STORMONT

HST

High Speed Train

Market Assessment Project

Air Canada

CP Rail System

STORMONT
CORPORATION

Mr. Terry Phillips, HST Project Leader
CP Rail System
Room 155, Windsor Station
P.O. Box 6042, Station A
Montreal, Quebec H3C 3E4

Mr. Marc Trudeau, HST Project Leader
Air Canada
Air Canada Centre 274
P.O. Box 14000, Postal Station Saint Laurent
Montreal, Quebec H4Y 1H4

September 7, 1993

Dear Mr. Phillips and Mr. Trudeau:

I am pleased to submit this Final Report, which has been prepared for Air Canada and CP Rail System with respect to the High Speed Trains Market Assessment.

Although this report is presented by SC Stormont Corporation, acting as Project Manager, the contents summarize the combined efforts of a sizeable team of individuals from several professional firms that have worked under contract for this project and from each of your organizations. I would like to acknowledge everyone's contributions to a high quality end product.

It has been a pleasure working for Air Canada and CP Rail System on this important assignment.

Sincerely,

J. Hugh MacDiarmid
President

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SC STORMONT CORPORATION
SUITE 1940 • WORLD EXCHANGE PLAZA • 45 O'CONNOR STREET • OTTAWA • ONTARIO • CANADA K1P 1A4
PHONE (613) 238-2308 • FAX (613) 238-2911

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1. EXECUTIVE SUMMARY

In May 1991, Air Canada and CP Rail System initiated a joint study of the market for High Speed Train (**HST**) service on the corridor between Windsor and Quebec City. The primary aim of the project was to forecast the likely future demand and revenue potential for **HST** service, based on sound research into consumer travel behaviour. Other associated objectives included evaluating consumer attitudes and preferences relating to inter-city travel, reviewing key **HST** service design characteristics, and assessing ancillary revenue opportunities that might arise.

This report summarizes the findings and conclusions from the **HST** market assessment project. It consolidates results from project Work Modules undertaken both by firms working under contract and by internal Air Canada and CP Rail System staff.

HST would bring a new dimension to passenger travel on the corridor - essentially a service that is a hybrid of air and conventional rail. **HST would attract many business travellers away from air, which is currently the prime travel mode for time-sensitive business travellers. Our research, however, did not indicate that HST could achieve a significant diversion of auto travellers**. The private automobile is dominantly a non-business travel mode, and is the largest market by far on the corridor; but, the auto market is highly sensitive to price and values the benefits and flexibilities offered by the personal automobile to an extent that would limit the appeal of **HST** to this market. Travellers using today's conventional rail service would largely choose **HST**, assuming conventional rail service were discontinued on the corridor, but some would choose bus on the basis of lower fares. Current bus travellers would not be influenced by the introduction of **HST** service, with the possible exception of the Montreal-Quebec City and Montreal-Ottawa routes, where bus is a more significant public mode of travel.

Ridership and revenue forecasts were generated for the year 2010 using a nested multinominal logit estimation model, applying a range of assumptions about key factors such as fares, service levels and consumer mode preference. Model results were naturally dependent on input variables, and our experience demonstrated that significant swings in projected ridership and revenue could be created through plausible changes in underlying assumptions. For purposes of illustrating model output in this document, we have chosen to present the results from a "revenue maximization" methodology (REVMAX), which generates a mid-range forecast of ridership and an upper-range forecast of revenue. Other approaches - e.g. assuming a fixed HST fare structure pegged at a certain percentage of comparable airfares - produce differing results. Where possible, we have shown the sensitivity of our forecasts to changes in input assumptions. We do not view these results as the final answer - indeed, there is much more to be learned before investment grade projections can be developed. To summarize the key findings from the demand estimation effort:

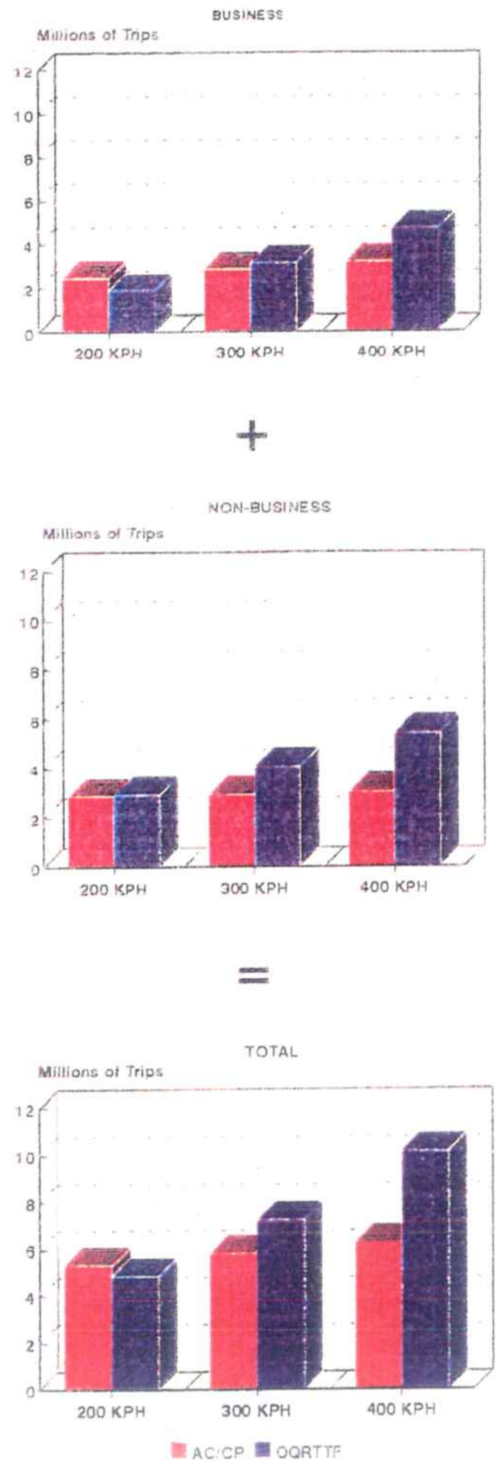
1. **The REVMAX model projects that 300 kph HST service would attract 5.8 million passengers in 2010, excluding any induced demand**. More aggressive assumptions could increase the demand forecast above 9 million, while more conservative assumptions yield forecasts as low as 5.2 million riders. This projection compares to a 2010 forecast, produced by the Ontario Quebec Rapid Train Task Force (OQRTTF), of 7.25 million riders for 300 kph service, also excluding induced demand.

2. **Ridership was not as elastic in response to either increased or decreased speed as was found in the OQRTTF study**. Using the REVMAX methodology, and excluding induced demand, higher speed service (400 kph) would not attract as much additional ridership as OQRTTF projected - an 8% increase relative to the 300 kph option versus 40% - while lower speed service (200 kph) would lose only 9% of the 300 kph ridership versus a 33% decrease forecast by the OQRTTF. Due to this relative insensitivity of demand to speed, our projections, when compared to the OQRTTF results, call for slightly higher ridership at 200 kph and significantly lower ridership at 400 kph. We attribute these differences in estimated future ridership to the consumer research findings on mode choice in our study, which indicated relatively high sensitivity to price among non-business travellers and high loyalty to the private automobile as a mode of inter-city travel. Exhibit 1-1 graphically summarizes the key ridership estimates for the REVMAX forecasting model.

3. **Consumer mode choice behaviour is strongly influenced by perception, particularly in relation to expected quality, comfort, and ease of travel**. We believe that HST could attract significantly higher patronage than our forecasts have shown if the HST operator were able to achieve a shift away from the current negative perceptions that consumers attach to rail travel. To illustrate, by altering the mode bias constant for HST (a statistical term in the demand forecasting model that measures the aggregated impact on traveller behaviour of

EXHIBIT 1 - 1

2010 HST RIDERSHIP FORECAST
(REVMAX Model, excluding induced demand)



all factors not otherwise reflected in the model) to reduce the perceived gap between **HST** and the personal automobile by one-half would increase the REVMAX 300 kph **HST** ridership forecast by 58%. In our judgment, the **only** valid basis for projecting significantly higher demand for **HST** than in our forecasts, other than pricing the service at extraordinarily low fares, would be to assume an improvement in consumer perceptions of rail travel sufficient to attract auto travellers to use the **HST** alternative. There is no evidence from our work that this is achievable.

4. **Ridership densities would be highest on the Toronto-Ottawa-Montreal segment of the corridor, followed by Toronto-London; both Montreal-Quebec and Windsor-London would have significantly lower ridership than the London-Montreal core of the corridor.** Considering the importance of frequency of service to consumers, as shown in the consumer research, the economics of providing service on these segments of the corridor would likely be less attractive than the core. Exhibits 1-2 and 1-3 graphically highlight this differing profile of passenger traffic by major track segment.

5. **Of the 5.8 million passengers in the REVMAX 300 kph scenario, 49% would be using HST for business trip purposes**. Considering that non-business trips outnumber business trips by a ratio of almost 4 to 1 in the overall inter-city passenger transportation market, this mix of travellers would make **HST** primarily a business-oriented mode of travel.

6. **Roughly 1.6 million HST trips in the REVMAX 300 kph scenario would be diversions from existing air trips, representing a market share loss of 45% and revenue loss exceeding $200 million for air carriers that could be attributed to the introduction of HST service**. The extent of air passenger diversions that is forecast varies considerably depending on the modelling assumptions and approaches used. The 45% diversion estimate is, in fact, at the **lower** end of the projections that were generated during the demand estimation process. Irrespective of the precise estimate, there is more than enough evidence to conclude that the introduction of **HST** service on the corridor would have a profound downward impact on the demand for air service. Competitive responses from air carriers in terms of fares, frequency of service, and size of aircraft have not been considered in this analysis.

EXHIBIT 1 - 2

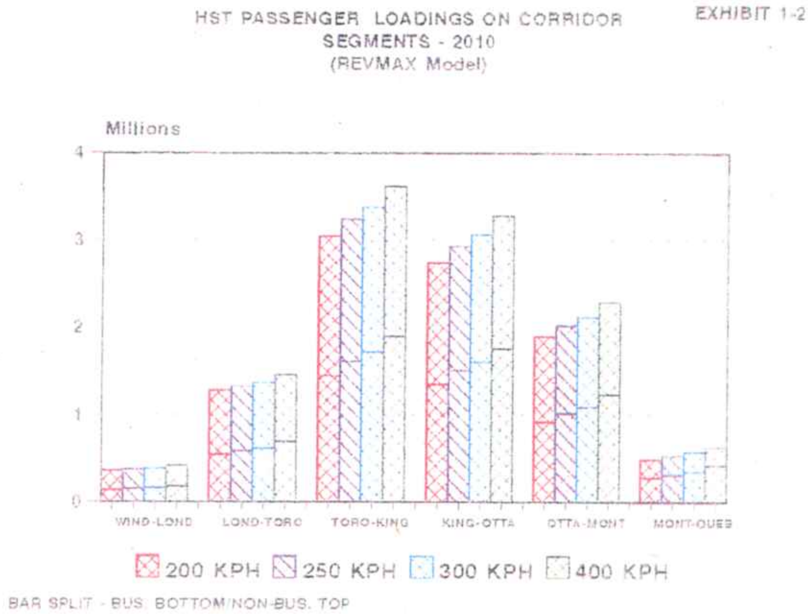
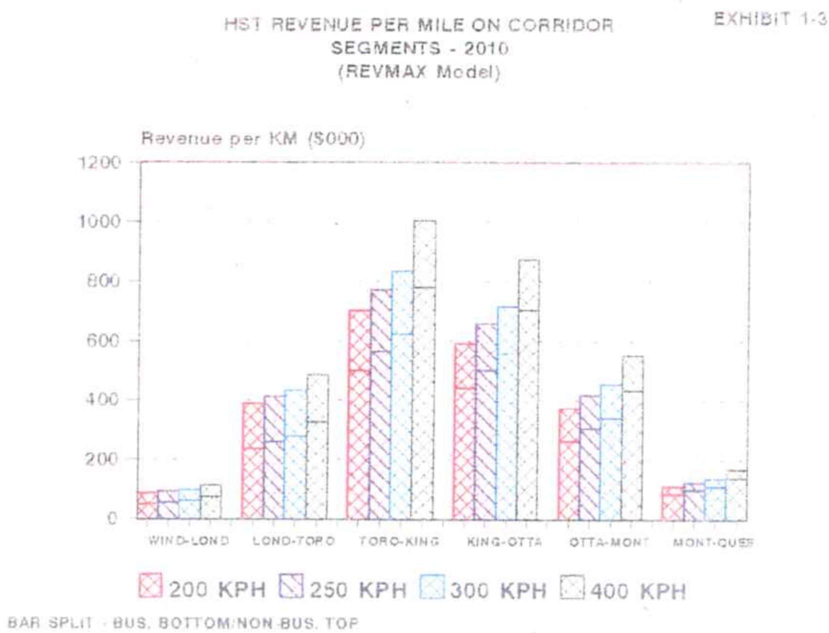


EXHIBIT 1 - 3



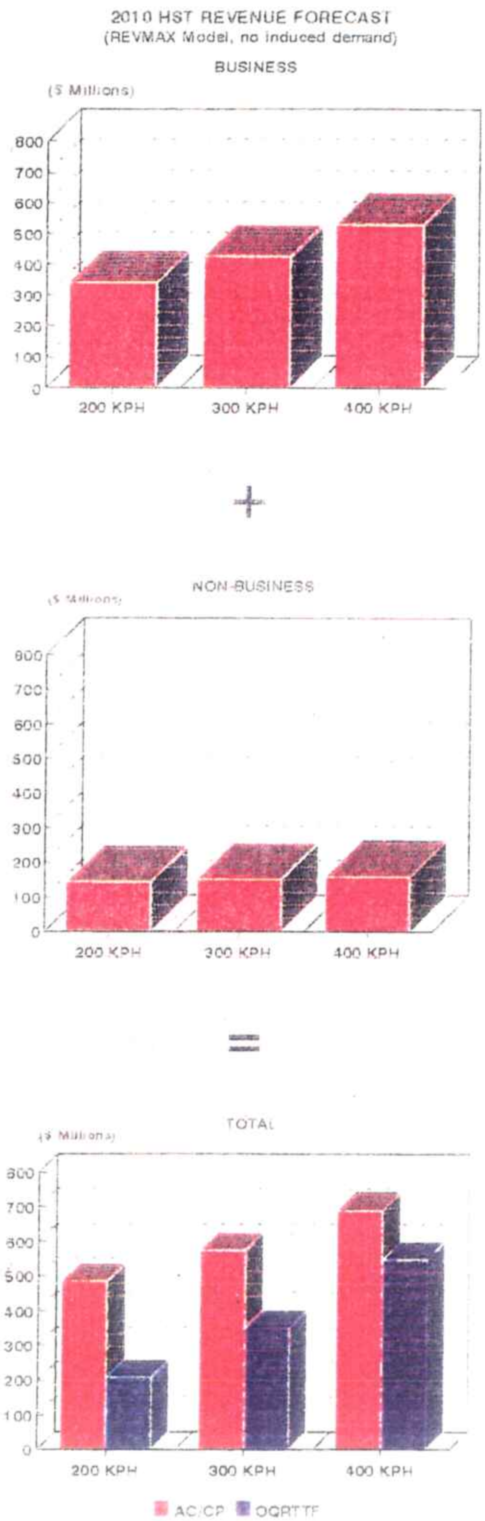
7. **<u>Bus carriers could benefit from HST if HST fares were set to generate the highest revenues, which would imply a higher average fare</u>**. This would encourage price sensitive passengers on conventional rail service to switch to bus rather than **HST**. For example, the REVMAX 300 kph forecast indicates a 25% **increase** in bus ridership if **HST** service were introduced at fares averaging 80% to 100% of airfare. At lower **HST** fare levels, more existing rail travellers would choose **HST** rather than bus, thereby reducing the bus ridership growth.

The revenue opportunity for **HST**, based on the REVMAX demand forecasts and related pricing assumptions, is summarized in Exhibit 1-4. The forecasting technique used in this projection generated a revenue forecast for each origin-destination pair on the network - over 400 individual routes - by finding the price and ridership combination that maximized **HST** revenues. **For the majority of O - D combinations, the revenue maximizing HST fare was between 80% and 100% of the comparable air fare for that route, a price positioning for HST that would be considerably higher than was used by the OQRTTF**. This approach resulted in a significantly higher revenue opportunity than was found in that study - $575 million at 300 kph versus $350 million. By assuming a fixed fare structure at a lower level, i.e. 60% of air fare for business travellers and 50% of air fare for non-business, revenue declines by 13% but ridership increases by 30% to over 7.5 million.

Although the linear logit demand model formulation used in this project is widely accepted, the Project Team found that a linear model could not be fully responsive to key parameters such as travel time and fares. A companion study using a non-linear modelling technique, known as Box-Cox Logit, was commissioned, the results of which are reported separately in this document. The Box-Cox versus linear model comparisons suggest that higher ridership levels than forecast here are achievable, but at lower average fares and, consequently, with lower total revenues. The overall conclusions are not changed by adopting this alternative approach.

HST would offer many logistical and operational challenges, both in designing and building the system and in serving the diverse range of passenger needs in the market. **HST** customer service and fares would more closely resemble air than today's conventional rail for business travellers, yet would mirror traditional rail service for leisure and less-time-sensitive travellers. Stations would be more conveniently located and accessible than airport terminals, typically closer to the city centres. The number of stations on the **HST** network and the specific routing of the system would likely be linked

EXHIBIT 1 - 4


2010 HST REVENUE FORECAST
(REVMAX Model, no induced demand)
BUSINESS
($ Millions)
800
700
600
500
400
300
200
100
0
200 KPH
300 KPH
400 KPH
+
NON-BUSINESS
($ Millions)
800
700
600
500
400
300
200
100
0
200 KPH
300 KPH
400 KPH
=
TOTAL
($ Millions)
800
700
600
500
400
300
200
100
0
200 KPH
300 KPH
400 KPH
AC/CP
OQRTTF

to the speed of service selected. For example, lower speed **HST** service could have more stops and offer increased access at intermediate locations, which could influence routing, particularly west of Toronto. There could be **HST** airport terminals in Toronto and/or Montreal, although costs, passenger volumes, and access considerations could ultimately limit the "seamless modal connection" concept. Scheduling would call for high frequencies, with hourly and half-hourly departures at daily peak periods.

The findings from this market study point to lower speed solutions on the Windsor to Quebec City corridor. The ongoing tri-government study will ascertain whether **HST** could bring economic and social benefits that would justify government support, and will recommend whether and how to proceed. Significant government financial involvement would create many complexities in transportation policy, particularly vis a vis modal equity and open market competition. Both Air Canada and CP Rail System should remain actively engaged in the process of studying this important new concept to ensure that the interests of their shareholders and the Canadian travelling public are well served.

2. PROJECT SCOPE AND APPROACH

The joint Steering Committee provided the framework for directing project activities, and specified a set of end results that were expected. Gaining an understanding of consumer behaviour, attitudes and motivations was considered to be of paramount importance in the project design. Demand estimation was to be based on the consumer research, not simply extrapolation of historical travel patterns. The split of the project's budget (2/3 on consumer research and 1/3 on demand estimation) reflected this emphasis.

It is important to note that the project's scope did not include evaluation of the commercial feasibility of **HST**, potential profitability of the system, capital requirements, or potential returns on capital. The study also did not evaluate the impact on competing modes or the behaviour of competing carriers in response to the introduction of **HST.**

It was planned from the outset that specialized contractors would be retained to lead the consumer research and demand estimation components of the project, considering the specialized knowledge and expertise required in these fields. While the project budget did not necessarily support the generation of "investment quality" forecasts, the clear goal was to develop analytically rigorous and defensible forecasts with a sound methodological base. A comprehensive qualification and selection process was applied in selecting the prime research contractors. The four independent contractors selected were: Traveldata International and Resource Systems Group for consumer research and traveller mode choice behaviour analysis, and Wilbur Smith Associates and Dr. Richard Laferriere for demand estimation and analysis.

Another important dimension to the project was to develop a qualitative sense of the **HST** "product", in addition to the quantitative views on the future. How might consumers perceive **HST**, and how would they use it? What passenger processing considerations might dictate future operational strategies for the **HST** operator? How could technological change influence **HST** service? How would the **HST** network be structured in terms of frequency of service, routing, station locations and local access/egress? These remaining work elements were led by internal Air Canada and CP Rail System personnel, working under the guidance of the Project Manager and Project Leaders.

A brief overview of the five major blocks of activity:

1. **Consumer Research.** The consumer research programme combined focus groups, a telephone survey of 1500 households, and a computer mode choice simulation of over 400 respondents, including 200 air travellers intercepted at Pearson and Dorval airport terminals. Each research component fed into the next, with the focus groups contributing to the design of the telephone survey, which in turn contributed to shaping the Interactive Video Interview Station (IVIS) computer simulation. The IVIS research was the first such implementation in North America - an innovation that yielded rich insights into consumer behaviour. Traveldata International (TDI) and Resource Systems Group (RSG) conducted the consumer research components of the study.

2. **Demand Estimation.** Forecasts of future demand were compiled using widely accepted forecasting methodologies and techniques. This effort involved the compilation of origin-destination "trip tables" that estimate current travel patterns, development of a forecasting model, and estimation of mode choice algorithms for the purpose of projecting mode shares in the future. Wilbur Smith Associates (WSA) acted as the prime demand estimation contractor, with support from Resource Systems Group.

   Dr. Richard Laferriere of the Centre de recherche sur les transports (crt) de l'Université de Montréal examined non-linearity in demand forecasting using a specialized technique developed at that centre.

3. **Supply Definition.** The **HST** "product" has many facets, and the project was designed to examine **HST** in sufficient detail to highlight the key attributes that would shape future consumer acceptance and demand. These factors included such issues as fares, scheduling, routing and station locations, customer service and strategic alliances.

4. **Demand Factors.** Several key considerations in demand forecasting extend beyond the core demand modelling effort, including such issues as induced demand, freight revenues and the impact of "macro-factors" such as political, social and economic forces. These were analyzed qualitatively.

5. **Market Assessment.** The fifth Work Module was created as a mechanism for synthesizing the outputs from the other four, leading to the preparation of this Final Summary Report.

The project was launched during the summer months of 1991. The field research, analysis and reporting was completed by the end of March 1992. The remainder of the project entailed extensive demand modelling and revenue estimation activities, which required an iterative process of testing, revision and review of alternative modelling approaches, data sets, and assumptions. First rounds of demand model output were completed by the end of March 1992, with subsequent refinements and documentation occupying the balance of the project timetable.

The forecasts presented have been thoroughly reviewed and tested, and are defensible in relation to the underlying data and assumptions applied. Many sources of variability are inherent in the modelling techniques, consumer research, source data, and assumptions used, the combination of which makes the forecasts subject to uncertainty. Furthermore, many factors such as lifestyle trends, socio-political shifts, demographics and population redistribution can produce profound changes in travel patterns over a 20 year period - the timeframe of our forecasts - that cannot be predicted with any validity.

Our conclusions include observations on actions that could be taken to improve the predictive ability of the forecasts, should the Sponsors decide to conduct further research.

3. ANALYSIS OF CONSUMER TRAVEL BEHAVIOUR

A key objective of the **HST** project was to gain insight into the behaviour of travel consumers, using a balanced and cost-effective research design. The Project Team issued a Request for Proposals during the summer of 1991 and reviewed submissions from over 10 potential research contractors. Many different concepts for consumer research were proposed, including mail-back questionnaires, telephone surveys, focus groups, in-home personal interviews, and computer-based simulations. The ultimate consumer research design merged proposals from Traveldata International and Resource Systems Group (acting as a sub-contractor to Wilbur Smith Associates). This approach combined focus groups, a telephone survey, and a computer simulation, with each of the three elements contributing a different and valuable component of the overall programme. In particular, the use of computing technology offered a research design innovation that enabled our project to explore consumer behaviour and travel decision intentions.

The consumer research yielded results in four key areas: profile of current travel behaviour; segmentation of consumers; analysis of travel benefits; and, consumer mode choice behaviour. Each will be reviewed separately in this section of the document.

3.1 Current Travel Behaviour

The telephone survey gathered information for 1500 respondents on both their most recent 12 months' travel history and details of the most recent trip taken. The sample design ensured balanced representation along the full Windsor-to-Quebec corridor, and across key demographic factors such as age, income, occupation and sex.

Key findings included:

- **Travel Incidence.** 24% of households took at least one intercity trip of greater than 100 km on the corridor in the most recent 12 month period. The average number of trips was 7 for each individual. Males travelled **twice** as frequently as females. Individuals for whom their most recent trip was for a business purpose travelled **twice** as often as the average.

- **Trip Purpose.** Business trips represented 40% of the total trips taken in the last 12 months. Of these trips, over 25% were by air and 60% by automobile. Non-business trips were 55% of the total, with 85% of these trips being by private automobile. Trips with a combined business and non-business purpose represented 5% of total trips, with the personal automobile being the mode of travel for over 80% of these trips.

  Of the most recent trips, 74% were for **non-business** purposes and had an average duration of 4.4 days. 19% of the recent trips were for **business** and lasted, on average, 3.2 days. 7% of most recent trips were for **combined business and non-business** purposes and lasted the same average duration as the non-business trips - 4.4 days.

- **Mode of Travel.** Aggregating the last 12 months' trips by mode, the personal auto was the primary means of transport for 75% of trips, while air was used in 14%, rail in 5% and bus in 4%. Rental cars were used for the balance of 2% of intercity trips. These mode shares are in line with findings from other research projects, including the OQRTTF.

- **Occupation.** Professional, managerial and sales occupations exhibited the highest propensity to travel, with roughly 9 to 10 trips annually, while individuals not in the work force travelled only 5 times annually.

- **Expenditure.** Combined business and non-business trips had the highest average total expenditure of $629, while business trips incurred $458 and non-business incurred $374. Auto travel had the lowest incurred cost, which was further reinforced by the high incidence of multiple travellers using the same vehicle.

- **Trip Characteristics.** Several interesting findings emerged that rounded out the research profile of intercity travellers:

  * Business trips were dominantly weekday travel - over 80% - while non-business trips were over 60% weekend travel.

  * Over 90% of business trips were individuals travelling alone, while over 60% of non-business trips were in parties of 2 or more.

* 70% of auto travellers stated that they needed their vehicle at the destination for that trip.

* Access and egress time was a significant component of overall trip time, particularly for air travellers, who, on average, spent only 1/3 of total trip time actually on board the airplane.

These travel behaviour findings were largely consistent with results from other studies, with some minor exceptions that can be attributed to sampling distortions. The most significant insights were the major differences in profile between business and non-business trip purposes, the existence of a differentiated segment of "combined" trip purposes with a distinctive profile, and the loyalty of auto travellers to their chosen mode of transport.

3.2 Consumer Segmentation

The 1500 telephone survey respondents were asked a number of questions about their lifestyle and demographics in order to construct a segmentation profile. This data was analyzed using factor and cluster analysis techniques to provide a means of grouping together segments of travellers based on common attitudes, behaviours and lifestyles. The five factors used were: extravagance, desire to remain close to home, budget and health consciousness, active leadership, and contemporary business orientation.

The analysis yielded six distinct lifestyle segments. These are summarized and profiled in Exhibit 3-1. As shown, Independent Traditionalists and Big Spenders attach the highest priority to service and are less price sensitive than most travellers. Big Spenders, however, do pay attention to cost more than the Independent Traditionalists. Budget Conscious, Beaten Path Followers, and Passive Travellers all exhibit high sensitivity to price, and look for the best value in travel as opposed to the best service. Reluctant Travellers are typically older males on business trips, and use the air mode most often.

CONSUMER SEGMENTATION PROFILE

	BIG SPENDERS	RELUCTANT TRAVELLERS	INDEPENDENT TRADITIONALISTS	BUDGET CONSCIOUS	PASSIVE TRAVELLERS	BEATEN PATH FOLLOWERS
% OF RESPONDENTS	27 %	14 %	11 %	19 %	16 %	11 %
AGE	Younger	Older	Younger	Younger	Older	Younger
SEX		Male	Male		Female	Male
INCOME	Higher		Higher		Lower	Lower
OCCUPATION	Professional	Non-Managerial	Professional/Managerial			
USUAL TRIP PURPOSE		Business	Business		Non-Business	
USUAL MODE		Air	Air	Auto	Auto	
FREQUENCY OF TRAVEL			Frequent		Infrequent	

KEY TARGET SEGMENTS FOR HST

Note: Blank = No statistically significant bias on identified factor.

EXHIBIT 3 - 1

Positively for **HST**, the Big Spenders, Reluctant Travellers, and Independent Traditionalists, who would likely see the most value in a high speed surface transport mode, represent over 50% of the consumer population and are heavy travellers as well. Less positively, the remaining three segments would be resistant to higher fares for **HST** relative to current rail fares, and would remain loyal to the automobile as a low cost and flexible mode of transportation.

Considering the importance of consumer perception in shaping mode choice, further examination of these consumer segments could yield valuable insights. To the extent that the keys to developing a positive image for **HST** could be identified through segmentation analysis, higher expectations could be set for ridership and revenue in the future.

3.3 Analysis of Travel Benefits

Travellers have different needs and priorities, depending on their individual preferences and their purpose in travelling. They also have different perceptions about how the various modes of transportation will meet their needs. These factors combine to shape mode choice. The telephone survey posed numerous questions relating to these issues and provided insights into consumer benefit priorities among the sample population.

Business and non-business trip purposes exhibit quite different benefits profiles. Using a factor analysis scale to rank and measure importance, the following results were revealed:

TRAVEL BENEFITS FACTOR ANALYSIS

(SCALE = 1 to 10)

BUSINESS		NON-BUSINESS	
FACTOR	**SCORE**	**FACTOR**	**SCORE**
On-time performance	8.1	Cost & performance	7.3
Scheduling & organization	5.4	Meals	5.9
Meals & services	5.1	Scheduling & organization	4.4
Cost	5.1	Other services	2.9

The preferences of the Business Traveller clearly tend toward efficient use of time, and reinforce the importance of reliability, frequency, and accessibility of service to the time-sensitive traveller. Non-Business Travellers attach higher importance to amenities and cost.

The degree to which the competing modes deliver successfully against these needs varied in the eyes of the survey population. Air was perceived as fast, but stressful and complicated, with little in the way of amenities or services. Rail was seen as easy to access and more leisurely. Bus was seen as low cost and easy to access, but with less service than any other public mode. The auto offered control, flexibility, privacy and low cost.

3.4 Consumer Response to HST

Response to **HST** was gauged in two ways: focus groups, which measured reactions to **HST** in an unstructured and qualitative manner, and the "IVIS" (Interactive Video Interview Station) computer simulation, which provided measurable data on consumer "stated preferences" in response to a mode choice situation in which **HST** was offered as an alternative to the mode of transportation chosen on the most recent intercity trip taken on the corridor.

The Focus Groups revealed, first and foremost, that most consumers are not knowledgeable about **HST**. There is little known about the concept beyond a vague linkage to the TGV in France or the "bullet train" in Japan. The idea was appealing due to its novelty, but price resistance was apparent. Most participants stated that they could not see themselves paying more than 60% of the comparable air fare for **HST** - an intuitive response that needs further testing before **HST** pricing strategy could be determined. Dissatisfaction with current rail service was noted as a major perception problem that **HST** would need to overcome in order to build sustained ridership.

The IVIS research was designed to gather "stated preference" data on consumer mode choice intentions, as well as "revealed preference" data from actual travel patterns. Furthermore, the research was specifically aimed at understanding how consumers make trade-offs among important attributes of travel that shape their decision. Prime attributes that were tested were travel time, fares, frequency of service, and on-time performance. The computer-based implementation also provided insights into less top-of-mind issues such as access and egress time in relation to the length of trip and the linkages between demographic variables and travel behaviour.

The IVIS trade-off situations were simulated by asking participants, first of all, to reconstruct their most recent corridor trip, including all relevant information about time, cost and geographic origin and destination. They were then asked to consider a similar future trip and to choose between the travel option they had used and an alternative means of travel that was presented as a package of mode, travel time, fare etc. Exhibit 3 - 2 illustrates the visual format presented to the respondent on the video screen, providing an easy-to-follow procedure for setting up the mode choice simulation.

Air travellers were presented with **HST** as the alternative mode; other respondents were presented with the **HST** option and at least one mode other than the one they had used for the trip being studied. Respondents were given a series of choice situations, each involving a different combination of the key attributes, thereby yielding measurable data as to the impact of the different factors on their ultimate decision.

The key feature of the computer-based implementation was the power to force the respondent to make a mode choice decision by making the alternative progressively more attractive until the mode switching point was reached. This capability yielded much more powerful insights into consumer stated preferences than would be achievable in traditional consumer research designs.

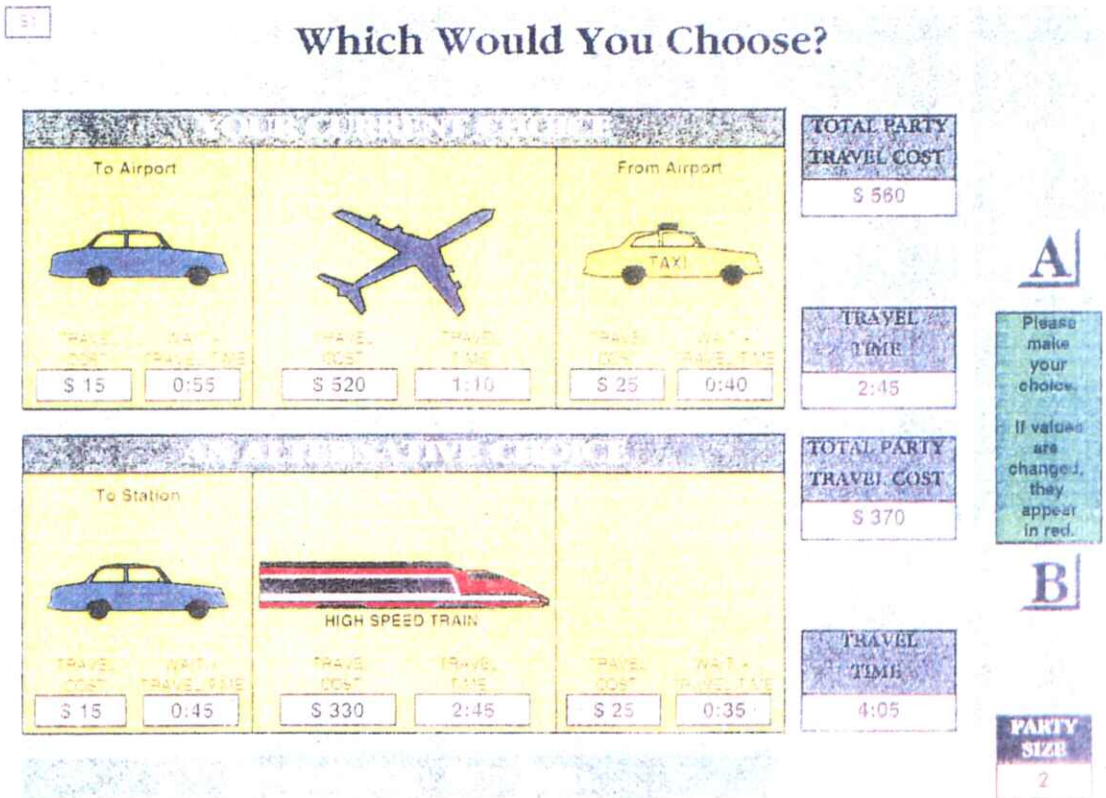
Highlights of the IVIS findings included:

1. Strong differences exist in the relative importance of service variables between business and non-business trip purposes. For example, the "value of time" (VOT), a measure of what a traveller would be willing to pay to save a unit of time, is three times higher for a business trip than a non-business trip for individuals with the same income level.

2. Value of time is related to income, with higher income earners attaching a higher value to their time. This compounds the effect of the distinction between business and non-business trip purposes, because business travellers have an average income of $60,000 while non-business travellers have an average income of $40,000. Corporate travel policies may blur the impact of income on mode choice for business trips, but the basic

EXHIBIT 3 - 2

IVIS VISUAL FORMAT



IVIS PROCEDURE:

1. Respondent reconstructs latest trip.
2. System provides modal options briefing presentation.
3. System presents series of modal alternatives combining different travel costs, times and modes (up to 27 choice situations).
4. Respondent chooses A or B for each alternative.
5. System requests demographic profile data.

distinction between business and non-business trips still applies.

3. Combining the differentials due to trip purpose and income, the value of time for business trips was calculated as $80/hour and for non-business trips as $15/hour. This makes business travellers, on average, much more sensitive to travel time than non-business travellers, and much more willing to pay a higher fare for reduced travel time. Conversely, non-business travellers reflect a markedly lower willingness to pay for higher speed.

   If the effect of income is not reflected in value of time, VOT is $73/hour for business and $6/hour for non-business trips.

   The calculated VOT for non-business trips approximates the median for other comparable studies; the VOT for business trips is higher than previously found.

4. For combined business/non-business trip purposes, which were 9% of the IVIS survey sample and 7% of the telephone survey sample, the attitude toward value of time was much closer to the non-business level than the business level. This increases the proportion of price-sensitive travellers in relation to a sample that only considers the traditional business vs. non-business trip purpose segmentation.

5. Propensity of travellers to switch from another mode of transport to **HST** is affected by many variables beyond price and time, including the following observations from the IVIS research:

   - Individuals taking longer trips, greater than 400 km, are significantly **more** likely to consider **HST** than those taking shorter trips under 200 km

   - Older travellers are **less** likely to switch to **HST**

   - Individuals with more education are **more** likely to switch to **HST**

   - Individuals travelling alone are **more** likely to choose **HST**

- Business travellers are **more** likely to select **HST** than non-business travellers

6. Survey respondents did not consider access and egress time to be equivalent to major mode travel time. For business travellers, access/egress time was considered more onerous than major mode time for short trips (<300 km), while for longer trips (>300 km) it was less onerous.

7. Frequency of service was important to business travellers but had no measurable impact on non-business travellers.

8. Of the auto travellers surveyed, almost 60% indicated that they would not use high speed trains for their most recent intercity trip, even at extremely low fares and with speeds equivalent to mag-lev service.

9. Air travellers were receptive to **HST**, with less than 15% finding **HST** unsuitable. Over 50% of air traveller respondents indicated that they would choose **HST** for their next similar trip if it were 300kph service priced at 60-80% of airfare.

Taken together, these findings indicate that **HST** would compete against different modal alternatives depending on the trip purpose. For business travellers, **HST** would compete primarily against air travel, and indirectly against auto and bus. For non-business trips, **HST** would compete directly against auto, and selectively against air. The impact of frequent flyer programmes in establishing mode loyalty and retention of passengers was not studied in this analysis, but would likely be a significant element of the competitive dynamics in the marketplace.

The study findings indicate a greater distinction in price sensitivity between business and non-business trip purposes than has been found in other research. This could be due to the combined effect of defining the "combined business/non-business" trip purpose category and the more explicit treatment of income differentials in measuring mode choice behaviour, both of which will tend to amplify the differences between business and non-business travellers. The results also confirm the difficulties that could be expected in attracting auto travellers to use **HST** - they value the personal auto and would not pay for the additional speed that **HST** offers relative to conventional rail service.

*   *   *

The consumer research findings brought an added dimension of reality to the **HST** project, taking the forecasts of future demand out of the realm of statistics and computers and into the minds of the travelling public. Some key findings bode well for **HST**: the appeal to the business traveller; the ability to attract different consumer segments; the opportunity for market share growth through reshaping consumer perception. Equally, though, the resistance of non-business travellers to higher fares and consumer loyalty to the automobile are reminders of the challenges awaiting **HST** in the marketplace.

4. TRAVEL DEMAND & REVENUE FORECASTS

Although consumer research was the prime focus of the project and the major budgetary component, generation of demand and revenue forecasts was the other top priority. The demand and revenue estimation methodology is outlined in section 4.1, followed by analysis of the results in section 4.2. The balance of section 4 deals with comparison of our results to the OQRTTF and the implications of our research findings for air travel on the corridor.

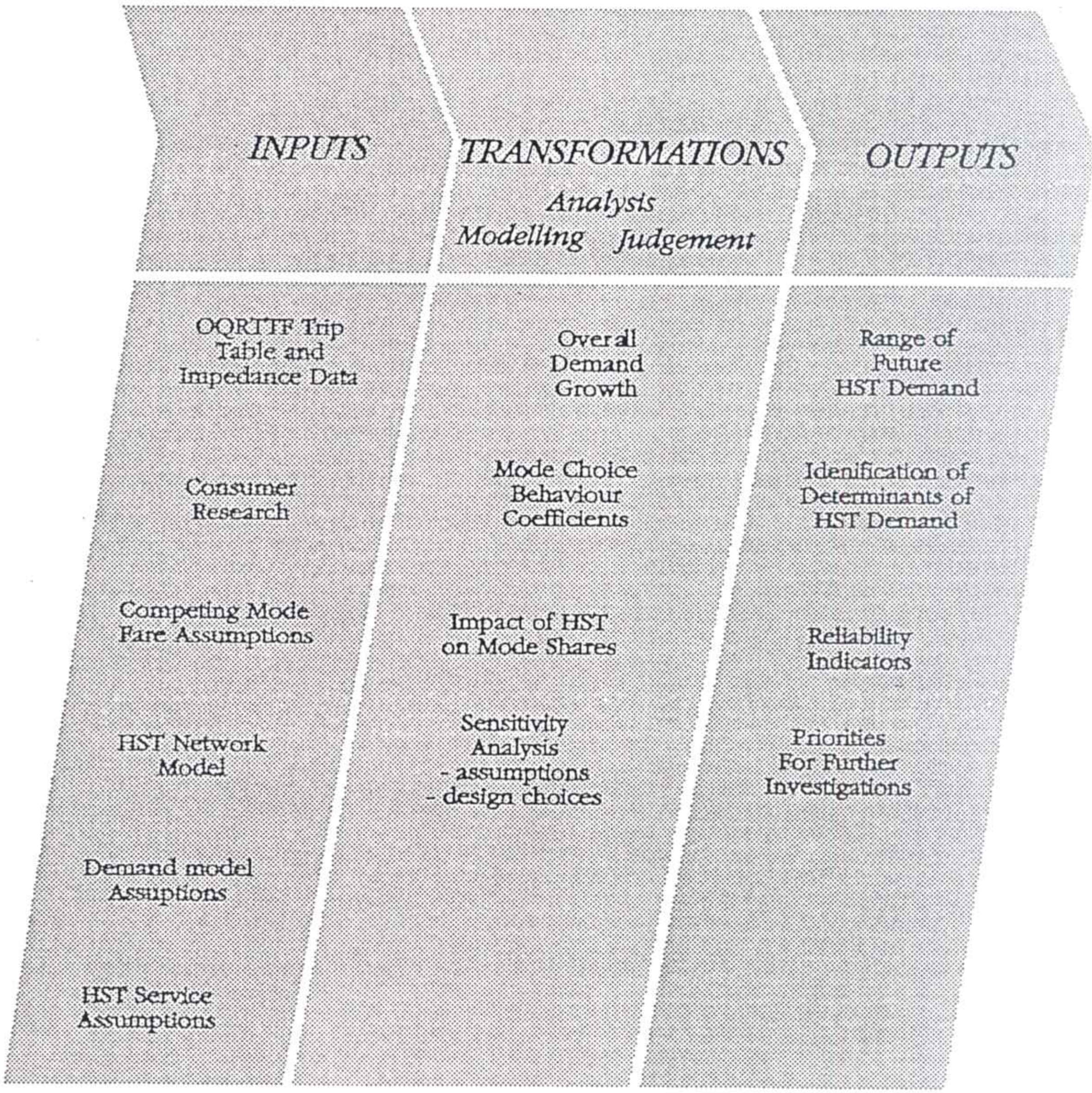
4.1 Methodology

The overall approach taken to demand estimation is summarized graphically in Exhibit 4 - 1. Inputs to the process included data compiled from previous studies, findings from the consumer research described in the previous section, and a range of forecasting assumptions and model design choices made by the project team. The transformation process involved statistical modelling, based on widely accepted procedures and techniques, and sensitivity analysis to identify the impact of assumptions and model design choices on the results derived. Finally, outputs included not only forecasts of the future but also insights into the demand estimation process that will be useful in evaluating the degree of accuracy we can attach to the results and in directing any future research activities.

The travel database used by the Ontario-Quebec Rapid Train Task Force (OQRTTF), which was based on a survey of travel by mode among 136 geographic origin-destination "zones" along the corridor, was made available to our project courtesy of the OQRTTF and VIA Rail. The original database had been commissioned by VIA Rail in 1987 and updated by the OQRTTF consultants in 1989, and represented the most comprehensive survey data available for the corridor. This "trip table" served as the starting point for estimating future demand, providing a profile of passenger movements by mode of travel that could be projected forward into the future. Additionally, the database contained "impedance" data covering variables such as travel time, cost, and fares by mode that were used in generating forecasting models. Although this database has known limitations, our judgment was that launching our own field research could not be achieved within realistic budget guidelines, and that our demand estimates would still be the most advanced available until the new tri-government study updated

EXHIBIT 4 - 1

HST DEMAND ESTIMATION PROCESS



the trip table information with more recent surveys of actual travel behaviour (This study is now expected to be completed by late 1993).

The project team chose to use a two-stage forecasting methodology, similar again to the OQRTTF, involving estimation of overall demand growth followed by estimation of mode shares, both with and without the new **HST** service. The year 2010 was selected as the base year for forecasting, based on the assumption that the **HST** system would have matured by that point in time such that passenger volumes would have stabilized at their ongoing levels.

After reviewing and testing the assumptions of future transportation demand growth that had been used by the OQRTTF, it was decided to adopt their forecasts of underlying demand through to 2010 without substantial modification. The major determinants of demand growth were forecasts of population, employment and income for the major centres of population on the corridor, assuming no new modes of travel on the corridor. These forecasts predicted an assumed growth of roughly 25% in overall intercity trip making from the current time to 2010, representing a compound annual growth rate of roughly 1.25%.

The ridership projections by mode, introducing the **HST** alternative, involved sophisticated analytical and statistical techniques, combining development of a mode choice model with a demand forecasting "engine" to generate the detailed forecasts of travel by individual origin-destination pair. This modelling process involved numerous judgments: estimated fares for all public modes and costs of auto travel; travel times on all possible routings; access and egress times and costs; station locations for all competing modes; layout of a proposed **HST** network, including the number (19) and location of stations by zone, etc.

There was also judgment involved in the specification of the mode choice model structure to ensure that the mathematical model, which was based on the widely accepted multinominal logit formulation, closely replicated traveller decision behaviour. First of all, the differences in mode choice behaviour between business and non-business trip purposes needed to be recognized, resulting in different models for each. Secondly, the most appropriate "nesting" structure for the model needed to be selected, to set-up appropriate comparisons in the traveller's decision-making process. For the business model, air and **HST** were compared against a composite "slow" mode that combined auto, rail and bus; for the non-business model, auto was not combined with the "slow" modes, considering its more prominent positioning in the minds of non-business travellers as they make mode choice decisions.

The two nesting structures are depicted graphically in Exhibit 4 - 2. This nested logit structure differed from the OQRTTF approach, which used a non-nested logit formulation. It is worth noting that a study of alternative mode choice model structures, recently released from Northwestern University, recommended our approach in a completely independent research effort. That study also validated the approaches used here with respect to the impact of income on value of time and the impact of trip length on the importance of access/egress time.

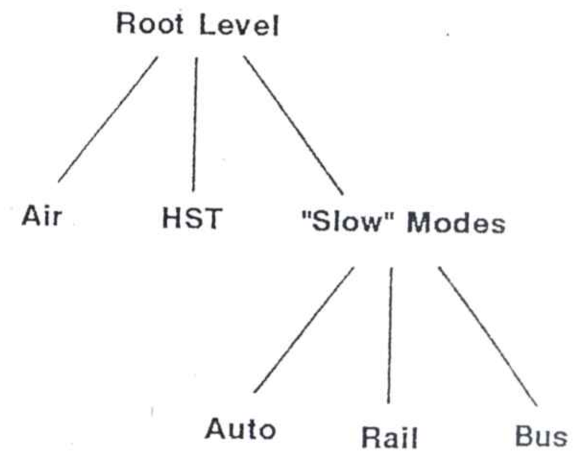
A further set of refinements was made to the trip table database in order to provide a more detailed basis for the modelling activities. These changes resulted in a trip table with 19 geographic sectors, rather than the 10 "super-zones" that had been used in the OQRTTF work. The network was also divided into three geographic segments - west of Toronto, east of Ottawa, and all other trips - to enhance the estimating ability of the model through calibration. We believe that this added precision has improved the reliability of the forecasting results.

Having made all of these judgments, the model was set up to maximize HST revenue on each origin-destination combination on the network by finding the price level that generated the highest-revenue-producing combination of ridership and fare. This process was repeated for each of the four speed levels defined - 200 kph, 250 kph, 300 kph, and 400 kph - for each of business and non-business trip purposes. To illustrate, Exhibits 4 - 3 and 4 - 4 show the ridership and revenue curves for the Toronto-Montreal origin-destination combination for both the business and non-business models. The aggregated system-wide forecasts use the indicated ridership and fare combination that achieves the maximum revenue for each route.

Beyond the model design issues described above, the project team encountered six specific areas of design judgement that posed challenges in estimating future demand. The combination of uncertainties introduced by these design issues caused us to adopt a "range of demand" approach to the estimation of future ridership. Both aggressive and conservative assumptions were chosen for each of the factors, allowing the project team to reach a consensus on the design parameter selection after reviewing and understanding the impact of the various assumptions on the end result.

EXHIBIT 4 - 2

BUSINESS MODEL STRUCTURE



NON-BUSINESS MODEL STRUCTURE

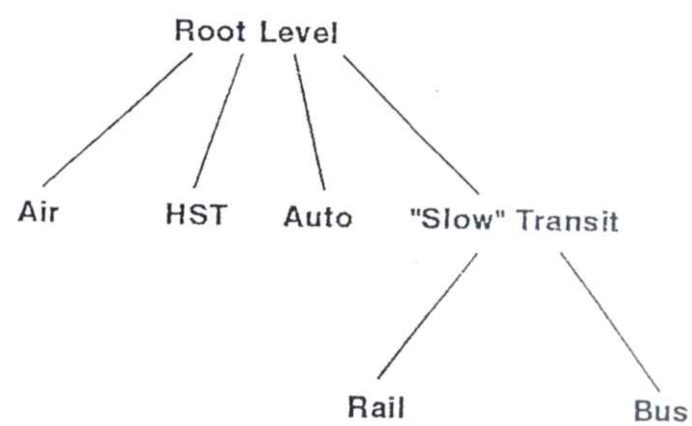
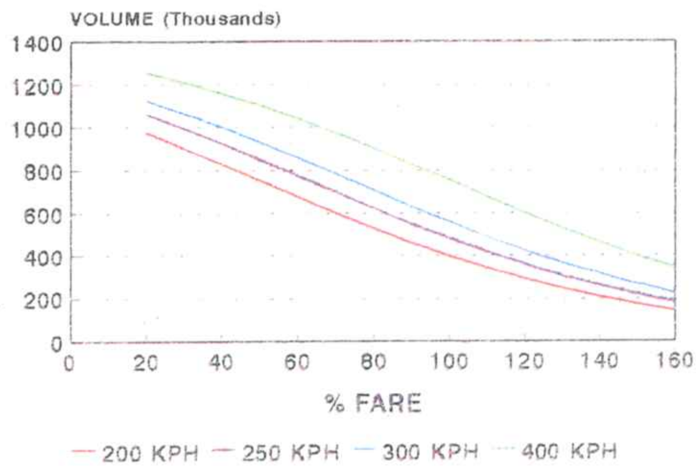
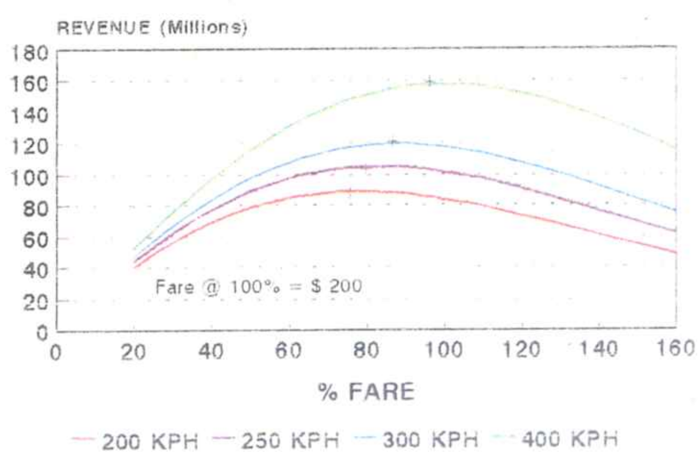


EXHIBIT 4 - 3

TORONTO - MONTREAL
BUSINESS



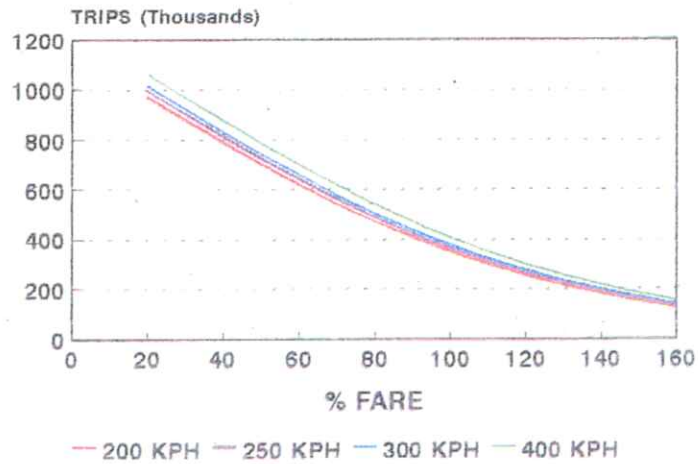
TORONTO - MONTREAL
BUSINESS



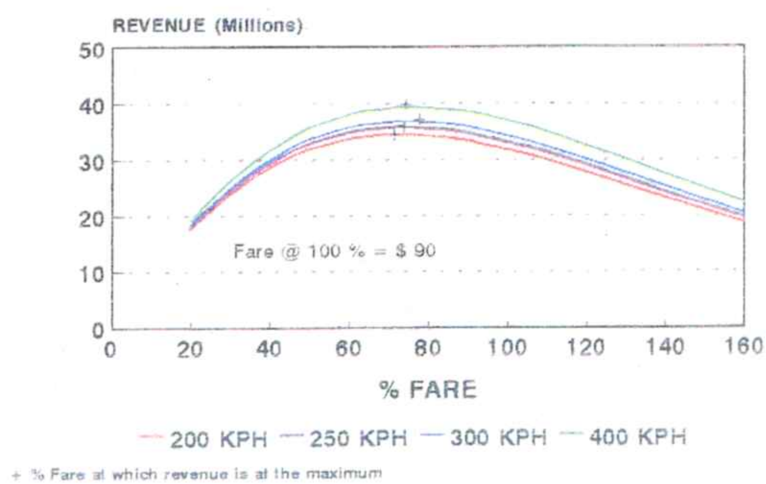
+ % Fare at which revenue is at the maximum

EXHIBIT 4 - 4

TORONTO - MONTREAL
NON-BUSINESS



TORONTO - MONTREAL
NON-BUSINESS



To summarize the six issues, and the assumptions we have used for each:

- **Reduced versus Full Trip Table.** In theory, the demand forecasting technique should screen out any trips that are not practical for **HST** travel, for example, very short distance trips or trips between zones that are remote to the **HST** line where the direct point-to-point auto distance would be less than the distance to and from the nearest **HST** terminal. As a test, a reduced trip table was developed by eliminating an identified group of these trips from the overall market for all modes of travel, which produced a reduction of over 50 million annual trips in 2010 - from roughly 122 million to 69 million. The vast majority of the trips eliminated were short distance auto trips between contiguous zones.

  After reviewing the demand model results for both the full and reduced trip tables, the project team felt that the full trip table possibly overstated demand, but the reduced trip table almost certainly understated demand. On balance, the project team decided to use the full trip table as the closest estimate to the likely market size.

- **Income.** The income level of the traveller is well accepted as a key factor in travel behaviour, but capturing it in a reliable demand model remains a challenge. The OQRTTF database provided income codes for zones on the corridor, representing aggregated averages of the income of all residents in each zone. When this income co-efficient is used in the demand model, it increases ridership and revenues for **HST** and results in fewer Non-Business patrons and more Business patrons.

  Given the relatively crude measure being used for the Income code, which was limited by the availability of data in the OQRTTF tables, the project team was not prepared to defend the validity of a forecast generated using the income co-efficient. The "most likely" forecast, therefore, is based on a model without an income co-efficient.

- **Mode bias constant for HST.** This term is used to represent the aggregated impact on traveller behaviour of all factors not otherwise reflected in the model - in other words, the net perception or "bias" for or against a particular mode that cannot be explained by the variables such as travel time, cost, frequency etc. It is typical that bus has a highly negative bias constant due to the negative perceptions of the quality of the bus travel experience, while auto has a positive constant due to the qualitative advantages of flexibility, privacy etc. that a car provides. Rail and air can be either positive or negative depending on the general perception of the mode in that corridor.

When forecasting a new mode, model designers must choose how to set a mode constant for that new mode because there is no basis to do so from actual traveller experience. In comparable research projects, the **HST** mode bias constant has frequently been set equal to either air or conventional rail, or alternatively in between the two. In our calibrated demand model, however, rail had a strongly negative bias constant, approaching the negative bias of bus travel; this could have suppressed **HST** demand in the forecasting model to a degree that did not seem reasonable. Air seemed a plausible alternative for longer trips, but **HST** offers many positive attributes of the travel experience that could make the air bias constant overly negative with respect to **HST**.

The solution that was selected is a composite constant that captures the benefits of **HST** in relation to other modes based on the IVIS consumer research. The composite constant produces results that are "mid-range" for **HST** demand. A less negative mode bias constant would increase the **HST** ridership forecast, as discussed at the beginning of the report, while a more negative value would reduce demand.

- **Pivoting technique.** Unadjusted mode share output that is generated by the demand model, based on consumer stated preferences, is typically normalized to existing mode shares. This technique, known as pivot point estimation, reduces the impact of variances in the model's estimated mode shares and the base year mode shares for individual Origin-Destination pairs. The model can be set up for the pivoting to occur in a way that normalizes the **HST** share back to the share for conventional rail or for another mode such as air. Again, as for the trip table and income issues, neither answer is perfectly satisfactory, and each likely either overstates or understates the **HST** demand. It was decided to pivot on a combined air/rail share to minimize any distortions from this procedure.

- **Treatment of HST fares.** As mentioned previously, the REVMAX demand forecasting model optimized revenue on individual routes to derive the estimates of ridership and revenue. The optimization procedure treated fares as variable, thereby resulting potentially in a different fare for each route. This procedure yields a theoretically correct result, and provides a prediction of the highest probable revenue outcomes; however, it does not deal with the possibility of a fare structure that is established at a certain level that may not necessarily generate the maximum revenue. Lower fares could be set with the purpose of stimulating non-business ridership, for example.

  The project team chose to retain the revenue maximizing model as its prime methodology in order to assess the **HST** market opportunity without the distorting effect of differing pricing policies and yield management techniques, but did perform sensitivity analyses on lower fixed fares to measure the sensitivity of ridership and revenue to changes in fare structure.

- **Induced Demand.** Estimating the magnitude of incremental demand that is created through the introduction of a new transportation mode, over and above mode switching, continues to preoccupy researchers and theorists world-wide. The project team could not identify a reliable or proven means of estimating induced demand for this forecast. Wilbur Smith Associates stated their belief that induced demand would be modest for any **HST** service other than mag-lev, because the corridor is already well served and **HST** does not offer an entirely new level of service. After reviewing all factors, the project team accepted this assessment,and chose to present a forecast that does not include any provision for induced demand. It is, however, an important variable that deserves further study.

The foregoing discussion underscores the degree to which any demand forecast must be viewed in the context of its input assumptions. By flexing the six variables discussed above in various combinations, ridership and revenue estimates can be driven up or down, and the mix of demand shifted dramatically. The project team's REVMAX scenario presented in this document is based on: 1) full trip table; 2) no income code model; 3) composite **HST** bias constant; 4) combined air/rail pivot; 5) revenue maximizing fares; and, 6) no induced demand.

4.2 Demand and Revenue Forecasts

Exhibit 4 - 5 summarizes ridership results by mode and Exhibit 4 - 6 the **HST** revenue results from the REVMAX forecasting model.

The following points are of note in the forecasts:

- Business travellers patronize **HST** more than non-business travellers. **HST** attracts an 11 % share of business trips at 300 kph, yet only a 3 % share of non-business trips. As a result, there are projected to be virtually an equal number of business to non-business trips on **HST**, despite a 4:1 relationship in overall trips between the two in the market.

- Diversions of travellers from air to **HST** is very significant, especially for business purposes, with over a 45 % reduction in overall air mode trips and a 50% reduction in business air trips with the introduction of 300 kph **HST**. 50% of **HST** business travellers, and 28% of all **HST** travellers, would be diversions from air. (This estimate does not consider possible competitive responses from air carriers.)

- **HST** travel demand does not display significant elasticity to speed. Relative to the 300 kph scenario there is only a 7% increase in ridership accruing from the increased speed of 400 kph, and a 9% reduction for 200 kph service. Revenues change upward 20% and downward 16% on the same comparison.

- Auto diversions are less than 1% for all **HST** speed levels. **HST** does not appear to offer the price-benefit combination necessary to attract the auto traveller.

- Bus travel increases substantially - a 25% increase under all **HST** speed scenarios. The removal of conventional rail service and the introduction of a higher priced **HST** service with fewer station locations than existing VIA service combine to shift a large number of existing rail travellers towards the bus alternative. (As mentioned earlier, the higher **HST** fares in the REVMAX model are the primary cause of this shift.)

EXHIBIT 4-5

2010 DEMAND FORECAST BY MODE - REVMAX MODEL

(Millions of Trips)

	AUTO	BUS	AIR	RAIL	HST	TOTAL
BUSINESS						
AC/CP						
NO HST	22.37	0.16	2.89	0.74	0.00	26.16
200 KPH	21.89	0.15	1.64	0.00	2.47	26.15
250 KPH	21.78	0.15	1.53	0.00	2.70	26.16
300 KPH	21.69	0.15	1.45	0.00	2.87	26.16
400 KPH	21.47	0.14	1.34	0.00	3.21	26.16
OQRTTF						
200 KPH	22.00	0.18	2.06	0.00	2.02	26.26
300 KPH	21.33	0.17	1.85	0.00	3.52	26.87
400 KPH	20.40	0.15	1.75	0.00	5.62	27.92
NON-BUSINESS						
AC/CP						
NO HST	88.18	3.87	0.73	3.26	0.00	96.04
200 KPH	87.75	4.91	0.54	0.00	2.85	96.05
250 KPH	87.71	4.91	0.53	0.00	2.90	96.05
300 KPH	87.67	4.90	0.53	0.00	2.95	96.05
400 KPH	87.59	4.88	0.52	0.00	3.05	96.04
OQRTTF						
200 KPH	85.02	4.90	0.53	0.00	2.98	93.43
300 KPH	84.65	4.82	0.49	0.00	4.26	94.22
400 KPH	84.22	4.74	0.46	0.00	5.85	95.27
TOTAL						
AC/CP						
NO HST	110.56	4.03	3.62	4.00	0.00	122.21
200 KPH	109.64	5.06	2.18	0.00	5.32	122.20
250 KPH	109.49	5.05	2.06	0.00	5.60	122.20
300 KPH	109.35	5.04	1.98	0.00	5.83	122.20
400 KPH	109.06	5.03	1.86	0.00	6.26	122.21
OQRTTF						
NO HST	106.96	5.10	2.98	5.56	0.00	120.60
200 KPH	107.02	5.09	2.59	0.00	5.00	119.70
300 KPH	105.98	4.99	2.34	0.00	7.79	121.10
400 KPH	104.62	4.89	2.21	0.00	11.47	123.19

NOTE: *OQRTTF data includes induced demand*
AC/CP data excludes induced demand

EXHIBIT 4-6

2010 HST REVENUE FORECAST - REVMAX MODEL
($ millions)

FULL NETWORK

REVMAX(1992$)	200 KPH	250 KPH	300 KPH	400 KPH
BUSINESS	$340.1	$384.9	$424.2	$530.0
NON-BUSINESS	144.6	148.3	151.4	159.6
TOTAL	$484.7	$533.2	$575.6	$689.6
OQRTTF TOTAL (1987$)	$208.0	N/A	$350.3	$547.0

BY TRIP LENGTH

	200 KPH	250 KPH	300 KPH	400 KPH
BUSINESS				
< 100 km	$ 11.3	$ 11.6	$ 11.9	$ 12.5
100-200 km	38.8	41.5	43.8	49.4
200-300 km	41.6	46.2	50.1	60.7
300-400 km	72.9	80.4	87.4	105.4
400-500 km	48.4	54.4	59.4	73.0
500-600 km	100.4	118.4	134.2	177.9
> 600 km	26.7	32.4	37.4	51.1
NON-BUSINESS				
< 100 km	$ 8.3	$ 8.3	$ 8.4	$ 8.5
100-200 km	23.4	23.7	24.0	24.6
200-300 km	24.3	24.7	25.1	26.1
300-400 km	25.8	26.4	27.1	28.5
400-500 km	12.2	12.6	13.0	13.8
500-600 km	36.6	37.9	38.9	41.5
> 600 km	14.0	14.7	14.9	16.6

- Almost 50% of total **HST** revenues arise from business trips of 300 km to 600 km in length - clearly the core target market for this service.

Exhibit 4 - 7 portrays the relative mode shares by length of trip. It first highlights the decline in market share for the automobile as trip length increases. The lower chart shows the natural competitiveness of **HST** and air, particularly for longer trips.

The revenue forecast includes only passenger ticketing revenues. The project scope also included examinations of ancillary revenue potential from activities such as parcel/freight service, additional customer services, linkages to strategic partners etc. None of these have been included in the revenue estimates.

Parcel service was studied in detail with the conclusion that the business opportunity was negligible. Other areas cannot be accurately estimated at this stage.

4.3 Comparison to OQRTTF Results

Several important comparisons should be made between the findings from this project and the results of the OQRTTF. There are methodological differences and data input differences that should be thoroughly understood in interpreting the results.

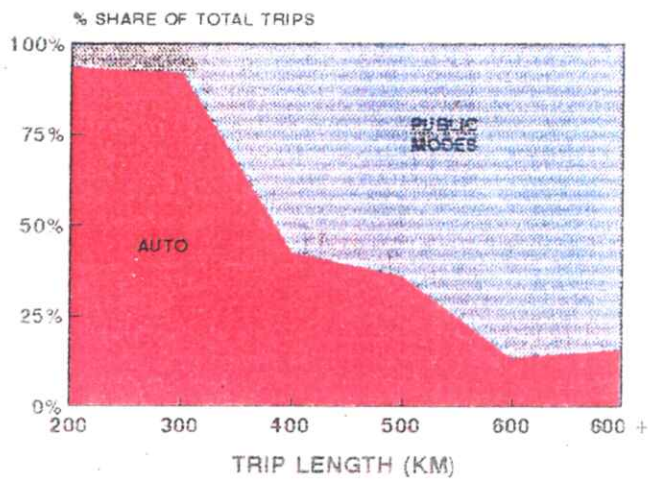
To highlight the key differences:

- OQRTTF used a non-nested logit model while we used a nested logit model. There is not necessarily a profound difference in results between the two, but the behaviour of the demand models reflects this difference in design.

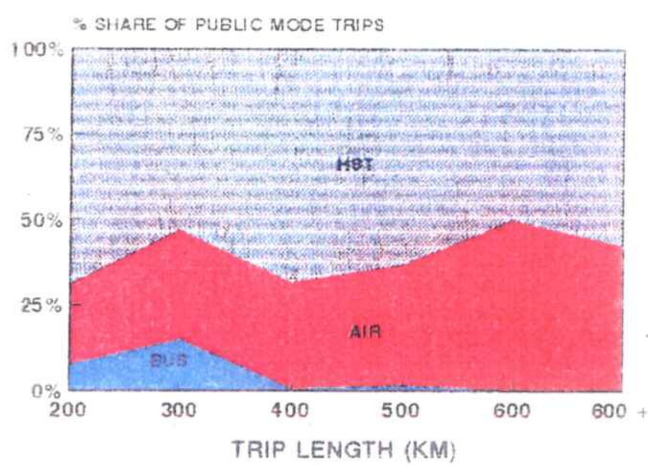
- OQRTTF did not use a revenue maximizing approach to demand and revenue estimation, choosing instead to establish fixed fare structures. We have used the fixed fare scenario as a sensitivity analysis with the REVMAX model as a base. In general, our approach has produced lower ridership, but higher fares and revenues, than the OQRTTF approach. The REVMAX methodology assumes, in effect, a non-regulated fare environment and no public policy influence on fares.

EXHIBIT 4 - 7

AUTO VS. PUBLIC MODES



PUBLIC MODES



* EXCLUDES TRIPS LESS THAN 100 KM

- Consumer research data from the IVIS computer simulation was a major input variable to the mode choice equations in this study. This data, again speaking in generalities, showed high sensitivity to price among non-business travellers and high sensitivity to time among business travellers, which produced less auto diversions and more air diversions in our forecasts.

- OQRTTF demand forecasts for 2010 without **HST** show a 1% increase in market share for conventional rail relative to rail's 1987 base year share, while our model has produced results that have kept the share of conventional rail from the base year to 2010 relatively constant at roughly 3% for business and 3.5% for non-business. It appears that the OQRTTF model assumed an increase in airfares relative to other modes, which shifted projected 2010 ridership toward rail. As a result, the starting point for rail's ridership in 2010 shows a difference of over 1.5 million trips - 4.0 million for this study versus 5.6 million for OQRTTF. Given the pivoting technique and other model design issues that link to the assumed share for rail, this variance in assumptions flows through to account for a significant portion of the difference between the two forecasts.

- OQRTTF used a different induced demand estimation method, allocating incremental ridership to all modes in proportion to the mode shares after the introduction of **HST** service, rather than 100% to the new mode. Their induced demand estimates were included in their base case results, while we chose to treat induced demand as a sensitivity analysis.

Top level comparative results for our project and OQRTTF are contained in Exhibits 1 - 1, 1 - 4, 4 - 5 and 4 - 6. Their study did not report on a 250 kph scenario, so comparisons are limited to the three remaining speed assumptions. Some comments on the key differences:

1. Our projected ridership exceeds OQRTTF at lower speeds but is much less than OQRTTF at higher speeds. In general, our results do not demonstrate the potential for demand growth in the non-business market that was shown in that study.

2. Revenues are higher in our results, due to a different pricing assumption and methodology.

3. Our results show far less auto diversions and significantly higher air diversions than OQRTTF found. We show the bus mode to be a beneficiary of **HST**'s existence, due to migration of price-sensitive conventional rail passengers and reduced accessibility to the system as a result of fewer stations.

4.4 Implications for Air Service on the Corridor

HST would not be a positive development for air carriers serving the corridor. To illustrate, the following impacts are forecast on air patronage in the business market on the two key routes:

BUSINESS AIR DIVERSIONS ANALYSIS
300 kph SCENARIO
(millions of trips)

ROUTE	NO HST	WITH HST	% DIVERSIONS
Toronto - Ottawa	.71	.28	60
Toronto - Montreal	1.24	.64	48

These results were based on the following air and **HST** impedance data:

AIR-HST COMPARISON - 300 kph BUSINESS MODEL

ROUTE	AIR	HST
Toronto-Ottawa		
Transit Time(minutes)	60	107
Access/Egress Time	63	20
Terminal Time	55	30
Door-to-door Time	178	157
Fare($)	184	184
Access/Egress Cost	35	30
Door-to-door Cost	219	214
Frequency(daily trips)	40	40

Toronto-Montreal

Transit Time(minutes)	68	167
Access/Egress Time	63	20
Terminal Time	55	30
Door-to-door Time	186	217
Fare($)	210	167
Access/Egress Cost	44	30
Door-to-door Cost	254	197
Frequency(daily trips)	45	45

On these two routes alone, revenue loss would approach $150 million for air carriers, assuming an average one-way fare of $150.

With this magnitude of reduced passenger traffic and revenue, air carriers would be faced with fundamental restructuring of their service, including changes to fleet procurement and mix. The infrastructure for air service would need to be revamped, including terminal facilities and services for the major city pairs that are currently dominated by the air mode for business travel. The Toronto Island airport would be particularly vulnerable in competing against **HST** for the Toronto downtown core market.

Evaluation of the "spiral effects" on air carriers of reduced demand, fare competition, pressures on frequency and quality of service, use of smaller aircraft etc. should be an important component of any further study of **HST**.

5. SENSITIVITY ANALYSIS

As discussed earlier in this report, the REVMAX demand forecast is based on a scenario of combined assumptions that was purposely designed to present a mid-range ridership demand estimate and upper-range revenue projection. The sensitivity of that forecast to changes in assumptions is an important measure of the predictive power in the forecasting model and is indicative of the degree of risk that must be attached to the estimates.

This section reviews the impact on the ridership and revenue forecasts of making changes in key assumptions. The sensitivity analysis approach uses the REVMAX model as a base and measures the impact on that model's results of changing a single variable. It is emphasized, however, that the underlying structure of the REVMAX methodology is to maintain fares as a variable; therefore, the net impact of each sensitivity "test" represents the combined effect of the change in the stated assumption and the associated change in the derived REVMAX fares.

- **Speed.** The following table summarizes ridership and revenue results at four different speed levels:

SENSITIVITY TO SPEED

	200 KPH	250 KPH	300 KPH	400 KPH
RIDERSHIP(millions of trips)				
Business	2.47	2.70	2.87	3.21
Non-business	2.85	2.90	2.95	3.05
TOTAL	5.32	5.60	5.83	6.26
REVENUE($ millions)				
Business	325	385	424	530
Non-business	145	148	151	160
TOTAL	485	533	576	690
FARES($ - one way)				
Business	138	143	148	165
Non-business	51	51	51	52

Non-business ridership and revenues are extremely insensitive to speed, with only a 7% difference in ridership and 10% difference in revenue between 200 kph and 400 kph. Business patronage is more responsive to speed, with 30% and 56% differentials for the same comparison. The Business model also indicates a willingness, on average, to pay a 20% fare premium for an increase in speed from 200 kph to 400 kph. Nevertheless, even these results suggest that the marketplace will not reward extra speed with dramatic increases in usage.

- **Fares.** **HST** price sensitivity was tested in the business and non-business markets separately. A fare level was established for each route that was 20 percentage points lower relative to the comparable airfare than the revenue maximizing fare in the REVMAX model. This fare was used to derive the revenue and ridership sensitivity forecast, which naturally resulted in higher ridership and lower revenues:

SENSITIVITY TO FARE - 300 kph

TRIP PURPOSE	FARE	RIDERSHIP (millions of trips)	REVENUE ($ million)
BUSINESS	REVMAX - 20	3.47	396
NON-BUSINESS	REVMAX - 20	3.88	136

The lower business fares produced a 21% increase in ridership but a 7% reduction in revenue. The lower non-business fares increased ridership by 32% but reduced revenue by 10%.

- **Trip Table.** The impact of using the reduced trip table, as opposed to the full trip table provided by the OQRTTF, was a reduction of 660,000 **HST** trips and $22 million in revenue for the 300 kph scenario. This significant decline of over 10% in ridership suggests that the demand model may not fully screen out ineligible trips that exist in the full trip table. As a result, it is probable that the base forecast has a modest **overstatement** of demand. Further, it would be desirable for future generations of demand models to improve the process of screening out ineligible trips.

- **Income Coefficient.** Relative to the results presented in the REVMAX 300 kph scenario **excluding income codes**, a model **with an income code** generated the following results:

COMPARISON OF INCOME vs NO INCOME CODE MODELS

	NO INCOME	WITH INCOME	% CHANGE
TRIPS(millions)			
Business	2.87	4.61	+60
Non-Business	2.95	2.56	- 13
TOTAL	5.83	7.17	+23
REVENUE($million)			
Business	424	461	+ 9
Non-Business	151	172	+14
TOTAL	576	634	+10

An important related point is that air diversions under the Income model increased to 1.9 million passengers, due to the large swing in Business riders. This would amount to a 52% reduction in patronage for the air mode.

- **Mode Bias Constant.** For a number of technical reasons relating to sample size and model structure, the demand forecasts have a much-higher-than-desirable sensitivity to the selection of **HST** mode bias constant. To illustrate, by moving the **HST** bias constant to a value 50% closer to the bias constant for auto, **HST** ridership is increased by 58%. Further refinements to demand estimation should include actions that will reduce the impact of the mode bias constant on the behaviour of the demand model.

- **Induced Demand.** The generally accepted approach to reflecting induced demand in a forecasting model is to measure the overall Level of Service (LOS) on each route combination and to impute an improvement in this variable through the introduction of the new mode of transportation. The improved LOS causes more travel to occur, and the model allocates incremental ridership among modes. A common approach is to base the allocation of induced demand on mode shares. Wilbur Smith Associates chose a different technique that spreads the incremental demand among modes based on the respective mode utilities. We chose to allocate all induced demand to the new mode (**HST**) in the belief that other methods understate the potential impact of demand induction on the new mode. The following results were derived for incremental **HST** ridership under the REVMAX forecasting model:

ESTIMATED INDUCED DEMAND
(millions of trips)

	200kph	250kph	300kph	400kph
Business	.85	1.26	1.6	2.28
Non-Business	.88	.96	1.03	1.17
TOTAL	1.73	2.22	2.63	3.45

The revenue increases ranged from $125 million at 200 kph to $384 million at 400 kph.

We suggest some caution in interpreting these results, as they present potentially an overly optimistic picture.

Clearly, induced demand is a factor that cannot be ignored, but equally it cannot be treated as a given in the near term. Although the phenomenon will show itself eventually, we expect it to be a lengthy emergence cycle that will likely extend beyond the relevant time horizon for the initial capital investment to be depleted. **As a result, we do not recommend considering induced demand in near-term financial evaluation of HST.**

The level of demand induction should logically be linked to the proficiency of the **HST** operator in providing an enhanced level of service, thereby not only increasing mode switching but also creating new travel demand because of the not-previously-available combination of travel benefits. Other evidence in our research also points to improving the quality of the overall travel experience as being a vital link in stimulating demand - the mode bias constant reflects this impact - so we must conclude that induced demand will not be a "hard" forecasting element but rather a surrogate indicator for the ability of the **HST** operator to build a consumer franchise through offering a distinctive and pleasurable travel experience.

- **Frequency**. Frequency of service is another dimension of travel demand estimation that appears to have a significant impact on ridership, fares, and revenue. To illustrate, we ran the 300 kph REVMAX Business model using both the current VIA frequency and a higher **HST** frequency, with the following results:

IMPACT OF REDUCED FREQUENCY

	HST FREQUENCY	VIA FREQUENCY	% DIFFERENCE
Ridership (millions)	2.87	1.57	-45%
Revenue ($ million)	424	191	-55%
Average fare ($)	148	122	-18%

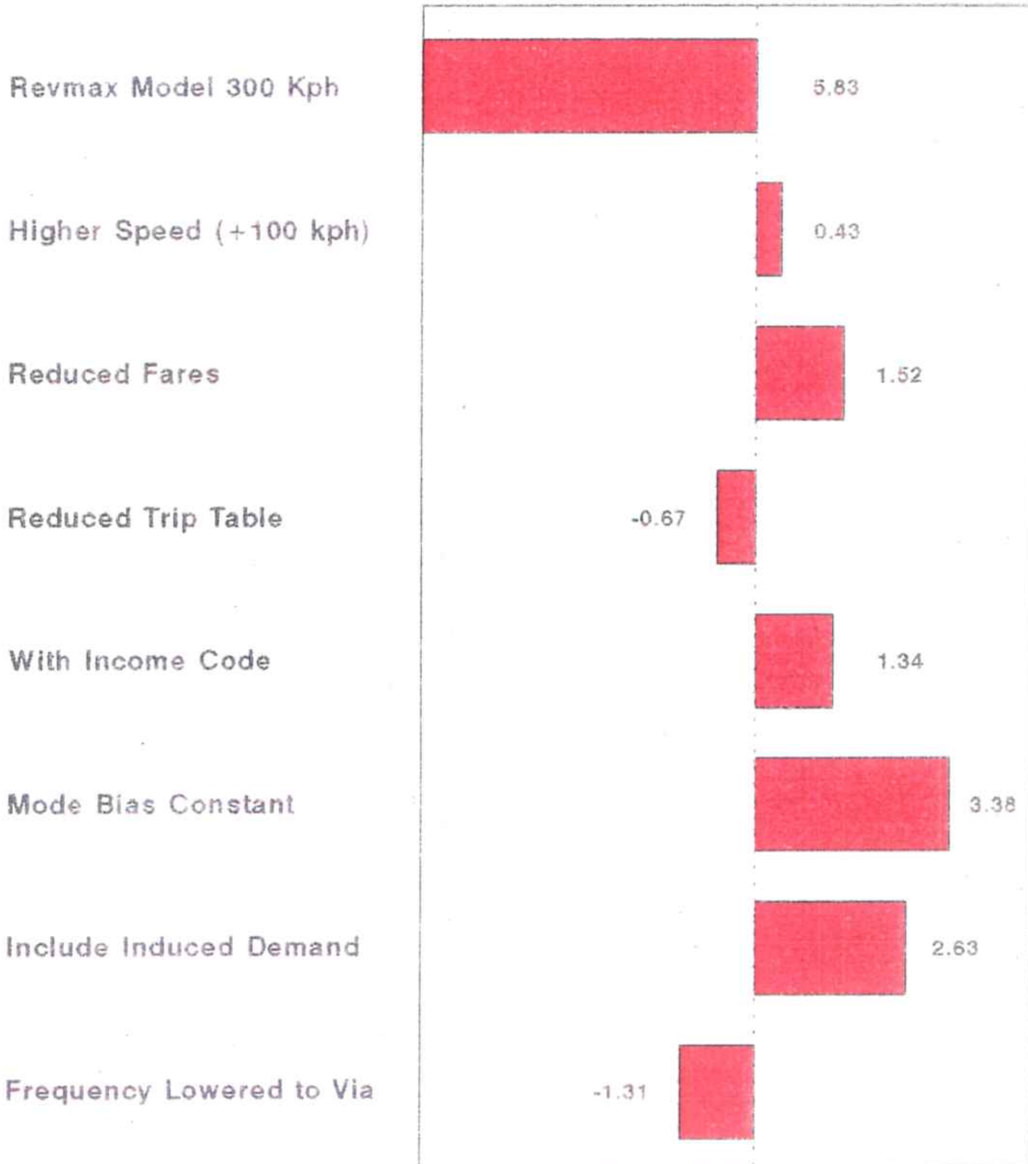
While differentials of this magnitude may not be borne out in practice, they underscore the importance of frequency as a design parameter and suggest that detailed study of this issue is warranted.

Exhibit 5 - 1 summarizes graphically the sensitivity analyses described above, highlighting the degree of forecast variability that can be introduced through changes in assumptions.

Further study of these sensitivity variables is clearly an important component of improving the usefulness of future demand estimates. In addition to the variables described above, the Project Team recommends that the number of stations and their specific locations be reviewed, considering the impact of access and egress on demand.

EXHIBIT 5 - 1

SUMMARY OF RIDERSHIP SENSITIVITY ANALYSIS
(Millions of 2010 Trips)



6. NON-LINEAR DEMAND MODEL RESULTS

Linear logit demand models are the widely accepted standard in transportation demand estimation. The linear logit formulation, however, does have one attribute that could potentially pose a shortcoming: the model presumes that consumer responses to changes in mode choice criteria will be linear. For example, a 30 minute change in travel time is presumed to have twice as great an impact on demand as a 15 minute change in travel time. Non-linearity in response characteristics could also arise from the relative magnitude of change with respect to the base condition. For example a 10 minute improvement in travel time on a long journey may not stimulate a consumer to switch modes, while the same 10 minute improvement for a short journey could generate a distinctly different response.

Researchers at the Centre de recherche sur les transports, led by Dr. Marc Gaudry and supported by Dr. Richard Laferriere, have developed a modelling technique that addresses the non-linearity issue by transforming the input variables to the logit formulation. This technique is called Box-Cox Logit formulation. Dr. Laferriere was retained by the HST Project Team to apply this technique to our research findings to ascertain whether the Box-Cox Logit approach produced materially different results from the linear nested logit model that was used.

In brief, the Box-Cox transformation, when applied to the REVMAX model, produced higher ridership but lower fares and lower revenues than the linear nested logit formulation. To highlight the key differences, the following results were obtained for the 300 kph scenario:

BOX-COX VS. LINEAR NESTED LOGIT FORMULATION
(300 KPH REVMAX MODEL)

	LINEAR	BOX-COX	DIFFERENCE
BUSINESS			
Ridership (million)	2.33	2.81	0.48
Revenue ($million)	346	302	(44)
Average HST fare ($)	148	107	(41)
NON-BUSINESS			
Ridership	2.86	4.91	2.05
Revenue	155	144	(11)
Average HST fare	54	29	(25)

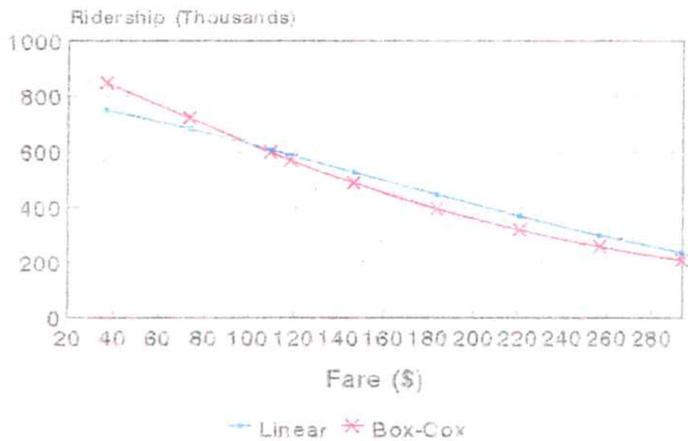
The general implication of these findings is that the linear model displays lower price and travel time sensitivity, and consequently lower elasticity of demand, than the Box-Cox model. The result is a greater resistance to increased fares, partially offset by higher attraction to increased speed. The net impact is a revenue maximization at lower fares with higher ridership. Exhibits 6 - 1 and 6 - 2 illustrate the differing revenue maximization results of the two models for the business and non-business markets respectively.

These findings could be significant in terms of the pricing strategy for HST, in that they clearly indicate that substantially higher ridership can be obtained by setting prices at lower levels. On the negative side, however, they indicate that the revenue opportunity may not be as large as was indicated in the linear nested logit model - using the REVMAX methodology, Box-Cox results show almost a 10% decrease in revenues versus linear nested logit.

The project team's interest in investigating the Box-Cox transformation technique stemmed from the possibility that demand response to travel time savings could differ with trip purpose. Exhibit 6 - 3 shows that for the Business model the Box-Cox transformation does not cause any significant shift in demand. However the Non-business model demand function is more responsive to higher speeds.

EXHIBIT 6 - 1

Ottawa-Toronto
Business
Trips @ 300 kph



Ottawa-Toronto
Business
Revenue @ 300 kph

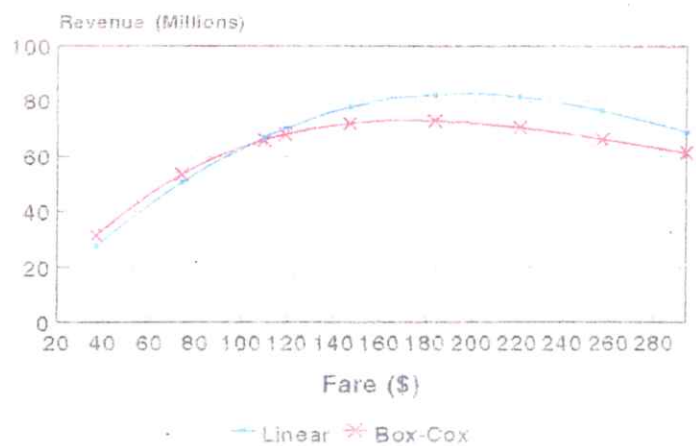
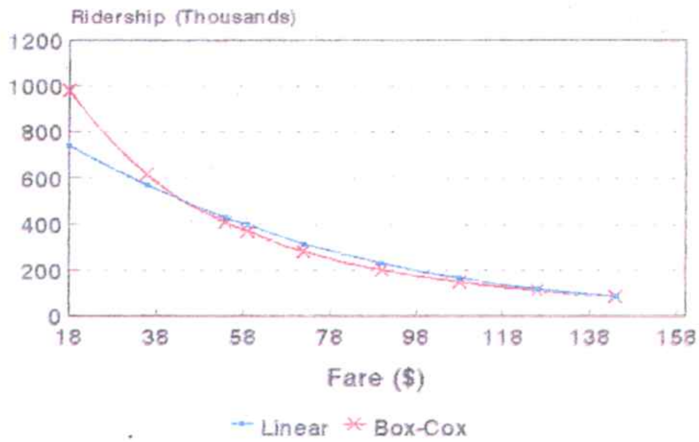


EXHIBIT 6 - 2

Ottawa-Toronto
Non-Business
Trips @ 300 kph



Ottawa-Toronto
Non-Business
Revenue @ 300 kph

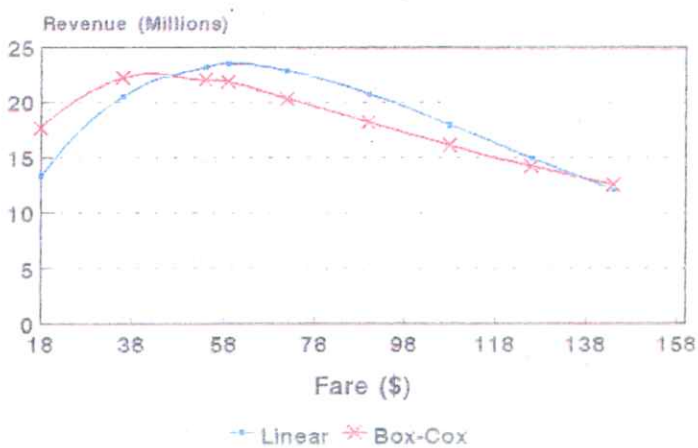
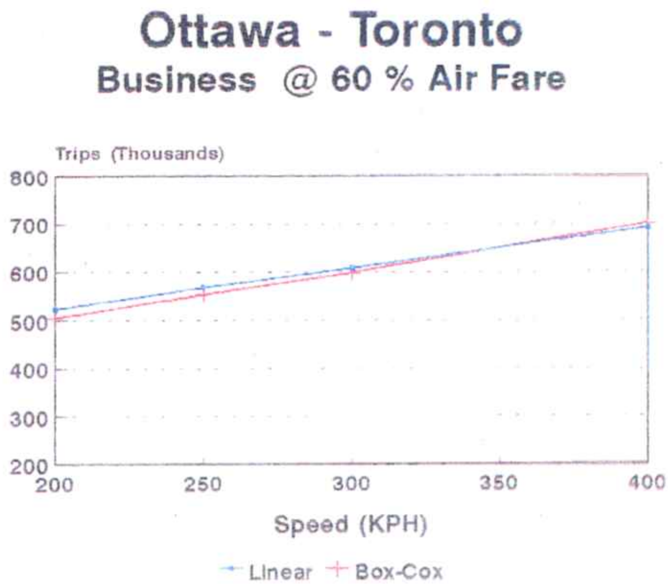
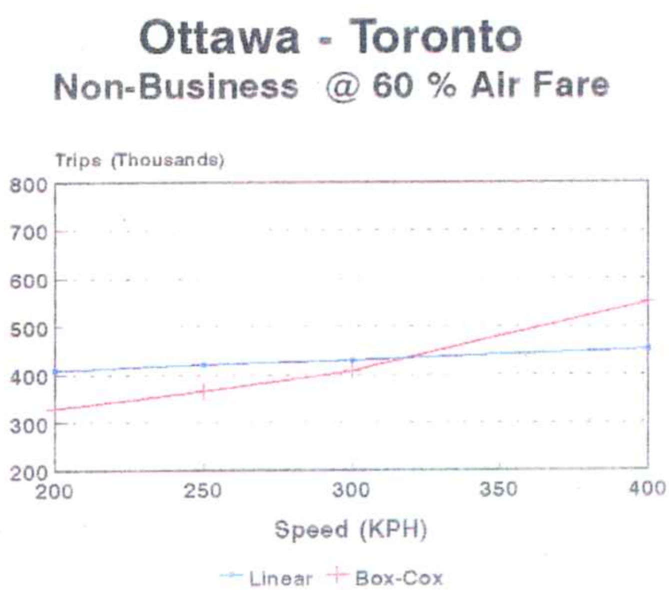


EXHIBIT 6 - 3


Ottawa - Toronto
Business @ 60 % Air Fare
Trips (Thousands)
800
700
600
500
400
300
200
200
250
300
350
400
Speed (KPH)
Linear
Box-Cox


Ottawa - Toronto
Non-Business @ 60 % Air Fare
Trips (Thousands)
800
700
600
500
400
300
200
200
250
300
350
400
Speed (KPH)
Linear
Box-Cox

7. HST SERVICE CHARACTERISTICS

In order to assess the anticipated future demand for **HST** properly, the project team devoted considerable attention to defining the **HST** service carefully, capturing the many dimensions of the **HST** product that could have an impact on patronage. This activity continued throughout the project, with the future vision for **HST** being refined continually as new information became available.

HST could be a hybrid of air and rail service, drawing on the best of both to create a superior transportation experience for travellers. The traditional virtues of air service have been speed and sophisticated passenger processing systems - reservations, baggage handling, enhanced levels of on-board service - that cater to the needs of the business traveller. These benefits have come at a price that is often multiples of the fares charged by slower modes, and certainly multiples of the cost of making the trip via automobile. The virtues of rail have been on-board comfort and flexibility, convenience, ease of access, and relatively low cost - an ideal combination for pleasure travel or economy-minded business travellers. The challenge for **HST** is to find the optimal blend of these features in defining its product positioning.

The following sections highlight the key factors that could shape **HST** service in the future.

7.1 Speed/Travel Time

Research has shown that door-to-door travel time is a key determinant in consumer mode preference, particularly for business travellers. Sometimes the consumer's perception may be distorted - e.g. air travellers can ignore access, egress and terminal times in making their decision to fly based on a certain "in air" time. Nevertheless, time is a prime consideration, which in turn translates into speed. The term "High SPEED Train" makes speed central to the concept and positioning of the product.

For the purposes of this study, we have consciously chosen to avoid the issues relating to choice of technology. All consumer research was structured to concentrate on elapsed time of travel, not choice of technology. Demand estimates were prepared using generic speed levels - 200 kph, 250 kph, 300 kph, and 400 kph - to focus attention on the speed and time issue rather than technology.

Speed increases in importance as trip length increases, as the time benefit achieved through greater speeds is enhanced. Looked at in the opposite way, though, it is hard to justify additional cost in return for speed on any but the longest routes on the corridor, because the travel time differentials among the alternative speed levels on shorter routes are not meaningful to consumers.

The number of stations and their location would affect travel times: distance to the station would affect access and egress time, while the number of stops on the network would affect transit times. The forces are countervailing, in that more stations would improve access and egress but would deteriorate transit time. System designers would need to search for the optimal combination of stops and routings to achieve the best overall transit times for the largest possible market.

The demand model results point in the direction of lower speed solutions on this corridor. Projected incremental ridership and revenues for higher speed options must be sufficient to offset any increased capital costs involved in achieving those speed levels.

7.2 Fares

Fares are inextricably linked to overall level of service versus competing alternatives, and must therefore be viewed in a very dynamic way, adjusting to suit the various combinations of service parameters offered. For **HST**, the key issues would be elapsed travel time and class of service, linked to trip purpose - either business or non-business.

From the IVIS simulation and the other inputs available, it is apparent that **HST** could command a premium versus conventional rail and compete virtually head-to-head with air in the business market. A comparison of fare levels is shown in Exhibits 7-1 and 7-2, highlighting the positioning of **HST** relative to competing modes. Exhibit 7-1 reveals a decline in fares/km for public modes as distance increases, while auto stays constant. As a consequence, Exhibit 7-2 shows the increase in relative cost of the auto mode as trip length increases. **HST** is clearly positioned in a fare range from 65-85% of airfare, although **HST** fares reached 100% on the key Toronto-Ottawa and Toronto-Montreal routes.

EXHIBIT 7 - 1

BUSINESS MODEL FARE COMPARISION BY TRIP LENGTH (CENTS/KM)

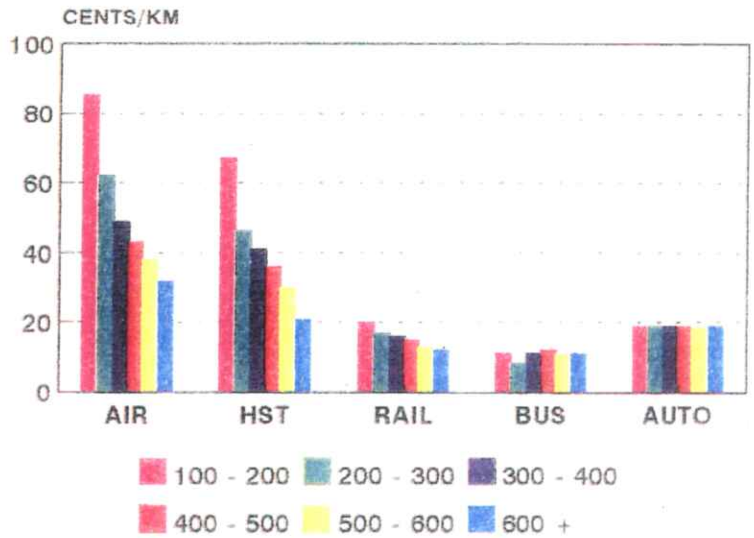
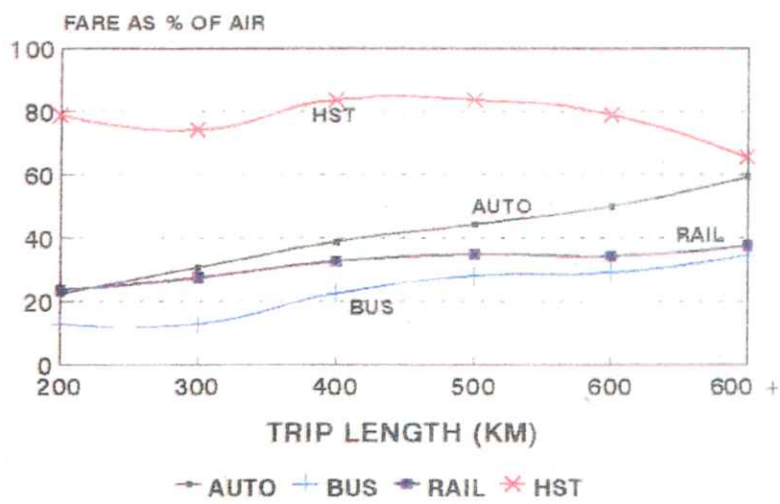


EXHIBIT 7 - 2

BUSINESS MODEL FARE COMPARISION % OF AIR (BUSINESS MODEL)



EXCLUDES TRIPS LESS THAN 100 KM.

Our analysis indicates that non-business travellers are far more sensitive to changes in fares than they are to changes in travel time, suggesting that trading-off speed for fare reductions could increase ridership and revenues in that market. For instance, 200 kph service priced at 50% of airfare is projected to attract 9% more non-business riders than 300 kph service priced at 60% of airfare.

Government policy can affect consumer behaviour. For instance, the imposition of road tolls would significantly increase the comparative cost of auto travel, thereby creating a different competitive benchmark for **HST**.

Yield management strategies would certainly apply to **HST**, and would provide opportunities to improve overall profitability for the **HST** operator and to offer differentiated product "packages" to consumers. No specific techniques of this nature were applied in this project, other than to make assumptions about the projected mix of fares in developing revenue forecasts.

No examination was done of the potential impact of competitive pricing retaliation on **HST** revenues or ridership. It would be reasonable to expect stiff competition for passenger loyalty, including the full range of inducements such as frequent traveller programmes and pricing specials, at least during the introductory stages of the new system. The forecasts presented could be viewed as "steadystate" estimates of revenue once the initial competitive response had been absorbed and the market had stabilized.

7.3 Network Design

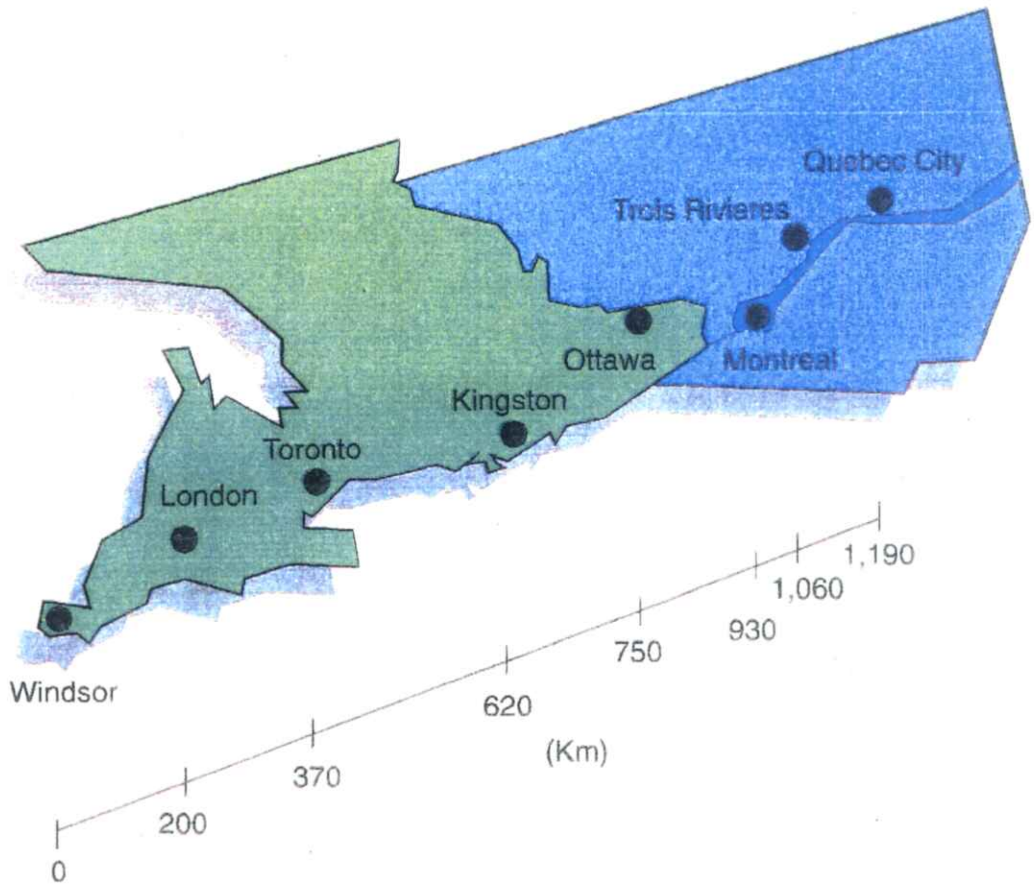
The route network and stations that were used for the demand forecasting are shown in Exhibit 7-3.

The project team selected a "spine" network for use in demand estimation, with the result that travel times between Toronto and Montreal were marginally longer than they would be with a "triangle" design. Further, we did not force the choice of a northern or southern routing westbound from Toronto, but rather assumed a composite routing that best served all the communities along that portion of the corridor.

We chose to assume a constant number of stations on the network - 19 - irrespective of speed level. As discussed earlier, system design issues are linked to the

EXHIBIT 7 - 3

HST NETWORK



WIND	LOND	TORO	KING	OTTA	MONT	TR RIV	QUE	
	200	370	620	750	930	1,060	1,190	WIND
		170	420	550	730	860	990	LOND
			250	380	560	690	820	TORO
				130	310	440	570	KING
					180	310	440	OTTA
						130	260	MONT
							130	TR RIV
								QUE

choice of speed level for the system and various marketing and economic considerations. Additionally, the business and non-business markets will need to be examined separately, as the business market's demand for reduced travel time and bias toward city centre to city centre travel (i.e. fewer station stops) opposes the non-business market's demand for expanded access (i.e. more station stops). Reducing access points from the existing 50 for VIA to 19 on **HST** is a constraining factor for non-business **HST** patronage.

7.4 Scheduling & Frequencies

HST will need to offer high frequencies of travel in order to appeal to the business market, which appears to be the core target market from the demand estimation work. The demand model used an assumption of 16 departures daily from the major urban centres on the corridor, with hourly departures at most times of day and half-hourly at peak morning and evening times. On routes where air service frequency exceeded 16, **HST** was set to match air.

It is not clear whether this frequency of service could be sustained on the track segments west of London or east of Montreal, while still maintaining adequate passenger loadings on each train, in light of the demand forecasts. The London-Toronto-Ottawa-Montreal segment should not pose any difficulties of this nature, from our analysis.

7.5 Air-Rail Linkages

There is a market for intercity connecting air passengers that **HST** could service quite well, assuming the right systems, infrastructure and services. Our preliminary estimate is a market opportunity of roughly $150 million, representing 3 million outbound passengers, which is certainly not a trivial opportunity. Further in-depth investigation of this market is warranted, particularly in view of the costs and complexities inherent in making the air-rail link work effectively.

Inter-modal connectivity is desirable, but logistics and economic factors would need to be addressed. Co-location of **HST** terminals with airports in Toronto and Montreal would pose many difficulties and would be extremely expensive - much more detailed study of the costs and benefits will be required before judging whether such an investment would be justified. Security would constrain the degree to which a truly "seamless" connection could be made between **HST** and air.

Passenger processing tactics and strategies will be extremely important for the **HST** operator and for competing or complementary carriers on other modes - strategic alliances will be key competitive battlegrounds. Reservations and ticketing systems will be one of the hottest battlegrounds where the integration of air and rail will be seen as a competitive advantage. However, much of this will be transparent to the travelling public, with the result that the passenger experience will likely combine the best of rail and air - speedy travel, high levels of on-board comfort, and ease of access.

7.6 Customer Interface

The starting point for assessing how **HST** should manage its customer relationships is to review the competitive battlefield: what is **HST** up against in the marketplace, and how does each of the competitive alternatives meet the particular needs of the travelling public? The two key competing modes are air and auto: the personal automobile offers freedom and flexibility, but is demanding on the driver over long distances; air is fast and reliable, with many services for the business traveller, but imposes stressful and time consuming requirements for access, egress and boarding.

Many tools will be available to **HST** to offer the most appealing travel experience:

- **Ticketing and reservations systems** could be modelled on the air system, and ideally integrated with air for the connecting passenger market. Advance seat selection is likely a prerequisite for attracting the mainstream business market.

- **Terminal facilities** could be designed for ease of transit and comfort during stopovers or waiting time, and located for convenience of access - possibly with direct connections to local public transit and readily available auto rental.

- **Baggage handling** could be automated and integrated to the greatest extent possible with connecting modes. The added room on a train relative to an airplane could be used to advantage for overnight travellers who don't enjoy an air cabin with constrained room for carry-on luggage.

- **Security** could be kept to a prudent minimum and made as unobtrusive as possible.

- **Reliability of service** is a hallmark of European and Japanese **HST** systems and highly valued by their customers. On-time departures and arrivals would attract passengers with deadlines, particularly in winter months.

- **On-board services** could extend beyond the boundaries offered by air carriers to include virtually any service or amenity for which there was a profitable market. Business services are widely provided in Europe - telephone, computer hook-up etc. - and personal services could also find a market niche. Offering an in-transit work opportunity for business travellers has been highly valued in European **HST** markets.

HST could apply a broad range of advanced technology to improve the travel experience for customers. Ticketing and reservations systems could be accessible and highly functional; check-in and baggage handling could be highly automated; security systems could be secure and non-intrusive; on-board amenities and business conveniences could be readily available if the demand for the service existed.

* * *

HST must find a positioning in the minds of consumers that will attract sustained ridership in both the business and non-business travel markets. The new system could take advantage of many opportunities to differentiate itself from conventional rail, and to appeal to the particular needs of travellers currently using either air or auto for inter-city travel. **HST** must succeed in establishing a positive perception if it is to deliver ridership and revenue results that will justify the upfront financial commitments and risks.

8. CONCLUSIONS

The High Speed Trains Market Assessment project has yielded significant insights into the potential impact of this new service being introduced into the Windsor-to-Quebec passenger transportation marketplace. The preceding sections of this Final Report have summarized and synthesized the key findings, based on the consumer research, demand estimation, and related investigations that were conducted. This section summarizes the conclusions of the Project Team with respect to the **HST** market, and lays out the implications and key considerations for the Sponsors.

8.1 Conclusions

To recap the major conclusions that have emerged from the project:

1. Travellers make mode choices very differently depending on whether the trip is for a business or non-business purpose. Non-business travellers are highly sensitive to price and less responsive to travel time reductions, while business travellers place a high value on their time, and are, therefore, more responsive to travel time as a factor in mode choice. As a result, the **HST** service combination of higher fares than conventional rail in return for less travel time is much more appealing to business travellers than non-business travellers.

2. Considering the high price sensitivity of non-business travellers, many of whom currently travel by automobile, **HST** is unlikely to succeed in capturing a major share of non-business travel, unless the consumer perception of **HST** travel can be shifted fundamentally in a positive direction. Given this difficulty in shifting travel from auto to **HST**, the **HST** system is unlikely to have a material positive impact on issues such as road congestion or auto pollution.

3. **HST** ridership, particularly at higher speeds, would be unlikely to reach the levels forecast by the OQRTTF, based on the data set and consumer research findings that were available to us, unless fare levels were intentionally set at a low level to stimulate demand and induce mode

switching. However, the revenue opportunity could be substantial if fares were set by market forces.

4. Diversions of travellers from air to **HST** would be significant, making the cross-modal policy implications of **HST** more serious than previously reported.

5. Ridership would be relatively inelastic to speed, making lower speed options seem more financially attractive. Viewed from a revenue perspective, the increases in revenues that would arise from higher speed service would be unlikely to justify the incremental capital investment required to achieve those speed levels.

6. A London-to-Montreal "core" of the **HST** network would attract ridership levels necessary to sustain high service frequencies with reasonable economics, but the Windsor-to-London and Montreal-to-Quebec segments could have difficulty in achieving acceptable passenger load factors at high frequencies.

8.2 Implications & Considerations

An important starting point in assessing the next steps for Air Canada and CP Rail System is to evaluate the results of this project and to identify areas of further refinement or investigation that would offer material improvements in our ability to predict the future impact of **HST** on the inter-city travel market in this corridor.

The following points are emphasized:

1. The base year trip table provided by VIA and the OQRTTF has known limitations that introduce serious risk factors to our projections. The more recent market data developed by the tri-government study may offer significant improvements to forecasting accuracy, and we now have the modelling capability in-house to work with new data to update our forecasts.

2. The sample size for the consumer research was not sufficient to meet our ingoing demand estimation objectives, particularly for the auto traveller. With the benefit of hindsight, we now recognize that the sample size must be

large enough to allow sub-segmentation and stratification of the population to measure specific factors affecting travel behaviour much more precisely. For example, consumer behaviour was measured on a system-wide basis for key variables such as price and time sensitivity, while we know that traveller decisions are affected by many local variables - we need enough data elements to measure consumer behaviour at the level of individual routes. Frequency was another factor that was not captured adequately for the non-business market. Additionally, a larger sample would allow the demand model to be specified with a larger number of independent variables, which would enhance the explanatory power of the measurable factors and reduce the degree to which the mode bias constant determines the model output. A related benefit would be more precise constant factors and less calibration.

3. The mode bias constant issue deserves further study, considering its importance. In this project, the consumer research found the **HST** bias constant to be quite close to the level of the auto bias constant; without the effect of model calibration, such a positive mode constant produced significantly higher **HST** demand, as shown in the sensitivity analysis. However, the combination of the model calibration procedure, low sample sizes and resultant high impact of the mode constant, and negative mode bias toward conventional rail travel, yielded a demand estimate that is not encouraging for **HST**. Intuitively, the project team believes that higher demand levels could be achieved, but predicting such a future is difficult with the imperfections inherent in the existing data and models.

4. Induced demand is another aspect of the market assessment that has not been explored and captured to the full satisfaction of the project team. Wilbur Smith Associates have registered their view that induced demand will not be significant, and they present valid reasons to support this view. Nevertheless, the project team feels that many important factors that could generate induced demand cannot be reflected in today's demand estimation state-of-the-art, and senses that the area merits further rigorous exploration. The existence of **HST** service could provoke shifts in destination preference for consumers that would change travel patterns permanently - e.g. Ottawa residents viewing travel to Toronto as a regular, routine event rather than a major outing - which could increase intercity travel on **HST**. Further, longer-term effects of population and employment redistribution have not been

studied in depth to gauge the potential impact on intercity travel. The project team is aware of at least one specific **HST** corridor study where the **HST** investment is being viewed as a tool in promoting population redistribution - certainly a clear signal that new demand will be created through this service.

5. The possibility of non-linearity of demand also deserves additional study, especially in light of Dr. Laferriere's findings in this project. To the extent that dramatically different results are produced using this modified technique, further investigation is justified.

To sum up from a demand estimation perspective, the combination of new data from the tri-government study and targeted additional research could produce significantly more precise forecasts that would be suitable for investment decisions.

Air Canada and CP Rail System have made a joint investment in understanding the **HST** market. While preliminary in nature, the conclusions from the market research suggest that **HST** could attract a stable patronage that would be drawn in large part from the air travel market, and could do so at the lower end of the **HST** speed spectrum. Given this possibility, we recommend that both Sponsors continue to remain actively engaged in the process of evaluating this new possibility for inter-city passenger travel.