VALUE OF TIME ANALYSIS
QUÉBEC-ONTARIO HIGH SPEED RAIL STUDY

PREPARED BY

TEMS/TRAFIX

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TABLE OF CONTENTS

1. INTRODUCTION

As part of the overall market research for the Québec-Ontario High Speed Rail Study, a Stated Preference Survey was carried out by Market Facts. The survey was conducted between mid-November 1992 and the end of February 1993. Data were collected by on-board surveys for rail and bus, terminal lounge surveys for air, and by a mixture of mail-out surveys and roadside surveys for road. The Stated Preference Survey used a quota design which ensured that a range of responses was obtained for different travel purposes, income groups, trip travel distances, sizes of travel parties, and geographic areas. TEMS staff established quota requirements by category (mode/distance/purpose) for the survey and laid out the questionnaire design.

The questionnaire was designed to provide information on the following variables:

- Value of Time by mode and purpose
- Value of Frequency by mode and purpose
- Value of Access Time by mode and purpose
- Value of Interchange Time by mode and purpose
- Value of Modal Bias

A typical questionnaire is shown in Appendix 1. The number of valid surveys collected for each mode/purpose group and each mode/purpose/distance group are shown in Exhibits 1 and 2 respectively. The minimum statistical requirement to ensure valid results, i.e., estimated errors that are significantly smaller than the coefficient estimates, is 40 surveys. It can be seen that quota numbers that exceeded the minimum requirement were obtained for all the mode/purpose groups except rail and bus commuter.

For auto commuters, although the quota is small (i.e., 53 observations), the results are likely to be valid. With respect to the mode/purpose/distance breakdown, the number of insignificant quota groups was larger but in only six cases were the surveys invalid. These included the bus business medium- and short-distance quotas, the bus commuter short-distance quota, and the rail business and commuter short-distance quotas. The results for the bus business quota group are not too surprising as it is notoriously difficult to obtain valid surveys for this particular quota group. However, the short-distance bus commuter result is quite surprising since large numbers of

commuters use the bus for journeys to work. In the case of rail, again the business short-distance results are not too surprising but the commuter short-distance results are disappointing.

For all other quota groups, the results were very good with a substantial number of valid surveys in each case.

EXHIBIT 1
STATED PREFERENCE SURVEY RETURNS BY MODE AND PURPOSE

Mode/Purpose		Specified Sample	Minimum Return Required	Sample Collected	Sample Collected as Percent of Minimum Return
Air	Business	611	392	400	101
	Non-Business[1]	457	298	303	102
Rail	Business	426	288	221	77
	Commuter	72	48	15	31
	Other	670	427	585	137
Bus	Business	208	130	20	15
	Commuter	18	12	8	67
	Other	712	450	952	212
Auto	Business	1,032	346	338	98
	Commuter	214	72	53	74
	Other	1,209	404	517	128

[1] *Includes commuter and other travel purposes.*

EXHIBIT 2
STATED PREFERENCE SURVEY RETURNS BY MODE, PURPOSE, AND DISTANCE[1]

Mode/Purpose		Short-Distance	Medium-Distance	Long-Distance
Air	Business	n/a[2]	143	257
	Commuter	n/a	n/a	n/a
	Other	n/a	99	204
Rail	Business	23	151	47
	Commuter	15	n/a	n/a
	Other	125	222	238
Bus	Business	3	17	n/a
	Commuter	8	n/a	n/a
	Other	89	642	221
Auto	Business	78	165	95
	Commuter	53	n/a	n/a
	Other	89	261	167

[1] Short-distance trips are defined as less than 100 km, medium-distance as 100 to 300 km, and long-distance as more than 300 km.
[2] N/A denotes quotas not requested

2. TRADE-OFF ANALYSIS

The Trade-Off Analysis was completed using two distinct methods: Binary Logit Method and Direct Comparison Method. Each method was applied to the different trade-offs that each individual made when completing the stated preference questionnaire to determine his/her Value of Time, Value of Frequency, Value of Access Time, and Value of Interchange Time.

In the Binary Logit Model, a logit curve is used to calculate the relevant coefficients, e.g., for Value of Time, the coefficient describing the trade-off between time and cost with the Value of Time being expressed in dollars. In the Direct Comparison Method, the trade-off choices made by an individual when answering the trade-off questions are ranked by, firstly, the choices made between time and money and, secondly, the degree of preference expressed for the different time and money choices. The individual's Value of Time is then calculated by estimating the point of inflection, or the point at which an individual changes from spending time to save money or spending money to save time.

3. TRADE-OFF ANALYSIS RESULTS

3.1 Value of Time

The results of the Trade-Off Analysis for Value of Time (VOT) are shown in Exhibit 3. As expected, the VOT's for air are higher than those for auto and rail, which in turn are higher than those for bus. However, the numbers while being similar to the estimates derived in 1987 show some differences. As shown in Exhibit 4, in 1993 the business VOT's are higher for air, lower for bus, and essentially the same for auto and rail; however, the commuter and other VOT's are consistently lower for all of the modes. The difference between the results of 1987 and 1993 are in all likelihood due to the effects of the recession. It could well be that the VOT's have fallen by 10 to 20 percent for commuter and other travel purposes because individuals are more careful with their own money and are prepared to spend more time per dollar than previously.

In the case of business travel, the situation is more complex. Auto and rail VOT's remained constant but air VOT's have risen since 1987 (see Exhibit 4). The rise in the air VOT's could be due to an increase in the proportion of flights being taken by senior managers who are under more pressure than before the recession to travel greater distances (more places) in less time. If this is the case, their VOT's would naturally rise. Also, it is possible that individuals with lower VOT's, perhaps less senior managers, moved out of air to auto or rail travel, which would also tend to increase the air VOT.

While it is interesting that the auto VOT rose slightly, this level of increase is well within statistical error and therefore the difference may not be significant. For the slowest mode, bus, the business VOT fell, suggesting that individuals seeking the low-cost travel alternative in the recession were prepared to give up even more time than previously (and possibly even their leisure time) to make business journeys.

Overall, given the very real changes that can be attributed to the recession and the error range on estimates, the VOT results for 1987 and 1993 show a remarkable similarity. It is TEMS' view that non-business VOT's fell 10 to 20 percent because of the recession and that business VOT's for air rose, remained constant for auto and rail, and fell for bus.

EXHIBIT 3
VALUE OF TIME RESULTS (1993$ per Hour)

Purpose	Air	Auto	Rail	Bus
Business	72.80	27.00	29.20	16.00
Commuter	30.00	14.60	16.00	10.70
Other	26.90	18.10	14.10	9.70

EXHIBIT 4
COMPARISON OF 1993 AND 1987 VALUE OF TIME RESULTS (1993/1987 in 1993$)

Pupose	Air	Auto	Rail	Bus
Business	1.22	1.04	1.00	0.88
Commuter	0.92	0.78	0.70	0.80
Other	0.85	0.97	0.61	0.72

3.2 Value of Frequency

The results of the Trade-Off Analysis for Value of Frequency (VOF) are shown in Exhibit 5. It can be seen that the business VOF for air is twice that of rail and four times that of bus. The effect of the recession (see Exhibit 6) has been to increase air/business VOF's and reduce rail and bus VOF's, probably for reasons similar to those made for the Value of Time. With respect to commuter and other purpose VOF's, the rail and bus values are similar, i.e., just less than half the respective values for air. Comparison with the 1987 survey results shows that, with the exception of air business, the VOF's have fallen 5 percent for air and 20 to 50 percent for rail and bus. This lower value for rail is in marked contrast to 1987 when rail VOF's were 65 percent of air VOF's and twice bus VOF's.

While the results of the VOF Trade-Off Analysis are rational and reasonable, there is little doubt that the VOF's are higher for air/business travel and lower for all other categories because of the recession.

3.3 Value of Access Time

Inclusion of trade-off questions relating to access time is one of the new dimensions of the 1993 Stated Preference Survey. Previously, TEMS made the assumption (in line with urban research findings) that access time is valued at twice in-vehicle time. The results of the Value of Access Time (VOA) analysis are shown in Exhibit 7.

It can be seen that the VOA's are highest for air, lower for rail, and lowest for bus. Business VOA's for rail and bus are 62 percent and 40 percent respectively of the air business VOA. For the other travel purpose, the rail VOA is 80 percent of air and 36 percent higher than for bus. The consistency of the results for rail and bus commuter and other purpose VOA's suggests that the air commuter VOA is about 28 dollars.

The most interesting aspect of the results is the ratio of the VOA's to the VOT's (see Exhibit 8). The air VOA is consistently the same as the air VOT. However, rail and bus have VOA's that are 1.5 and 1.8 times their respective VOT's.

In the case of the bus mode, the VOA/VOT ratio moves closer to the urban factor of two, i.e., 1.87 for business, 1.74 for commuter, and 1.77 for other. This is not too surprising, since bus

EXHIBIT 5
VALUE OF FREQUENCY RESULTS (1993$ per Hour)

Purpose	Air	Auto	Rail	Bus
Business	43.80	--	22.00	11.30
Commuter	20.00	--	8.30	9.30
Other	21.90	--	10.10	7.60

EXHIBIT 6
COMPARISON OF 1993 AND 1987 VALUE OF FREQUENCY RESULTS (1993/1987 in 1993$)

Purpose	Air	Auto	Rail	Bus
Business	1.23	--	0.81	0.58
Commuter	0.95	--	0.38	0.71
Other	0.97	--	0.47	0.58

EXHIBIT 7
VALUE OF ACCESS TIME RESULTS (1993$ per Hour)

Purpose	Air	Auto	Rail	Bus
Business	72.30	--	45.00	30.00
Commuter	--	--	23.30	18.70
Other	28.40	--	23.40	17.20

EXHIBIT 8
VALUE OF ACCESS TIME AS A RATIO OF VALUE OF TIME

Purpose	Air	Auto	Rail	Bus
Business	0.99	--	1.54	1.87
Commuter	--	--	1.45	1.74
Other	1.06	--	1.66	1.77

access time is probably most comparable with urban access conditions where walking and waiting are an important part of a transit journey.

The results suggest that the VOA for air should be similar to its VOT, i.e., a VOA/VOT ratio of 1.0, and for rail and bus, ratios of 1.5 and 1.8 respectively should be adopted. It should be noted that the recession may not have affected access time to the same degree as in-vehicle time values, even though it is possible that people again selected less expensive access options. However, if this is the case, the VOA/VOT ratio of in-vehicle time to access time might have been reduced, i.e., the ratio of access time values to in-vehicle time values might be higher.

3.4 Value of Interchange Time

The Value of Interchange Time (VOI) was measured for the three public modes. Interchange time was defined as time spent waiting at airports, railway stations, and bus stations. As shown in Exhibit 9, the VOI's for air were highest, followed by rail and bus. The differences between the VOI's for rail and bus are relatively small. Another interesting observation is that the business VOI's are generally less than those for commuter or other purpose travel. In the case of rail and bus, this might be just due to statistical error. On the other hand, the VOI for air other is 25 percent higher than for the business purpose. This could be due to the fact that air business trips are more planned than for other purpose trips, and interchange time is of a shorter duration and thus less exasperating.

When the VOI's are compared with the VOT's (see Exhibit 10), the VOI/VOT ratios are very different for the three modes, despite the fact that their VOI's are generally similar. The VOI/VOT ratio for the other and commuter air and rail interchange is about 2.0 but, for the bus interchange, it is between 3.0 and 4.0. This might reflect the condition of bus terminals compared with airports and railway stations. In the case of business, there is a distinct progression from air to rail to bus, with the VOI/VOT ratio increasing from 0.6 for the air interchange, to 1.0 for the rail interchange, and to 1.8 for the bus interchange.

3.5 Comparison of Values of Time and Frequency with Other Corridors

A comparison of the Values of Time and Values of Frequency from the 1993 and 1987 surveys for the Québec-Ontario Corridor and other corridors in the Midwest and Northeast U.S. is given in Exhibit 11. It can be seen that the 1993 values for the non-business purpose are significantly

EXHIBIT 9
VALUE OF INTERCHANGE TIME RESULTS (1993$)

Purpose	Air	Auto	Rail	Bus
Business	42.70	--	30.60	28.70
Commuter	--	--	30.90	35.80
Other	52.60	--	29.60	35.60

EXHIBIT 10
VALUE OF INTERCHANGE TIME AS A RATIO OF VALUE OF TIME

Purpose	Air	Auto	Rail	Bus
Business	0.59	--	1.05	1.79
Commuter	--	--	1.93	3.35
Other	1.96	--	2.10	3.67

lower. Not only are the VOT's and VOF's for the 1987 Québec-Ontario survey higher than those of the 1993 survey, but the values for the Portland-Boston survey, conducted in 1992, are also higher. The latter may be due to the fact that the recession has been more severe in the Québec-Ontario Corridor than in the Portland-Boston Corridor.

3.6 Modal Bias Values

An important addition to the 1993 Stated Preference Survey was the inclusion of modal bias questions. Typically, the questions asked by TEMS' Stated Preference Surveys are abstract mode questions set out as a series of choices between different combinations of travel characteristics. By providing options which reflect different modal characteristics and asking "enveloped" questions, it is possible to obtain a realistic assessment of how individuals trade off travel variables such as time and cost without reference to any specific mode. The values of time, frequency, access time, and interchange time needed for model calibration are then derived. During calibration, the modal bias or modal preference values are generated. Modal bias reflects the differences between modes that are not quantifiable such as mode image, comfort, convenience, and reliability.

When introducing a new, modern high speed rail service, the existing rail modal bias from the calibrated model is unlikely to reflect the attributes of the high speed rail option which offers substantial improvements in service factors such as comfort and reliability. As a result, the modal bias for high speed rail should be adjusted to account for these improvements. To provide an understanding of what kind of adjustment would be required, the 1993 Stated Preference Survey included questions which allowed individuals to identify the relative attractiveness of using a high speed train versus flying. The analysis suggested that individuals found prospective high speed rail travel much more attractive than existing rail travel and almost as attractive as existing air travel. The relative rankings resulting from the 1993 survey are shown in Exhibit 12.

Some care is needed in interpreting the rankings. In particular, it would be very difficult to apply the technique described above to a situation in which the modal attributes being considered are not travel-related. For example, because the auto is much more than merely a means of transportation, e.g., it is a "home away from home" for many users, it would be difficult to obtain a ranking for high speed rail versus auto without facing severe survey bias. If high speed rail is to be compared with auto, it would probably be more appropriate to simply modify the auto versus air modal bias by the known relationship between air and high speed rail. This is the procedure TEMS adopted for adjusting its modal split models to account for high speed rail.

EXHIBIT 11
COMPARISON OF QUEBEC-ONTARIO VOT AND VOF RESULTS WITH OTHER CORRIDORS

		Tri-State	New York	Illinois	Portland-Boston	1987 Que-Ont	1993 Que-Ont	1993 Que-Ont Adjusted[2]
Values of Time (1990 US$/Hour)								
Air	Business	65	51	54	54	58	65	65
	Non-Business[1]	34	32	19	21	32	27	30
Rail	Business	40	26	28	24	25	25	25
	Non-Business	28	21	13	14	19	14	18
Auto	Business	43	26	23	24	25	24	25
	Non-Business	26	26	13	14	18	16	18
Bus	Business	25	--	--	16	17	14	18
	Non-Business	22	32	--	12	12	9	12
Values of Frequency (1990 US$/Hour)								
Air	Business	33	24	11	20	31	38	33
	Non-Business	22	--	7	13	21	18	21
Rail	Business	18	11	6	15	15	19	16
	Non-Business	8	11	4	10	11	8	10
Auto	Business	17	18	7	15	18	--	--
	Non-Business	14	12	6	10	12	--	--
Bus	Business	--	13	--	12	13	9	14
	Non-Business	10	9	--	9	9	7	10

(1) *Includes commuter and other travel purposes.*
(2) *Adjusted for effects of recession.*

EXHIBIT 12
RANKING OF MODAL PREFERENCE

Mode	Business	Non-Business
Existing Rail	0	0
High Speed Rail	69	75
Air	100	100

4.0 CONCLUSION

The 1993 Stated Preference Survey produced results similar to those of the 1987 survey, with the exception that non-business VOT values which are about 20 percent lower. It would appear that the recession has had a distinct impact on the Values of Time and, in effect, individuals' travel behaviour has changed. As a result, it is proposed that a set of "adjusted" values to reflect more normal travel behaviour be developed for forecasting purposes. This will give a second set of forecasts that can be compared with those based directly on the results of the 1993 survey. The proposed "adjusted" values are shown in Exhibit 11.

APPENDIX 1

SAMPLE QUESTIONNAIRE
1993 STATED PREFERENCE SURVEY

INTERCITY AIR TRAVEL SURVEY
TEMS-MB

LE BUREAU DE RECHERCHE SOLUMAR,
a division of Market Facts of Canada Limited
1200 McGill College Ave., Montreal, Quebec

Dear Traveller,

In order to better understand the needs of travellers in Ontario and Québec, this survey is being conducted by Le Bureau de recherche Solumar, a division of Market Facts of Canada with the co-operation of the Travel Industry. The results of this survey will help ensure better transportation facilities for people across Ontario and Québec.

We would like you to fill out this questionnaire for the one-way air trip you are about to take. When you have completed the questionnaire, please return it to our representative in the departure lounge (or mail it back to us in the postage paid return envelope provided). Thank you for your cooperation.

YOUR ANSWERS ARE IMPORTANT!

Cash prizes of $200.00 will be awarded to respondents each week from November 30th to December 21st. *Details on page 7.*

The information you provide will be kept strictly confidential and will be used only for research analysis purposes. Your assistance in completing this survey is greatly appreciated.

Le français disponible au verso du questionnaire.

ABOUT YOUR ONE-WAY JOURNEY

6-1
7-1

A. What is your flight number? _____ (airline) _____ (flight number) 8- 9-

B. Please write in today's date: _____ 13-

C. Where did you begin your one-way trip to this airport? Please state nearest street, intersection, prominent landmark, place of interest, institution, etc.

TRIP BEGAN AT:

Intersection/Place _____ 15-
City/Town _____ 17-
Prov./State _____ 20-
Postal Code _____ 21-

D. How much time did it take you to get from this place to the airport terminal?

ENTER THE TRAVEL TIME TO AIRPORT: _____ hours and _____ minutes 24-

E. And where will you end this one-way part of your journey? This place must be different from where you began your one-way journey in "C".

TRIP WILL END AT:

Intersection/Place _____ 28-
City/Town _____ 30-
Prov./State _____ 33-
Postal Code _____ 34-

F. How long will it take you to get from the airport terminal at your destination to this ending place?

ENTER THE TRAVEL TIME FROM AIRPORT: hours and minutes 37

1. Approximately how far is the one-way trip you are now making counting all of your connections? ("X" ONE BOX ONLY)

-41

- ☐ 1 Less than 50 km or 35 miles
- ☐ 2 50 to 149 km or 35 to 99 miles
- ☐ 3 150 to 360 km or 100 to 225 miles
- ☐ 4 More than 360 km or 225 miles

2. Have you or will you be making a connection either to or from another flight? ("X" ONE BOX ONLY)

-42

- ☐ 1 No air connections made
- ☐ 2 Yes, connected to this flight from a previous flight
- ☐ 3 Yes, will connect to a subsequent flight

3. What is the main purpose of your trip? ("X" ONE BOX ONLY)

-43

- ☐ 1 Business - trip paid by employer
- ☐ 2 Business - trip not paid by employer
- ☐ 3 Commuting to/from work
- ☐ 4 Going to/from University or College
- ☐ 5 Vacation or recreation
- ☐ 6 Shopping or personal business
- ☐ 7 Visiting friends or relatives
- ☐ 8 Other (PLEASE WRITE IN) _____

4. Right now, are you going to or returning from your main destination? ("X" ONE BOX ONLY)

-44

- ☐ 1 Going to
- ☐ 2 Returning from

5. Including yourself, in total, how many people are travelling with you in your immediate party on this trip?

WRITE IN NUMBER: _____ -45

6. Do you own a car? ("X" ONE BOX ONLY)

-47

- ☐ 1 Yes
- ☐ 2 No

7. Please check your gender. ("X" ONE BOX ONLY)

-48

- ☐ 1 Male
- ☐ 2 Female

8. Please check your age group. ("X" ONE BOX ONLY)

-49

- ☐ 1 Under 20 years
- ☐ 2 20 - 34 years
- ☐ 3 35 - 49 years
- ☐ 4 50 - 64 years
- ☐ 5 65 years or over

9. How many people live in your household? WRITE IN NUMBER: _____ -50

10. Which one category represents your household 's total gross income for the year before taxes? ("X" ONE BOX ONLY)

-52

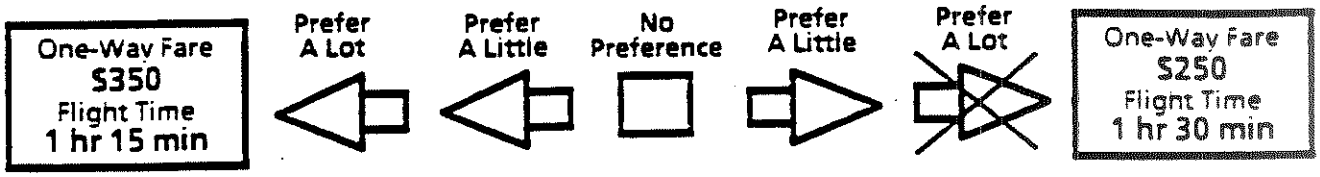
- ☐ 1 Less than $20,000
- ☐ 2 $20,000 to $39,999
- ☐ 3 $40,000 to $59,999
- ☐ 4 $60,000 to $79,999
- ☐ 5 $80,000 or over

11. Imagine that you are planning to make a trip to the SAME PLACE, for the SAME REASON as the trip you are making today.

We need your help to find out what is important when you are considering such a trip. Please answer all of the following questions, each of which presents a choice between two alternatives. There are no right or wrong answers.

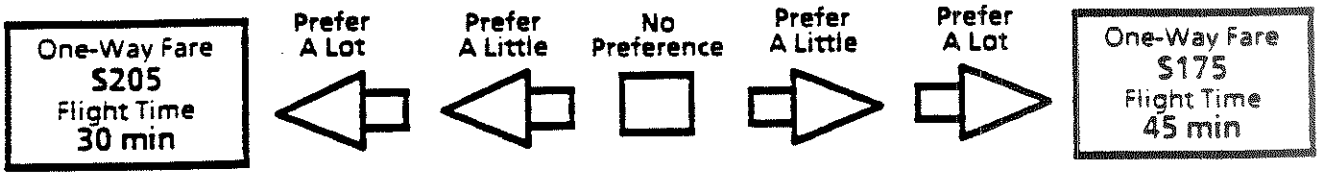
Just indicate how you feel with an "X" like this:

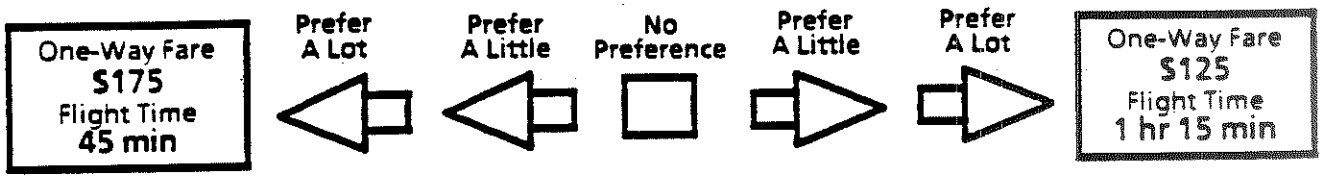
Example

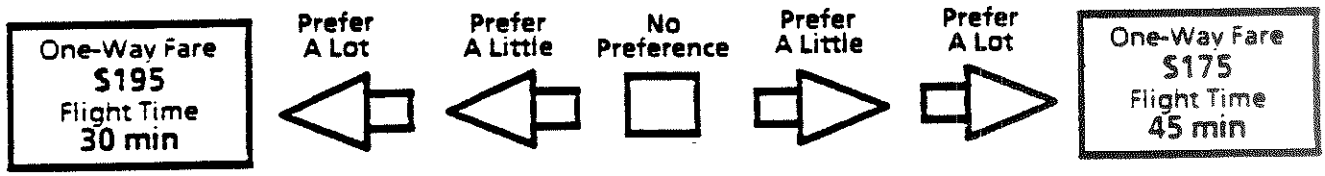


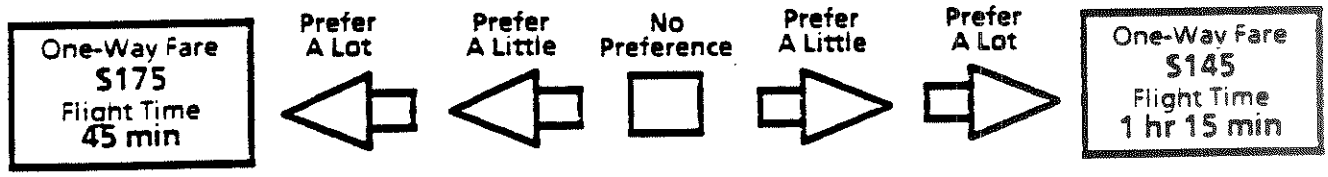
Imagine that you are making the same trip and you are presented with the following choices concerning time and cost. Fare is the cost of your air ticket and flight time is the time spent on the airplane.

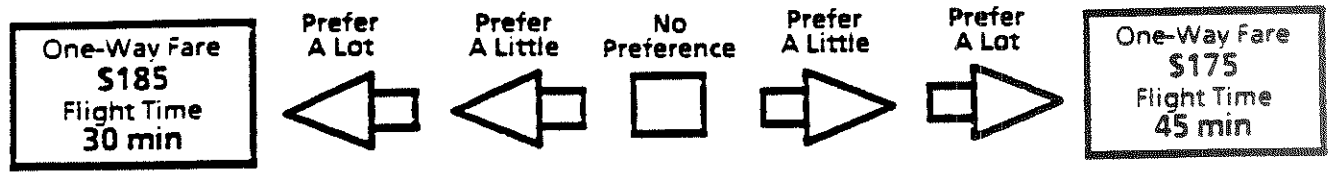
All times and costs are ONE-WAY.

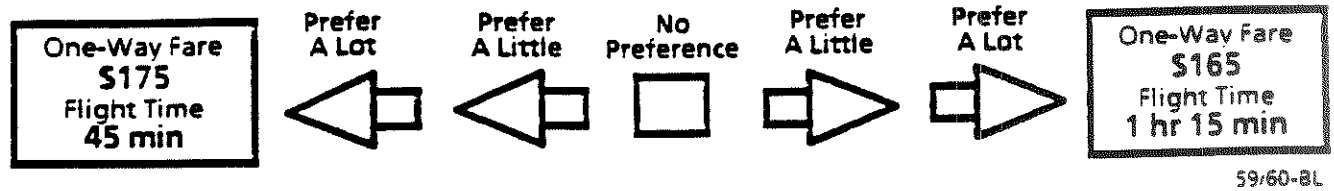












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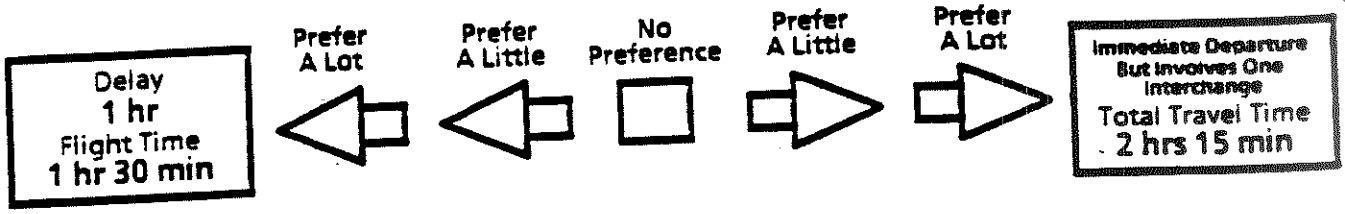
PLEASE MAKE SURE EACH LINE HAS AN "X"

12. Imagine that you are making the same trip and you are presented with the following choices concerning delay times and interchanges. Delay times must be spent at the terminal waiting for the flight.

Assume costs are equal and all times are ONE-WAY.

You arrive at the airport and your choice is to wait for a direct flight or go immediately on a service that involves changing planes.

-61



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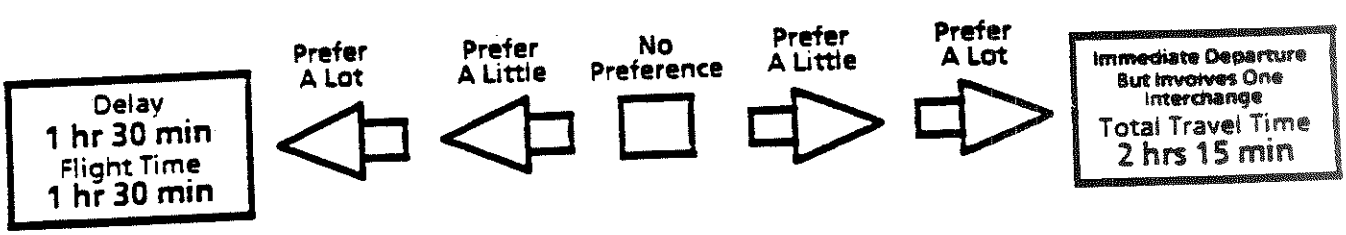

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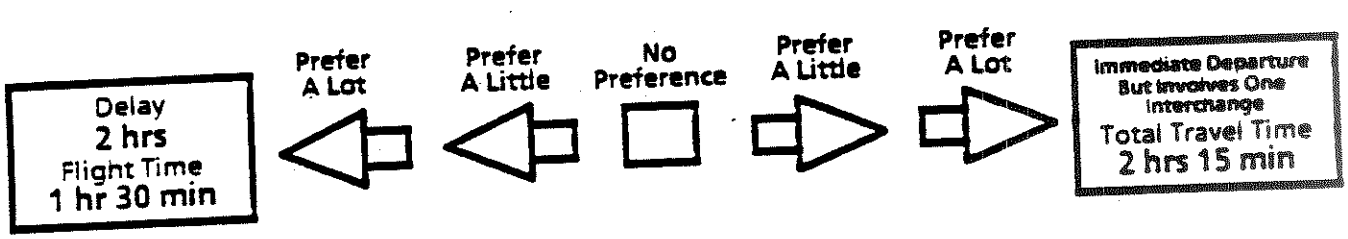

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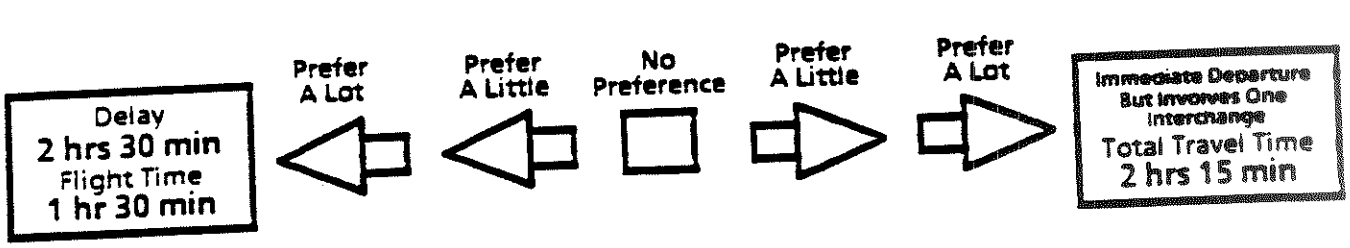

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PLEASE MAKE SURE EACH LINE HAS AN "X"

Air-VOI

PROPOSED HIGH SPEED RAIL SERVICE

13. A High Speed Rail Service is being proposed for the Québec, Montreal, Toronto, London and Windsor corridor. We need your responses to the following questions to understand how people may respond to this service.

The High Speed Rail Service would be comparable to the services offered by the European High Speed trains. These trains offer a standard of comfort and speed (300km/h) far above existing VIA Rail services.

NOTE: Access and wait time consists of the time spent travelling to/from the airports or stations and the time spent waiting in the lounge before departures.