are very high, reaching as much as US$100 per hour as previously discussed for a second hour of wait time for a connecting flight.

The $23.33 value of the terminal transfer "penalty" for connecting air business travelers is equivalent to about half an hour of line-haul time. While this is probably longer than the time it takes to switch air terminals in Toronto, the major

[13] A limitation of the analysis of connect air trips relates to zone sizes in our analysis. Because Pearson Airport is west of downtown Toronto, HSR travel times from Pearson to final destinations west of the city would be less than from downtown (and likewise higher for eastern destinations), making the connecting HSR service relatively more attractive for destinations west of Toronto. Because CRA's analysis was done on a superzone level (which included the entire Toronto area), the models do not capture this additional level of detail.

connecting hub airport in the corridor, it incorporates a very reasonable estimate of the added disutility of such a transfer.

Finally, the modal constant of $35 shown in Table 2-7 may be interpreted as an additional transfer penalty for air business trips, regardless of whether the transfer takes place in the same or a different terminal. Its large magnitude (equivalent to about 0.7 hours of line-haul time) indicates there is considerable resistance to changing line-haul modes in this corridor.

Connect Air Nonbusiness Mode Choice Model

In this model, all coefficients and constants are significant and have the expected signs, as shown in Table 2-2. The value of line-haul time is very slightly higher than for local air nonbusiness travelers, and less than it is for connecting air business travelers. The latter is the usual result (business travelers value time more), while the former in this case may be due to the higher time value of longer air trips offsetting the lower representation of nonstop air travelers in the local air travelers surveyed. In any event, the difference between the time values of local and connecting nonbusiness air travelers is very small.

The value of the terminal transfer penalty of C$11.67 is half that for connect air business travelers and is equivalent to about 20 minutes of line-haul time. Again, this terminal transfer penalty, although lower by both measures than for business travelers, appears to incorporate a reasonable estimate of the disutility of a terminal transfer.

Conversely, the mode constant of $35, or about an hour of line-haul travel time, is equal to or higher than for connect air business travelers. This indicates a somewhat higher resistance on the part of nonbusiness travelers to change line-haul modes in this corridor. This could be attributed to concern over more luggage (which would, of course, be checked through) and more people in the group who are generally less familiar with airports having to switch between modes.

Auto Business Mode Choice Model

The estimated coefficients for the auto business model appear in Table 2-3. All coefficients have the expected signs and are significant.

Forecasting Methodology and Estimation of Ridership Forecasting Models

As anticipated, time is a less important determining factor for individuals traveling on business by automobile than by air, shown in Table 2-6. We expect people who fly to place a high value on their travel time, and people who take auto to place a lower value on time and a much higher value on the other attributes of auto travel — for example, flexibility, privacy, and the ability to make multiple stops.

The high value placed on the flexibility of the auto is apparent from the relative values of the HSR constants for the air and auto models shown in Table 2-7. The HSR constant in the auto business model is worth C$74.66. This value equals the fare advantage needed to make a traveler indifferent between auto and HSR if all times and costs explicitly included in the model were equal. This constant is worth about two hours of line-haul travel time.

The much larger auto constants (in dollars and hours) than air constants mean that travelers in the air market segments are much more likely to switch to another common carrier mode, such as HSR, all else being equal, than are auto travelers. Since auto travelers also value the line-haul time reductions that HSR can produce less than air travelers do, HSR is much more substitutable for air than it is for auto.

The value of line-haul time for auto business travelers is C$36.50 per hour, which is about the same multiple of average household income of travelers in the auto intercept survey as it was for local air business travelers. There are essentially no comprehensive studies of the value of intercity auto business travel time in the literature. The values of HSR access/egress time and wait time relative to line-haul time vary consistently across all market segments, as discussed above and shown in Table 2-6. In addition, as discussed previously, these relative values are consistent with the results of our auto market segment mode choice models from other HSR studies.

As discussed earlier, some auto travelers are harder to divert than others, and some are essentially impossible to divert. The auto intercept survey provided us with information to divide auto travelers into three additional categories:

- those driving vehicles who do not need to stop along the way, and do not need to use their vehicles at their final destination ("noncaptive" auto travelers);

Forecasting Methodology and Estimation of Ridership Forecasting Models

- those driving vehicles who do not need to stop along the way, but who do need a vehicle at their final destination ("destination captive" auto travelers); and
- those driving vehicles who need their vehicles to make stops along the way ("enroute captive" auto travelers).

HSR is certainly a viable alternative for the first group of auto travelers. It may also be a viable alternative for the second group, but they will need to rent vehicles when they get to their final destination. Hence, as discussed earlier, the cost of vehicle rental and the extra time necessary to obtain and return rental vehicles was added to the cost and access/egress time for the HSR alternative (for business and nonbusiness travelers, respectively, the added cost equals $45.00 and $33.75 per day times the duration of the trip divided by group size from the survey; the added time equals 20 minutes each to obtain and return the rental vehicle). These values are intended to reflect the added impedance of changing modes to complete a door-to-door trip. With the added cost and time, we can expect the HSR share for the second group of "destination captive" auto travelers to be lower than for "noncaptive" auto travelers.[14]

For the third "enroute captive" group of travelers, HSR was assumed not to be a viable alternative. While it is possible that some of the enroute stops could be made on the train (e.g., Québec–Toronto, stopping in Montréal), it was more conservative to assume that such trips were few in number and not make any of this third group of travelers eligible for HSR diversion.

Auto Nonbusiness Mode Choice Models

Table 2-3 also shows the models for auto nonbusiness travelers. All of the coefficients have the expected signs and are statistically significant.

Table 2-6 shows that the value of line-haul time for this market segment is lower than for auto business trips, again reflecting the discretionary nature of nonbusiness trips relative to business trips. The average value of C$25 per hour

[14] Specifically, the inputs for the auto model are adjusted for this market segment by adding the rental processing time to the total travel time and by adding the average rental cost (daily fee x duration + occupancy) to the total cost when computing the HSR utility. The coefficients (shown in Table 2-3), however, remain unchanged.

Forecasting Methodology and Estimation of Ridership Forecasting Models

equals about the same multiple of average household income for auto nonbusiness travelers in our intercept survey as for auto business travelers. This is larger than the proportion of income reported in a large English value-of-time study,[15] which reported about $6.00 per hour (unadjusted for inflation) for nonbusiness "long-distance" auto trips by the highest income group surveyed (lower than the income of our surveyed auto nonbusiness travelers). The English study did not report actual trip lengths, but a review of the survey methodology suggests that fairly short trips (100 miles) comprise most of the sample.

The values of the out-of-vehicle times are also lower than those for auto business trips, for the same reasons. That is, business travelers are willing to pay more for improvements to most of the attributes of travel. Conversely, the auto nonbusiness market segment exhibits a larger negative HSR constant in both dollar terms (C$83.83) and equivalent line-haul time (3.4 hours) than auto business travelers. As discussed above, this is consistent with our expectations and the findings of our other HSR forecasting studies.

Conventional Rail Mode Choice Models

Table 2-4 shows the estimated models for business and nonbusiness conventional rail travelers. All of the coefficients are significant and have the expected signs.

Table 2-6 shows that the values of line-haul time of conventional rail travelers are markedly lower than for auto and air travelers. The values of access/egress and wait time relative to line-haul time for the rail models (and the bus models discussed below) are also much higher than for local air and auto travelers. Access/egress time values are more than three times higher than line-haul time (compared to about 1.5 times higher for local air and auto travelers), and more than 2.5 times higher for wait time (compared to about 40 percent higher for local air and one-third lower for auto travelers). These high multiples on the "out-of-vehicle" time of these non-air intercity common carrier modes reflect the large disutility attached to such time by users of these modes. Diversion to HSR of conventional rail (and intercity bus) travelers will be quite sensitive to station location and headway. HSR alternatives with remotely located stations (i.e.,

[15]The MVA Consultancy, Institute for Transportation Studies (University of Leeds), and Transport Studies Unit (University of Oxford), "The Value of Travel Time Savings," in *Policy Journals*, Berks, England, 1987.

outside the central cities) relative to existing rail and bus stations will have difficulty diverting users of conventional intercity rail and bus.

Conversely, the modal constants in the conventional rail models shown in Table 2-7 are favorable to HSR. Their values of C$11.42 and C$11.61 for business and nonbusiness travelers, respectively, are worth 0.8 hours and 1.2 hours in equivalent line-haul time. However, in equivalent access/egress time, the increased comfort and amenity included in the HSR mode constant are only worth 0.24 hours ($11.42 ÷ $48.22 per hour) and 0.4 hours ($11.61 ÷ $29.70) for business and nonbusiness travelers, respectively, reflecting the importance of station location for conventional rail travelers.

Intercity Bus Mode Choice Models

Table 2-5 shows the estimated models for business and nonbusiness bus travelers. Again, all of the coefficients are significant and have the expected signs.

Table 2-6 shows that the values of line-haul time for bus travelers are the lowest of any intercity travel market segment. This means that business and nonbusiness bus travelers show the least willingness to pay for the time savings that HSR may provide. A fare difference of, for example, $50 between bus and HSR is worth 4 and 7.5 hours, respectively, of business and nonbusiness line-haul travel time. Therefore, diversion to HSR from intercity bus is likely only with very "competitively" (low) priced service. Since any time savings from higher line-haul speeds are smaller for short-distance trips, diverting short-distance trips will require even smaller fare differentials between bus and HSR service.

Bus travelers exhibit the same very high value of out-of-vehicle time relative to line-haul time that was noted above for conventional rail travelers. Again, this means that HSR stations located remotely from existing bus terminals are not likely to divert many bus travelers.

On the other hand, the HSR modal constants in the bus models indicate that bus travelers look very favorably on the comfort and amenity of HSR, all else being equal. The modal constant values of C$18.43 or 1.5 hours of line-haul travel time for bus business travelers, and C$12.71 or 1.9 hours of line-haul time for bus nonbusiness travelers are the largest values for any common carrier mode. However, these differences between HSR and bus are much less in equivalent

Forecasting Methodology and Estimation of Ridership Forecasting Models

access/egress time, reflecting the importance of station location for intercity bus travelers.

SUMMARY OF INTERCITY DIVERSION MODELS

In summary, these mode choice models relate traveler preferences for the existing modes and HSR to their level of service values and to the attributes inherent in the modes themselves. The values of time and the modal constants in the models exhibit very strong face validity and conform very well to the findings in our several previous HSR ridership studies, and to values of time reported in the literature (where available).

These mode choice models were used to estimate HSR market shares of travel in each market segment, given the anticipated service levels on the competing modes. These market shares were then applied to the future-year forecasts of travel on each mode to determine the number of travelers (riders) diverted from each mode.

Induced travel was also estimated using the attribute values in the mode choice models to measure the attractiveness of the new mode to travelers in the corridor. Diverted and induced travel in the intercity travel markets in the corridor were then combined as shown in Figure E-2 in the executive summary to produce the total HSR intercity ridership forecasts resulting from the study. These results are described in Chapter 4.

FORECASTING INDUCED TRAVEL

The introduction of HSR service by itself will improve the overall level of service for intercity travel within this corridor. For example, the addition of HSR will increase the frequency of high speed common carrier service, the centralized location of stations will reduce the average time and cost required for terminal access/egress, and the new mode will provide comfort and other quality of service improvements for many travelers. These improvements will make conditions more favorable for travel, and will decrease the *disutility* of travel relative to the benefits travelers experience at their trip ends. Trips will therefore be taken on HSR that would not otherwise have been made using any of the current modes (air and auto). These new trips made on the new or improved mode, in addition to

Forecasting Methodology and Estimation of Ridership Forecasting Models

those diverted from the existing modes, are commonly referred to as *induced trips*. They can be defined as:

Induced Travel = Total Travel With High Speed Rail – Total Travel Before High Speed Rail

It is important to note that this formula takes into account the fact that the level of service provided on the existing modes may change with the introduction of HSR (for example, air frequencies may be reduced). The calculation of induced demand must therefore identify the *net change* in the level of transportation service that occurs with the introduction of HSR.

To calculate induced travel, the effect of service improvements on total travel demand must be known. It was not possible to estimate models of total travel demand in the corridor by relating separately total air, rail, bus, and auto trips to the disutility of each mode, along with socioeconomic characteristics of the cities involved. Typically, the disutility of a mode would be equal to a generalized price term calculated using the same utility function specification as in the mode choice models described earlier. Barring the estimation of a total travel demand model, we estimated an elasticity of total travel demand with respect to the *utility* of each mode, using relationships we developed elsewhere. Since the modal choice models related the utility of each mode to HSR, we can compute a *composite utility*, which reflects the overall level of service characteristics that exist after HSR is introduced. Inasmuch as the overall level of service must by definition increase with the introduction (only) of HSR, we calculate the composite utility as the *logsum*[16] of the utilities derived from the modal choice models:

$$\text{Composite Utility } (U_{Existing\ Mode\ +\ HSR}) = \ln\left(e^{U_{Existing\ Mode}} + e^{U_{HSR}}\right) \quad (1)$$

This method allows the utility (generalized price) of travel after the introduction of HSR to be higher (lower) than the utility that would be obtained for either mode individually. To calculate the percentage of travel induced, we compare this composite utility with the utility or generalized price of travel before HSR. The generalized price of travel before HSR is simply the utility of the existing mode,

[16]Charles River Associates, "Application of Disaggregate Travel Demand Models," NCHRP Report 253, December 1982.

Forecasting Methodology and Estimation of Ridership Forecasting Models

calculated with the level of service characteristics that exist before HSR. This can be expressed as (ignoring the O/D and business/nonbusiness subscripts):

$$T_B = (S / E)^{\alpha} \times (U_B)^{\theta} \tag{2}$$

Where

T_B	=	Total travel volume between O/D before HSR;
S/E	=	Socioeconomic factors for O and D;
U	=	Utility of travel between O and D (negative of the generalized price); and
α, θ	=	estimation coefficients.

Total travel after HSR can be calculated as:

$$T_A = (S / E)^{\alpha} \times (U_A)^{\theta} \tag{3}$$

The induced demand percentage can be calculated as:

$$\text{Induced Demand \%} = \frac{T_A - T_B}{T_B} = \frac{U_A^{\theta} - U_B^{\theta}}{U_B^{\theta}} \tag{4}$$

or

$$\frac{(-\ln(e^{U_{ExistingMode_{AfterHSR}}} + e^{U_{HSR}}))^{\theta} - (-U_{ExistingMode_{BeforeHSR}})^{\theta}}{(-U_{ExistingMode_{BeforeHSR}})^{\theta}} \tag{5}$$

Where

$U_{Existing\ Mode_{Before\ HSR}}$ is calculated using the mode diversion model coefficients along with the values for the level of service that exists before HSR.

$U_{Existing\ Mode_{After\ HSR}}$ is calculated using the mode diversion model coefficients along with the values for the level of service that exists after HSR is introduced.

U_{HSR} is calculated using the mode diversion model coefficients along with the estimated level of service values for HSR.

The result is the percentage change in travel that occurs due to the introduction of HSR service. For any given market segment, the percentage increase in travel is

Forecasting Methodology and Estimation of Ridership Forecasting Models

added to the number of trips diverted to HSR, because HSR represents the service improvement that has caused, or induced, the additional travel.

This methodology is attractive because it allows us to account for the possibility of foregone ridership arising from reducing the level of service on the existing modes (reducing air service, for example). The formula, therefore, can be used to calculate *net induced demand*. If the reduction in the existing mode level of service outweighs the improvement in service resulting from HSR (i.e., it reduces the overall generalized price), the result will be negative (foregone ridership); if there is no worsening of existing service or if the reduction is outweighed by the improvement in HSR, the result will be positive (induced travel). As shown in Tables E-2 and E-3 of the executive summary and in Chapter 4, the percentage of induced riders on the proposed HSR system is about 14 percent *of total riders*.

3
Development of HSR Fares to Maximize Passenger Revenue

This chapter describes the procedure we followed to derive the passenger revenue-maximizing HSR fares used in our forecasts of ridership for the various alternatives considered. After discussions with other study staff, we concluded that the fare should be computed as a function of distance, as is the convention in rail operations. Specifically, we adopted the following basic requirements that the optimal HSR fare "function" (taper) had to satisfy:

1. No "hidden city" fares. These are the fares often observed in airline fare structures, but not permissible in rail operations.[17] That is, fares in some longer distance air O/D markets are lower than those for intermediate destinations, a nonsensical result for a linear HSR system.

2. Fare per kilometer must decrease monotonically as distance increases (i.e., there should be a taper).

3. A consistent relationship must exist between business and nonbusiness fares.

PROCEDURE

Hypothesizing That The Optimal Fare Taper Will Vary By Market Segment

Obviously, the same fare must be charged between any city pair, regardless of the existing mode (market segment) from which the travelers are diverted. We hypothesized that the optimal taper would vary considerably by previous mode, which was borne out. For example, the optimal taper for air divertees would be quite steep and downward sloping, while for auto divertees, it would be quite flat or even upward sloping. The reasons for these differences are as follows. Air fares in the short-distance markets are quite high. Since HSR is quite competitive with air at short distances (e.g., 300 km) the revenue-maximizing HSR fare can equal the high air fare. Conversely, on the principal longer O/D pair, Montréal–Toronto, the air fare is much lower on a per kilometer basis than between the

[17]For a recent discussion of this issue, see "Some Fliers Profit From Quirks in Fares," *Wall Street Journal*, November 12, 1993.

Development of HSR Fares to Maximize Passenger Revenue

shorter O/D pairs, and even lower in absolute terms in many cases (e.g., the Montréal–Toronto air fare is lower than the Montréal–Québec fare). At the longer distances, HSR must compete with air by reducing its fare since it is less competitive at long distances on travel time. Therefore the optimal HSR fare taper would be very steep if HSR only competed with air.

However, in competing with auto, the reverse is true. At short distances, HSR offers no significant travel time savings, particularly in view of the large modal constants (2 to 3½ hours) in favor of auto. Thus, to the extent it can be competitive at all, HSR must compete using low fares at short distances. However, at very long distances, HSR can indeed compete with auto on travel time, and charge revenue-maximizing fares that no longer "give the store away." Therefore, the revenue-maximizing taper for diverting (only) auto trips may be positive, resulting in higher per kilometer fares for longer trips than for shorter trips.

At the same time, HSR diversions from conventional rail and intercity bus are likely to result in an optimal HSR fare taper that is similar to the current (negative slope) conventional rail taper, indeed probably with a slightly greater slope. The reason for the slightly greater slope (taper) is the positive modal constants for bus and conventional rail in favor of HSR. This means HSR starts off (at short distances) with its largest relative time advantage, which it can charge extra for, if it chooses to maximize revenue. At longer distances, the relative HSR advantage provided by its positive modal constant becomes less important as the constant becomes a smaller portion of the total (dis)utility of travel by each competing mode. This is the reason for the slightly steeper taper than for the conventional rail or bus fare taper.

In short, knowing the behavior of each market segment in the Québec–Windsor corridor that our market segment models provide, we hypothesize that the optimal (revenue-maximizing) fare taper that satisfies all four requirements listed above would have a slope similar to the current rail taper. The flat or positive auto slope should offset the steep negative air slope, suggesting that generations of railroad pricing experience in this high volume corridor count for something.

Approximating the Optimal HSR Fare Taper Versus Air

We began by computing revenue-maximizing fares for each of the six major markets for which detailed forecasts are provided in Chapter 4 (Montréal–Toronto, Montréal–Québec, Ottawa–Toronto, London–Toronto, Ottawa–Québec, and Toronto–Windsor). Because these major markets include the largest air markets in the corridor they are the closest approximation we have to the revenue-maximizing fares from diverted air trips. However, as expected, these O/D pair optimized fares shown in Figure 3-1 resulted in the hidden city fare problem. That is, fares in some longer distance air O/D markets were lower than those for intermediate destinations, a nonsensical result for a linear HSR system. This also meant that the optimized fare structure did not exhibit the required monotonically decreasing price per kilometer taper that has been the standard practice in railroad operations.

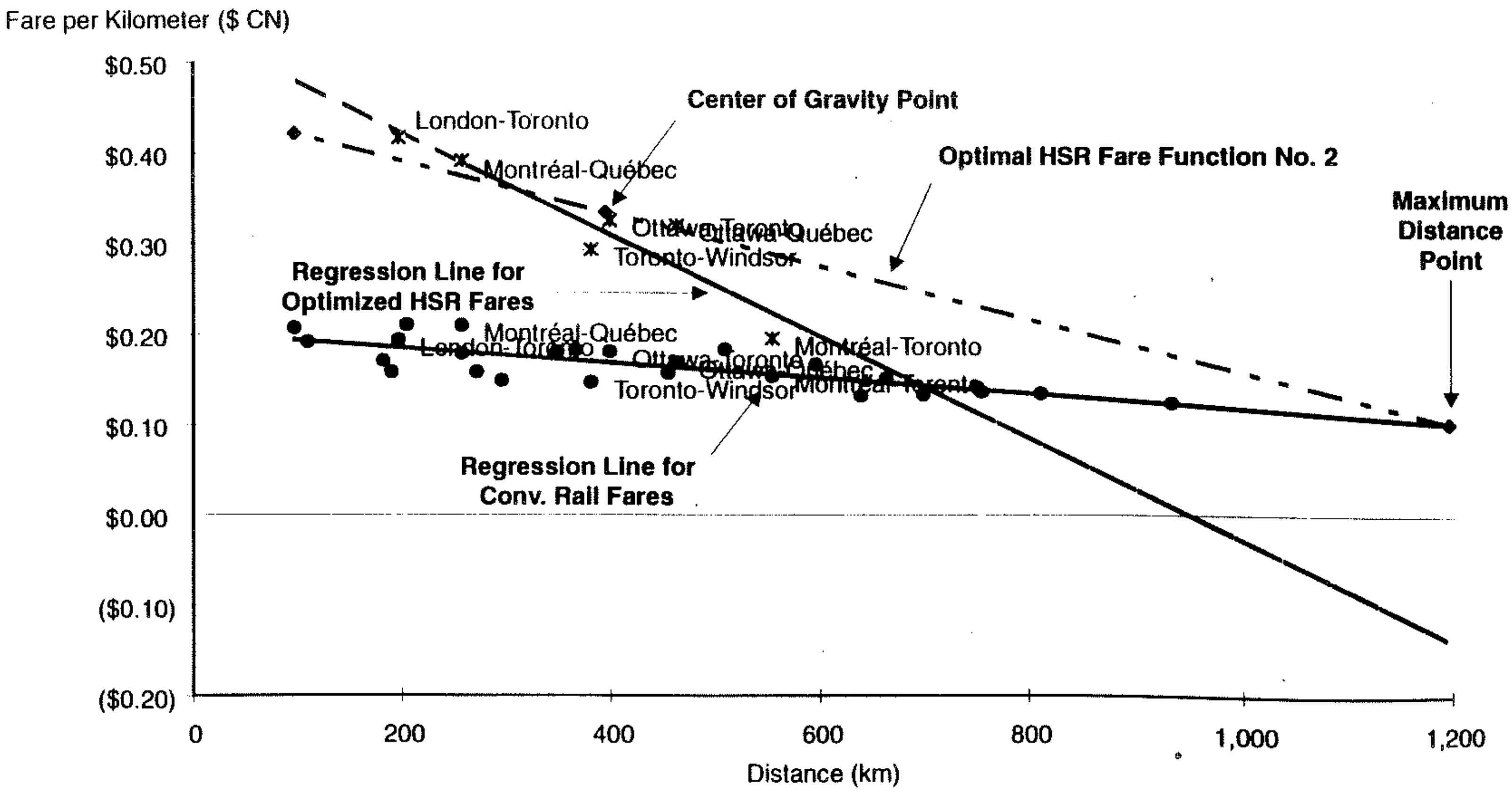
To obtain a monotonically decreasing taper, we estimated (regressed) a fare per kilometer versus distance relationship from the six optimized fares. This relationship is named the "Regression Line for Optimized HSR Fares" in Figure 3-1. It provides a fare-distance relationship (taper) while still approximating the optimal fares for the six major markets. As expected, this taper exhibited the characteristics of the optimal HSR fare taper for trips diverted from air. It was very steep, in fact too steep to meet requirements (1) and (3) above (no hidden city fares, whether from a few specific intermediate city pairs having higher fares, or from a too steep monotonic fare taper that yields lower absolute fares over longer distances). With regard to the latter requirement this attempt at an "optimal" taper caused HSR fares above about 800 km to become cheaper with distance, resulting in the recurrence of hidden city fares. Finally, this taper was also nonoptimal when all the other O/D pairs were added in. That is, after running the entire forecasting model, this taper yielded *less* passenger revenue for the entire system than the nonoptimized fares used earlier in the study.

Flattening the Taper to Meet All Four Requirements

The next step was to flatten the taper to eliminate the cheaper fares at longer distances within the distance spanned by the corridor. We did this by constraining the function to intersect the conventional rail fare function line at the length of the longest distance market (Québec–Windsor — about 1,185 km). Since we could no longer use the regression line fitted through the six optimal fare points, we constrained the line to pass through the weighted average point (or "center of

Figure 3-1

Intermediate Calculated Optimal Fares per Km by Distance - Rail Business



Legend: ✱ Optimized HSR fares by city pair

● Current conventional rail fares

SOURCE: Charles River Associates, 1994.

gravity") of the six large markets. This line is labeled "Optimal HSR Fare Function No. 2" in Figure 3-1.

This new function provided a compromise "optimal" fare-per-kilometer slope, and required the additional step of shifting the line up or down (to compute the optimal *y*-intercept). However, when the intercept that maximized passenger revenue was computed, the new function was so much lower than the original line that it caused fares for added trip length to again become negative within the corridor, this time at about 1,100 km. This meant that we were again faced with the hidden city fare problem, albeit in fewer markets. In addition, the maximized revenue was again lower than the revenue calculated using 160 percent of conventional rail fares.

Adopting the Conventional Rail Taper

These exercises of testing steep and somewhat less steep "air fare–based tapers" took a great deal of effort and many forecasting runs of the model. They demonstrated that neither a steep taper through the optimized fares in the six major markets, nor a less steep taper whose optimal intercept brought much of the function below the existing conventional rail taper produced system revenue greater than HSR fares, which were optimized using the current conventional rail taper. This left us two options. The first was to use a function derived from a regression line fitted to the conventional rail fares, as shown in Figure 3-1. This yielded an exact formula for HSR fare per kilometer, which we could use to compute the optimal intercept to maximize system revenue. The second option was to shift all of the conventional rail fares directly by applying a constant factor (i.e., a multiple of the conventional rail fares) to maximize revenue. The latter yielded more total passenger revenue and thus this approach was adopted.

Using this technique, we computed optimal multiples of the conventional rail fare shown in Table 3-2, which varied by year, speed, and corridor configuration. As expected and logical, higher fares can be charged for the higher speed alternative resulting in the year 2005 maximum revenue fare of 152 percent of conventional rail fare for the 300 kph alternative, but only 146 percent for the 200 kph alternative. The higher fare charged for the higher speed alternative obviously lowers the ridership increase that would result from the speed increase alone. The specific optimized fares for each O/D city pair are shown in the "HSR Input Data" sheets provided with the base forecasts.

Development of HSR Fares to Maximize Passenger Revenue

Figure 3-2 shows how ridership and revenue vary with the multiple of conventional rail fares at 2005 for the full corridor 200 kph alternative. Figure 3-3 shows the same information for the 300 kph alternative. The empirical work we carried out as described here also validated our hypothesis that the revenue-maximizing HSR fare taper in the context of all the O/D pairs in the corridor, including the markets dominated by auto travel, is quite flat.

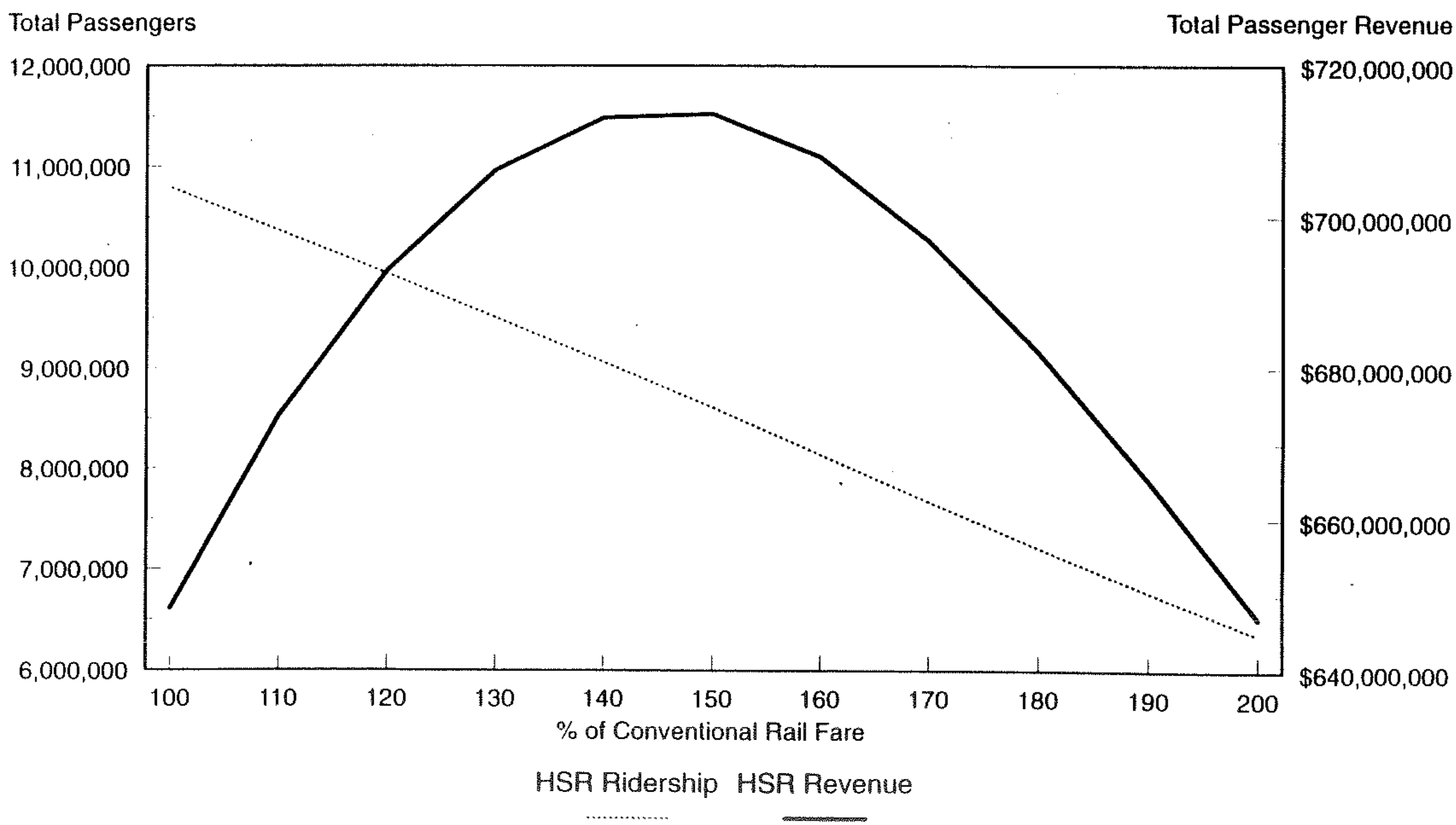
Table 3-2. Optimal HSR fares as a Percent of VIA Rail Fare

Year	Technology	HSR Corridor	HSR Fare as a Percentage of VIA Rail Fare
2005	200 kph	Québec–Windsor	146%
		Québec–Toronto	138%
		Montréal–Toronto	136%
	300 kph	Québec–Windsor	152%
		Québec–Toronto	143%
		Montréal–Toronto	141%
2025	200 kph	Québec–Windsor	153%
		Québec–Toronto	145%
		Montréal–Toronto	142%
	300 kph	Québec–Windsor	160%
		Québec–Toronto	151%
		Montréal–Toronto	149%

Source: Charles River Associates, 1994.

Figure 3-2

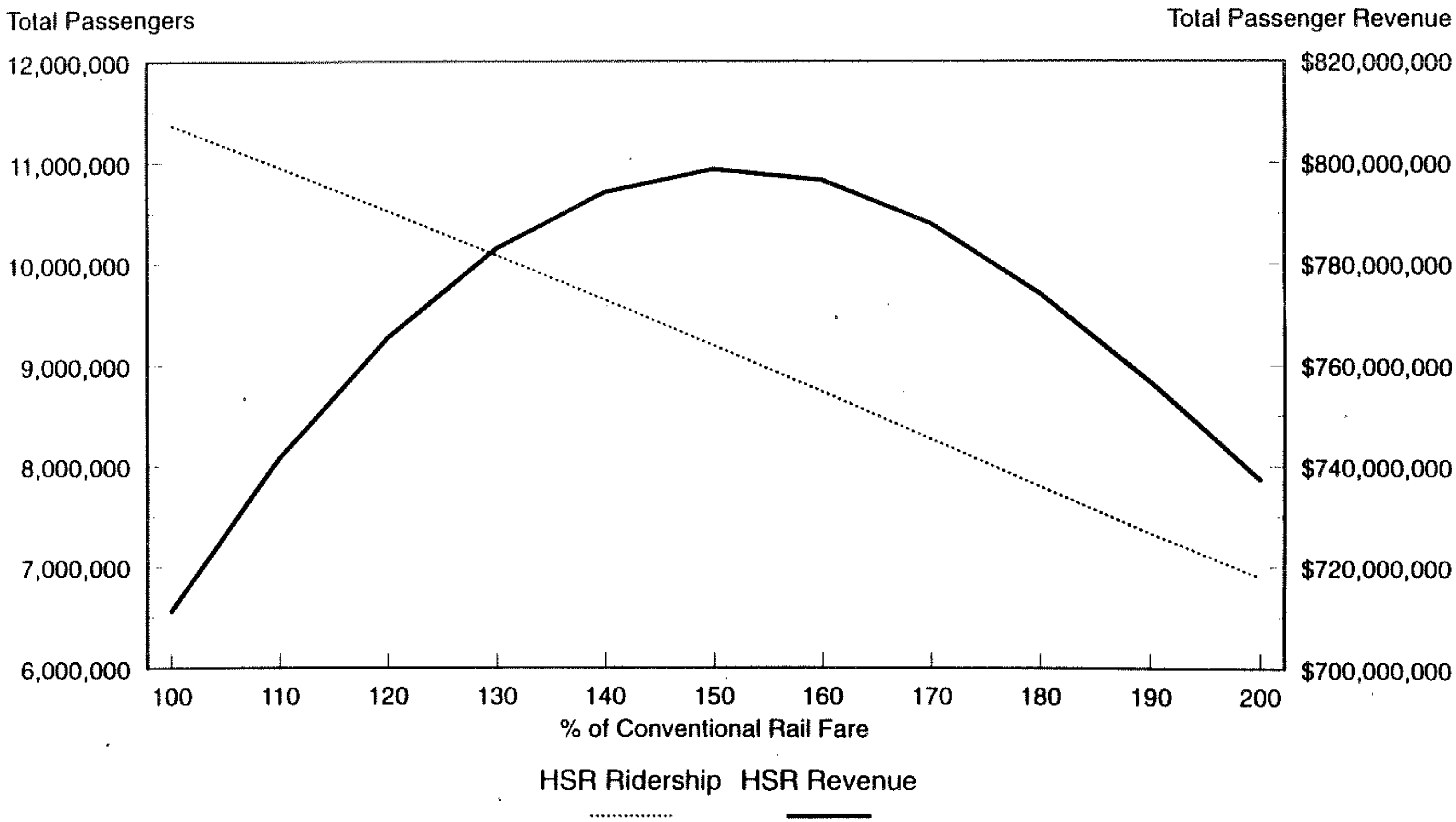
Relationship of Ridership, Revenue, and HSR Fare for the Full Corridor 200 kph Alternative (Year 2005)



SOURCE: Charles River Associates, 1994.

Figure 3-3

Relationship of Ridership, Revenue, and HSR Fare for the Full Corridor 300 kph Alternative (Year 2005)



SOURCE: Charles River Associates, 1994.

CRA

4
Forecasts of HSR Ridership and Revenue

This chapter presents our detailed estimates of HSR ridership and passenger revenue for the years 2005 and 2025 for the proposed system alternatives (i.e., 200 kph and 300 kph) and corridor lengths under consideration. The chapter begins by discussing the existing (1992) intercity volumes by mode that were used in our analysis. This chapter also includes the results of several sensitivity analyses that were undertaken.

EXISTING MODAL VOLUMES

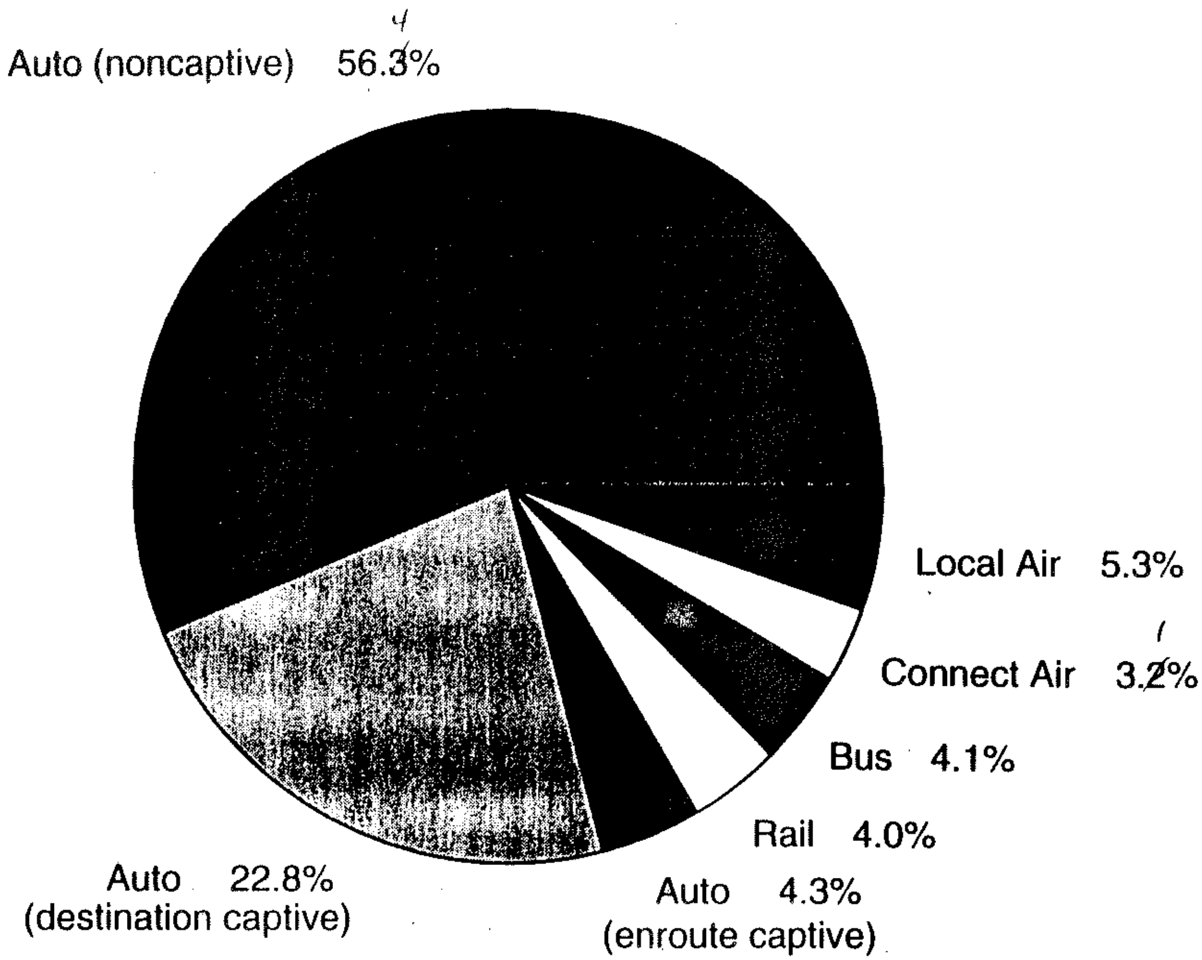
In making ridership and passenger revenue projections for HSR, we began with the annual 1992 base year modal volumes on an O/D basis. Figure 4-1 displays the percentage of long-distance intercity person trips by mode in the corridor in 1992. In addition, for intercity auto travel, trips were disaggregated into three groups using our survey results: (1) need for the automobile at the destination ("destination captive"), (2) need to make stops along the way ("enroute captive"), and (3) all other (long-distance) intercity auto travel. Using the auto survey responses, an average group size of 1.4 and 2.2 was calculated for business and nonbusiness trips, respectively.

Within the corridor it was possible to use the results from the air, rail, bus, and auto surveys to estimate the shares of trips made for each trip purpose category. A summary of these results is presented in Table 4-1. The 1992 trip purpose distribution for each O/D pair was kept constant in the future forecast years.

Next, using step 1 of the approach described in Chapter 2, we determined how the base year (1992) modal volumes would change for the years 2005 and 2025. Table 4-2 shows the annual growth rates we were directed to use for the various modes. Note that for rail (VIA) and bus, the annual growth rates are 0 percent, implying no change in intercity volumes for these modes. Air trips are assumed to increase by an annual average growth rate of 2.95 percent to the year 2005, and by 2.72 percent over the entire forecast period. Annual auto rates of growth are somewhat smaller: 2.19 percent to 2005, and 2.13 percent over the entire forecast period. Graphically, these changes over time are shown in Figure 4-3.

Figure 4-1

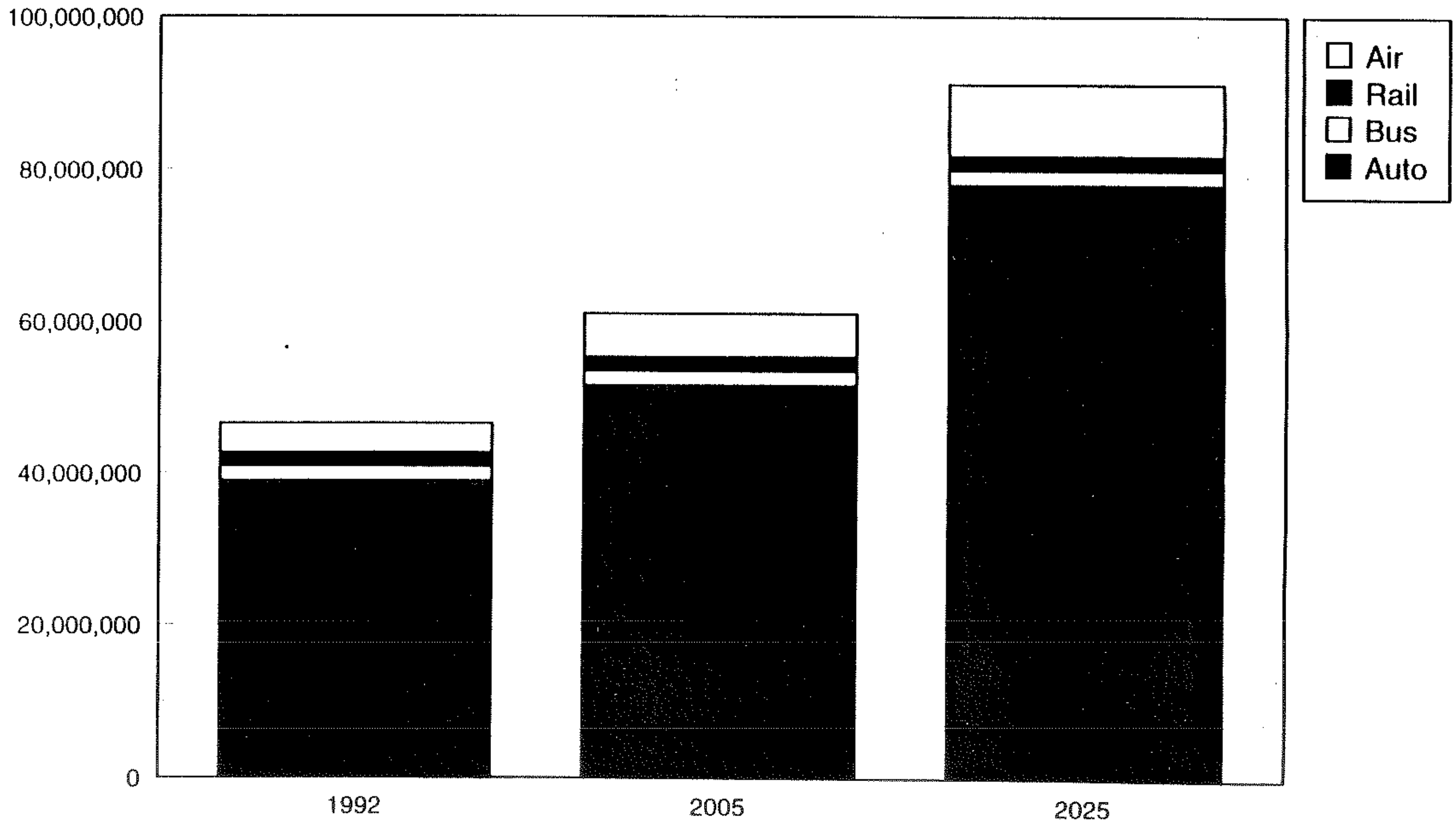
Market Shares of Trips by Mode before HSR (1992)
Québec-Windsor Corridor



SOURCE: Charles River Associates, 1994.

Figure 4-2

Growth in Total Intercity Travel in the Québec-Windsor Corridor without HSR (1992-2025)



SOURCE: CIGGT with calculations by Charles River Associates, 1994.

CRA

Forecasts of HSR Ridership and Revenue

Table 4-1. Share of Business/Nonbusiness Person Trips by Mode in the Québec–Windsor Corridor

	% Business	% Nonbusiness	% Total
Air	73	27	100
Rail	32	68	100
Bus	20	80	100
Auto (all types)	22	78	100
Auto (noncaptive)	21	79	100

SOURCE: Consumer Contact Limited with calculations by Charles River Associates, 1994.

Table 4-2. Growth in Travel Without HSR for the Québec–Windsor Corridor (1992–2025)

Mode	1992	2005	2025	1992–2005	1992–2025
Local air	2,483,289	3,623,847	6,020,640	2.95%	2.72%
Connect air	1,421,689	2,074,660	3,446,829	2.95%	2.72%
Rail	1,854,592	1,854,592	1,854,592	0.00%	0.00%
Bus	1,901,839	1,901,839	1,901,839	0.00%	0.00%
Auto	38,916,557	51,575,518	78,017,920	2.19%	2.13%

SOURCE: Consumer Contact Limited and CIGGT with calculations by Charles River Associates, 1994.

HSR RIDERSHIP AND REVENUE FORECASTS

Level of service information pertaining to HSR fares (see Chapter 3), frequencies, line-haul times, access/egress times, and terminal processing times were developed by us or provided to each study team for each relevant O/D pair (see Chapter 1). Based on this information, we projected the number of trips that could be expected to be diverted to and induced by HSR, by mode and trip purpose (see Chapter 2). Table 4-3 presents the results of these forecasts for the year 2005 for the 200 kph and 300 kph alignments.

As shown in Table 4-3, our forecast for the entire Windsor–Québec corridor is that the 200 kph HSR alternative would carry about 10.2 million trips in 2005, resulting in gross passenger revenues of C$713.7 million (1992 dollars). This system would capture more than 46 percent of local air travelers within the corridor, and almost 90 percent of intercity rail users. Conversely, only about 6

Forecasts of HSR Ridership and Revenue

percent of intercity auto travelers within the corridor would divert to this HSR system. Figure 4-4 shows these percentage diversions in a bar chart format.

Table 4-3 shows induced demand for the 200 kph alternative to be about 16 percent of the total year 2005 number of trips diverted to HSR. As a point of comparison, estimates of induced demand for other HSR studies range from a low of 7 percent to a high of 48 percent.[18] Figure 4-5 shows intercity modal shares for the full corridor with the 200 kph HSR system. Figure 4-6 shows in both absolute and percentage terms the sources of the HSR trips projected for the 200 kph alternative. Figure 4-7 shows in graphical form the estimated intercity modal shares for the 300 kph alternative operating in the full Québec–Windsor corridor.

Table 4-3. HSR Passengers in 2005 by Source (Full Corridor)

	200 kph Alternative		300 kph Alternative	
Source	**HSR Trips**	**Percent**	**HSR Trips**	**Percent**
Local Air	1,656,656	16.2	1,965,458	18.6
Connect Air	935,931	9.2	755,028	7.1
Rail	1,696,973	16.6	1,705,655	16.1
Bus	1,146,783	11.2	1,109,065	10.5
Auto	3,376,924	33.1	3,601,460	34.0
Subtotal	8,813,267		9,136,667	
Induced	1,395,008	13.7	1,449,458	13.7
Total	10,208,275	100.0	10,586,125	100.0

SOURCE: Charles River Associates, 1994.

For HSR operating over the full Windsor–Québec corridor, Table 4-4 shows the results for six major O/D pairs.

[18]Transportation Research Board, "In Pursuit of Speed: New Options for Intercity Passenger Transport," Special Report 233, 1991.

CRA

Forecasts of HSR Ridership and Revenue

Table 4-4. HSR Ridership and Passenger Revenue for Six Major O/D Pairs

O/D Pair	200 kph Alternative		300 kph Alternative	
	HSR Ridership	Passenger Revenue	HSR Ridership	Passenger Revenue
Montréal-Toronto	1,320,579	$143,875,573	1,541,542	$176,792,179
Montréal-Québec	1,196,264	$81,057,238	1,151,307	$80,548,501
Ottawa-Toronto	1,832,476	$177,632,683	2,061,564	$208,562,729
London-Toronto	1,203,812	$52,117,512	1,263,203	$56,983,290
Ottawa- Québec	105,912	$10,246,838	117,112	$71,819,965
Toronto-Windsor	519,082	$37,346,800	571,219	$42,875,521

SOURCE: Charles River Associates, 1994.

Link and station volumes for HSR ridership in the year 2005 are presented in Tables 4-5 and 4-6, respectively. In each alternative, the link from Kingston to Toronto has the largest volumes, while the Toronto station has the highest number of HSR passengers boarding and alighting.

Table 4-5. 2005 Link Volumes (HSR in Full Corridor)

Link	Total Link Volume	
	200 kph Alternative	300 kph Alternative
London-Windsor	952,248	1,050,672
Kitch.-Waterloo-London	2,053,893	2,215,535
Kitch.-Waterloo-Toronto	2,291,109	2,467,689
Kingston-Toronto	4,265,300	4,838,499
Kingston-Ottawa	3,973,561	4,518,206
Montréal-Ottawa	3,261,092	3,238,851
Montréal-Trois Rivières	1,784,123	1,801,893
Québec-Trois Rivières	1,449,266	1,460,423

SOURCE: Charles River Associates, 1994.

Forecasts of HSR Ridership and Revenue

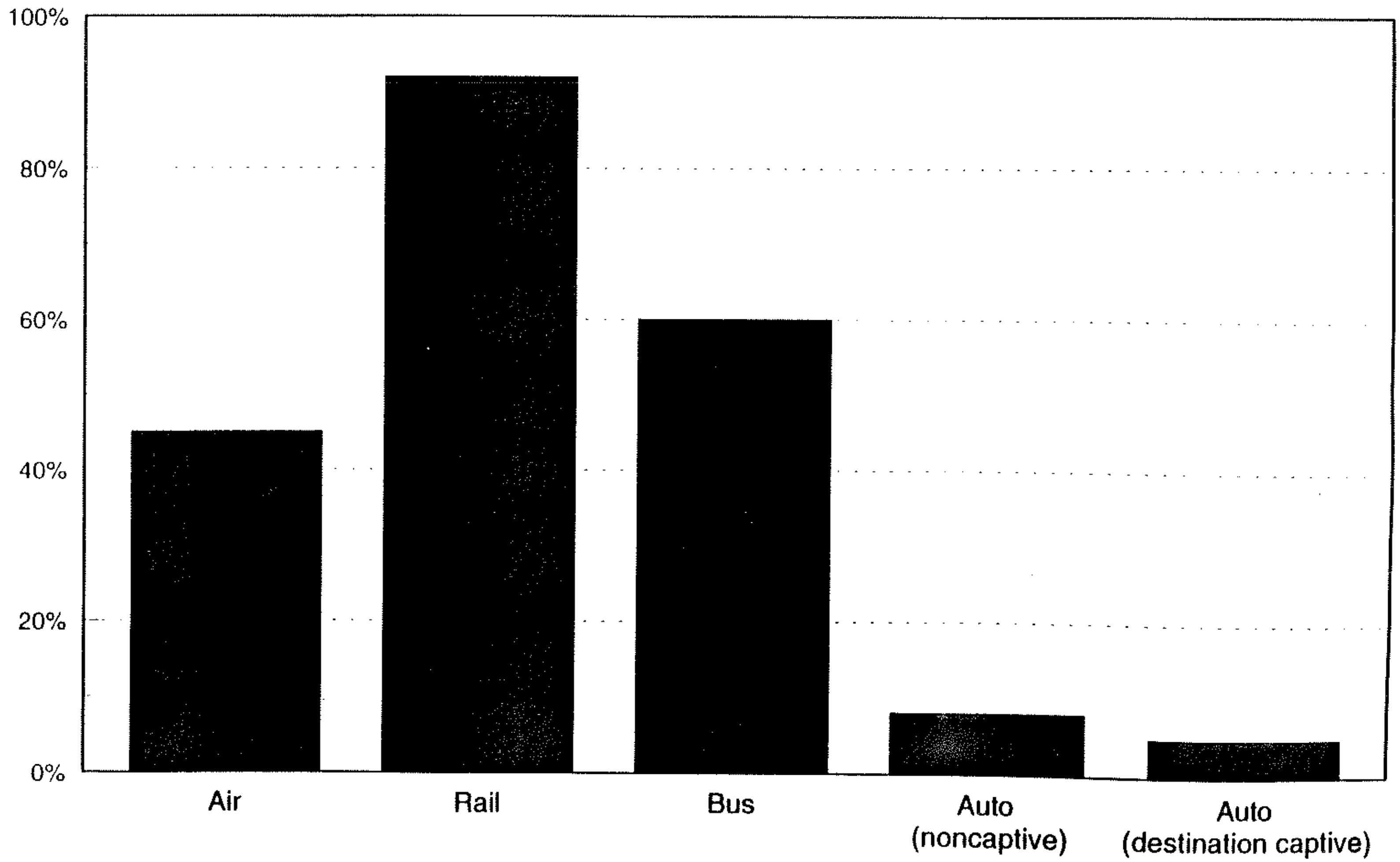
Table 4-6. 2005 Station Volumes (HSR in Full Corridor)

Station	Total Station Volume	
	200 kph Alternative	300 kph Alternative
Kingston	1,160,506	1,194,635
Kitchener	456,262	484,227
London	1,720,233	1,827,394
Montréal	4,510,948	4,396,117
Ottawa	3,864,773	3,803,856
Québec	1,449,266	1,460,423
Toronto	5,951,150	6,597,144
Trois Rivières	351,166	357,783
Windsor	952,248	1,050,672
TOTAL	20,416,551	21,172,250

SOURCE: Charles River Associates, 1994.

Figure 4-3

Percent Diversion to HSR by Mode in 2005 for the 200 kph Alternative/Optimized Fares in the Québec-Windsor Corridor

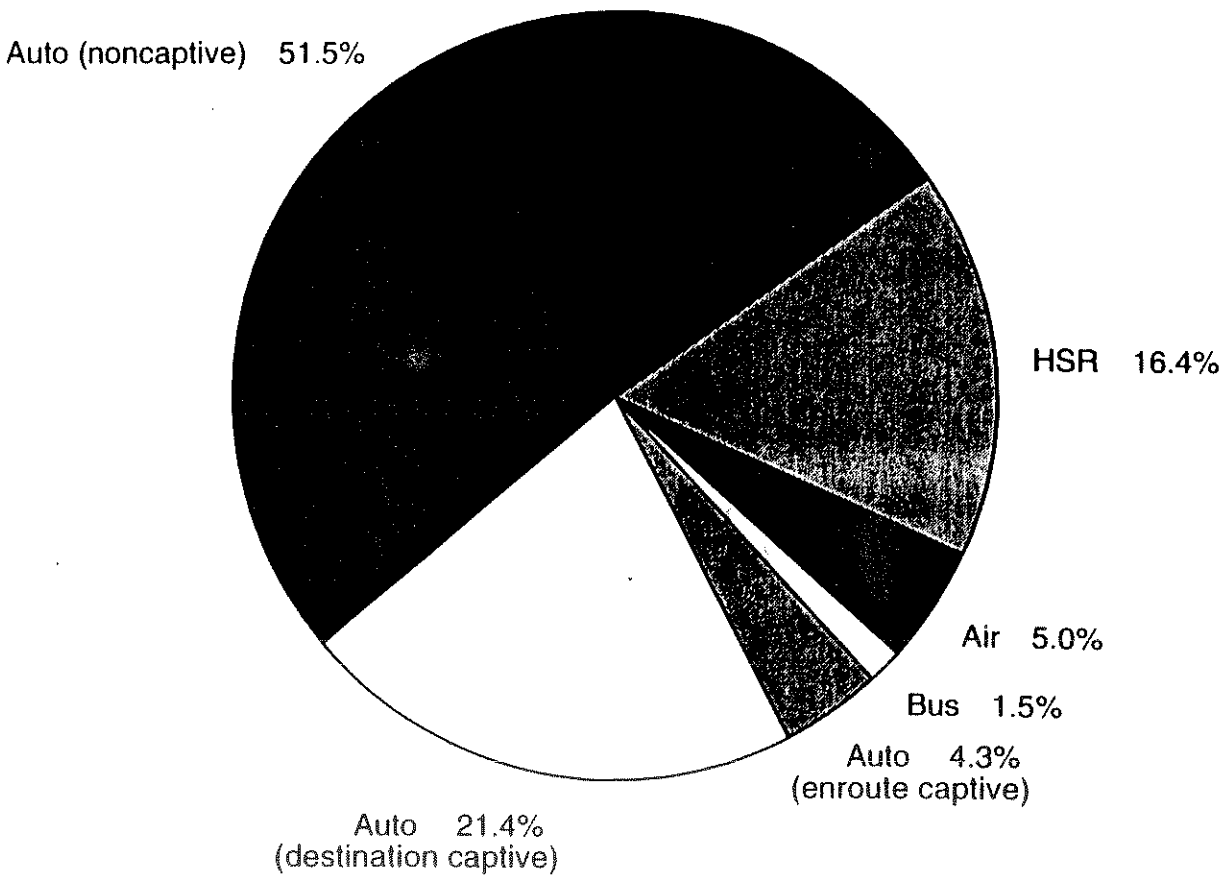


SOURCE: Charles River Associates, 1994.

CRA

Figure 4-4

Québec-Windsor Corridor Market Shares of Trips by Mode in 2005 with HSR in Place for the 200 kph Alternative/Optimized Fares

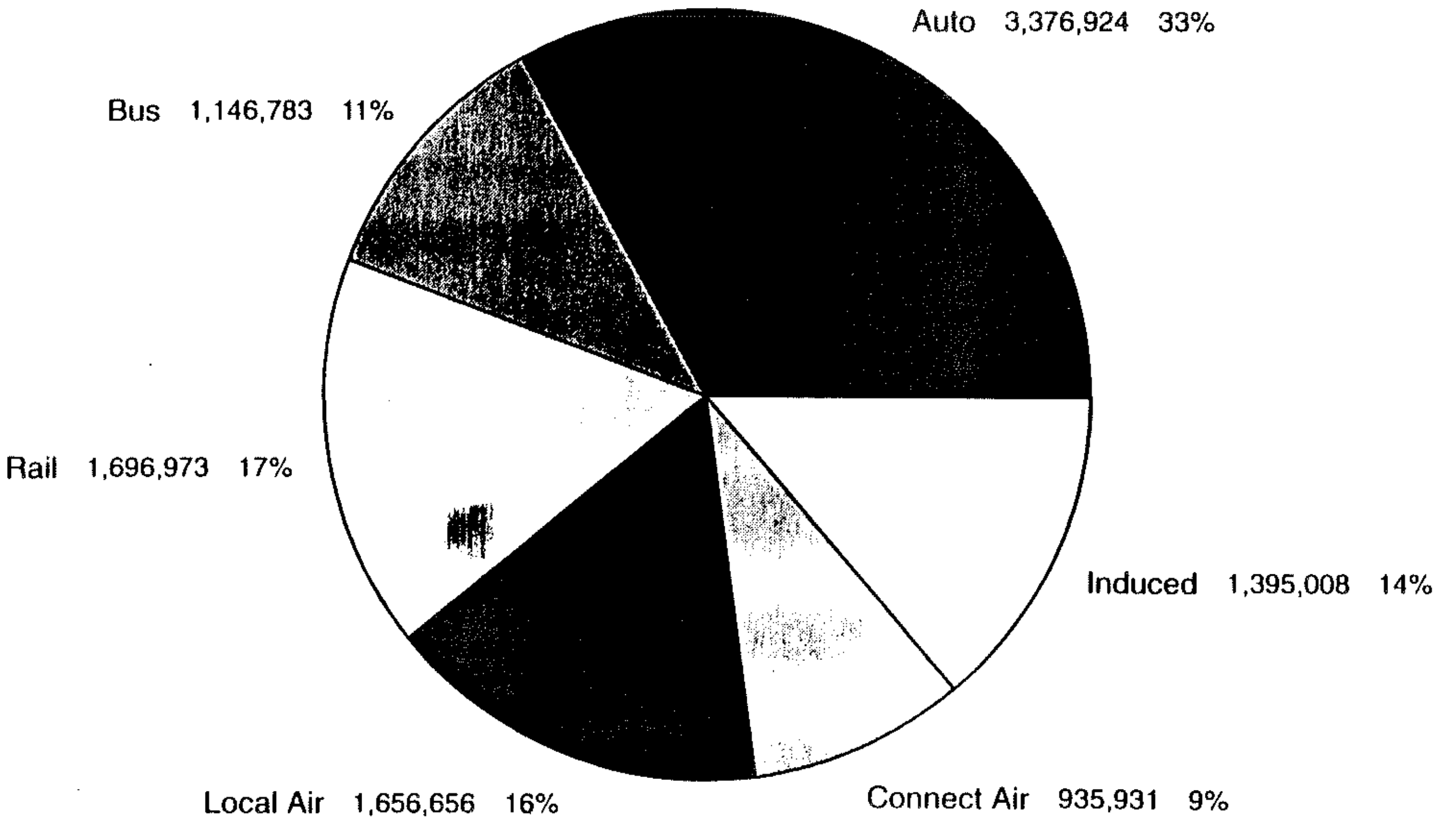


SOURCE: Charles River Associates, 1994.

CRA

Figure 4-5

Québec-Windsor Corridor HSR Ridership in 2005 by Source for the 200 kph Alternative/Optimized Fares



SOURCE: Charles River Associates, 1994.

CRA

Forecasts of HSR Ridership and Revenue

SENSITIVITY ANALYSIS

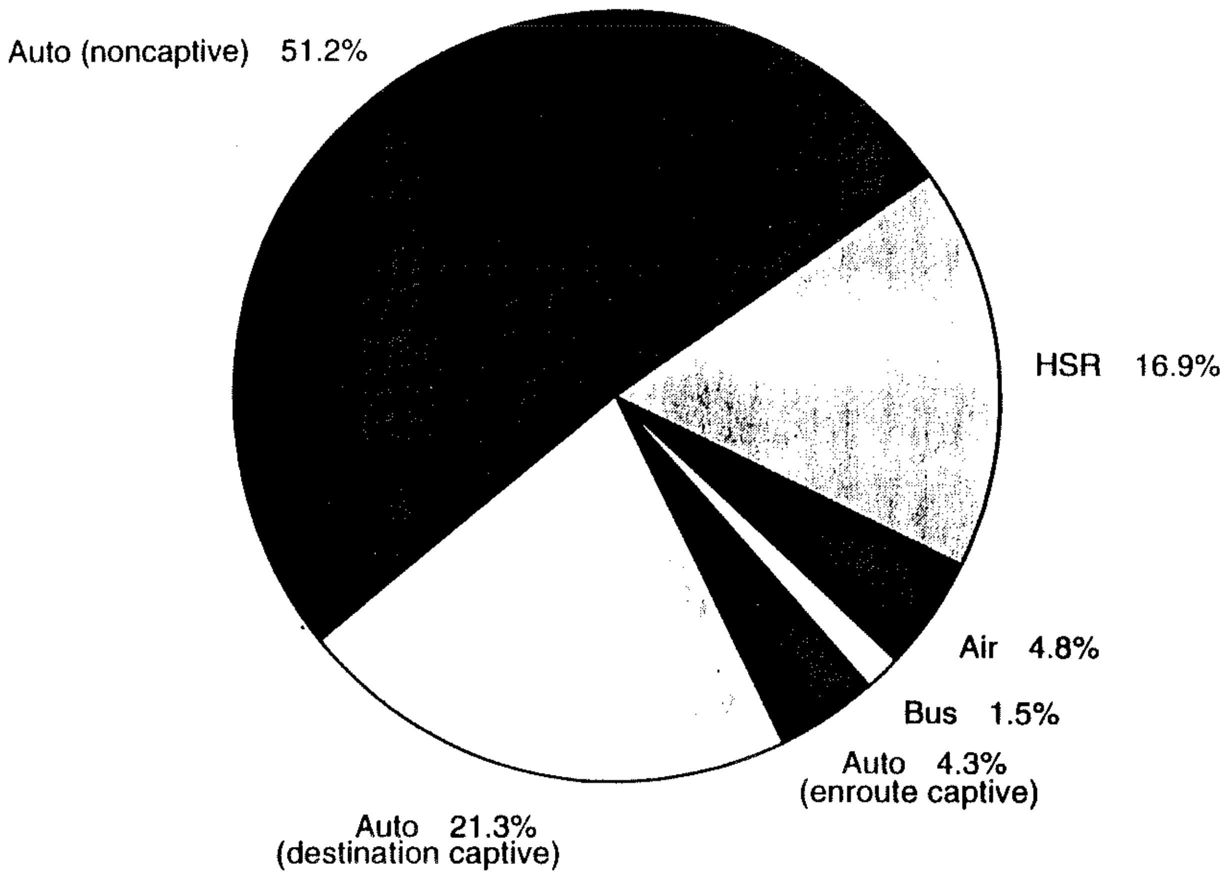
This section of the report presents the results of various sensitivity analyses of our ridership and passenger revenue forecasts. These analyses illustrate the sensitivity of the results to varying conditions, some of which may be out of the direct control of the system operator.

The sensitivity analyses presented here include variations in the following:

- HSR corridor length — two shortened corridors are examined:
  - Toronto–Québec
  - Toronto–Montréal
- HSR frequency
- HSR fare
- HSR line-haul travel times
- HSR routing

Figure 4-6

Québec-Windsor Corridor Trips by Mode with HSR (2005)
300 kph Alternative/Optimized Fares



SOURCE: Charles River Associates, 1994.

Forecasts of HSR Ridership and Revenue

HSR Corridor Length

For segments without HSR, it was assumed that VIA Rail would continue to operate. In these instances a separate transfer penalty between VIA Rail and HSR of 20 minutes was used. Table 4-7 presents a summary of results showing projections of HSR passengers and passenger revenues for the years 2005 and 2025 assuming the full corridor (Windsor–Québec) and two shorter HSR corridors (Toronto–Québec and Toronto–Montréal). For the 200 kph technology, Figure 4-8 shows the differences in HSR ridership between the three corridors while Figure 4-9 shows the same for HSR revenue. The total or full corridor yields the 10.2 million passenger estimate given previously. As Figure 4-8 illustrates, more than half the HSR ridership would be achieved with an HSR system operating only between Toronto and Montréal, while more than 7 million HSR trips would be generated with a system operating between Toronto and Québec.

HSR Frequency

For both the 200 kph and 300 kph alternatives, Table 4-8 presents the percentage change in HSR ridership and passenger revenue by source (i.e., current mode and induced) in the year 2005 that would result from increasing HSR frequency by three trains per day. Overall, it is expected that ridership and revenue would increase on average by about 4 percent. Note that on a *percentage* basis, the largest increase would be from former bus users. The increase in former rail riders is quite small since a very large share of these users already divert to the 200 kph HSR system.

HSR Fares

By increasing HSR fares by 10 percent, over their optimized values, Table 4-9 shows that for the full HSR corridor, HSR ridership would decrease by about 9 percent while HSR passenger revenues would decrease by 1 percent. Since the HSR fares were selected to optimize passenger revenues, Table 4-9 shows that any increase in these fares will result in less passenger revenue.

Forecasts of HSR Ridership and Revenue

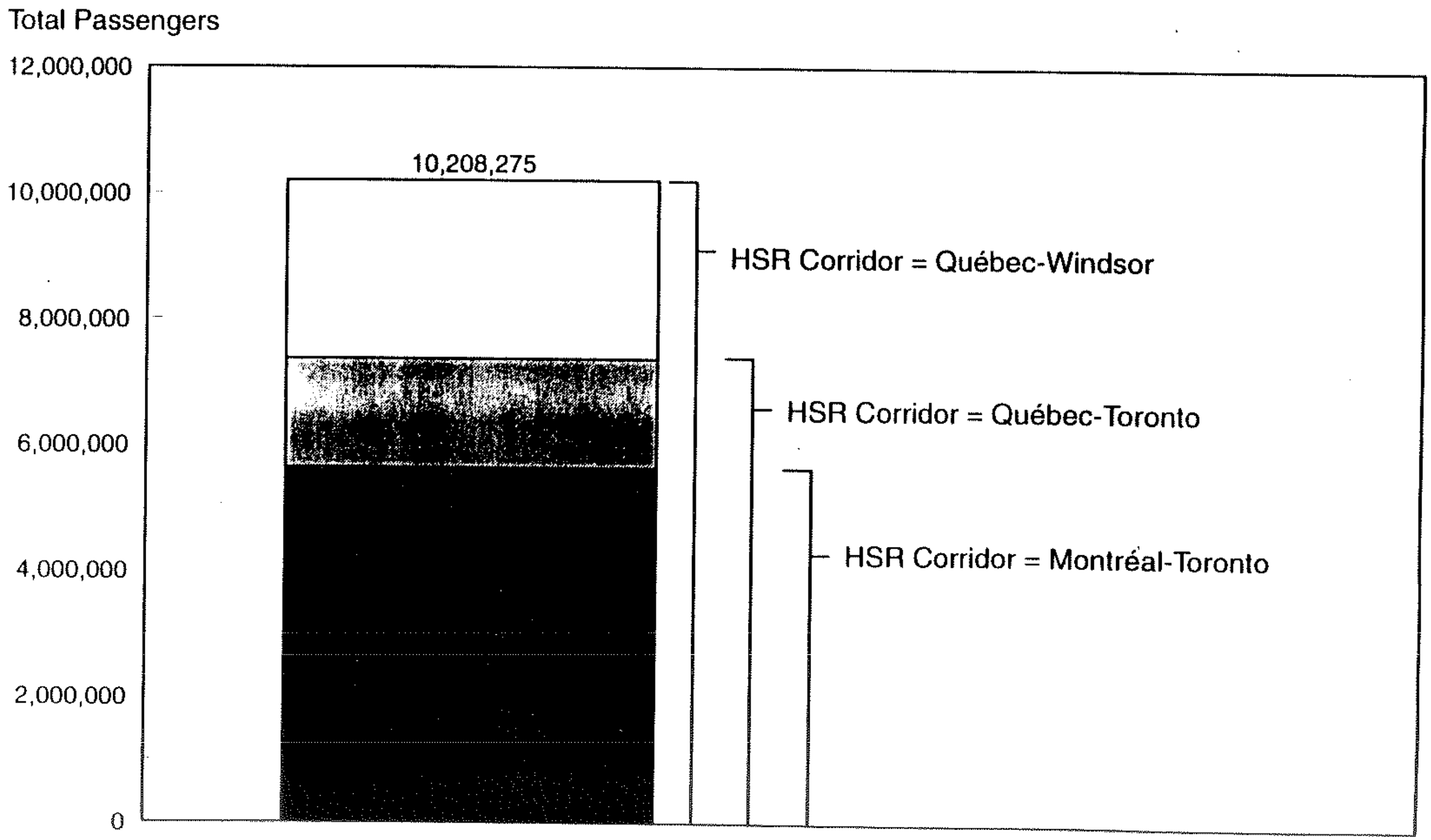
Table 4-7. Total Annual HSR Ridership and Revenue Projections by Year and Scenario

Year	Technology	HSR Service	HSR Passengers	Passenger Revenue (1992 dollars)
2005	200 kph	Québec-Windsor	10,208,000	$713,696,000
		Québec-Toronto Only	7,374,000	519,914,000
		Montréal-Toronto Only	5,634,000	406,090,000
	300 kph	Québec-Windsor	10,586,000	798,329,000
		Québec-Toronto Only	7,507,000	573,923,000
		Montréal-Toronto Only	5,755,000	452,298,000
2025	200 kph	Québec-Windsor	14,690,000	1,131,932,000
		Québec-Toronto Only	10,597,000	819,560,000
		Montréal-Toronto Only	8,127,000	641,682,000
	300 kph	Québec-Windsor	15,175,000	1,270,928,000
		Québec-Toronto Only	10,715,000	907,437,000
		Montréal-Toronto Only	8,273,000	719,166,000

Source: Charles River Associates, 1994.

Figure 4-7

HSR Ridership for Staged Construction of HSR System (2005)
200 kph Alternative

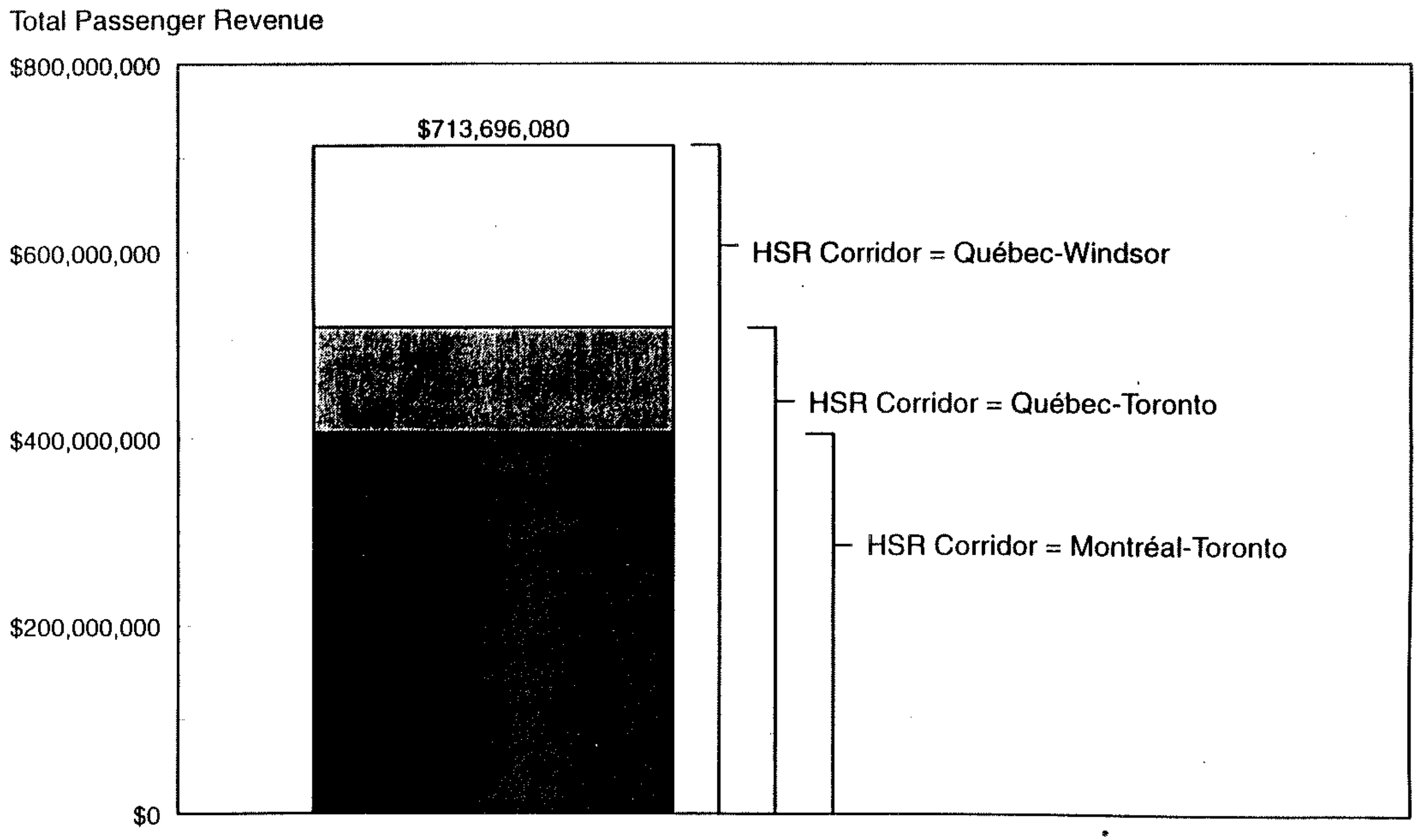


SOURCE: Charles River Associates, 1994.

CRA

Figure 4-8

HSR Passenger Revenue for Staged Construction of HSR System (2005)
200 kph Alternative



SOURCE: Charles River Associates, 1994.

CRA

Forecasts of HSR Ridership and Revenue

Table 4-8. Sensitivity of 2005 HSR Ridership and Revenue to an Increase in HSR Frequency of Three Trains per Day (Passengers and 1992 Dollar Revenue in Millions)

Current Mode	200 kph			300 kph		
	Base	3 More HSR Trains/Day	Percent Change	Base	3 More HSR Trains/Day	Percent Change
Local Air	1.66	1.73	4%	1.96	2.04	4%
	$173.68	$181.90	5%	$218.89	$228.07	4%
Connect Air	0.94	0.97	3%	0.76	0.78	3%
	$75.42	$78.44	4%	$70.22	$73.09	4%
Rail	1.70	1.71	1%	1.71	1.72	1%
	$121.80	$123.28	1%	$127.61	$129.04	1%
Bus	1.15	1.22	6%	1.11	1.19	7%
	$56.07	$60.30	8%	$56.16	$60.81	8%
Auto	3.38	3.44	2%	3.60	3.68	2%
	$201.06	$204.95	2%	$226.57	$231.26	2%
Induced	1.40	1.51	8%	1.45	1.57	8%
	$85.67	$92.83	8%	$98.88	$107.16	8%
Total	10.21	10.59	4%	10.59	10.98	4%
	$713.70	$741.70	4%	$798.33	$829.44	4%

Source: Charles River Associates, 1994.

Forecasts of HSR Ridership and Revenue

Table 4-9. Sensitivity of 2005 HSR Ridership and Revenue to a 10% Increase in HSR Fares (Passengers and 1992 Dollar Revenue in Millions)

Current Mode	200 kph			300 kph		
	Base	10% HSR Fare Increase	Percent Change	Base	10% HSR Fare Increase	Percent Change
Local Air	1.66	1.50	-10%	1.96	1.80	-8%
	$173.68	$171.48	-1%	$218.89	$218.62	0%
Connect Air	0.94	0.89	-5%	0.76	0.72	-5%
	$75.42	$78.55	4%	$70.22	$72.68	4%
Rail	1.70	1.60	-6%	1.71	1.61	-6%
	$121.80	$123.82	2%	$127.61	$129.85	2%
Bus	1.15	0.99	-14%	1.11	0.95	-14%
	$56.07	$50.40	-10%	$56.16	$50.13	-11%
Auto	3.38	3.16	-7%	3.60	3.36	-7%
	$201.06	$204.95	2%	$226.57	$230.30	2%
Induced	1.40	1.19	-15%	1.45	1.22	-16%
	$85.67	$78.10	-9%	$98.88	$89.40	-10%
Total	10.21	9.33	-9%	10.59	9.65	-9%
	$713.70	$707.29	-1%	$798.33	$790.98	-1%

Source: Charles River Associates, 1994.

Forecasts of HSR Ridership and Revenue

HSR Line-Haul Travel Times

Table 4-10 shows the impact of operating at maximum speeds of 250 kph on the 200 kph alignment and 350 kph on the 300 kph alignment. As shown in the table, the impact on HSR ridership and passenger revenue is greatest in the former case. In this sensitivity analysis, there is no change in HSR frequencies or fares. The resultant changes, therefore, are due strictly to higher speeds. In interpreting the results shown in Table 4-10, it should be noted that a 50 kph increase for the 200 kph alternative reflects roughly a 25 percent increase, while a 50 kph increase in the 300 kph alternative reflects roughly a 16.7 percent increase. (Roughly is used here since 200 kph does not denote an average speed but rather a particular alignment. Consequently, an average change in travel time cannot be simply computed.)

HSR Routing

Table 4-11 illustrates the impact of operating the 200 kph trains on the North Shore route and the 300 kph trains on the South Shore route. The biggest change occurs in the "connect air" volumes, since the North Shore alignment operates with an HSR station at Mirabel Airport and the South Shore route serves Dorval Airport. In both full corridor alternatives, Pearson International Airport in Toronto is assumed to have an HSR station. Overall, the South Shore alternative results in a 6 percent increase in HSR ridership.

Forecasts of HSR Ridership and Revenue

Table 4-10. Sensitivity of 2005 HSR Ridership and Revenue to Increased HSR Maximum Speed (Passengers and 1992 Dollar Revenue in Millions)

	200 kph			300 kph		
Current Mode	**Base**	**250 kph Maximum Speed**	**Percent Change**	**Base**	**350 kph Maximum Speed**	**Percent Change**
Local Air	1.66	1.98	19%	1.96	2.13	9%
	$173.68	$212.43	22%	$218.89	$239.59	9%
Connect Air	0.94	1.01	7%	0.76	0.79	4%
	$75.42	$82.62	10%	$70.22	$73.87	5%
Rail	1.70	1.73	2%	1.71	1.72	1%
	$121.80	$124.94	3%	$127.61	$129.29	1%
Bus	1.15	1.19	3%	1.11	1.13	2%
	$56.07	$59.21	6%	$56.16	$57.81	3%
Auto	3.38	3.64	8%	3.60	3.75	4%
	$201.06	$219.26	9%	$226.57	$237.03	5%
Induced	1.40	1.60	14%	1.45	1.57	8%
	$85.67	$103.04	20%	$98.88	$109.55	11%
Total	10.21	11.15	9%	10.59	11.09	5%
	$713.70	$801.50	12%	$798.33	$847.14	6%

Source: Charles River Associates, 1994.

Forecasts of HSR Ridership and Revenue

Table 4-11. Sensitivity of 2005 HSR Ridership and Revenue to Alternative Routing between Ottawa and Montréal (Passengers and 1992 Dollar Revenue in millions)

	200 kph			300 kph		
Current Mode	**Base**	**North Shore via Mirabel**	**Percent Change**	**Base**	**South Shore via Dorval**	**Percent Change**
Local Air	1.66	1.57	-5%	1.96	2.09	7%
	$173.68	$162.38	-7%	$218.89	$234.98	7%
Connect Air	0.94	0.67	-29%	0.76	1.02	34%
	$75.42	$59.11	-22%	$70.22	$87.97	25%
Rail	1.70	1.68	-1%	1.71	1.72	1%
	$121.80	$120.10	-1%	$127.61	$129.15	1%
Bus	1.15	1.12	-3%	1.11	1.13	2%
	$56.07	$54.57	-3%	$56.16	$57.75	3%
Auto	3.38	3.32	-2%	3.60	3.67	2%
	$201.06	$197.42	-2%	$226.57	$231.09	2%
Induced	1.40	1.26	-10%	1.45	1.60	10%
	$85.67	$77.66	-9%	$98.88	$109.43	11%
Total	10.21	9.62	-6%	10.59	11.24	6%
	$713.70	$671.23	-6%	$798.33	$850.37	7%

Source: Charles River Associates, 1994.

Appendix A
Detailed Results

The first sheet of Table A-1 shows HSR ridership and passenger revenue results for the 200 kph system by previous mode and trip purpose, given that HSR operates over the full Windsor–Québec corridor. Subsequent pages of Table A-1 show the results for 6 specific O/D pairs:

1. Montréal–Toronto (Sheet 2),
2. Montréal–Québec (Sheet 3),
3. Ottawa–Toronto (Sheet 4),
4. Montréal–Québec (Sheet 3),,
5. Ottawa–Québec (Sheet 6), and
6. Toronto–Windsor (Sheet 7).

Link and station volumes for HSR ridership in the year 2005 are presented next on Sheet 8 of Table A-1. The link from Kingston to Toronto has the largest volumes, while the Toronto station has the highest number of HSR passengers boarding and alighting. Sheet 9 of Table A-1 presents diverted trips (only) by mode and trip purpose on an O/D basis, while Sheet 10 shows total (diverted and induced) HSR trips by purpose on an O/D basis. The last two sheets of Table A-1 show the HSR fare and level of service input data by trip purpose used to produce the HSR projections shown in the table.

Using the same format as Table A-1, Table A-2 presents our projection for the 300 kph HSR alternative. Although HSR ridership for the year 2005 is projected to be higher (10.6 million trips) *we must point out that these two alternatives differ in many ways other than speed.* Specifically, there are differences in line-haul times, frequencies, and fares. For example, between at least one O/D pair, HSR line-haul times are higher for the 300 kph alternative than the 200 kph alternative. Also, in some instances, fewer HSR trains operate over the 300 kph alignment compared to the 200 kph alignment. Finally, as shown in Table 3-2, optimized fares are consistently higher for the 300 kph system than for the 200 kph system. For all these reasons, and because top speeds are reached for only a fraction of the trip distance, the differences in ridership between the two speed alternatives are not as large as might be expected from a simple inspection of the top speeds.

Table A-1.

2005 Québec-Windsor Corridor Forecast Summary by Mode
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips		Percent Diverted to High Speed Rail	High Speed Rail Trips			High Speed Rail Revenue			Mode Share After High Speed Rail
		Before High Speed Rail	After High Speed Rail		Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	
Business	Local Air	3,075,038	1,661,499	46%	1,413,539	NA	1,413,539	$153,469,255	NA	$153,469,255	3%
	Connect Air	1,090,355	583,539	46%	506,817	NA	506,817	$45,971,795	NA	$45,971,795	1%
	Rail	596,839	0	93%	556,192	NA	556,192	$46,425,704	NA	$46,425,704	0%
	Bus	378,703	279,377	37%	139,972	NA	139,972	$9,332,326	NA	$9,332,326	0%
	Auto	11,487,187	10,383,156	10%	1,104,031	NA	1,104,031	$83,081,314	NA	$83,081,314	17%
	Noncaptive Auto	7,221,317	6,402,167	11%	819,150	NA	819,150	$59,710,610	NA	$59,710,610	10%
	Destination Captive Auto	3,499,370	3,214,489	8%	284,881	NA	284,881	$23,370,704	NA	$23,370,704	5%
	En Route Captive Auto	766,500	766,500	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	4,244,455	NA	NA	NA	NA	NA	NA	NA	7%
	Total	16,628,122	17,152,025	22%	3,720,551	523,903	4,244,455	$338,280,394	$42,382,591	$380,662,985	27%
Nonbusiness	Local Air	548,809	305,692	44%	243,117	NA	243,117	$20,206,418	NA	$20,206,418	0%
	Connect Air	984,305	555,191	44%	429,114	NA	429,114	$29,447,855	NA	$29,447,855	1%
	Rail	1,257,753	0	91%	1,140,781	NA	1,140,781	$75,378,422	NA	$75,378,422	0%
	Bus	1,523,136	633,297	66%	1,006,811	NA	1,006,811	$46,734,168	NA	$46,734,168	1%
	Auto	40,088,331	37,815,438	6%	2,272,893	NA	2,272,893	$117,979,513	NA	$117,979,513	61%
	Noncaptive Auto	27,596,052	25,757,543	7%	1,838,509	NA	1,838,509	$93,675,611	NA	$93,675,611	41%
	Destination Captive Auto	10,577,203	10,142,819	4%	434,384	NA	434,384	$24,303,902	NA	$24,303,902	16%
	En Route Captive Auto	1,915,076	1,915,076	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	5,963,821	NA	NA	NA	NA	NA	NA	NA	10%
	Total	44,402,334	45,273,438	11%	5,092,716	871,105	5,963,821	$289,746,376	$43,286,718	$333,033,094	73%
Total	Local Air	3,623,847	1,967,191	46%	1,656,656	NA	1,656,656	$173,675,674	NA	$173,675,674	3%
	Connect Air	2,074,660	1,138,729	45%	935,931	NA	935,931	$75,419,650	NA	$75,419,650	2%
	Rail	1,854,592	0	92%	1,696,973	NA	1,696,973	$121,804,126	NA	$121,804,126	0%
	Bus	1,901,839	912,674	60%	1,146,783	NA	1,146,783	$56,066,494	NA	$56,066,494	1%
	Auto	51,575,518	48,198,594	7%	3,376,924	NA	3,376,924	$201,060,827	NA	$201,060,827	77%
	Noncaptive Auto	34,817,370	32,159,710	8%	2,657,660	NA	2,657,660	$153,386,220	NA	$153,386,220	52%
	Destination Captive Auto	14,076,573	13,357,308	5%	719,264	NA	719,264	$47,674,607	NA	$47,674,607	21%
	En Route Captive Auto	2,681,576	2,681,576	0%	0	NA	0	$0	NA	$0	4%
	High Speed Rail	0	10,208,275	NA	NA	NA	NA	NA	NA	NA	16%
	Total	61,030,456	62,425,464	14%	8,813,268	1,395,008	10,208,275	$628,026,770	$85,669,309	$713,696,080	100%

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

2005 Montréal-Toronto Forecast Summary by Mode
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips		Percent Diverted to High Speed Rail	High Speed Rail Trips			High Speed Rail Revenue			Mode Share After High Speed Rail
		Before High Speed Rail	After High Speed Rail		Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	
Business	Local Air	1,478,590	1,083,806	27%	394,784	NA	394,784	$48,903,310	NA	$48,903,310	23%
	Connect Air	309,365	236,178	24%	73,187	NA	73,187	$9,065,944	NA	$9,065,944	5%
	Rail	123,770	0	82%	101,525	NA	101,525	$12,576,283	NA	$12,576,283	0%
	Bus	12,730	28,277	53%	6,698	NA	6,698	$829,695	NA	$829,695	1%
	Auto	352,946	279,340	21%	73,606	NA	73,606	$9,117,773	NA	$9,117,773	6%
	Noncaptive Auto	161,610	115,578	28%	46,032	NA	46,032	$5,702,113	NA	$5,702,113	2%
	Destination Captive Auto	180,035	152,461	15%	27,574	NA	27,574	$3,415,660	NA	$3,415,660	3%
	En Route Captive Auto	11,301	11,301	0%	0	NA	0	$0	NA	$0	0%
	High Speed Rail	0	676,573	NA	NA	NA	NA	NA	NA	NA	15%
	Total	2,277,401	2,304,174	29%	649,800	26,773	676,573	$80,493,005	$3,316,470	$83,809,475	50%
Nonbusiness	Local Air	273,347	193,048	29%	80,299	NA	80,299	$7,489,427	NA	$7,489,427	4%
	Connect Air	345,980	249,897	28%	96,083	NA	96,083	$8,961,630	NA	$8,961,630	5%
	Rail	345,891	0	82%	283,168	NA	283,168	$26,410,962	NA	$26,410,962	0%
	Bus	105,446	114,255	51%	53,915	NA	53,915	$5,028,577	NA	$5,028,577	2%
	Auto	1,224,716	1,137,464	7%	87,252	NA	87,252	$8,137,925	NA	$8,137,925	24%
	Noncaptive Auto	571,514	513,319	10%	58,195	NA	58,195	$5,427,817	NA	$5,427,817	11%
	Destination Captive Auto	607,226	578,169	5%	29,057	NA	29,057	$2,710,107	NA	$2,710,107	12%
	En Route Captive Auto	45,976	45,976	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	644,006	NA	NA	NA	NA	NA	NA	NA	14%
	Total	2,295,381	2,338,670	26%	600,717	43,289	644,006	$56,028,521	$4,037,577	$60,066,098	50%
Total	Local Air	1,751,937	1,276,854	27%	475,083	NA	475,083	$56,392,737	NA	$56,392,737	28%
	Connect Air	655,345	486,075	26%	169,270	NA	169,270	$18,027,574	NA	$18,027,574	10%
	Rail	469,662	0	82%	384,694	NA	384,694	$38,987,246	NA	$38,987,246	0%
	Bus	118,176	142,532	51%	60,612	NA	60,612	$5,858,272	NA	$5,858,272	3%
	Auto	1,577,662	1,416,804	10%	160,857	NA	160,857	$17,255,698	NA	$17,255,698	31%
	Noncaptive Auto	733,124	628,897	14%	104,227	NA	104,227	$11,129,930	NA	$11,129,930	14%
	Destination Captive Auto	787,260	730,630	7%	56,631	NA	56,631	$6,125,768	NA	$6,125,768	16%
	En Route Captive Auto	57,277	57,277	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	1,320,579	NA	NA	NA	NA	NA	NA	NA	28%
	Total	4,572,781	4,642,844	27%	1,250,517	70,062	1,320,579	$136,521,527	$7,354,047	$143,875,573	100%

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

2005 Montréal-Québec Forecast Summary by Mode
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips		Percent Diverted to High Speed Rail	High Speed Rail Trips			High Speed Rail Revenue			Mode Share After High Speed Rail
		Before High Speed Rail	After High Speed Rail		Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	
Business	Local Air	61,343	8,382	86%	52,961	NA	52,961	$4,167,830	NA	$4,167,830	0%
	Connect Air	127,383	57,133	55%	70,250	NA	70,250	$5,528,434	NA	$5,528,434	1%
	Rail	49,447	0	99%	48,719	NA	48,719	$3,833,958	NA	$3,833,958	0%
	Bus	164,431	153,503	7%	11,657	NA	11,657	$917,348	NA	$917,348	2%
	Auto	2,042,002	1,777,120	13%	264,882	NA	264,882	$20,845,154	NA	$20,845,154	19%
	Noncaptive Auto	1,134,680	940,456	17%	194,224	NA	194,224	$15,284,659	NA	$15,284,659	10%
	Destination Captive Auto	824,082	753,424	9%	70,658	NA	70,658	$5,560,495	NA	$5,560,495	8%
	En Route Captive Auto	83,239	83,239	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	505,643	NA	NA	NA	NA	NA	NA	NA	6%
	Total	2,444,606	2,501,780	18%	448,469	57,174	505,643	$35,292,724	$4,499,407	$39,792,132	27%
Nonbusiness	Local Air	9,113	1,997	78%	7,116	NA	7,116	$425,160	NA	$425,160	0%
	Connect Air	51,630	27,913	46%	23,717	NA	23,717	$1,417,080	NA	$1,417,080	0%
	Rail	90,524	0	98%	89,058	NA	89,058	$5,321,252	NA	$5,321,252	0%
	Bus	254,712	220,976	14%	35,202	NA	35,202	$2,103,355	NA	$2,103,355	2%
	Auto	6,166,304	5,692,247	8%	474,057	NA	474,057	$28,325,238	NA	$28,325,238	62%
	Noncaptive Auto	4,217,405	3,820,585	9%	396,820	NA	396,820	$23,710,308	NA	$23,710,308	42%
	Destination Captive Auto	1,754,742	1,677,505	4%	77,236	NA	77,236	$4,614,930	NA	$4,614,930	18%
	En Route Captive Auto	194,157	194,157	0%	0	NA	0	$0	NA	$0	2%
	High Speed Rail	0	690,621	NA	NA	NA	NA	NA	NA	NA	8%
	Total	6,572,282	6,633,754	10%	629,148	61,472	690,621	$37,592,086	$3,673,021	$41,265,107	73%
Total	Local Air	70,456	10,379	85%	60,077	NA	60,077	$4,592,990	NA	$4,592,990	0%
	Connect Air	179,013	85,046	52%	93,967	NA	93,967	$6,945,514	NA	$6,945,514	1%
	Rail	139,971	0	98%	137,776	NA	137,776	$9,155,210	NA	$9,155,210	0%
	Bus	419,143	374,478	11%	46,859	NA	46,859	$3,020,703	NA	$3,020,703	4%
	Auto	8,208,306	7,469,367	9%	738,938	NA	738,938	$49,170,392	NA	$49,170,392	82%
	Noncaptive Auto	5,352,086	4,761,042	11%	591,044	NA	591,044	$38,994,967	NA	$38,994,967	52%
	Destination Captive Auto	2,578,824	2,430,930	6%	147,894	NA	147,894	$10,175,425	NA	$10,175,425	27%
	En Route Captive Auto	277,396	277,396	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	1,196,264	NA	NA	NA	NA	NA	NA	NA	13%
	Total	9,016,888	9,135,534	12%	1,077,617	118,647	1,196,264	$72,884,810	$8,172,428	$81,057,238	100%

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

2005 Ottawa-Toronto Forecast Summary by Mode
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips: Before High Speed Rail	Total Trips: After High Speed Rail	Percent Diverted to High Speed Rail	High Speed Rail Trips: Diverted	High Speed Rail Trips: Induced	High Speed Rail Trips: Total	High Speed Rail Revenue: From Diverted Trips	High Speed Rail Revenue: From Induced Trips	High Speed Rail Revenue: Total	Mode Share After High Speed Rail
Business	Local Air	872,364	230,562	74%	641,802	NA	641,802	$67,343,093	NA	$67,343,093	5%
	Connect Air	335,175	169,190	50%	165,985	NA	165,985	$17,416,526	NA	$17,416,526	4%
	Rail	76,815	0	99%	76,294	NA	76,294	$8,005,385	NA	$8,005,385	0%
	Bus	18,533	1,371	95%	17,683	NA	17,683	$1,855,405	NA	$1,855,405	0%
	Auto	530,589	411,834	22%	118,755	NA	118,755	$12,460,710	NA	$12,460,710	9%
	Noncaptive Auto	231,840	155,671	33%	76,169	NA	76,169	$7,992,322	NA	$7,992,322	4%
	Destination Captive Auto	234,244	191,658	18%	42,585	NA	42,585	$4,468,387	NA	$4,468,387	4%
	En Route Captive Auto	64,505	64,505	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	1,162,506	NA	NA	NA	NA	NA	NA	NA	26%
	Total	1,833,476	1,975,463	56%	1,020,519	141,987	1,162,506	$107,081,120	$14,898,464	$121,979,584	45%
Nonbusiness	Local Air	114,164	35,902	69%	78,262	NA	78,262	$6,501,095	NA	$6,501,095	1%
	Connect Air	278,334	149,095	46%	129,239	NA	129,239	$10,735,656	NA	$10,735,656	3%
	Rail	124,661	0	99%	123,524	NA	123,524	$10,260,881	NA	$10,260,881	0%
	Bus	103,970	27,918	74%	77,189	NA	77,189	$6,411,980	NA	$6,411,980	1%
	Auto	1,742,396	1,573,366	10%	169,030	NA	169,030	$14,041,027	NA	$14,041,027	36%
	Noncaptive Auto	897,762	778,355	13%	119,407	NA	119,407	$9,918,871	NA	$9,918,871	18%
	Destination Captive Auto	779,327	729,703	6%	49,624	NA	49,624	$4,122,156	NA	$4,122,156	16%
	En Route Captive Auto	65,307	65,307	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	669,970	NA	NA	NA	NA	NA	NA	NA	15%
	Total	2,363,525	2,456,250	24%	577,245	92,725	669,970	$47,950,639	$7,702,460	$55,653,100	55%
Total	Local Air	986,529	266,464	73%	720,064	NA	720,064	$73,844,189	NA	$73,844,189	6%
	Connect Air	613,510	318,285	48%	295,225	NA	295,225	$28,152,182	NA	$28,152,182	7%
	Rail	201,476	0	99%	199,818	NA	199,818	$18,266,265	NA	$18,266,265	0%
	Bus	122,503	29,289	77%	94,872	NA	94,872	$8,267,386	NA	$8,267,386	1%
	Auto	2,272,985	1,985,200	13%	287,785	NA	287,785	$26,501,737	NA	$26,501,737	45%
	Noncaptive Auto	1,129,602	934,026	17%	195,576	NA	195,576	$17,911,193	NA	$17,911,193	21%
	Destination Captive Auto	1,013,571	921,362	9%	92,209	NA	92,209	$8,590,544	NA	$8,590,544	21%
	En Route Captive Auto	129,812	129,812	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	1,832,476	NA	NA	NA	NA	NA	NA	NA	41%
	Total	4,197,001	4,431,713	38%	1,597,764	234,712	1,832,476	$155,031,759	$22,600,924	$177,632,683	100%

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

2005 London-Toronto Forecast Summary by Mode
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

		Total Trips			High Speed Rail Trips			High Speed Rail Revenue			
Trip Purpose	Mode	Before High Speed Rail	After High Speed Rail	Percent Diverted to High Speed Rail	Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	Mode Share After High Speed Rail
Business	Local Air	22,775	4,870	79%	17,905	NA	17,905	$991,538	NA	$991,538	0%
	Connect Air	84,667	40,357	52%	44,309	NA	44,309	$2,453,797	NA	$2,453,797	1%
	Rail	69,704	0	97%	67,919	NA	67,919	$3,761,250	NA	$3,761,250	0%
	Bus	12,765	2,783	92%	11,767	NA	11,767	$651,662	NA	$651,662	0%
	Auto	1,423,393	1,243,564	13%	179,829	NA	179,829	$9,958,725	NA	$9,958,725	20%
	Noncaptive Auto	937,151	790,908	16%	146,243	NA	146,243	$8,098,761	NA	$8,098,761	13%
	Destination Captive Auto	433,582	399,995	8%	33,586	NA	33,586	$1,859,964	NA	$1,859,964	6%
	En Route Captive Auto	52,660	52,660	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	371,924	NA	NA	NA	NA	NA	NA	NA	6%
	Total	1,613,304	1,663,498	20%	321,730	50,195	371,924	$17,816,972	$2,779,711	$20,596,683	27%
Nonbusiness	Local Air	10,829	1,405	87%	9,424	NA	9,424	$357,100	NA	$357,100	0%
	Connect Air	99,721	41,120	59%	58,601	NA	58,601	$2,220,432	NA	$2,220,432	1%
	Rail	141,631	0	98%	138,386	NA	138,386	$5,243,551	NA	$5,243,551	0%
	Bus	142,746	14,499	92%	131,492	NA	131,492	$4,982,337	NA	$4,982,337	0%
	Auto	4,077,350	3,723,884	9%	353,466	NA	353,466	$13,393,070	NA	$13,393,070	59%
	Noncaptive Auto	2,939,668	2,635,752	10%	303,916	NA	303,916	$11,515,599	NA	$11,515,599	42%
	Destination Captive Auto	1,018,936	969,387	5%	49,550	NA	49,550	$1,877,470	NA	$1,877,470	15%
	En Route Captive Auto	118,746	118,746	0%	0	NA	0	$0	NA	$0	2%
	High Speed Rail	0	831,888	NA	NA	NA	NA	NA	NA	NA	13%
	Total	4,472,277	4,612,796	15%	691,370	140,518	831,888	$26,196,490	$5,324,340	$31,520,829	73%
Total	Local Air	33,604	6,275	81%	27,329	NA	27,329	$1,348,638	NA	$1,348,638	0%
	Connect Air	184,387	81,477	56%	102,910	NA	102,910	$4,674,229	NA	$4,674,229	1%
	Rail	211,335	0	98%	206,305	NA	206,305	$9,004,802	NA	$9,004,802	0%
	Bus	155,512	17,282	92%	143,260	NA	143,260	$5,633,999	NA	$5,633,999	0%
	Auto	5,500,743	4,967,448	10%	533,295	NA	533,295	$23,351,794	NA	$23,351,794	79%
	Noncaptive Auto	3,876,819	3,426,660	12%	450,159	NA	450,159	$19,614,360	NA	$19,614,360	55%
	Destination Captive Auto	1,452,518	1,369,382	6%	83,136	NA	83,136	$3,737,434	NA	$3,737,434	22%
	En Route Captive Auto	171,406	171,406	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	1,203,812	NA	NA	NA	NA	NA	NA	NA	19%
	Total	6,085,581	6,276,294	17%	1,013,099	190,713	1,203,812	$44,013,462	$8,104,050	$52,117,512	100%

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

2005 Ottawa-Quebec Forecast Summary by Mode
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

		Total Trips			High Speed Rail Trips			High Speed Rail Revenue			
Trip Purpose	Mode	Before High Speed Rail	After High Speed Rail	Percent Diverted to High Speed Rail	Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	Mode Share After High Speed Rail
Business	Local Air	39,874	7,015	82%	32,859	NA	32,859	$3,735,114	NA	$3,735,114	2%
	Connect Air	2,640	1,111	58%	1,529	NA	1,529	$173,805	NA	$173,805	0%
	Rail	1,314	0	100%	1,313	NA	1,313	$149,203	NA	$149,203	0%
	Bus	4,792	4,281	11%	513	NA	513	$58,291	NA	$58,291	1%
	Auto	44,460	34,597	22%	9,863	NA	9,863	$1,121,185	NA	$1,121,185	8%
	Noncaptive Auto	26,567	19,312	27%	7,256	NA	7,256	$824,750	NA	$824,750	4%
	Destination Captive Auto	17,893	15,285	15%	2,608	NA	2,608	$296,435	NA	$296,435	4%
	En Route Captive Auto	0	0	0%	0	NA	0	$0	NA	$0	0%
	High Speed Rail	0	52,438	NA	NA	NA	NA	NA	NA	NA	12%
	Total	93,080	99,442	50%	46,076	6,361	52,438	$5,237,600	$723,117	$5,960,717	23%
Nonbusiness	Local Air	6,651	281	96%	6,370	NA	6,370	$510,563	NA	$510,563	0%
	Connect Air	386	114	70%	272	NA	272	$21,794	NA	$21,794	0%
	Rail	8,280	0	100%	8,269	NA	8,269	$662,750	NA	$662,750	0%
	Bus	14,948	10,949	27%	4,010	NA	4,010	$321,448	NA	$321,448	3%
	Auto	299,522	271,646	9%	27,877	NA	27,877	$2,234,407	NA	$2,234,407	62%
	Noncaptive Auto	185,795	163,841	12%	21,953	NA	21,953	$1,759,621	NA	$1,759,621	38%
	Destination Captive Auto	105,650	99,726	6%	5,923	NA	5,923	$474,786	NA	$474,786	23%
	En Route Captive Auto	8,078	8,078	0%	0	NA	0	$0	NA	$0	2%
	High Speed Rail	0	53,474	NA	NA	NA	NA	NA	NA	NA	12%
	Total	329,787	336,464	14%	46,797	6,677	53,474	$3,750,962	$535,160	$4,286,122	77%
Total	Local Air	46,525	7,297	84%	39,228	NA	39,228	$4,245,677	NA	$4,245,677	2%
	Connect Air	3,026	1,225	60%	1,801	NA	1,801	$195,600	NA	$195,600	0%
	Rail	9,594	0	100%	9,581	NA	9,581	$811,954	NA	$811,954	0%
	Bus	19,740	15,229	23%	4,523	NA	4,523	$379,739	NA	$379,739	3%
	Auto	343,983	306,243	11%	37,740	NA	37,740	$3,355,592	NA	$3,355,592	70%
	Noncaptive Auto	212,362	183,153	14%	29,209	NA	29,209	$2,584,371	NA	$2,584,371	42%
	Destination Captive Auto	123,543	115,011	7%	8,531	NA	8,531	$771,221	NA	$771,221	26%
	En Route Captive Auto	8,078	8,078	0%	0	NA	0	$0	NA	$0	2%
	High Speed Rail	0	105,912	NA	NA	NA	NA	NA	NA	NA	24%
	Total	422,867	435,905	22%	92,874	13,038	105,912	$8,988,561	$1,258,277	$10,246,838	100%

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

2005 Toronto-Windsor Forecast Summary by Mode
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips		Percent Diverted to High Speed Rail	High Speed Rail Trips			High Speed Rail Revenue			Mode Share After High Speed Rail
		Before High Speed Rail	After High Speed Rail		Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	
Business	Local Air	160,320	35,630	78%	124,690	NA	124,690	$10,176,007	NA	$10,176,007	2%
	Connect Air	37,302	16,605	55%	20,697	NA	20,697	$1,689,085	NA	$1,689,085	1%
	Rail	30,385	0	98%	29,710	NA	29,710	$2,424,668	NA	$2,424,668	0%
	Bus	7,366	901	97%	7,140	NA	7,140	$582,703	NA	$582,703	0%
	Auto	305,589	262,902	14%	42,687	NA	42,687	$3,483,728	NA	$3,483,728	13%
	Noncaptive Auto	135,317	108,655	20%	26,663	NA	26,663	$2,175,981	NA	$2,175,981	5%
	Destination Captive Auto	159,825	143,800	10%	16,024	NA	16,024	$1,307,747	NA	$1,307,747	7%
	En Route Captive Auto	10,447	10,447	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	254,328	NA	NA	NA	NA	NA	NA	NA	12%
	Total	540,962	570,367	42%	224,924	29,405	254,328	$18,356,192	$2,399,729	$20,755,921	28%
Nonbusiness	Local Air	33,475	13,218	61%	20,257	NA	20,257	$1,269,410	NA	$1,269,410	1%
	Connect Air	50,354	27,111	46%	23,243	NA	23,243	$1,456,549	NA	$1,456,549	1%
	Rail	78,888	0	97%	76,861	NA	76,861	$4,816,500	NA	$4,816,500	0%
	Bus	32,673	5,150	90%	29,550	NA	29,550	$1,851,764	NA	$1,851,764	0%
	Auto	1,248,467	1,164,238	7%	84,229	NA	84,229	$5,278,240	NA	$5,278,240	57%
	Noncaptive Auto	715,216	650,665	9%	64,551	NA	64,551	$4,045,106	NA	$4,045,106	32%
	Destination Captive Auto	467,128	447,450	4%	19,678	NA	19,678	$1,233,134	NA	$1,233,134	22%
	En Route Captive Auto	66,123	66,123	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	264,753	NA	NA	NA	NA	NA	NA	NA	13%
	Total	1,443,857	1,474,470	16%	234,140	30,614	264,753	$14,672,464	$1,918,414	$16,590,878	72%
Total	Local Air	193,795	48,848	75%	144,946	NA	144,946	$11,445,417	NA	$11,445,417	2%
	Connect Air	87,656	43,716	50%	43,940	NA	43,940	$3,145,634	NA	$3,145,634	2%
	Rail	109,273	0	98%	106,571	NA	106,571	$7,241,168	NA	$7,241,168	0%
	Bus	40,039	6,052	92%	36,690	NA	36,690	$2,434,468	NA	$2,434,468	0%
	Auto	1,554,056	1,427,140	8%	126,916	NA	126,916	$8,761,968	NA	$8,761,968	70%
	Noncaptive Auto	850,534	759,320	11%	91,214	NA	91,214	$6,221,087	NA	$6,221,087	37%
	Destination Captive Auto	626,952	591,250	6%	35,702	NA	35,702	$2,540,881	NA	$2,540,881	29%
	En Route Captive Auto	76,570	76,570	0%	0	NA	0	$0	NA	$0	4%
	High Speed Rail	0	519,082	NA	NA	NA	NA	NA	NA	NA	25%
	Total	1,984,819	2,044,837	23%	459,063	60,018	519,082	$33,028,656	$4,318,143	$37,346,800	100%

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

2005 Link Volumes
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Link	Eastbound	Westbound	Total Link Volume
London-Windsor	476,124	476,124	952,248
Kitch.-Waterloo-London	1,026,946	1,026,946	2,053,893
Kitch.-Waterloo-Toronto	1,145,555	1,145,555	2,291,109
Kingston-Toronto	2,132,650	2,132,650	4,265,300
Kingston-Ottawa	1,986,781	1,986,781	3,973,561
Montreal-Ottawa	1,630,546	1,630,546	3,261,092
Montreal-Trois Rivieres	892,061	892,061	1,784,123
Quebec-Trois Rivieres	724,633	724,633	1,449,266

2005 Station Volumes
Base Run - 200+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Station	Boardings	Alightings	Total Station Volume
Hamilton	0	0	0
Kingston	580,253	580,253	1,160,506
Kitchener	228,131	228,131	456,262
London	860,117	860,117	1,720,233
Montreal	2,255,474	2,255,474	4,510,948
Ottawa	1,932,386	1,932,386	3,864,773
Quebec	724,633	724,633	1,449,266
Toronto	2,975,575	2,975,575	5,951,150
Trois Rivieres	175,583	175,583	351,166
Windsor	476,124	476,124	952,248
Total	10,208,275	10,208,275	20,416,551

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

Diverted HSR Trips for 2005 / 200+ kph / Composite ROW / Optimized HSR Fares — Base Case / HSR in Full Corridor

Superzone Pair	Business						Nonbusiness						Total Volume
	Local Air	Connect Air	Rail	Bus	Noncaptive Auto	Captive Auto	Local Air	Connect Air	Rail	Bus	Noncaptive Auto	Captive Auto	
HAMILTON-KINGSTON	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-KITCH.-WATERLOO	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-LONDON	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-MONTREAL	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-OTTAWA	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-QUEBEC	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-TORONTO	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-TROIS RIVIERES	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-WINDSOR	0	0	0	0	0	0	0	0	0	0	0	0	0
KINGSTON-KITCH.-WATERLOO	0	0	0	762	1,915	1,027	0	0	2,181	2,516	3,779	879	13,058
KINGSTON-LONDON	841	0	1,083	36	1,229	96	0	0	5,594	2,067	7,004	1,388	19,337
KINGSTON-MONTREAL	26	0	12,825	2,978	1,673	1,507	0	0	19,935	31,810	14,055	6,183	90,993
KINGSTON-OTTAWA	0	0	13,422	7,045	30,981	8,300	0	0	17,961	57,916	89,100	16,804	241,529
KINGSTON-QUEBEC	0	0	424	0	0	0	0	0	1,147	0	278	94	1,943
KINGSTON-TORONTO	8,789	21,179	68,587	7,214	61,548	17,247	5,014	12,487	120,691	77,683	143,078	31,711	575,227
KINGSTON-TROIS RIVIERES	0	0	0	0	1,220	0	0	0	0	0	0	0	1,220
KINGSTON-WINDSOR	0	0	1,309	0	686	250	0	0	3,459	914	801	388	7,808
KITCH.-WATERLOO-LONDON	0	0	1,238	775	0	0	0	0	19,085	10,139	0	0	31,238
KITCH.-WATERLOO-MONTREAL	0	0	1,520	110	4,462	2,551	0	0	4,472	1,425	6,121	1,663	22,322
KITCH.-WATERLOO-OTTAWA	0	0	719	421	1,240	2,853	0	0	3,097	3,345	11,037	3,907	26,618
KITCH.-WATERLOO-QUEBEC	0	0	0	0	3,784	0	0	0	487	0	324	60	4,655
KITCH.-WATERLOO-TORONTO	0	0	4,199	18,598	0	0	0	0	29,429	153,401	0	0	205,627
KITCH.-WATERLOO-TROIS RIVIERES	0	0	0	0	0	172	0	0	0	0	0	0	172
KITCH.-WATERLOO-WINDSOR	0	0	0	375	12,264	2,897	0	0	2,811	947	16,835	4,416	40,545
LONDON-MONTREAL	11,461	0	388	217	193	1,671	2,593	0	12,063	1,731	9,150	991	40,458
LONDON-OTTAWA	26,915	774	1,492	178	4,586	1,824	6,126	131	8,765	4,738	7,824	2,301	65,654
LONDON-QUEBEC	2,293	0	0	0	123	0	138	0	584	0	33	200	3,371
LONDON-TORONTO	17,905	44,309	67,919	11,767	146,243	33,586	9,424	58,601	138,386	131,492	303,916	49,550	1,013,099
LONDON-TROIS RIVIERES	0	0	0	0	0	0	0	0	0	0	0	0	0
LONDON-WINDSOR	0	0	8,600	620	62,879	14,185	0	0	27,251	20,833	108,086	27,512	269,965
MONTREAL-OTTAWA	42,072	95,513	104,499	26,654	88,403	29,175	8,666	76,533	108,837	231,184	295,130	81,590	1,188,258
MONTREAL-QUEBEC	52,961	70,250	48,719	11,657	194,224	70,658	7,116	23,717	89,058	35,202	396,820	77,236	1,077,617
MONTREAL-TORONTO	394,784	73,187	101,525	6,698	46,032	27,574	80,299	96,083	283,168	53,915	58,195	29,057	1,250,517
MONTREAL-TROIS RIVIERES	0	0	0	15,153	37,847	3,836	0	0	0	52,658	148,146	15,133	272,775
MONTREAL-WINDSOR	13,917	0	1,912	56	664	54	6,654	0	7,171	199	2,309	219	33,156
OTTAWA-QUEBEC	32,859	1,529	1,313	513	7,256	2,608	6,370	272	8,269	4,010	21,953	5,923	92,874
OTTAWA-TORONTO	641,802	165,985	76,294	17,683	76,169	42,585	78,262	129,239	123,524	77,189	119,407	49,624	1,597,764
OTTAWA-TROIS RIVIERES	0	0	0	1,999	944	0	0	0	0	9,225	1,077	56	13,300
OTTAWA-WINDSOR	6,046	0	819	51	1,243	0	3,532	0	6,745	2,237	2,957	2,650	26,281
QUEBEC-TORONTO	36,180	13,392	7,677	446	3,906	3,619	8,667	8,808	18,615	4,400	4,835	4,652	115,198
QUEBEC-TROIS RIVIERES	0	0	0	734	771	395	0	0	0	2,237	854	420	5,411
QUEBEC-WINDSOR	0	0	0	0	0	0	0	0	1,137	0	101	0	1,238
TORONTO-TROIS RIVIERES	0	0	0	91	0	187	0	0	0	3,849	754	98	4,980
TORONTO-WINDSOR	124,690	20,697	29,710	7,140	26,663	16,024	20,257	23,243	76,861	29,550	64,551	19,678	459,063
TROIS RIVIERES-WINDSOR	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1,413,539	506,817	556,192	139,972	819,150	284,881	243,117	429,114	1,140,781	1,006,811	1,838,509	434,384	8,813,268

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

Total HSR Trips for 2005 / 200+ kph / Composite ROW / Optimized HSR Fares **Base Case / HSR in Full Corridor**

Superzone Pair	Business	Nonbusiness	Total Volume
HAMILTON-KINGSTON	0	0	0
HAMILTON-KITCH.-WATERLOO	0	0	0
HAMILTON-LONDON	0	0	0
HAMILTON-MONTREAL	0	0	0
HAMILTON-OTTAWA	0	0	0
HAMILTON-QUEBEC	0	0	0
HAMILTON-TORONTO	0	0	0
HAMILTON-TROIS RIVIERES	0	0	0
HAMILTON-WINDSOR	0	0	0
KINGSTON-KITCH.-WATERLOO	3,968	12,520	16,488
KINGSTON-LONDON	4,193	18,433	22,625
KINGSTON-MONTREAL	22,319	87,428	109,747
KINGSTON-OTTAWA	75,379	245,510	320,888
KINGSTON-QUEBEC	577	1,862	2,439
KINGSTON-TORONTO	230,467	447,007	677,474
KINGSTON-TROIS RIVIERES	1,309	0	1,309
KINGSTON-WINDSOR	2,663	6,872	9,535
KITCH.-WATERLOO-LONDON	3,738	60,091	63,829
KITCH.-WATERLOO-MONTREAL	10,171	17,778	27,949
KITCH.-WATERLOO-OTTAWA	6,057	25,156	31,213
KITCH.-WATERLOO-QUEBEC	4,354	956	5,310
KITCH.-WATERLOO-TORONTO	27,909	237,677	265,586
KITCH.-WATERLOO-TROIS RIVIERES	193	0	193
KITCH.-WATERLOO-WINDSOR	16,878	28,816	45,693
LONDON-MONTREAL	14,676	29,517	44,193
LONDON-OTTAWA	38,865	33,518	72,384
LONDON-QUEBEC	2,970	1,125	4,096
LONDON-TORONTO	371,924	831,888	1,203,812
LONDON-TROIS RIVIERES	0	0	0
LONDON-WINDSOR	97,094	212,200	309,294
MONTREAL-OTTAWA	490,260	965,706	1,455,966
MONTREAL-QUEBEC	505,643	690,621	1,196,264
MONTREAL-TORONTO	676,573	644,006	1,320,579
MONTREAL-TROIS RIVIERES	65,102	255,624	320,725
MONTREAL-WINDSOR	17,201	18,322	35,524
OTTAWA-QUEBEC	52,438	53,474	105,912
OTTAWA-TORONTO	1,162,506	669,970	1,832,476
OTTAWA-TROIS RIVIERES	3,229	11,045	14,274
OTTAWA-WINDSOR	9,347	22,313	31,660
QUEBEC-TORONTO	69,256	56,375	125,631
QUEBEC-TROIS RIVIERES	2,566	5,588	8,154
QUEBEC-WINDSOR	0	1,460	1,460
TORONTO-TROIS RIVIERES	301	6,209	6,510
TORONTO-WINDSOR	254,328	264,753	519,082
TROIS RIVIERES-WINDSOR	0	0	0
TOTAL	4,244,455	5,963,821	10,208,275

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

HSR Input Data for 2005 / 200+ kph / Composite ROW / Optimized HSR Fares HSR in Full corridor

Superzone Pair	Business									
	Linehaul Time	Connect Egress Time	Access/ Egress Time	Terminal Proc. Time	Total Access/ Egress Time	Daily Frequency	Wait Time	Fare	Connect Egress Cost	Access/ Egress Cost
HAMILTON-KINGSTON	999.00	0.37	0.83	0.27	1.09	12.00	0.75	$56.84	$4.39	$9.90
HAMILTON-KITCH.-WATERLOO	999.00	0.37	0.58	0.27	0.84	12.00	0.75	$56.84	$4.39	$6.92
HAMILTON-LONDON	999.00	0.37	0.44	0.27	0.70	12.00	0.75	$29.88	$4.39	$5.25
HAMILTON-MONTREAL	999.00	0.37	0.74	0.30	1.04	12.00	0.75	$72.87	$4.39	$8.84
HAMILTON-OTTAWA	999.00	0.37	0.75	0.27	1.02	12.00	0.75	$80.88	$4.39	$9.01
HAMILTON-QUEBEC	999.00	0.37	0.59	0.27	0.86	12.00	0.75	$155.93	$4.39	$7.12
HAMILTON-TORONTO	999.00	0.37	0.61	0.30	0.91	12.00	0.75	$22.59	$4.39	$7.31
HAMILTON-TROIS RIVIERES	999.00	0.37	0.90	0.27	1.17	12.00	0.75	$22.59	$4.39	$10.79
HAMILTON-WINDSOR	999.00	0.37	0.57	0.27	0.84	12.00	0.75	$76.87	$4.39	$6.86
KINGSTON-KITCH.-WATERLOO	2.27	0.50	1.00	0.27	1.27	14.00	0.64	$97.64	$8.40	$16.80
KINGSTON-LONDON	2.82	0.43	0.85	0.27	1.12	14.00	0.64	$103.47	$7.65	$15.30
KINGSTON-MONTREAL	1.98	0.44	1.00	0.30	1.30	18.00	0.50	$64.12	$8.15	$16.70
KINGSTON-OTTAWA	0.87	0.44	0.88	0.27	1.15	22.00	0.41	$45.18	$8.15	$18.30
KINGSTON-QUEBEC	3.93	0.48	0.95	0.27	1.22	14.00	0.64	$64.12	$5.72	$11.44
KINGSTON-TORONTO	1.43	0.44	1.05	0.30	1.35	23.00	0.39	$67.04	$8.15	$16.80
KINGSTON-TROIS RIVIERES	3.10	0.63	1.26	0.27	1.53	14.00	0.64	$68.49	$7.56	$15.11
KINGSTON-WINDSOR	3.78	0.57	1.13	0.27	1.40	12.00	0.75	$122.42	$11.70	$23.40
KITCH.-WATERLOO-LONDON	0.55	0.48	0.95	0.27	1.22	16.00	0.56	$29.15	$7.90	$15.80
KITCH.-WATERLOO-MONTREAL	4.25	0.55	1.12	0.30	1.42	14.00	0.64	$145.73	$8.65	$17.20
KITCH.-WATERLOO-OTTAWA	3.13	0.55	0.98	0.27	1.25	14.00	0.64	$135.53	$8.65	$18.80
KITCH.-WATERLOO-QUEBEC	6.20	0.35	0.71	0.27	0.97	14.00	0.64	$102.01	$4.23	$8.46
KITCH.-WATERLOO-TORONTO	0.63	0.55	1.15	0.30	1.45	16.00	0.56	$30.60	$8.65	$17.30
KITCH.-WATERLOO-TROIS RIVIERES	5.37	0.51	1.01	0.27	1.28	14.00	0.64	$26.23	$6.07	$12.13
KITCH.-WATERLOO-WINDSOR	1.52	0.63	1.25	0.27	1.52	12.00	0.75	$62.67	$11.95	$23.90
LONDON-MONTREAL	4.80	0.40	0.97	0.30	1.27	14.00	0.64	$154.48	$7.15	$15.70
LONDON-OTTAWA	3.68	0.40	0.83	0.27	1.10	14.00	0.64	$144.28	$7.15	$17.30
LONDON-QUEBEC	6.75	0.28	0.57	0.27	0.83	14.00	0.64	$77.24	$3.40	$6.79
LONDON-TORONTO	1.18	0.40	1.00	0.30	1.30	16.00	0.56	$55.38	$7.15	$15.80
LONDON-TROIS RIVIERES	5.92	0.44	0.87	0.27	1.14	14.00	0.64	$150.11	$5.23	$10.46
LONDON-WINDSOR	0.97	0.55	1.10	0.27	1.37	12.00	0.75	$43.72	$11.20	$22.40
MONTREAL-OTTAWA	1.03	0.43	1.00	0.30	1.30	20.00	0.45	$62.67	$9.60	$18.60
MONTREAL-QUEBEC	1.75	0.39	0.93	0.30	1.23	14.00	0.64	$78.70	$6.10	$14.60
MONTREAL-TORONTO	3.42	0.56	1.17	0.33	1.50	18.00	0.50	$123.87	$8.50	$17.10
MONTREAL-TROIS RIVIERES	0.92	0.38	1.02	0.30	1.32	14.00	0.64	$40.08	$9.00	$17.50
MONTREAL-WINDSOR	5.77	0.69	1.25	0.30	1.55	12.00	0.75	$169.05	$15.25	$23.80
OTTAWA-QUEBEC	2.98	0.39	0.82	0.27	1.08	14.00	0.64	$113.67	$6.10	$16.20
OTTAWA-TORONTO	2.30	0.39	1.03	0.30	1.33	25.00	0.36	$104.93	$9.60	$18.70
OTTAWA-TROIS RIVIERES	2.15	0.45	0.90	0.27	1.17	14.00	0.64	$91.81	$9.00	$19.10
OTTAWA-WINDSOR	4.65	0.57	1.13	0.27	1.40	12.00	0.75	$150.11	$15.25	$25.40
QUEBEC-TORONTO	5.37	0.39	0.98	0.30	1.28	14.00	0.64	$158.85	$6.10	$14.70
QUEBEC-TROIS RIVIERES	0.83	0.42	0.83	0.27	1.10	14.00	0.64	$40.99	$7.55	$15.10
QUEBEC-WINDSOR	7.72	0.35	0.70	0.27	0.97	12.00	0.75	$34.98	$4.20	$8.40
TORONTO-TROIS RIVIERES	4.53	0.53	1.07	0.30	1.37	14.00	0.64	$135.53	$9.00	$17.60
TORONTO-WINDSOR	2.15	0.69	1.30	0.30	1.60	12.00	0.75	$81.61	$15.25	$23.90
TROIS RIVIERES-WINDSOR	6.88	0.50	1.01	0.27	1.27	12.00	0.75	$116.59	$6.03	$12.07

SOURCE: Charles River Associates, 1994

Table A-1. (continued)

HSR Input Data for 2005 / 200+ kph / Composite ROW / Optimized HSR Fares   HSR in Full corridor

Superzone Pair	Nonbusiness									
	Linehaul Time	Connect Egress Time	Access/ Egress Time	Terminal Proc. Time	Total Access/ Egress Time	Daily Frequency	Wait Time	Fare	Connect Egress Cost	Access/ Egress Cost
HAMILTON-KINGSTON	999.00	0.37	0.83	0.27	1.09	12.00	0.75	$47.73	$2.20	$4.95
HAMILTON-KITCH.-WATERLOO	999.00	0.37	0.58	0.27	0.84	12.00	0.75	$47.73	$2.20	$3.46
HAMILTON-LONDON	999.00	0.37	0.44	0.27	0.70	12.00	0.75	$27.69	$2.20	$2.63
HAMILTON-MONTREAL	999.00	0.37	0.74	0.30	1.04	12.00	0.75	$94.73	$2.20	$4.42
HAMILTON-OTTAWA	999.00	0.37	0.75	0.27	1.02	12.00	0.75	$91.81	$2.20	$4.51
HAMILTON-QUEBEC	999.00	0.37	0.59	0.27	0.86	12.00	0.75	$123.87	$2.20	$3.56
HAMILTON-TORONTO	999.00	0.37	0.61	0.30	0.91	12.00	0.75	$26.96	$2.20	$3.65
HAMILTON-TROIS RIVIERES	999.00	0.37	0.90	0.27	1.17	12.00	0.75	$0.00	$2.20	$5.40
HAMILTON-WINDSOR	999.00	0.37	0.57	0.27	0.84	12.00	0.75	$38.98	$2.20	$3.43
KINGSTON-KITCH.-WATERLOO	2.27	0.50	1.00	0.27	1.27	14.00	0.64	$68.49	$3.80	$7.60
KINGSTON-LONDON	2.82	0.43	0.85	0.27	1.12	14.00	0.64	$72.87	$3.85	$7.70
KINGSTON-MONTREAL	1.98	0.44	1.00	0.30	1.30	18.00	0.50	$49.55	$4.65	$7.90
KINGSTON-OTTAWA	0.87	0.44	0.88	0.27	1.15	22.00	0.41	$33.52	$4.65	$8.50
KINGSTON-QUEBEC	3.93	0.48	0.95	0.27	1.22	14.00	0.64	$77.24	$2.86	$5.72
KINGSTON-TORONTO	1.43	0.44	1.05	0.30	1.35	23.00	0.39	$59.75	$4.65	$7.90
KINGSTON-TROIS RIVIERES	3.10	0.63	1.26	0.27	1.53	14.00	0.64	$64.36	$3.78	$7.56
KINGSTON-WINDSOR	3.78	0.57	1.13	0.27	1.40	12.00	0.75	$85.98	$6.80	$13.60
KITCH.-WATERLOO-LONDON	0.55	0.48	0.95	0.27	1.22	16.00	0.56	$20.40	$3.00	$6.00
KITCH.-WATERLOO-MONTREAL	4.25	0.55	1.12	0.30	1.42	14.00	0.64	$102.01	$2.90	$6.10
KITCH.-WATERLOO-OTTAWA	3.13	0.55	0.98	0.27	1.25	14.00	0.64	$94.73	$2.90	$6.70
KITCH.-WATERLOO-QUEBEC	6.20	0.35	0.71	0.27	0.97	14.00	0.64	$157.39	$2.12	$4.23
KITCH.-WATERLOO-TORONTO	0.63	0.55	1.15	0.30	1.45	16.00	0.56	$21.86	$2.90	$6.10
KITCH.-WATERLOO-TROIS RIVIERES	5.37	0.51	1.01	0.27	1.28	14.00	0.64	$144.28	$3.03	$6.07
KITCH.-WATERLOO-WINDSOR	1.52	0.63	1.25	0.27	1.52	12.00	0.75	$43.72	$5.90	$11.80
LONDON-MONTREAL	4.80	0.40	0.97	0.30	1.27	14.00	0.64	$107.84	$3.05	$6.30
LONDON-OTTAWA	3.68	0.40	0.83	0.27	1.10	14.00	0.64	$100.56	$3.05	$6.90
LONDON-QUEBEC	6.75	0.28	0.57	0.27	0.83	14.00	0.64	$102.01	$1.70	$3.40
LONDON-TORONTO	1.18	0.40	1.00	0.30	1.30	16.00	0.56	$37.89	$3.05	$6.30
LONDON-TROIS RIVIERES	5.92	0.44	0.87	0.27	1.14	14.00	0.64	$129.70	$2.62	$5.23
LONDON-WINDSOR	0.97	0.55	1.10	0.27	1.37	12.00	0.75	$30.60	$6.00	$12.00
MONTREAL-OTTAWA	1.03	0.43	1.00	0.30	1.30	20.00	0.45	$37.89	$3.80	$7.00
MONTREAL-QUEBEC	1.75	0.39	0.93	0.30	1.23	14.00	0.64	$59.75	$3.15	$6.40
MONTREAL-TORONTO	3.42	0.56	1.17	0.33	1.50	18.00	0.50	$93.27	$3.20	$6.40
MONTREAL-TROIS RIVIERES	0.92	0.38	1.02	0.30	1.32	14.00	0.64	$28.24	$3.50	$6.70
MONTREAL-WINDSOR	5.77	0.69	1.25	0.30	1.55	12.00	0.75	$118.04	$8.90	$12.10
OTTAWA-QUEBEC	2.98	0.39	0.82	0.27	1.08	14.00	0.64	$80.15	$3.15	$7.00
OTTAWA-TORONTO	2.30	0.39	1.03	0.30	1.33	25.00	0.36	$83.07	$3.80	$7.00
OTTAWA-TROIS RIVIERES	2.15	0.45	0.90	0.27	1.17	14.00	0.64	$83.07	$3.65	$7.30
OTTAWA-WINDSOR	4.65	0.57	1.13	0.27	1.40	12.00	0.75	$104.93	$6.35	$12.70
QUEBEC-TORONTO	5.37	0.39	0.98	0.30	1.28	14.00	0.64	$110.76	$3.15	$6.40
QUEBEC-TROIS RIVIERES	0.83	0.42	0.83	0.27	1.10	14.00	0.64	$29.15	$3.35	$6.70
QUEBEC-WINDSOR	7.72	0.35	0.70	0.27	0.97	12.00	0.75	$106.39	$2.10	$4.20
TORONTO-TROIS RIVIERES	4.53	0.53	1.07	0.30	1.37	14.00	0.64	$74.32	$3.35	$6.70
TORONTO-WINDSOR	2.15	0.69	1.30	0.30	1.60	12.00	0.75	$62.67	$6.05	$12.10
TROIS RIVIERES-WINDSOR	6.88	0.50	1.01	0.27	1.27	12.00	0.75	$106.39	$3.02	$6.03

SOURCE: Charles River Associates, 1994

Table A-2.

2005 Québec-Windsor Corridor Forecast Summary by Mode
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips: Before High Speed Rail	Total Trips: After High Speed Rail	Percent Diverted to High Speed Rail	High Speed Rail Trips: Diverted	High Speed Rail Trips: Induced	High Speed Rail Trips: Total	High Speed Rail Revenue: From Diverted Trips	High Speed Rail Revenue: From Induced Trips	High Speed Rail Revenue: Total	Mode Share After High Speed Rail
Business	Local Air	3,075,038	1,385,864	55%	1,689,174	NA	1,689,174	$194,696,410	NA	$194,696,410	2%
	Connect Air	1,090,355	694,741	36%	395,615	NA	395,615	$41,706,673	NA	$41,706,673	1%
	Rail	596,839	0	94%	559,280	NA	559,280	$48,668,792	NA	$48,668,792	0%
	Bus	378,703	285,780	34%	130,482	NA	130,482	$9,049,997	NA	$9,049,997	0%
	Auto	11,487,187	10,298,093	10%	1,189,095	NA	1,189,095	$94,133,141	NA	$94,133,141	16%
	Noncaptive Auto	7,221,317	6,344,118	12%	877,200	NA	877,200	$67,138,742	NA	$67,138,742	10%
	Destination Captive Auto	3,499,370	3,187,475	9%	311,895	NA	311,895	$26,994,399	NA	$26,994,399	5%
	En Route Captive Auto	766,500	766,500	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	4,546,103	NA	NA	NA	NA	NA	NA	NA	7%
	Total	16,628,122	17,210,581	24%	3,963,645	582,458	4,546,103	$388,255,014	$52,432,607	$440,687,620	28%
Nonbusiness	Local Air	548,809	272,525	50%	276,284	NA	276,284	$24,190,338	NA	$24,190,338	0%
	Connect Air	984,305	624,891	37%	359,413	NA	359,413	$28,509,856	NA	$28,509,856	1%
	Rail	1,257,753	0	91%	1,146,375	NA	1,146,375	$78,941,609	NA	$78,941,609	0%
	Bus	1,523,136	655,930	64%	978,584	NA	978,584	$47,107,882	NA	$47,107,882	1%
	Auto	40,088,331	37,675,965	6%	2,412,366	NA	2,412,366	$132,440,685	NA	$132,440,685	60%
	Noncaptive Auto	27,596,052	25,649,207	7%	1,946,845	NA	1,946,845	$104,764,242	NA	$104,764,242	41%
	Destination Captive Auto	10,577,203	10,111,683	4%	465,520	NA	465,520	$27,676,443	NA	$27,676,443	16%
	En Route Captive Auto	1,915,076	1,915,076	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	6,040,022	NA	NA	NA	NA	NA	NA	NA	10%
	Total	44,402,334	45,269,334	12%	5,173,022	867,000	6,040,022	$311,190,370	$46,451,447	$357,641,816	72%
Total	Local Air	3,623,847	1,658,389	54%	1,965,458	NA	1,965,458	$218,886,748	NA	$218,886,748	3%
	Connect Air	2,074,660	1,319,632	36%	755,028	NA	755,028	$70,216,529	NA	$70,216,529	2%
	Rail	1,854,592	0	92%	1,705,655	NA	1,705,655	$127,610,401	NA	$127,610,401	0%
	Bus	1,901,839	941,710	58%	1,109,065	NA	1,109,065	$56,157,879	NA	$56,157,879	2%
	Auto	51,575,518	47,974,058	7%	3,601,460	NA	3,601,460	$226,573,826	NA	$226,573,826	77%
	Noncaptive Auto	34,817,370	31,993,325	8%	2,824,045	NA	2,824,045	$171,902,984	NA	$171,902,984	51%
	Destination Captive Auto	14,076,573	13,299,158	6%	777,415	NA	777,415	$54,670,842	NA	$54,670,842	21%
	En Route Captive Auto	2,681,576	2,681,576	0%	0	NA	0	$0	NA	$0	4%
	High Speed Rail	0	10,586,125	NA	NA	NA	NA	NA	NA	NA	17%
	Total	61,030,456	62,479,914	15%	9,136,667	1,449,458	10,586,125	$699,445,383	$98,884,053	$798,329,437	100%

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

2005 Montréal-Toronto Forecast Summary by Mode
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

		Total Trips			High Speed Rail Trips			High Speed Rail Revenue			
Trip Purpose	Mode	Before High Speed Rail	After High Speed Rail	Percent Diverted to High Speed Rail	Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	Mode Share After High Speed Rail
Business	Local Air	1,478,590	945,043	36%	533,548	NA	533,548	$68,777,986	NA	$68,777,986	20%
	Connect Air	309,365	223,435	28%	85,930	NA	85,930	$11,076,990	NA	$11,076,990	5%
	Rail	123,770	0	84%	103,798	NA	103,798	$13,380,342	NA	$13,380,342	0%
	Bus	12,730	25,676	55%	7,025	NA	7,025	$905,611	NA	$905,611	1%
	Auto	352,946	271,018	23%	81,928	NA	81,928	$10,561,061	NA	$10,561,061	6%
	Noncaptive Auto	161,610	110,749	31%	50,861	NA	50,861	$6,556,345	NA	$6,556,345	2%
	Destination Captive Auto	180,035	148,968	17%	31,067	NA	31,067	$4,004,716	NA	$4,004,716	3%
	En Route Captive Auto	11,301	11,301	0%	0	NA	0	$0	NA	$0	0%
	High Speed Rail	0	853,163	NA	NA	NA	NA	NA	NA	NA	18%
	Total	2,277,401	2,318,335	36%	812,229	40,934	853,163	$104,701,989	$5,276,673	$109,978,662	50%
Nonbusiness	Local Air	273,347	176,637	35%	96,710	NA	96,710	$9,386,600	NA	$9,386,600	4%
	Connect Air	345,980	241,071	30%	104,909	NA	104,909	$10,182,394	NA	$10,182,394	5%
	Rail	345,891	0	83%	287,349	NA	287,349	$27,889,858	NA	$27,889,858	0%
	Bus	105,446	111,647	50%	52,342	NA	52,342	$5,080,321	NA	$5,080,321	2%
	Auto	1,224,716	1,127,547	8%	97,169	NA	97,169	$9,431,201	NA	$9,431,201	24%
	Noncaptive Auto	571,514	506,849	11%	64,665	NA	64,665	$6,276,346	NA	$6,276,346	11%
	Destination Captive Auto	607,226	574,721	5%	32,504	NA	32,504	$3,154,855	NA	$3,154,855	12%
	En Route Captive Auto	45,976	45,976	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	688,378	NA	NA	NA	NA	NA	NA	NA	15%
	Total	2,295,381	2,345,280	28%	638,479	49,899	688,378	$61,970,374	$4,843,144	$66,813,517	50%
Total	Local Air	1,751,937	1,121,680	36%	630,258	NA	630,258	$78,164,585	NA	$78,164,585	24%
	Connect Air	655,345	464,506	29%	190,839	NA	190,839	$21,259,383	NA	$21,259,383	10%
	Rail	469,662	0	83%	391,147	NA	391,147	$41,270,200	NA	$41,270,200	0%
	Bus	118,176	137,323	50%	59,368	NA	59,368	$5,985,932	NA	$5,985,932	3%
	Auto	1,577,662	1,398,564	11%	179,097	NA	179,097	$19,992,261	NA	$19,992,261	30%
	Noncaptive Auto	733,124	617,598	16%	115,526	NA	115,526	$12,832,691	NA	$12,832,691	13%
	Destination Captive Auto	787,260	723,689	8%	63,571	NA	63,571	$7,159,571	NA	$7,159,571	16%
	En Route Captive Auto	57,277	57,277	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	1,541,542	NA	NA	NA	NA	NA	NA	NA	33%
	Total	4,572,781	4,663,614	32%	1,450,709	90,833	1,541,542	$166,672,363	$10,119,816	$176,792,179	100%

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

2005 Montréal-Québec Forecast Summary by Mode
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips		Percent Diverted to High Speed Rail	High Speed Rail Trips			High Speed Rail Revenue			Mode Share After High Speed Rail
		Before High Speed Rail	After High Speed Rail		Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	
Business	Local Air	61,343	6,738	89%	54,605	NA	54,605	$4,471,787	NA	$4,471,787	0%
	Connect Air	127,383	122,548	4%	4,835	NA	4,835	$395,936	NA	$395,936	1%
	Rail	49,447	0	99%	48,717	NA	48,717	$3,989,636	NA	$3,989,636	0%
	Bus	164,431	154,837	6%	10,324	NA	10,324	$845,451	NA	$845,451	2%
	Auto	2,042,002	1,755,056	14%	286,945	NA	286,945	$23,499,050	NA	$23,499,050	19%
	Noncaptive Auto	1,134,680	924,749	19%	209,931	NA	209,931	$17,192,073	NA	$17,192,073	10%
	Destination Captive Auto	824,082	747,068	9%	77,014	NA	77,014	$6,306,977	NA	$6,306,977	8%
	En Route Captive Auto	83,239	83,239	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	454,565	NA	NA	NA	NA	NA	NA	NA	5%
	Total	2,444,606	2,493,744	17%	405,426	49,139	454,565	$33,201,859	$4,024,168	$37,226,028	27%
Nonbusiness	Local Air	9,113	1,772	81%	7,341	NA	7,341	$456,447	NA	$456,447	0%
	Connect Air	51,630	50,027	3%	1,602	NA	1,602	$99,631	NA	$99,631	1%
	Rail	90,524	0	98%	89,015	NA	89,015	$5,534,819	NA	$5,534,819	0%
	Bus	254,712	225,958	12%	30,263	NA	30,263	$1,881,683	NA	$1,881,683	2%
	Auto	6,166,304	5,657,202	8%	509,103	NA	509,103	$31,655,295	NA	$31,655,295	62%
	Noncaptive Auto	4,217,405	3,791,531	10%	425,874	NA	425,874	$26,480,279	NA	$26,480,279	42%
	Destination Captive Auto	1,754,742	1,671,513	5%	83,228	NA	83,228	$5,175,016	NA	$5,175,016	18%
	En Route Captive Auto	194,157	194,157	0%	0	NA	0	$0	NA	$0	2%
	High Speed Rail	0	696,742	NA	NA	NA	NA	NA	NA	NA	8%
	Total	6,572,282	6,631,701	10%	637,323	59,419	696,742	$39,627,876	$3,694,597	$43,322,473	73%
Total	Local Air	70,456	8,510	88%	61,946	NA	61,946	$4,928,234	NA	$4,928,234	0%
	Connect Air	179,013	172,576	4%	6,437	NA	6,437	$495,567	NA	$495,567	2%
	Rail	139,971	0	98%	137,732	NA	137,732	$9,524,455	NA	$9,524,455	0%
	Bus	419,143	380,795	10%	40,586	NA	40,586	$2,727,134	NA	$2,727,134	4%
	Auto	8,208,306	7,412,258	10%	796,048	NA	796,048	$55,154,346	NA	$55,154,346	81%
	Noncaptive Auto	5,352,086	4,716,280	12%	635,806	NA	635,806	$43,672,352	NA	$43,672,352	52%
	Destination Captive Auto	2,578,824	2,418,582	6%	160,242	NA	160,242	$11,481,994	NA	$11,481,994	27%
	En Route Captive Auto	277,396	277,396	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	1,151,307	NA	NA	NA	NA	NA	NA	NA	13%
	Total	9,016,888	9,125,446	12%	1,042,749	108,558	1,151,307	$72,829,735	$7,718,765	$80,548,501	100%

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

2005 Ottawa-Toronto Forecast Summary by Mode
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

		Total Trips			High Speed Rail Trips			High Speed Rail Revenue			
Trip Purpose	**Mode**	**Before High Speed Rail**	**After High Speed Rail**	**Percent Diverted to High Speed Rail**	**Diverted**	**Induced**	**Total**	**From Diverted Trips**	**From Induced Trips**	**Total**	**Mode Share After High Speed Rail**
Business	Local Air	872,364	154,730	82%	717,634	NA	717,634	$78,359,713	NA	$78,359,713	3%
	Connect Air	335,175	148,044	56%	187,131	NA	187,131	$20,433,177	NA	$20,433,177	3%
	Rail	76,815	0	99%	76,402	NA	76,402	$8,342,446	NA	$8,342,446	0%
	Bus	18,533	1,074	96%	17,872	NA	17,872	$1,951,430	NA	$1,951,430	0%
	Auto	530,589	396,491	25%	134,098	NA	134,098	$14,642,392	NA	$14,642,392	9%
	Noncaptive Auto	231,840	146,642	37%	85,198	NA	85,198	$9,302,939	NA	$9,302,939	3%
	Destination Captive Auto	234,244	185,344	21%	48,900	NA	48,900	$5,339,453	NA	$5,339,453	4%
	En Route Captive Auto	64,505	64,505	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	1,334,343	NA	NA	NA	NA	NA	NA	NA	30%
	Total	1,833,476	2,034,682	62%	1,133,137	201,206	1,334,343	$123,729,159	$21,970,058	$145,699,218	45%
Nonbusiness	Local Air	114,164	28,499	75%	85,665	NA	85,665	$7,405,185	NA	$7,405,185	1%
	Connect Air	278,334	139,070	50%	139,264	NA	139,264	$12,038,439	NA	$12,038,439	3%
	Rail	124,661	0	99%	123,699	NA	123,699	$10,692,943	NA	$10,692,943	0%
	Bus	103,970	27,337	75%	77,595	NA	77,595	$6,707,563	NA	$6,707,563	1%
	Auto	1,742,396	1,550,901	11%	191,495	NA	191,495	$16,553,524	NA	$16,553,524	34%
	Noncaptive Auto	897,762	762,900	15%	134,862	NA	134,862	$11,657,955	NA	$11,657,955	17%
	Destination Captive Auto	779,327	722,694	7%	56,633	NA	56,633	$4,895,569	NA	$4,895,569	16%
	En Route Captive Auto	65,307	65,307	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	727,221	NA	NA	NA	NA	NA	NA	NA	16%
	Total	2,363,525	2,473,029	26%	617,718	109,503	727,221	$53,397,654	$9,465,857	$62,863,511	55%
Total	Local Air	986,529	183,229	81%	803,299	NA	803,299	$85,764,898	NA	$85,764,898	4%
	Connect Air	613,510	287,115	53%	326,395	NA	326,395	$32,471,616	NA	$32,471,616	6%
	Rail	201,476	0	99%	200,101	NA	200,101	$19,035,390	NA	$19,035,390	0%
	Bus	122,503	28,412	78%	95,466	NA	95,466	$8,658,994	NA	$8,658,994	1%
	Auto	2,272,985	1,947,391	14%	325,593	NA	325,593	$31,195,916	NA	$31,195,916	43%
	Noncaptive Auto	1,129,602	909,542	19%	220,060	NA	220,060	$20,960,894	NA	$20,960,894	20%
	Destination Captive Auto	1,013,571	908,038	10%	105,533	NA	105,533	$10,235,022	NA	$10,235,022	20%
	En Route Captive Auto	129,812	129,812	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	2,061,564	NA	NA	NA	NA	NA	NA	NA	46%
	Total	4,197,001	4,507,711	42%	1,750,854	310,710	2,061,564	$177,126,814	$31,435,915	$208,562,729	100%

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

2005 London-Toronto Forecast Summary by Mode
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips		Percent Diverted to High Speed Rail	High Speed Rail Trips			High Speed Rail Revenue			Mode Share After High Speed Rail
		Before High Speed Rail	After High Speed Rail		Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	
Business	Local Air	22,775	3,986	82%	18,789	NA	18,789	$1,082,803	NA	$1,082,803	0%
	Connect Air	84,667	37,467	56%	47,199	NA	47,199	$2,720,042	NA	$2,720,042	1%
	Rail	69,704	0	98%	68,152	NA	68,152	$3,927,550	NA	$3,927,550	0%
	Bus	12,765	2,366	94%	11,951	NA	11,951	$688,713	NA	$688,713	0%
	Auto	1,423,393	1,231,990	13%	191,403	NA	191,403	$11,030,378	NA	$11,030,378	20%
	Noncaptive Auto	937,151	781,668	17%	155,484	NA	155,484	$8,960,360	NA	$8,960,360	12%
	Destination Captive Auto	433,582	397,662	8%	35,920	NA	35,920	$2,070,018	NA	$2,070,018	6%
	En Route Captive Auto	52,660	52,660	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	394,248	NA	NA	NA	NA	NA	NA	NA	6%
	Total	1,613,304	1,670,057	21%	337,495	56,753	394,248	$19,449,486	$3,270,603	$22,720,089	27%
Nonbusiness	Local Air	10,829	1,217	89%	9,613	NA	9,613	$379,035	NA	$379,035	0%
	Connect Air	99,721	38,963	61%	60,758	NA	60,758	$2,395,690	NA	$2,395,690	1%
	Rail	141,631	0	98%	138,781	NA	138,781	$5,472,184	NA	$5,472,184	0%
	Bus	142,746	13,109	93%	132,487	NA	132,487	$5,224,027	NA	$5,224,027	0%
	Auto	4,077,350	3,703,210	9%	374,140	NA	374,140	$14,752,461	NA	$14,752,461	59%
	Noncaptive Auto	2,939,668	2,618,136	11%	321,532	NA	321,532	$12,678,114	NA	$12,678,114	42%
	Destination Captive Auto	1,018,936	966,329	5%	52,608	NA	52,608	$2,074,346	NA	$2,074,346	15%
	En Route Captive Auto	118,746	118,746	0%	0	NA	0	$0	NA	$0	2%
	High Speed Rail	0	868,955	NA	NA	NA	NA	NA	NA	NA	14%
	Total	4,472,277	4,625,454	16%	715,779	153,177	868,955	$28,223,397	$6,039,804	$34,263,201	73%
Total	Local Air	33,604	5,202	85%	28,402	NA	28,402	$1,461,839	NA	$1,461,839	0%
	Connect Air	184,387	76,431	59%	107,957	NA	107,957	$5,115,732	NA	$5,115,732	1%
	Rail	211,335	0	98%	206,933	NA	206,933	$9,399,734	NA	$9,399,734	0%
	Bus	155,512	15,474	93%	144,438	NA	144,438	$5,912,741	NA	$5,912,741	0%
	Auto	5,500,743	4,935,200	10%	565,543	NA	565,543	$25,782,838	NA	$25,782,838	78%
	Noncaptive Auto	3,876,819	3,399,804	12%	477,015	NA	477,015	$21,638,474	NA	$21,638,474	54%
	Destination Captive Auto	1,452,518	1,363,991	6%	88,528	NA	88,528	$4,144,364	NA	$4,144,364	22%
	En Route Captive Auto	171,406	171,406	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	1,263,203	NA	NA	NA	NA	NA	NA	NA	20%
	Total	6,085,581	6,295,510	17%	1,053,273	209,929	1,263,203	$47,672,883	$9,310,407	$56,983,290	100%

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

2005 Ottawa-Quebec Forecast Summary by Mode
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips		Percent Diverted to High Speed Rail	High Speed Rail Trips			High Speed Rail Revenue			Mode Share After High Speed Rail
		Before High Speed Rail	After High Speed Rail		Diverted	Induced	Total	From Diverted Trips	From Induced Trips	Total	
Business	Local Air	39,874	4,614	88%	35,260	NA	35,260	$4,170,913	NA	$4,170,913	1%
	Connect Air	2,640	1,005	62%	1,635	NA	1,635	$193,375	NA	$193,375	0%
	Rail	1,314	0	100%	1,313	NA	1,313	$155,264	NA	$155,264	0%
	Bus	4,792	4,423	8%	370	NA	370	$43,769	NA	$43,769	1%
	Auto	44,460	32,887	26%	11,573	NA	11,573	$1,369,032	NA	$1,369,032	7%
	Noncaptive Auto	26,567	18,120	32%	8,447	NA	8,447	$999,239	NA	$999,239	4%
	Destination Captive Auto	17,893	14,767	17%	3,126	NA	3,126	$369,793	NA	$369,793	3%
	En Route Captive Auto	0	0	0%	0	NA	0	$0	NA	$0	0%
	High Speed Rail	0	58,818	NA	NA	NA	NA	NA	NA	NA	13%
	Total	93,080	101,747	54%	50,150	8,667	58,818	$5,932,353	$1,025,241	$6,957,594	23%
Nonbusiness	Local Air	6,651	210	97%	6,441	NA	6,441	$537,227	NA	$537,227	0%
	Connect Air	386	110	71%	276	NA	276	$22,997	NA	$22,997	0%
	Rail	8,280	0	100%	8,268	NA	8,268	$689,650	NA	$689,650	0%
	Bus	14,948	11,967	20%	2,993	NA	2,993	$249,606	NA	$249,606	3%
	Auto	299,522	266,683	11%	32,839	NA	32,839	$2,739,086	NA	$2,739,086	61%
	Noncaptive Auto	185,795	160,002	14%	25,793	NA	25,793	$2,151,363	NA	$2,151,363	36%
	Destination Captive Auto	105,650	98,603	7%	7,046	NA	7,046	$587,724	NA	$587,724	22%
	En Route Captive Auto	8,078	8,078	0%	0	NA	0	$0	NA	$0	2%
	High Speed Rail	0	58,295	NA	NA	NA	NA	NA	NA	NA	13%
	Total	329,787	337,266	15%	50,816	7,479	58,295	$4,238,567	$623,804	$4,862,371	77%
Total	Local Air	46,525	4,825	90%	41,701	NA	41,701	$4,708,140	NA	$4,708,140	1%
	Connect Air	3,026	1,115	63%	1,910	NA	1,910	$216,372	NA	$216,372	0%
	Rail	9,594	0	100%	9,581	NA	9,581	$844,914	NA	$844,914	0%
	Bus	19,740	16,390	17%	3,363	NA	3,363	$293,374	NA	$293,374	4%
	Auto	343,983	299,570	13%	44,412	NA	44,412	$4,108,119	NA	$4,108,119	68%
	Noncaptive Auto	212,362	178,122	16%	34,240	NA	34,240	$3,150,602	NA	$3,150,602	41%
	Destination Captive Auto	123,543	113,370	8%	10,172	NA	10,172	$957,517	NA	$957,517	26%
	En Route Captive Auto	8,078	8,078	0%	0	NA	0	$0	NA	$0	2%
	High Speed Rail	0	117,112	NA	NA	NA	NA	NA	NA	NA	27%
	Total	422,867	439,013	24%	100,966	16,146	117,112	$10,170,920	$1,649,045	$11,819,965	100%

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

2005 Toronto-Windsor Forecast Summary by Mode
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Trip Purpose	Mode	Total Trips: Before High Speed Rail	Total Trips: After High Speed Rail	Percent Diverted to High Speed Rail	High Speed Rail Trips: Diverted	High Speed Rail Trips: Induced	High Speed Rail Trips: Total	High Speed Rail Revenue: From Diverted Trips	High Speed Rail Revenue: From Induced Trips	High Speed Rail Revenue: Total	Mode Share After High Speed Rail
Business	Local Air	160,320	23,826	85%	136,493	NA	136,493	$11,591,944	NA	$11,591,944	1%
	Connect Air	37,302	14,384	61%	22,918	NA	22,918	$1,946,363	NA	$1,946,363	1%
	Rail	30,385	0	98%	29,865	NA	29,865	$2,536,362	NA	$2,536,362	0%
	Bus	7,366	685	98%	7,201	NA	7,201	$611,577	NA	$611,577	0%
	Auto	305,589	256,502	16%	49,087	NA	49,087	$4,168,767	NA	$4,168,767	12%
	Noncaptive Auto	135,317	104,857	23%	30,460	NA	30,460	$2,586,905	NA	$2,586,905	5%
	Destination Captive Auto	159,825	141,198	12%	18,626	NA	18,626	$1,581,863	NA	$1,581,863	7%
	En Route Captive Auto	10,447	10,447	0%	0	NA	0	$0	NA	$0	1%
	High Speed Rail	0	285,329	NA	NA	NA	NA	NA	NA	NA	14%
	Total	540,962	580,727	45%	245,564	39,765	285,329	$20,855,014	$3,377,124	$24,232,138	28%
Nonbusiness	Local Air	33,475	10,798	68%	22,677	NA	22,677	$1,478,802	NA	$1,478,802	1%
	Connect Air	50,354	25,337	50%	25,016	NA	25,016	$1,631,366	NA	$1,631,366	1%
	Rail	78,888	0	98%	77,247	NA	77,247	$5,037,399	NA	$5,037,399	0%
	Bus	32,673	4,531	91%	29,783	NA	29,783	$1,942,194	NA	$1,942,194	0%
	Auto	1,248,467	1,152,569	8%	95,898	NA	95,898	$6,253,672	NA	$6,253,672	56%
	Noncaptive Auto	715,216	641,847	10%	73,369	NA	73,369	$4,784,515	NA	$4,784,515	31%
	Destination Captive Auto	467,128	444,599	5%	22,529	NA	22,529	$1,469,157	NA	$1,469,157	22%
	En Route Captive Auto	66,123	66,123	0%	0	NA	0	$0	NA	$0	3%
	High Speed Rail	0	285,890	NA	NA	NA	NA	NA	NA	NA	14%
	Total	1,443,857	1,479,126	17%	250,621	35,269	285,890	$16,343,433	$2,299,949	$18,643,382	72%
Total	Local Air	193,795	34,625	82%	159,170	NA	159,170	$13,070,747	NA	$13,070,747	2%
	Connect Air	87,656	39,721	55%	47,935	NA	47,935	$3,577,729	NA	$3,577,729	2%
	Rail	109,273	0	98%	107,112	NA	107,112	$7,573,761	NA	$7,573,761	0%
	Bus	40,039	5,216	92%	36,984	NA	36,984	$2,553,771	NA	$2,553,771	0%
	Auto	1,554,056	1,409,071	9%	144,985	NA	144,985	$10,422,440	NA	$10,422,440	68%
	Noncaptive Auto	850,534	746,704	12%	103,829	NA	103,829	$7,371,419	NA	$7,371,419	36%
	Destination Captive Auto	626,952	585,797	7%	41,155	NA	41,155	$3,051,020	NA	$3,051,020	28%
	En Route Captive Auto	76,570	76,570	0%	0	NA	0	$0	NA	$0	4%
	High Speed Rail	0	571,219	NA	NA	NA	NA	NA	NA	NA	28%
	Total	1,984,819	2,059,853	25%	496,185	75,034	571,219	$37,198,447	$5,677,073	$42,875,521	100%

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

2005 Link Volumes
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Link	Eastbound	Westbound	Total Link Volume
London-Windsor	525,336	525,336	1,050,672
Kitch.-Waterloo-London	1,107,768	1,107,768	2,215,535
Kitch.-Waterloo-Toronto	1,233,844	1,233,844	2,467,689
Kingston-Toronto	2,419,250	2,419,250	4,838,499
Kingston-Ottawa	2,259,103	2,259,103	4,518,206
Montreal-Ottawa	1,619,426	1,619,426	3,238,851
Montreal-Trois Rivieres	900,946	900,946	1,801,893
Quebec-Trois Rivieres	730,211	730,211	1,460,423

2005 Station Volumes
Base Run - 300+ kph / Composite ROW / HSR in Full Corridor
Optimized HSR Fares

Station	Boardings	Alightings	Total Station Volume
Hamilton	0	0	0
Kingston	597,317	597,317	1,194,635
Kitchener	242,113	242,113	484,227
London	913,697	913,697	1,827,394
Montreal	2,198,058	2,198,058	4,396,117
Ottawa	1,901,928	1,901,928	3,803,856
Quebec	730,211	730,211	1,460,423
Toronto	3,298,572	3,298,572	6,597,144
Trois Rivieres	178,891	178,891	357,783
Windsor	525,336	525,336	1,050,672
Total	10,586,125	10,586,125	21,172,250

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

Diverted HSR Trips for 2005 / 300+ kph / Composite ROW / Optimized HSR Fares — Base Case / HSR in Full Corridor

	Business						Nonbusiness						
Superzone Pair	Local Air	Connect Air	Rail	Bus	Noncaptive Auto	Captive Auto	Local Air	Connect Air	Rail	Bus	Noncaptive Auto	Captive Auto	Total Volume
HAMILTON-KINGSTON	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-KITCH.-WATERLOO	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-LONDON	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-MONTREAL	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-OTTAWA	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-QUEBEC	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-TORONTO	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-TROIS RIVIERES	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON-WINDSOR	0	0	0	0	0	0	0	0	0	0	0	0	0
KINGSTON-KITCH.-WATERLOO	0	0	0	768	2,117	1,149	0	0	2,181	2,531	4,161	973	13,880
KINGSTON-LONDON	841	0	1,086	36	1,396	111	0	0	5,605	2,068	7,980	1,596	20,719
KINGSTON-MONTREAL	26	0	12,812	2,978	1,726	1,560	0	0	19,888	31,766	14,444	6,366	91,567
KINGSTON-OTTAWA	0	0	13,411	7,045	32,026	8,623	0	0	17,946	57,896	91,879	17,377	246,203
KINGSTON-QUEBEC	0	0	424	0	0	0	0	0	1,147	0	352	121	2,045
KINGSTON-TORONTO	8,791	21,232	69,197	7,251	66,541	18,845	5,022	12,541	121,330	77,115	153,448	34,157	595,468
KINGSTON-TROIS RIVIERES	0	0	0	0	1,484	0	0	0	0	0	0	0	1,484
KINGSTON-WINDSOR	0	0	1,310	0	820	312	0	0	3,461	915	988	486	8,292
KITCH.-WATERLOO-LONDON	0	0	1,238	775	0	0	0	0	19,086	10,140	0	0	31,239
KITCH.-WATERLOO-MONTREAL	0	0	1,520	111	5,035	2,946	0	0	4,472	1,433	6,982	1,912	24,411
KITCH.-WATERLOO-OTTAWA	0	0	719	463	1,431	3,374	0	0	3,097	3,420	12,822	4,584	29,910
KITCH.-WATERLOO-QUEBEC	0	0	0	0	4,427	0	0	0	487	0	449	84	5,448
KITCH.-WATERLOO-TORONTO	0	0	4,199	19,983	0	0	0	0	29,429	159,968	0	0	213,579
KITCH.-WATERLOO-TROIS RIVIERES	0	0	0	0	0	208	0	0	0	0	0	0	208
KITCH.-WATERLOO-WINDSOR	0	0	0	375	13,828	3,314	0	0	2,811	947	18,875	4,990	45,140
LONDON-MONTREAL	15,270	0	390	217	222	1,995	3,279	0	12,107	1,732	10,864	1,192	47,268
LONDON-OTTAWA	32,942	942	1,496	180	5,416	2,239	7,412	150	8,786	4,777	9,473	2,826	76,640
LONDON-QUEBEC	2,345	0	0	0	137	0	142	0	585	0	47	297	3,553
LONDON-TORONTO	18,789	47,199	68,152	11,951	155,484	35,920	9,613	60,758	138,781	132,487	321,532	52,608	1,053,273
LONDON-TROIS RIVIERES	0	0	0	0	0	0	0	0	0	0	0	0	0
LONDON-WINDSOR	0	0	8,611	623	68,140	15,498	0	0	27,282	20,935	116,390	29,768	287,247
MONTREAL-OTTAWA	41,768	6,142	104,202	16,552	83,846	27,530	8,583	4,922	108,617	204,647	281,969	77,711	966,490
MONTREAL-QUEBEC	54,605	4,835	48,717	10,324	209,931	77,014	7,341	1,602	89,015	30,263	425,874	83,228	1,042,749
MONTREAL-TORONTO	533,548	85,930	103,798	7,025	50,861	31,067	96,710	104,909	287,349	52,342	64,665	32,504	1,450,709
MONTREAL-TROIS RIVIERES	0	0	0	15,066	39,296	3,996	0	0	0	52,299	153,177	15,679	279,513
MONTREAL-WINDSOR	24,784	0	1,915	56	777	67	8,301	0	7,182	199	2,907	281	46,470
OTTAWA-QUEBEC	35,260	1,635	1,313	370	8,447	3,126	6,441	276	8,268	2,993	25,793	7,046	100,966
OTTAWA-TORONTO	717,634	187,131	76,402	17,872	85,198	48,900	85,665	139,264	123,699	77,595	134,862	56,633	1,750,854
OTTAWA-TROIS RIVIERES	0	0	0	1,931	1,069	0	0	0	0	7,673	1,207	63	11,943
OTTAWA-WINDSOR	6,612	0	819	51	1,474	0	3,660	0	6,745	2,239	3,782	3,468	28,851
QUEBEC-TORONTO	59,466	17,650	7,684	452	4,813	4,818	11,437	9,976	18,633	4,336	6,544	6,475	152,285
QUEBEC-TROIS RIVIERES	0	0	0	734	795	409	0	0	0	2,237	878	433	5,485
QUEBEC-WINDSOR	0	0	0	0	0	0	0	0	1,140	0	150	0	1,290
TORONTO-TROIS RIVIERES	0	0	0	91	0	247	0	0	0	3,849	983	132	5,302
TORONTO-WINDSOR	136,493	22,918	29,865	7,201	30,460	18,626	22,677	25,016	77,247	29,783	73,369	22,529	496,185
TROIS RIVIERES-WINDSOR	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1,689,174	395,615	559,280	130,482	877,200	311,895	276,284	359,413	1,146,375	978,584	1,946,845	465,520	9,136,667

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

Total HSR Trips for 2005 / 300+ kph / Composite ROW / Optimized HSR Fares   Base Case / HSR in Full Corridor

Superzone Pair	Business	Nonbusiness	Total Volume
HAMILTON-KINGSTON	0	0	0
HAMILTON-KITCH.-WATERLOO	0	0	0
HAMILTON-LONDON	0	0	0
HAMILTON-MONTREAL	0	0	0
HAMILTON-OTTAWA	0	0	0
HAMILTON-QUEBEC	0	0	0
HAMILTON-TORONTO	0	0	0
HAMILTON-TROIS RIVIERES	0	0	0
HAMILTON-WINDSOR	0	0	0
KINGSTON-KITCH.-WATERLOO	4,350	13,139	17,490
KINGSTON-LONDON	4,498	19,847	24,345
KINGSTON-MONTREAL	22,401	87,586	109,987
KINGSTON-OTTAWA	76,701	246,287	322,987
KINGSTON-QUEBEC	588	1,986	2,574
KINGSTON-TORONTO	242,140	463,284	705,423
KINGSTON-TROIS RIVIERES	1,622	0	1,622
KINGSTON-WINDSOR	2,927	7,278	10,206
KITCH.-WATERLOO-LONDON	3,797	61,123	64,920
KITCH.-WATERLOO-MONTREAL	11,281	19,044	30,326
KITCH.-WATERLOO-OTTAWA	6,908	27,997	34,904
KITCH.-WATERLOO-QUEBEC	5,367	1,115	6,482
KITCH.-WATERLOO-TORONTO	29,792	248,953	278,745
KITCH.-WATERLOO-TROIS RIVIERES	244	0	244
KITCH.-WATERLOO-WINDSOR	19,228	31,888	51,116
LONDON-MONTREAL	19,568	32,643	52,211
LONDON-OTTAWA	48,858	37,959	86,817
LONDON-QUEBEC	3,351	1,280	4,631
LONDON-TORONTO	394,248	868,955	1,263,203
LONDON-TROIS RIVIERES	0	0	0
LONDON-WINDSOR	105,396	225,870	331,265
MONTREAL-OTTAWA	340,648	791,842	1,132,490
MONTREAL-QUEBEC	454,565	696,742	1,151,307
MONTREAL-TORONTO	853,163	688,378	1,541,542
MONTREAL-TROIS RIVIERES	66,883	261,389	328,272
MONTREAL-WINDSOR	28,864	21,118	49,982
OTTAWA-QUEBEC	58,818	58,295	117,112
OTTAWA-TORONTO	1,334,343	727,221	2,061,564
OTTAWA-TROIS RIVIERES	3,266	9,382	12,649
OTTAWA-WINDSOR	10,721	24,611	35,332
QUEBEC-TORONTO	103,272	65,336	168,609
QUEBEC-TROIS RIVIERES	2,598	5,558	8,156
QUEBEC-WINDSOR	0	1,552	1,552
TORONTO-TROIS RIVIERES	367	6,472	6,839
TORONTO-WINDSOR	285,329	285,890	571,219
TROIS RIVIERES-WINDSOR	0	0	0
TOTAL	4,546,103	6,040,022	10,586,125

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

HSR Input Data for 2005 / 300+ kph / Composite ROW / Optimized HSR Fares HSR in Full corridor

Superzone Pair	Business									
	Linehaul Time	Connect Egress Time	Access/ Egress Time	Terminal Proc. Time	Total Access/ Egress Time	Daily Frequency	Wait Time	Fare	Connect Egress Cost	Access/ Egress Cost
HAMILTON-KINGSTON	999.00	0.37	0.83	0.27	1.09	12.00	0.75	$59.15	$4.39	$9.90
HAMILTON-KITCH.-WATERLOO	999.00	0.37	0.58	0.27	0.84	12.00	0.75	$59.15	$4.39	$6.92
HAMILTON-LONDON	999.00	0.37	0.44	0.27	0.70	12.00	0.75	$31.09	$4.39	$5.25
HAMILTON-MONTREAL	999.00	0.37	0.74	0.30	1.04	12.00	0.75	$75.83	$4.39	$8.84
HAMILTON-OTTAWA	999.00	0.37	0.75	0.27	1.02	12.00	0.75	$84.17	$4.39	$9.01
HAMILTON-QUEBEC	999.00	0.37	0.59	0.27	0.86	12.00	0.75	$162.27	$4.39	$7.12
HAMILTON-TORONTO	999.00	0.37	0.61	0.30	0.91	12.00	0.75	$23.51	$4.39	$7.31
HAMILTON-TROIS RIVIERES	999.00	0.37	0.90	0.27	1.17	12.00	0.75	$23.51	$4.39	$10.79
HAMILTON-WINDSOR	999.00	0.37	0.57	0.27	0.84	12.00	0.75	$80.00	$4.39	$6.86
KINGSTON-KITCH.-WATERLOO	1.88	0.50	1.00	0.27	1.27	15.00	0.60	$101.61	$8.40	$16.80
KINGSTON-LONDON	2.28	0.43	0.85	0.27	1.12	14.00	0.64	$107.68	$7.65	$15.30
KINGSTON-MONTREAL	1.82	0.44	1.00	0.30	1.30	18.00	0.50	$66.73	$8.15	$16.70
KINGSTON-OTTAWA	0.65	0.44	0.88	0.27	1.15	18.00	0.50	$47.01	$8.15	$18.30
KINGSTON-QUEBEC	2.95	0.48	0.95	0.27	1.22	11.00	0.82	$66.73	$5.72	$11.44
KINGSTON-TORONTO	1.12	0.44	1.05	0.30	1.35	23.00	0.39	$69.76	$8.15	$16.80
KINGSTON-TROIS RIVIERES	2.28	0.63	1.26	0.27	1.53	11.00	0.82	$71.28	$7.56	$15.11
KINGSTON-WINDSOR	2.97	0.57	1.13	0.27	1.40	12.00	0.75	$127.39	$11.70	$23.40
KITCH.-WATERLOO-LONDON	0.40	0.48	0.95	0.27	1.22	17.00	0.53	$30.33	$7.90	$15.80
KITCH.-WATERLOO-MONTREAL	3.70	0.55	1.12	0.30	1.42	15.00	0.60	$151.66	$8.65	$17.20
KITCH.-WATERLOO-OTTAWA	2.53	0.55	0.98	0.27	1.25	15.00	0.60	$141.04	$8.65	$18.80
KITCH.-WATERLOO-QUEBEC	4.83	0.35	0.71	0.27	0.97	11.00	0.82	$106.16	$4.23	$8.46
KITCH.-WATERLOO-TORONTO	0.57	0.55	1.15	0.30	1.45	18.00	0.50	$31.85	$8.65	$17.30
KITCH.-WATERLOO-TROIS RIVIERES	4.17	0.51	1.01	0.27	1.28	11.00	0.82	$27.30	$6.07	$12.13
KITCH.-WATERLOO-WINDSOR	1.08	0.63	1.25	0.27	1.52	12.00	0.75	$65.21	$11.95	$23.90
LONDON-MONTREAL	4.10	0.40	0.97	0.30	1.27	15.00	0.60	$160.75	$7.15	$15.70
LONDON-OTTAWA	2.93	0.40	0.83	0.27	1.10	15.00	0.60	$150.14	$7.15	$17.30
LONDON-QUEBEC	5.23	0.28	0.57	0.27	0.83	11.00	0.82	$80.38	$3.40	$6.79
LONDON-TORONTO	0.97	0.40	1.00	0.30	1.30	17.00	0.53	$57.63	$7.15	$15.80
LONDON-TROIS RIVIERES	4.57	0.44	0.87	0.27	1.14	11.00	0.82	$156.20	$5.23	$10.46
LONDON-WINDSOR	0.68	0.55	1.10	0.27	1.37	12.00	0.75	$45.50	$11.20	$22.40
MONTREAL-OTTAWA	1.08	0.43	1.00	0.30	1.30	18.00	0.50	$65.21	$9.60	$18.60
MONTREAL-QUEBEC	1.40	0.39	0.93	0.30	1.23	13.00	0.69	$81.89	$6.10	$14.60
MONTREAL-TORONTO	2.93	0.56	1.17	0.33	1.50	18.00	0.50	$128.91	$8.50	$17.10
MONTREAL-TROIS RIVIERES	0.73	0.38	1.02	0.30	1.32	13.00	0.69	$41.71	$9.00	$17.50
MONTREAL-WINDSOR	4.78	0.69	1.25	0.30	1.55	11.00	0.82	$175.92	$15.25	$23.80
OTTAWA-QUEBEC	2.22	0.39	0.82	0.27	1.08	11.00	0.82	$118.29	$6.10	$16.20
OTTAWA-TORONTO	1.77	0.39	1.03	0.30	1.33	25.00	0.36	$109.19	$9.60	$18.70
OTTAWA-TROIS RIVIERES	1.55	0.45	0.90	0.27	1.17	11.00	0.82	$95.54	$9.00	$19.10
OTTAWA-WINDSOR	3.62	0.57	1.13	0.27	1.40	11.00	0.82	$156.20	$15.25	$25.40
QUEBEC-TORONTO	4.07	0.39	0.98	0.30	1.28	11.00	0.82	$165.30	$6.10	$14.70
QUEBEC-TROIS RIVIERES	0.67	0.42	0.83	0.27	1.10	13.00	0.69	$42.65	$7.55	$15.10
QUEBEC-WINDSOR	5.92	0.35	0.70	0.27	0.97	9.00	1.00	$36.40	$4.20	$8.40
TORONTO-TROIS RIVIERES	3.40	0.53	1.07	0.30	1.37	11.00	0.82	$141.04	$9.00	$17.60
TORONTO-WINDSOR	1.65	0.69	1.30	0.30	1.60	12.00	0.75	$84.93	$15.25	$23.90
TROIS RIVIERES-WINDSOR	5.25	0.50	1.01	0.27	1.27	11.00	0.82	$121.32	$6.03	$12.07

SOURCE: Charles River Associates, 1994

Table A-2. (continued)

HSR Input Data for 2005 / 300+ kph / Composite ROW / Optimized HSR Fares HSR in Full corridor

Superzone Pair	Nonbusiness									
	Linehaul Time	Connect Egress Time	Access/ Egress Time	Terminal Proc. Time	Total Access/ Egress Time	Daily Frequency	Wait Time	Fare	Connect Egress Cost	Access/ Egress Cost
HAMILTON-KINGSTON	999.00	0.37	0.83	0.27	1.09	12.00	0.75	$49.67	$2.20	$4.95
HAMILTON-KITCH.-WATERLOO	999.00	0.37	0.58	0.27	0.84	12.00	0.75	$49.67	$2.20	$3.46
HAMILTON-LONDON	999.00	0.37	0.44	0.27	0.70	12.00	0.75	$28.81	$2.20	$2.63
HAMILTON-MONTREAL	999.00	0.37	0.74	0.30	1.04	12.00	0.75	$98.58	$2.20	$4.42
HAMILTON-OTTAWA	999.00	0.37	0.75	0.27	1.02	12.00	0.75	$95.54	$2.20	$4.51
HAMILTON-QUEBEC	999.00	0.37	0.59	0.27	0.86	12.00	0.75	$128.91	$2.20	$3.56
HAMILTON-TORONTO	999.00	0.37	0.61	0.30	0.91	12.00	0.75	$28.06	$2.20	$3.65
HAMILTON-TROIS RIVIERES	999.00	0.37	0.90	0.27	1.17	12.00	0.75	$0.00	$2.20	$5.40
HAMILTON-WINDSOR	999.00	0.37	0.57	0.27	0.84	12.00	0.75	$40.57	$2.20	$3.43
KINGSTON-KITCH.-WATERLOO	1.88	0.50	1.00	0.27	1.27	15.00	0.60	$71.28	$3.80	$7.60
KINGSTON-LONDON	2.28	0.43	0.85	0.27	1.12	14.00	0.64	$75.83	$3.85	$7.70
KINGSTON-MONTREAL	1.82	0.44	1.00	0.30	1.30	18.00	0.50	$51.56	$4.65	$7.90
KINGSTON-OTTAWA	0.65	0.44	0.88	0.27	1.15	18.00	0.50	$34.88	$4.65	$8.50
KINGSTON-QUEBEC	2.95	0.48	0.95	0.27	1.22	11.00	0.82	$80.38	$2.86	$5.72
KINGSTON-TORONTO	1.12	0.44	1.05	0.30	1.35	23.00	0.39	$62.18	$4.65	$7.90
KINGSTON-TROIS RIVIERES	2.28	0.63	1.26	0.27	1.53	11.00	0.82	$66.98	$3.78	$7.56
KINGSTON-WINDSOR	2.97	0.57	1.13	0.27	1.40	12.00	0.75	$89.48	$6.80	$13.60
KITCH.-WATERLOO-LONDON	0.40	0.48	0.95	0.27	1.22	17.00	0.53	$21.23	$3.00	$6.00
KITCH.-WATERLOO-MONTREAL	3.70	0.55	1.12	0.30	1.42	15.00	0.60	$106.16	$2.90	$6.10
KITCH.-WATERLOO-OTTAWA	2.53	0.55	0.98	0.27	1.25	15.00	0.60	$98.58	$2.90	$6.70
KITCH.-WATERLOO-QUEBEC	4.83	0.35	0.71	0.27	0.97	11.00	0.82	$163.79	$2.12	$4.23
KITCH.-WATERLOO-TORONTO	0.57	0.55	1.15	0.30	1.45	18.00	0.50	$22.75	$2.90	$6.10
KITCH.-WATERLOO-TROIS RIVIERES	4.17	0.51	1.01	0.27	1.28	11.00	0.82	$150.14	$3.03	$6.07
KITCH.-WATERLOO-WINDSOR	1.08	0.63	1.25	0.27	1.52	12.00	0.75	$45.50	$5.90	$11.80
LONDON-MONTREAL	4.10	0.40	0.97	0.30	1.27	15.00	0.60	$112.22	$3.05	$6.30
LONDON-OTTAWA	2.93	0.40	0.83	0.27	1.10	15.00	0.60	$104.64	$3.05	$6.90
LONDON-QUEBEC	5.23	0.28	0.57	0.27	0.83	11.00	0.82	$106.16	$1.70	$3.40
LONDON-TORONTO	0.97	0.40	1.00	0.30	1.30	17.00	0.53	$39.43	$3.05	$6.30
LONDON-TROIS RIVIERES	4.57	0.44	0.87	0.27	1.14	11.00	0.82	$134.97	$2.62	$5.23
LONDON-WINDSOR	0.68	0.55	1.10	0.27	1.37	12.00	0.75	$31.85	$6.00	$12.00
MONTREAL-OTTAWA	1.08	0.43	1.00	0.30	1.30	18.00	0.50	$39.43	$3.80	$7.00
MONTREAL-QUEBEC	1.40	0.39	0.93	0.30	1.23	13.00	0.69	$62.18	$3.15	$6.40
MONTREAL-TORONTO	2.93	0.56	1.17	0.33	1.50	18.00	0.50	$97.06	$3.20	$6.40
MONTREAL-TROIS RIVIERES	0.73	0.38	1.02	0.30	1.32	13.00	0.69	$29.38	$3.50	$6.70
MONTREAL-WINDSOR	4.78	0.69	1.25	0.30	1.55	11.00	0.82	$122.84	$8.90	$12.10
OTTAWA-QUEBEC	2.22	0.39	0.82	0.27	1.08	11.00	0.82	$83.41	$3.15	$7.00
OTTAWA-TORONTO	1.77	0.39	1.03	0.30	1.33	25.00	0.36	$86.44	$3.80	$7.00
OTTAWA-TROIS RIVIERES	1.55	0.45	0.90	0.27	1.17	11.00	0.82	$86.44	$3.65	$7.30
OTTAWA-WINDSOR	3.62	0.57	1.13	0.27	1.40	11.00	0.82	$109.19	$6.35	$12.70
QUEBEC-TORONTO	4.07	0.39	0.98	0.30	1.28	11.00	0.82	$115.26	$3.15	$6.40
QUEBEC-TROIS RIVIERES	0.67	0.42	0.83	0.27	1.10	13.00	0.69	$30.33	$3.35	$6.70
QUEBEC-WINDSOR	5.92	0.35	0.70	0.27	0.97	9.00	1.00	$110.71	$2.10	$4.20
TORONTO-TROIS RIVIERES	3.40	0.53	1.07	0.30	1.37	11.00	0.82	$77.34	$3.35	$6.70
TORONTO-WINDSOR	1.65	0.69	1.30	0.30	1.60	12.00	0.75	$65.21	$6.05	$12.10
TROIS RIVIERES-WINDSOR	5.25	0.50	1.01	0.27	1.27	11.00	0.82	$110.71	$3.02	$6.03

SOURCE: Charles River Associates, 1994