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Market Assessment of High Speed Rail Service in the Calgary-Edmonton Corridor

Technical Appendices

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Appendices

A

Fundamentals of Demand Modeling

A.1 COMPASS™ Demand Model

The COMPASS™ Model System is a flexible multimodal demand-forecasting tool that provides comparative evaluations of alternative socioeconomic and network scenarios. It also allows input variables to be modified to test the sensitivity of demand to various parameters such as elasticities, values of time, and values of frequency. This section describes in detail the model methodology and process using in the present study.

A.1.1 Description of the COMPASS™ Model System

The COMPASS™ Model is structured on three principal models: Total Demand Model, Hierarchical Modal Split Model, and Induced Demand Model. For this study, these three models were calibrated separately for two trip purposes, i.e., Business and Other (commuter, personal, and social). Moreover, since the behaviour of short-distance trip making is significantly different from long-distance trip making, the database was segmented by distance, and independent models were calibrated for both long and short-distance trips. For each market segment, the models were calibrated on origin-destination trip data, network characteristics, and base year socioeconomic data.

The models are calibrated on the base year data. In applying the models for forecasting, an incremental approach known as the "pivot point" method is used. By applying model growth rates to the base data observations, the "pivot point" method is able to preserve the unique travel flows present in the base data that are not captured by the model variables. Details on how this method is implemented are described below.

A.1.2 Total Demand Model

The Total Demand Model, shown in Equation 1, provides a mechanism for assessing overall growth in the travel market.

Equation 1:

$$T_{ijp} = e^{\beta_{0p}}(SE_{ijp})^{\beta_{1p}} e^{\beta_{2p} U_{ijp}}$$

Where,

T_{ijp}	=	Number of trips between zones *i* and *j* for trip purpose *p*
SE_{ijp}	=	Socioeconomic variables for zones *i* and *j* for trip purpose *p*
U_{ijp}	=	Total utility of the transportation system for zones *i* to *j* for trip purpose *p*
β_{0p}, β_{1p}, β_{2p}	=	Coefficients for trip purpose *p*

As shown in Equation 1, the total number of trips between any two zones for all modes of travel, segmented by trip purpose, is a function of the socioeconomic characteristics of the zones and the total utility of the transportation system that exists between the two zones. For this study, trip purposes include Business and Other, and socioeconomic characteristics consisting of population, employment, and per capita income. The utility function provides a logical and intuitively sound method of assigning a value to the travel opportunities provided by the overall transportation system.

A.1.3 Induced Demand

In the Total Demand Model, the utility function provides a measure of the quality of the transportation system in terms of the times, costs, reliability and level of service provided by all modes for a given trip purpose. The Total Demand Model equation may be interpreted as meaning that travel between zones will increase as socioeconomic factors such as population and income rise or as the utility (or quality) of the transportation system is improved by providing new facilities and services that reduce travel times and costs. The Total Demand Model can, therefore, be used to evaluate the effect of changes in both socioeconomic and travel characteristics on the total demand for travel.

A.1.4 Socioeconomic Variables

The socioeconomic variables in the Total Demand Model show the impact of economic growth on travel demand. The COMPASS™ Model System, in line with most intercity modelling systems, uses three variables (population, employment, and per capita income) to represent the socioeconomic characteristics of a zone. Different combinations were tested in the calibration process and it was found, as is typically found elsewhere, that the most reasonable and stable relationships consists of the following formulations:

Trip Purpose	***Socioeconomic Variable***
Business	$E_i E_j (I_i + I_j) / 2$
Other	$P_i P_j (I_i + I_j) / 2$

The business formulation consists of a product of employment in the origin zone, employment in the destination zone, and the average per capita income of the two zones. Since business trips are usually made between places of work, the presence of employment in the formulation is reasonable. The Other formulation consists of a product of population in the origin zone, population in the destination zone and the average per capita income of the two zones. Other trips encompass many types of trips, but the majority is home-based and thus, greater volumes of trips are expected from zones from higher population.

A.1.5 Travel Utility

Estimates of travel utility for a transportation network are generated as a function of generalized cost (GC), as shown in Equation 2:

Equation 2:

$$U_{ijp} = f(GC_{ijp})$$

Where,

GC_{ijp} = Generalized Cost of travel between zones *i* and *j* for trip purpose *p*

Because the generalized cost variable is used to estimate the impact of improvements in the transportation system on the overall level of trip making, it needs to incorporate all the key modal attributes that affect an individual's decision to make trips. For the public modes (i.e., rail, bus and air), the generalized cost of travel includes all aspects of travel time (access, egress, in-vehicle times), travel cost (fares, tolls, parking charges), schedule convenience (frequency of service, convenience of arrival/departure times) and reliability.

The generalized cost of travel is typically defined in travel time (i.e., minutes) rather than dollars. Costs are converted to time by applying appropriate conversion factors, as shown in Equation 3. The generalized cost (GC) of travel between zones i and j for mode m and trip purpose p is calculated as follows:

Equation 3:

$$GC_{ijmp} = TT_{ijm} + \frac{TC_{ijmp}}{VOT_{mp}} + \frac{VOF_{mp}\,OH}{VOT_{mp}\,F_{ijm}\,C_{ijm}} + \frac{VOR_{mp}\,\exp(-OTP_{ijm})}{VOT_{mp}}$$

Where,

TT_{ijm} = Travel Time between zones *i* and *j* for mode *m* (in-vehicle time + station wait time + connection wait time + access/egress time + interchange penalty), with waiting, connect and access/egress time multiplied by a factor (greater than 1) to account for the additional disutility felt by travellers for these activities

TC_{ijmp} = Travel Cost between zones *i* and *j* for mode *m* and trip purpose *p* (fare + access/egress cost for public modes, operating costs for auto)

VOT_{mp} = Value of Time for mode *m* and trip purpose *p*

VOF_{mp} = Value of Frequency for mode *m* and trip purpose *p*

VOR_{mp} = Value of Reliability for mode *m* and trip purpose *p*

F_{ijm} = Frequency in departures per week between zones *i* and *j* for mode *m*

C_{ijm} = Convenience factor of schedule times for travel between zones *i* and *j* for mode *m*

OTP_{ijm} = On-time performance for travel between zones *i* and *j* for mode *m*

OH = Operating hours per week

Station wait time is the time spent at the station before departure and after arrival. Air travel generally has higher wait times because of security procedures at the airport, baggage checking, and the difficulties of loading a plane. Air trips were assigned wait times of 45 minutes while rail trips were assigned wait times of 10 minutes and bus trips were assigned wait times of 15 minutes (Red Arrow) and 20 minutes

(Greyhound). On trips with connections, there would be additional wait times incurred at the connecting station. Wait times are weighted higher than in-vehicle time in the generalized cost formula to reflect their higher disutility as found from previous studies. Wait times are weighted 70 percent higher than in-vehicle time for Business trips and 90 percent higher for Other trips. Similarly, access/egress time has a higher disutility than in-vehicle time. Access time tends to be more stressful for the traveller than in-vehicle time because of the uncertainty created by trying to catch the flight or train.

TEMS has found from past studies that the physical act of transferring trains (or buses or planes) has a negative impact beyond the times involved. To account for this disutility, interchanges are penalized time equivalents. For both air and rail travel, each interchange for a trip results in 40 minutes being added to the Business generalized cost and 30 minutes being added to the Other generalized cost. For bus travel, the interchange penalties are 20 minutes and 15 minutes for Business and Other, respectively.

The third term in the generalized cost function converts the frequency attribute into time units. Operating hours divided by frequency is a measure of the headway or time between departures. Tradeoffs are made in the stated preference surveys resulting in the value of frequencies on this measure. Although there may appear to some double counting because the station wait time in the first term of the generalized cost function is included in this headway measure, it is not the headway time itself that is being added to the generalized cost. The third term represents the impact of perceived frequency valuations on generalized cost. TEMS has found it very convenient to measure this impact as a function of the headway.

The fourth term of the generalized cost function is a measure of the value placed on reliability of the mode. Reliability statistics in the form of on-time performance (i.e., the fraction of trips considered to be on time) were obtained for the rail and air modes only. The negative exponential form of the reliability term implies that improvements from low levels of reliability have slightly higher impacts than similar improvements from higher levels of reliability.

A.2 Generalized Cost Networks and Calibration

A.2.1 Networks

Exhibits A.1 to A.5 show the geographical spread of the networks for the various modes used for the simulation process. Details of the various zones used can be found in Appendix C.

Exhibit A.1: Base Year Auto Network as Coded in COMPASS™

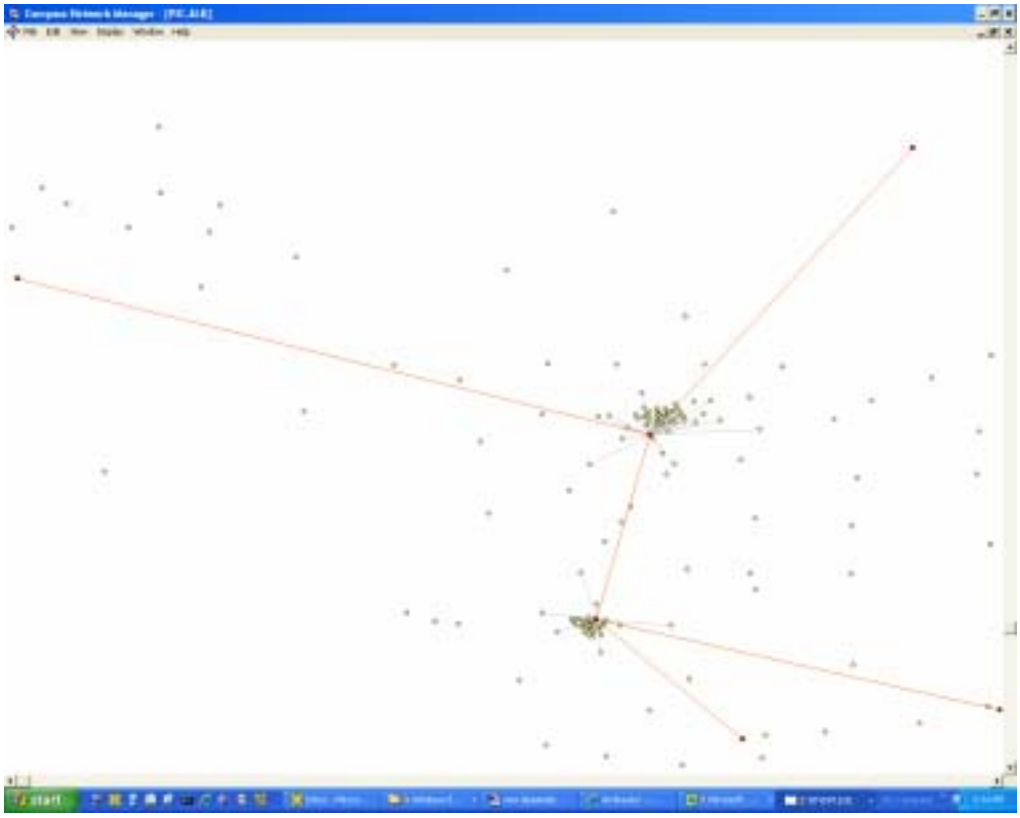


Exhibit A.2: Base Year Air Network as Coded in COMPASS™

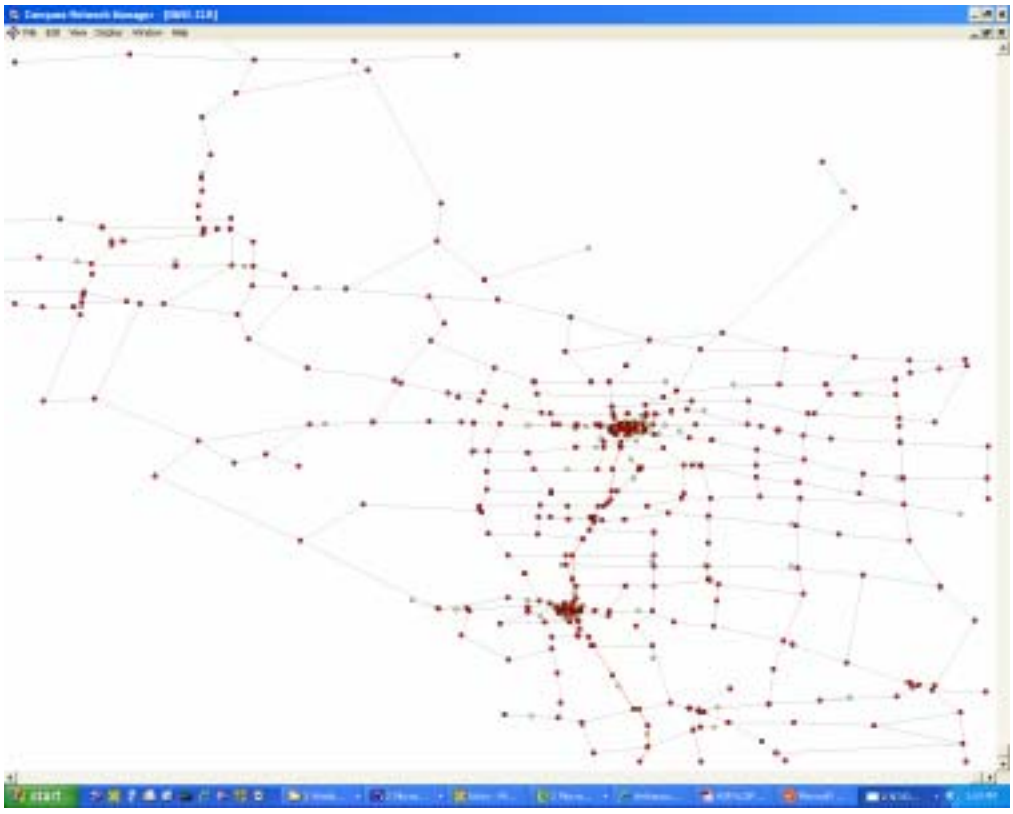


Exhibit A.3: Base Year Greyhound Network as Coded in COMPASS™

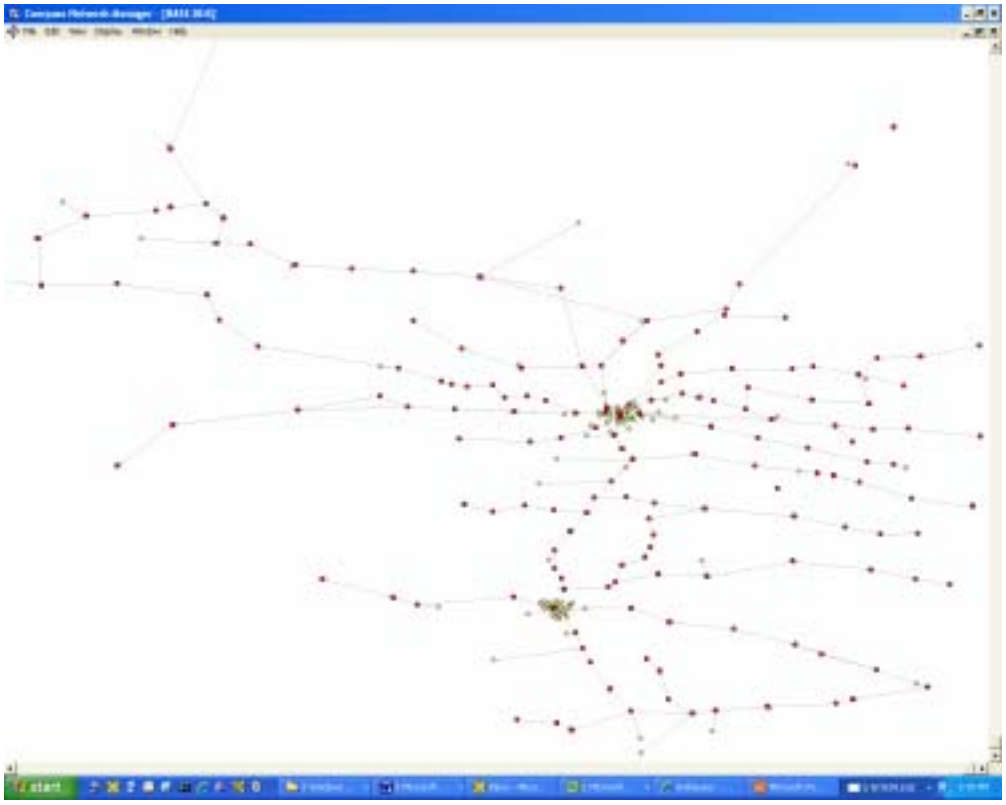


Exhibit A.4: Base Year Red Arrow Network as Coded in COMPASS™

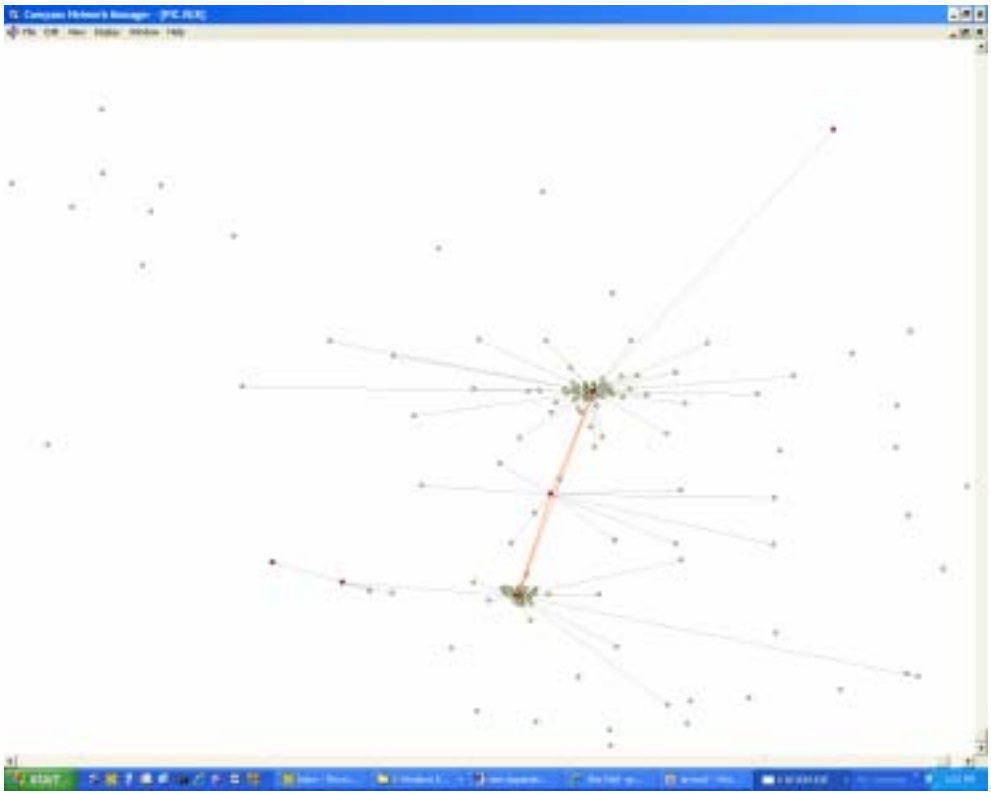
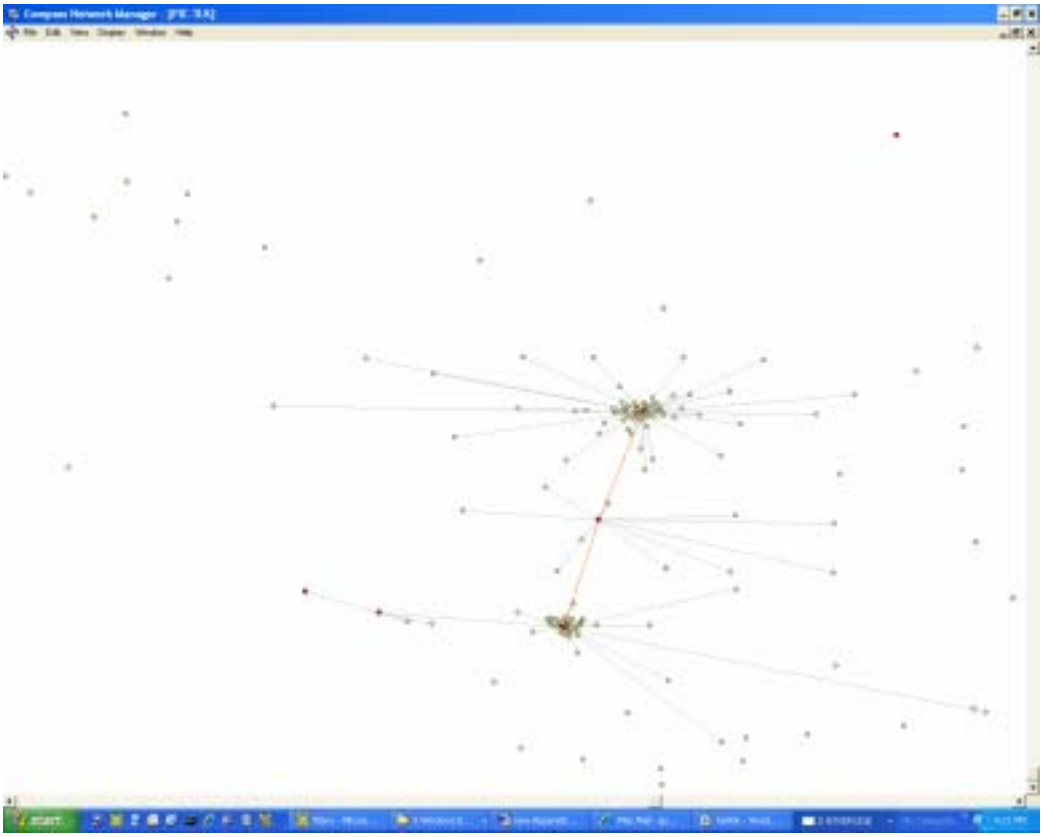


Exhibit A.5: Proposed HSR Network as Coded in COMPASS™



A.2.2 Calibration of the Total Demand Model

In order to calibrate the Total Demand Model, the coefficients are estimated using linear regression techniques. Equation 1, the equation for the Total Demand Model, is transformed by taking the natural logarithm of both sides, as shown in Equation 4:

Equation 4:

$$\log(T_{ijp}) = \beta_{0p} + \beta_{1p}\log(SE_{ijp}) + \beta_{2p}(U_{ijp})$$

Equation 4 provides the linear specification of the model necessary for regression analysis. The results of the calibration for the Total Demand Models for both slow and fast technologies are displayed in Exhibit A.6 and A.7.

Exhibit A.6: Total Demand Model Coefficients (slow HSR technologies) [1]

Business	$\log(T_{ij})$	=	1.930	+	0.800 $\log(SE)_{ij}$ + (88)	0.687 U_{ij} (19)	R^2=0.81
	where $U_{ij} = \log[\exp(10.460+1.011U_{Pub}) + \exp(-0.004\ GC_{Car})]$						
Other	$\log(T_{ij})$	=	-1.527	+	0.709 $\log(SE)_{ij}$ + (29)	0.500 U_{ij} (23)	R^2=0.67
	where $U_{ij} = \log[\exp(10.862+0.609U_{Pub}) + \exp(-0.006\ GC_{Car})]$						

Exhibit A.7: Total Demand Model Coefficients (fast HSR technologies) [1]

Business	$\log(T_{ij})$	=	-13.00	+	0.810 $\log(SE)_{ij}$ + (88)	1.660 U_{ij} (19)	R^2=0.72
	where $U_{ij} = \log[\exp(-1.32 + 0.150\ U_{Pub}) + \exp(-0.005\ GC_{Car})]$						
Other	$\log(T_{ij})$	=	-16.24	+	0.700 $\log(SE)_{ij}$ + (29)	1.560 U_{ij} (23)	R^2=0.75
	where $U_{ij} = \log[\exp(-0.32 + 0.020\ U_{Pub}) + \exp(-0.008\ GC_{Car})]$						

[1] *t-statistics are given in parentheses.*

In evaluating the validity of a statistical calibration, there are two key statistical measures: t-statistics and R2. The t-statistics are a measure of the significance of the model's coefficients; values of 1.95 and above are considered "good" and imply that the variable has significant explanatory power in estimating the level of trips. The R2 is a statistical measure of the "goodness of fit" of the model to the data; any data point that deviates from the model will reduce this measure. It has a range from 0 to a perfect 1, with 0.4 and above considered "good" for large data sets.

Based on these two measures, the total demand calibrations are good. The t-statistics are very high, aided by the large size of the Midwest data set. There are roughly five times as many long-distance observations as short-distance observations, resulting in higher t-statistics for the long- distance models. The R2 values imply very good fits of the equations to the data.

A.2.3 Incremental Form of the Total Demand Model

The calibrated Total Demand Models could be used to estimate the total travel market for any zone pair using the population, employment, per capita income, and the total utility of all the modes. However, there would be significant differences between estimated and observed levels of trip making for many zone pairs despite the good fit of the models to the data. To preserve the unique travel patterns contained in the base data, the incremental approach or "pivot point" method is used for forecasting. In the incremental approach, the base travel data assembled in the database are used as pivot points, and forecasts are made by applying trends to the base data. The total demand equation as described in

Equation 1 can be rewritten into the following incremental form that can be used for forecasting (Equation 5):

Equation 5:

$$\frac{T_{ijp}^{\ f}}{T_{ijp}^{\ b}} = \left(\frac{SE_{ijp}^{\ f}}{SE_{ijp}^{\ b}}\right)^{\beta_{1p}} \exp(\beta_{2p}\,(U_{ijp}^{\ f} - U_{ijp}^{\ b}))$$

Where,

- Tf_{ijp} = Number of Trips between zones *i* and *j* for trip purpose *p* in forecast year *f*
- Tf_{ijp} = Number of Trips between zones *i* and *j* for trip purpose *p* in base year *b*
- SEf_{ijp} = Socioeconomic variables for zones *i* and *j* for trip purpose *p* in forecast year *f*
- SE^{b}_{ijp} = Socioeconomic variables for zones *i* and *j* for trip purpose *p* in base year *b*
- Uf_{ijp} = Total utility of the transportation system for zones *i* to *j* for trip purpose *p* in forecast year *f*
- U^{b}_{ijp} = Total utility of the transportation system for zones *i* to *j* for trip purpose *p* in base year *b*

In the incremental form, the constant term disappears and only the elasticities are important.

A.2.4 Hierarchical Modal Split Model

The role of the Hierarchical Modal Split Model is to estimate relative modal shares, given the Total Demand Model estimate of the total market. The relative modal shares are derived by comparing the relative levels of service offered by each of the travel modes. The COMPASS™ Hierarchical Modal Split Model uses a nested logit structure, which has been adapted to model the intercity modal choices available in the study area. As shown in Exhibit A.8, four levels of binary choice are calibrated. Several hierarchical structures were tested, and two hierarchies were adopted in this study to model "slow" (125 mph and 150 mph) and "fast" (200 mph and 300 mph) HSR technologies.

Exhibit A.8: Hierarchical Modal Split Structure for "slow" HSR Technologies

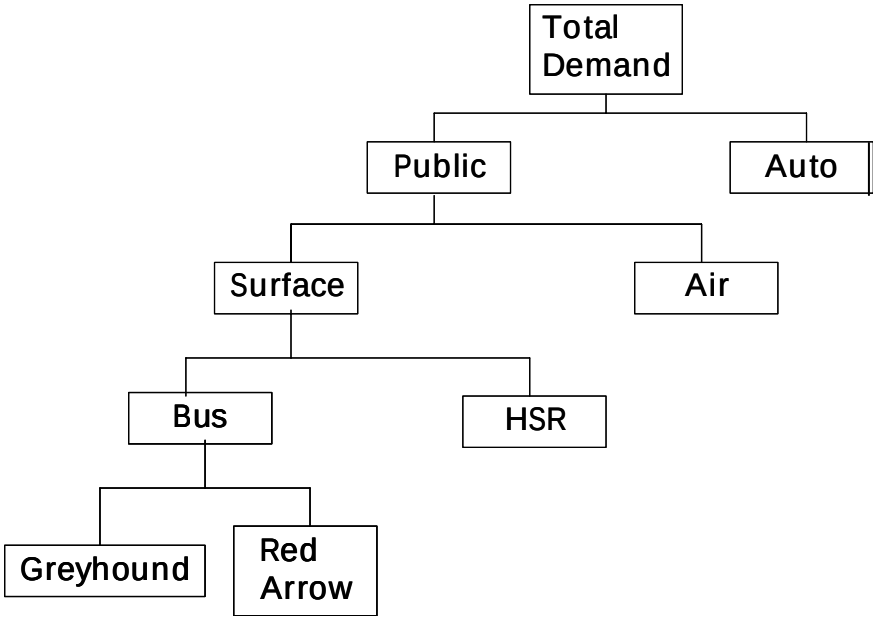
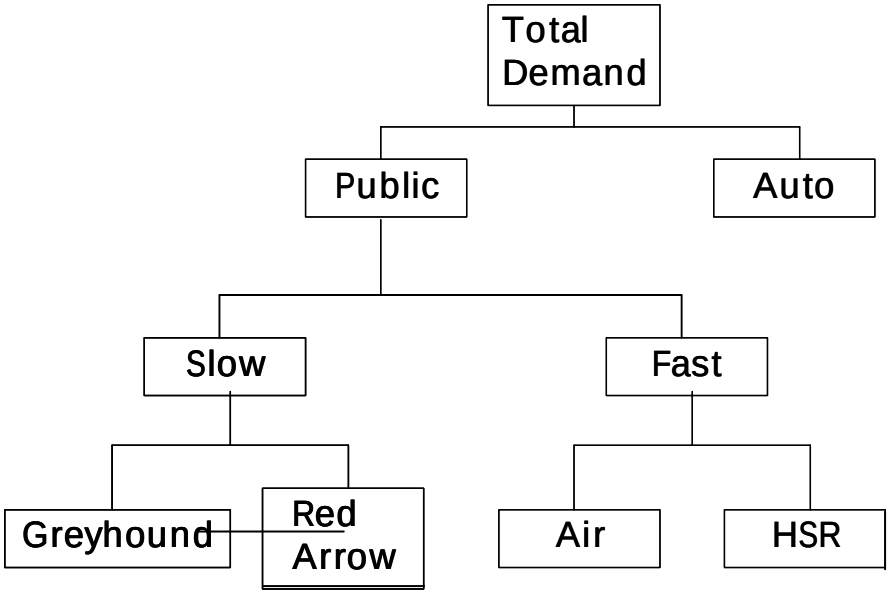


Exhibit A.9: Hierarchical Modal Split Structure for "fast" HSR Technologies



The main feature of the Hierarchical Modal Split Model structure is the increasing commonality of travel characteristics as the structure descends. The first level of the hierarchy separates private auto travel – with its spontaneous frequency, low access/egress times, low costs, and highly personalized characteristics – from the public modes. The second level of the structure separates air – the fastest, most expensive and perhaps most frequent and comfortable public mode – from the rail and bus surface modes. The lowest level of the hierarchy separates rail, a potentially faster, more reliable, and more comfortable mode, from the bus mode.

A.2.5 Form of the Hierarchical Modal Split Model

To assess modal split behaviour, the logsum utility function, which is derived from travel utility theory, has been adopted. As the modal split hierarchy ascends, the logsum utility values are derived by combining the generalized costs of travel. Advantages of the logsum utility approach are 1) the introduction of a new mode will increase the overall utility of travel; and 2) a new mode can readily be incorporated into the Hierarchical Modal Split Model, even if it were not included in the base-year calibration.

As only two choices exist at each level of the modal split hierarchical structure, a Binary Logit Model is used, as shown in Equation 6:

Equation 6: $$P_{ijmp} = \frac{\exp(U_{ijmp}/\rho)}{\exp(U_{ijmp}/\rho) + \exp(U_{ijnp}/\rho)}$$

Where,

P_{ijmp} = Percentage of trips between zones i and j by mode m for trip purpose p

U_{ijmp}, U_{ijnp} = Utility functions of modes m and n between zones i and j for trip purpose i

ρ is called the nesting coefficient

In Equation 6, the utility of travel between zones i and j by mode m for trip purpose p is a function of the generalized cost of travel. Where mode m is a composite mode (e.g., the surface modes in the third level of the Modal Split Model hierarchy, which consist of the rail and bus modes), the utility of travel, as described below, is derived from the utility of the two or more modes it represents.

A.2.6 Utility of Composite Modes

Where modes are combined, as in the upper levels of the modal split hierarchy, it is essential to be able to measure the "inclusive value" of the composite mode, e.g., how the combined utility for bus and rail compares with the utility for bus or rail alone. The combined utility is more than the utility of either of the modes alone, but it is not simply equal to the sum of the utilities of the two modes. A realistic approach to solving this problem, which is consistent with utility theory and the logit model, is to use the logsum function. As the name logsum suggests, the utility of a composite mode is defined as the natural logarithm of the sum of the utilities of the component modes. In combining the utility of separate modes, the logsum function provides a reasonable proportional increase in utility that is less than the combined utilities of the two modes, but reflects the value of having two or more modes available to the traveller.

In a nested binary logit model, the calibrated coefficients associated with the inclusive values of composite modes are the nesting coefficients and take on special meaning. If one of these coefficients is equal to 1, then that level of the hierarchical model collapses and two levels of the hierarchy essentially become 1. At this point, the Hierarchical Modal Split Model is a multinomial logit model that is analyzing three or more modes, i.e., all the modes comprising the composite mode, as well as the other modes in that level of the hierarchy. If one of the coefficients is greater than 1, then the hierarchy has been incorrectly specified and counterintuitive forecasts will result. Because of the assumptions behind the Hierarchical Modal Split Model, the coefficients must decrease as the modal split hierarchy is ascended or counterintuitive results will occur. Thus, the coefficients provide a check on whether the Modal Split Model hierarchy has been specified correctly.

A.2.7 Calibration of the Hierarchical Modal Split Model

Working from the bottom of the hierarchy up to the top, the first analysis is that of the rail mode versus the bus mode for slow HSR technologies. As shown in Exhibit A.10, the model was effectively calibrated for the two trip purposes and the two trip lengths, with reasonable parameters and R2 and t values. All the coefficients have the correct signs such that demand increases or decreases in the correct direction as travel times or costs are increased or decreased, and all the coefficients appear to be reasonable in terms of the size of their impact. Rail travellers are more sensitive than bus travellers to time and cost. This is as expected, given the general attitude that travellers, and in particular business travellers, have toward the bus mode. The higher coefficients on the short-distance models are partly due to the scale effect where the same time or cost improvements would be more meaningful on shorter trips.

Exhibit A.10: Rail versus Bus Modal Split Model Coefficients ("slow" rail modes only)

Business	$\log(P_{Bus}/P_{Rail})$	=	-0.935	+ 0.511 U_{Bus} (7)	+	0.011 GC_{Rail} (10)	R^2=0.44
Other	$\log(P_{Bus}/P_{Rail})$	=	-2.276	+ 0.519 U_{Bus} (8)	+	0.008 GC_{Rail} (8)	R^2=0.44

(1) *t-statistics are given in parentheses.*

Where the utility for Bus travel is obtained as (for both "slow" and "fast" rail modes)

Business	U_{Bus}	=	$\log[\exp(-0.37 - 0.01\ GC_{Grey})$ (51)	+	$\exp(-0.01\ GC_{RA})$ (20)	R^2=0.59
Other	U_{Other}	=	$\log[\exp(1.00 - 0.06\ GC_{Grey})$ (51)	+	$\exp(-0.06\ GC_{RA})$ (20)	R^2=0.35

(1) *t-statistics are given in parentheses.*

The constant term in each equation indicates the degree of bias towards one mode or the other. Since the terms are positive in all the market segments, there is a bias towards rail travel that is not explained by the variables (e.g., times, costs, frequencies, reliability) used to model the modes. As expected, this bias is towards rail for business travellers who tend to have very negative perceptions of intercity bus.

For the second level of the hierarchy, the analysis is of the surface modes (i.e., rail and bus) versus air. Accordingly, the utility of the surface modes is obtained by deriving the logsum of the utilities of rail and bus. As shown in Exhibit A.10, the model calibrations for both trip purposes are all statistically significant, with good R2 and t values and reasonable parameters. As indicated by the air coefficients, short-distance travellers are less sensitive to changes in the air costs than long-distance travellers. One explanation is some short-distance air trips are special trips responding to personal or business emergencies and, thus, are cost insensitive. As indicated by the constant terms, there is a large bias towards air travel for long-distance trips. However, for short trips, there is only a small bias towards air for both Business and Other travellers.

For the case of "fast" rail technologies, the next Exhibit shows the calibration for Air vs. HSR.

Exhibit A.11: Calibration Air – HSR for "fast" technologies

Business	$\log(P_{Air}/P_{Rail})$	=	-10.0	-0.515 GC_{Air} (7)	+	0.018 GC_{Rail} (10)	R^2=0.35
Other	$\log(P_{Air}/P_{Rail})$	=	-8.16	-0.211 GC_{Air} (8)	+	0.011 GC_{Rail} (8)	R^2=0.41

(1) *t-statistics are given in parentheses.*

This calibration is then fed into the utility function for the slow-fast calibration (again, for "fast" rail technologies.

Business	$\log(P_{Slow}/P_{Fast})$	=	-8.10	+0.24 U_{Slow} (26)	-	1.79 U_{Fast} (69)	R^2=0.72
	where $U_{Fast} = \log[\exp(-10 - 0.515\ GC_{Air}) + \exp(-0.018\ GC_{Rail})]$ and $U_{Slow} = U_{Bus}$						
Other	$\log(P_{Slow}/P_{Fast})$	=	-7.30	+0.21 U_{Slow} (19)	-	0.85 U_{Fast} (32)	R^2=0.43
	where $U_{Fast} = \log[\exp(-8.16 - 0.211\ GC_{Air}) + \exp(-0.011\ GC_{Rail})]$ and $U_{Slow} = U_{Bus}$						

Exhibit A.12: Surface versus Air Modal Split Model Coefficients (1)

Business	$\log(P_{Surf}/P_{Air})$	=	-3.301 +	1.256 U_{Surf} (12)	+ 0.10 GC_{Air} (49)	R^2=0.80
	where U_{Surf}	=	$\log[\exp(-0.935 + 0.511\ U_{Bus}) + \exp(-0.011\ GC_{Rail})]$			
Other	$\log(P_{Surf}/P_{Air})$	=	-4.578 +	0.565 U_{Surf} (20)	+ 0.12 GC_{Air} (30)	R^2=0.56
	where U_{Surf}	=	$\log[\exp(-2.276 + 0.519\ U_{Bus}) + \exp(0.008\ GC_{Rail})]$			

(1) *t-statistics are given in parentheses.*

The analysis for the top level of the hierarchy is of auto versus the public modes. The utility of the public modes is obtained by deriving the logsum of the utilities of the air, rail, and bus modes.

As shown in Exhibit A.12, the model calibrations for both trip purposes are all statistically significant, with good R2 and t values and reasonable parameters in most cases. Finally, at the top of the hierarchy in both cases, there is the Public vs. Auto calibration, reported in Exhibit A.13 below.

Exhibit A.13: Public versus Auto Hierarchical Modal Split Model Coefficients [1]

"slow" modes (125-mph and 150-mph)

Business $\log(P_{Pub}/P_{Auto}) = 10.460 + 1.011\ U_{Pub} + 0.004\ GC_{Auto}$ $R^2=0.60$
(28) (23)
where $U_{Pub} = \log[\exp(-3.301+1.256\ U_{Surf}) + \exp(-0.10\ GC_{Air})]$

Other $(P_{Pub}/P_{Auto}) = 10.862 + 0.609\ U_{Pub} + 0.006\ GC_{Auto}$ $R^2=0.69$
(58) (63)
where $U_{Pub} = \log[\exp(-4.578 + 0.565\ U_{Surf}) + \exp(-0.12\ GC_{Air})]$

"fast" modes (200-mph and 300-mph)

Business $\log(P_{Pub}/P_{Auto}) = -1.32 + 0.150\ U_{Pub} + 0.005\ GC_{Auto}$ $R^2=0.45$
(49) (60)
where $U_{Pub} = \log[\exp(-8.10 + 0.24\ U_{Slow}) + \exp(0.79\ U_{Fast})]$

Other $\log(P_{Pub}/P_{Auto}) = -0.32 + 0.020\ U_{Pub} + 0.008\ GC_{Auto}$ $R^2=0.55$
(74) (94)
where $U_{Pub} = \log[\exp(-7.30 + 0.20\ U_{Slow}) + \exp(0.65\ U_{Fast})]$

[1] *t-statistics are given in parentheses.*

A.2.8 Incremental Form of the Modal Split Model

Using the same reasoning as previously described, the modal split models are applied incrementally to the base data rather than imposing the model estimated modal shares. Different regions of the corridor may have certain biases toward one form of travel over another and these differences cannot be captured with a single model for the entire system. Using the "pivot point" method, many of these differences can be retained. To apply the modal split models incrementally, the following reformulation of the hierarchical modal split models is used (Equation 7):

Equation 7:

$$\frac{\left(\frac{P_A^f}{P_B^f}\right)}{\left(\frac{P_A^b}{P_B^b}\right)} = e^{\beta\left(GC_A^f - GC_B^b\right) + \gamma\left(GC_B^f - GC_B^b\right)}$$

For hierarchical modal split models that involve composite utilities instead of generalized costs, the composite utilities would be used in the above formula in place of generalized costs. Once again, the constant term is not used and the drivers for modal shifts are changed in generalized cost from base conditions.

A.2.9 Induced Demand Model

Induced demand refers to changes in travel demand related to improvements in a transportation system, as opposed to changes in socioeconomic factors that contribute to growth in demand. The quality or utility of the transportation system is measured in terms of total travel time, travel cost, and worth of travel by all modes for a given trip purpose. The induced demand model used the increased utility

resulting from system changes to estimate the amount of new (latent) demand that will result from the implementation of the new system adjustments. The model works simultaneously with the mode split model coefficients to determine the magnitude of the modal-induced demand based on the total utility changes in the system.

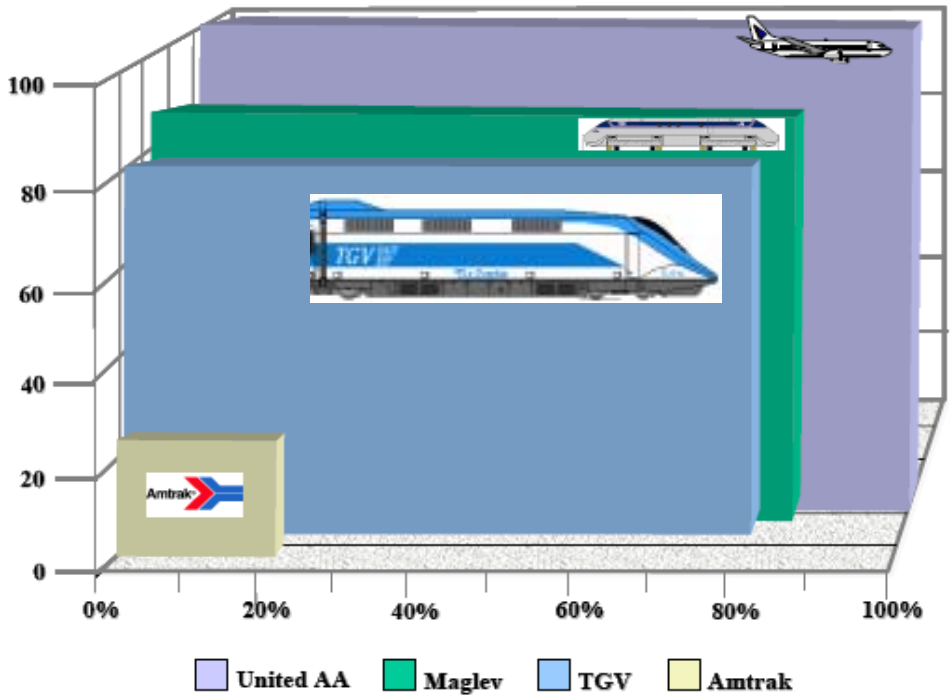
A.2.10 Modal Bias

Modal bias coefficients have an impact on the ridership and revenue that a system is able to achieve. In addition to system operations, (e.g., travel times, fares, and frequency of service) passengers prefer one mode over another based on specific modal factors. These factors include comfort, cleanliness, smoothness of ride and overall ease of transport. Given the fact that two systems are operating the same timetable, the modal bias factor is able to forecast what mode people will utilize.

Exhibit A.8 shows typical modal bias coefficients as estimated by TEMS in previous studies. When comparing the modes, it is shown that passengers exhibit large bias towards the air mode over rail, (i.e., Maglev, TGV and Amtrak). Given similar operating characteristics, (e.g., travel times, fares and frequency) passengers would prefer air to the rail options.

In this study, the four technologies carry different biases, increasing the likelihood of choosing HSR versus other competing modes as the performance is raised. Two different hierarchies have been used for the modeling process, hence the scale of modal bias is different. Assuming Maglev (300-mph) has a bias equal to 90% of Air, and assuming the 125-mph technology has a bias equal to Red Arrow, we estimated that a 125-mph technology having an overall modal bias of 45%, 150-mph of 55%, a 200-mph technology having a bias of 77%, and 300-mph of 90%.

Exhibit A.8: Schematic Representation of Modal Bias between Rail and Air



B

Sample Survey Forms

Shown below are the survey forms for Air, Greyhound, Red Arrow, and Auto -

Flight: ☐ AC ☐ WestJet Departure time: _____

Dear Respondent:

This survey is part of a transportation study conducted by Alberta Infrastructure and Transportation in order to better understand and serve travel needs for the Province of Alberta. Please take a few minutes to answer the questions on this form and return it to our representatives. The information you provide will be kept strictly confidential. Thank you for your cooperation.

1. Where are you going today? Please indicate your trip origin and destination cities.

   Origin (City): _____ (State/Province) _____

   Destination (City): _____ (State/Province) _____

   What is the city and state/province of your primary residence? _____

2. On average, how often do you make this trip? (Check one box)

   ☐ 2 times or more per week ☐ Twice a month ☐ Less than once a month
   ☐ Once a week ☐ Once a month

3. How did you get to the airport? (Check one box)

   ☐ Own Car ☐ Bus/Public Transport ☐ Connecting Flight
   ☐ Rental Car ☐ Ride from family/friends ☐ Other _____

4. What is the primary purpose of your trip? (Check one box)

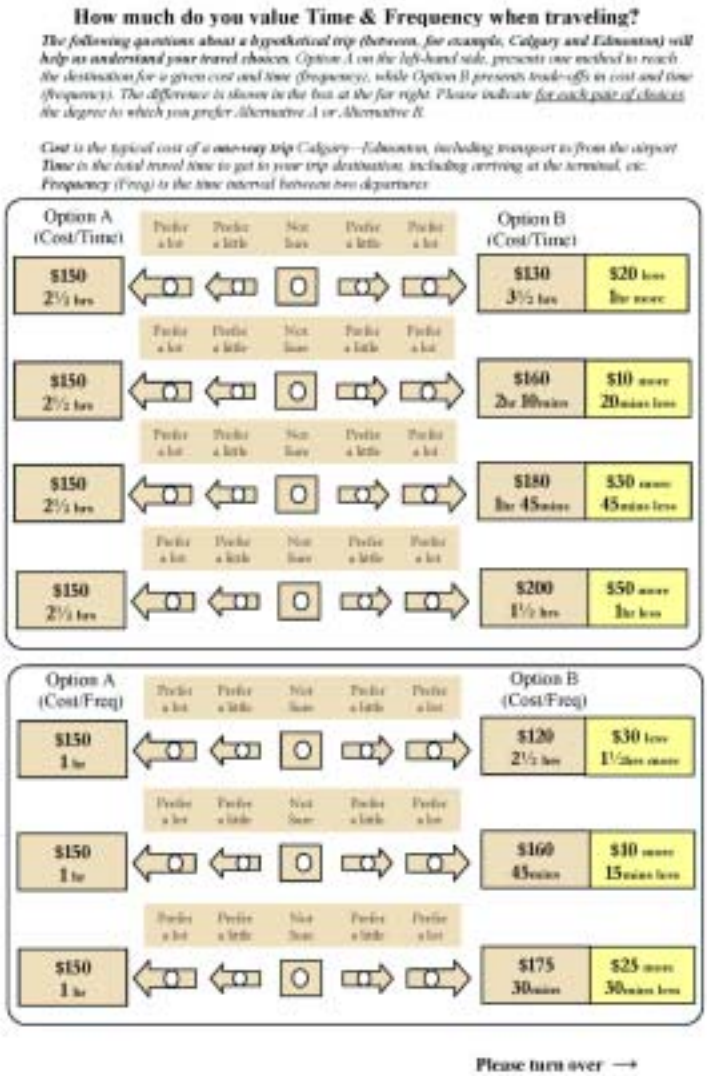
   ☐ Business
   ☐ Personal Business ☐ Attend school/college
   ☐ Recreation/Vacation ☐ Attend special social event
   ☐ Visit friends or relatives ☐ Other _____

5. What is your employment status? (Check one box)

   ☐ Employed full-time ☐ Employed part-time ☐ Other _____

6. The combined annual income of everyone in your household is:

   ☐ Less than $30,000 ☐ $30,000 to $59,000
   ☐ $60,000 to $99,000 ☐ $100,000 or more



How much do you value Time & Frequency when traveling?

The following questions about a hypothetical trip (between, for example, Calgary and Edmonton) will help us understand your travel choices. *Option A on the left-hand side, presents one method to reach the destination for a given cost and time (frequency), while Option B presents trade-offs in cost and time (frequency). The difference is shown in the box at the far right. Please indicate for each pair of choices the degree to which you prefer Alternative A or Alternative B.*

Cost *is the typical cost of a* ***one-way trip*** *Calgary—Edmonton, including transport to from the airport*
Time *is the total travel time to get to your trip destination, including arriving at the terminal, etc.*
Frequency *(Freq) is the time interval between two departures*

Option A (Cost/Time)	Prefer a lot	Prefer a little	Not sure	Prefer a little	Prefer a lot	Option B (Cost/Time)	
$150 2½ hrs						$130 3½ hrs	$20 less 1hr more
$150 2½ hrs						$160 2hr 10mins	$10 more 20mins less
$150 2½ hrs						$180 1hr 45mins	$30 more 45mins less
$150 2½ hrs						$200 1½ hrs	$50 more 1hr less

Option A (Cost/Freq)	Prefer a lot	Prefer a little	Not sure	Prefer a little	Prefer a lot	Option B (Cost/Freq)	
$150 1 hr						$120 2½ hrs	$30 less 1½hrs more
$150 1 hr						$160 45mins	$10 more 15mins less
$150 1 hr						$175 30mins	$25 more 30mins less

Please turn over →

Alberta Travel Survey (Greyhound)

Dear Respondent: This survey is part of a transportation study being conducted by the Alberta Infrastructure and Transportation Department in order to better understand and serve travel needs for the Province of Alberta. Please take a few minutes to answer the questions on this form and return it to our representatives. The information you provide will be kept strictly confidential. Thank you for your cooperation

1. Could you describe the Origin / Destination of your trip?

Origin City: _____ Postal code _____

Destination City: _____ Postal code _____

Is either place your residence? If yes, is it the ☐ Trip Origin ☐ Trip Destination
If not, please provide the Postal Code of your primary residence _____

2. How frequently do you make such trip?

☐ Once a week ☐ Once a month ☐ Less than once a year
☐ Twice a month ☐ Twice a year

3. How do you complete this trip?

☐ Own Car ☐ Air ☐ Bus
☐ Rental Car ☐ Ride from family/friends ☐ Other _____

4. What is the primary purpose of your travel? (Check one box)

☐ Business ☐ Shop
☐ Personal Business ☐ Attend school/college
☐ Recreation/Vacation ☐ Attend special social event
☐ Visit friends or relatives ☐ Other _____

5. What is your employment status?

☐ Employed full-time ☐ Employed part-time ☐ Other _____

6. The combined annual income of everyone in your household is:

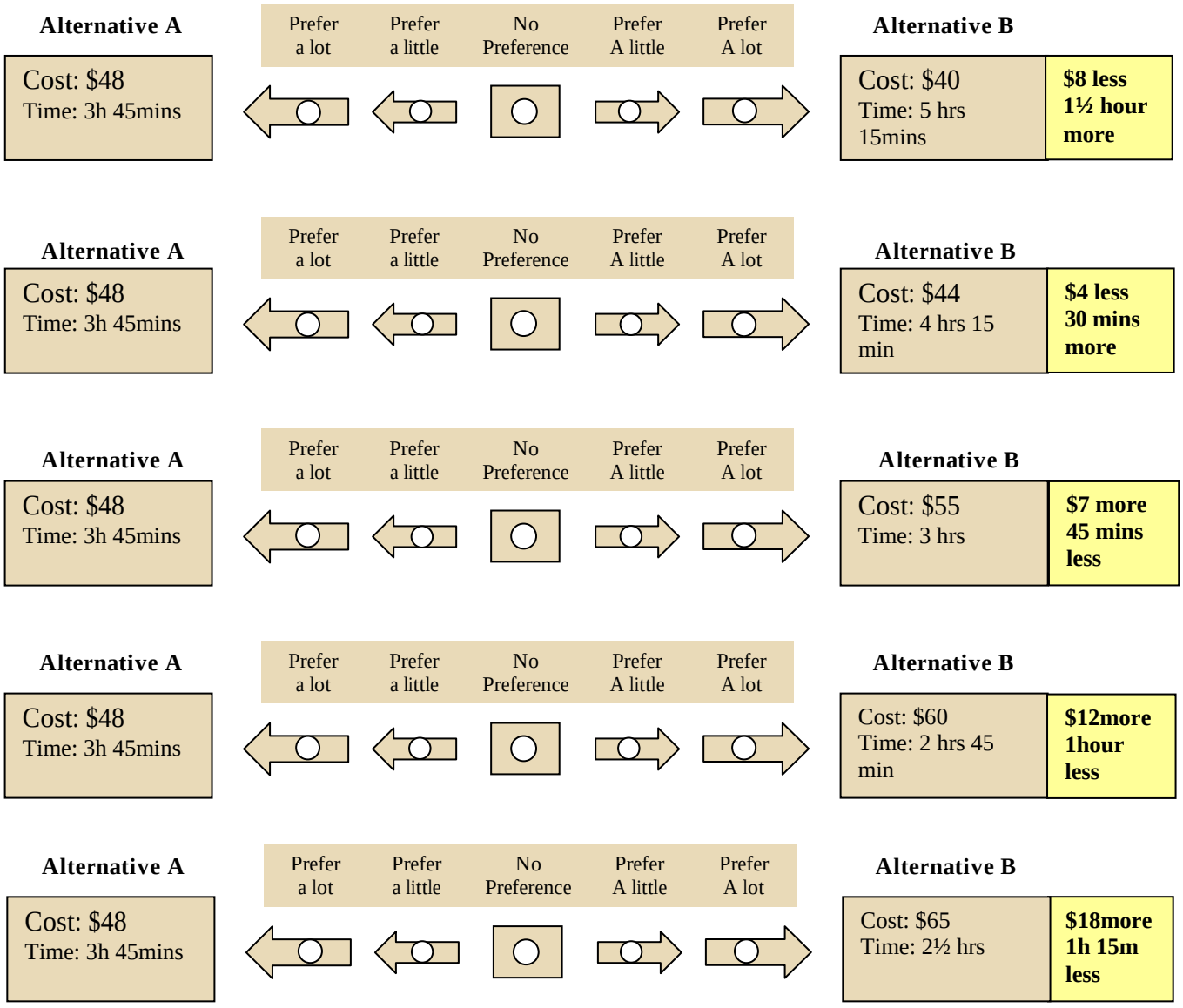
☐ Less than $30,000 ☐ $30,000 to $59,000 ☐ $60,000 to $99,000 ☐ $100,000 or more

(Continue next page)

How much do you value your time when travelling? (Bus)

The following questions about a hypothetical trip (between, for example, Calgary and Edmonton) will help us understand your travel choices. Option A on the left-hand side, presents one method to reach the destination for a given cost and time, while Option B presents trade-offs in cost and time. As shown in the example, please indicate for each pair of choices the degree to which you prefer Alternative A or Alternative B.

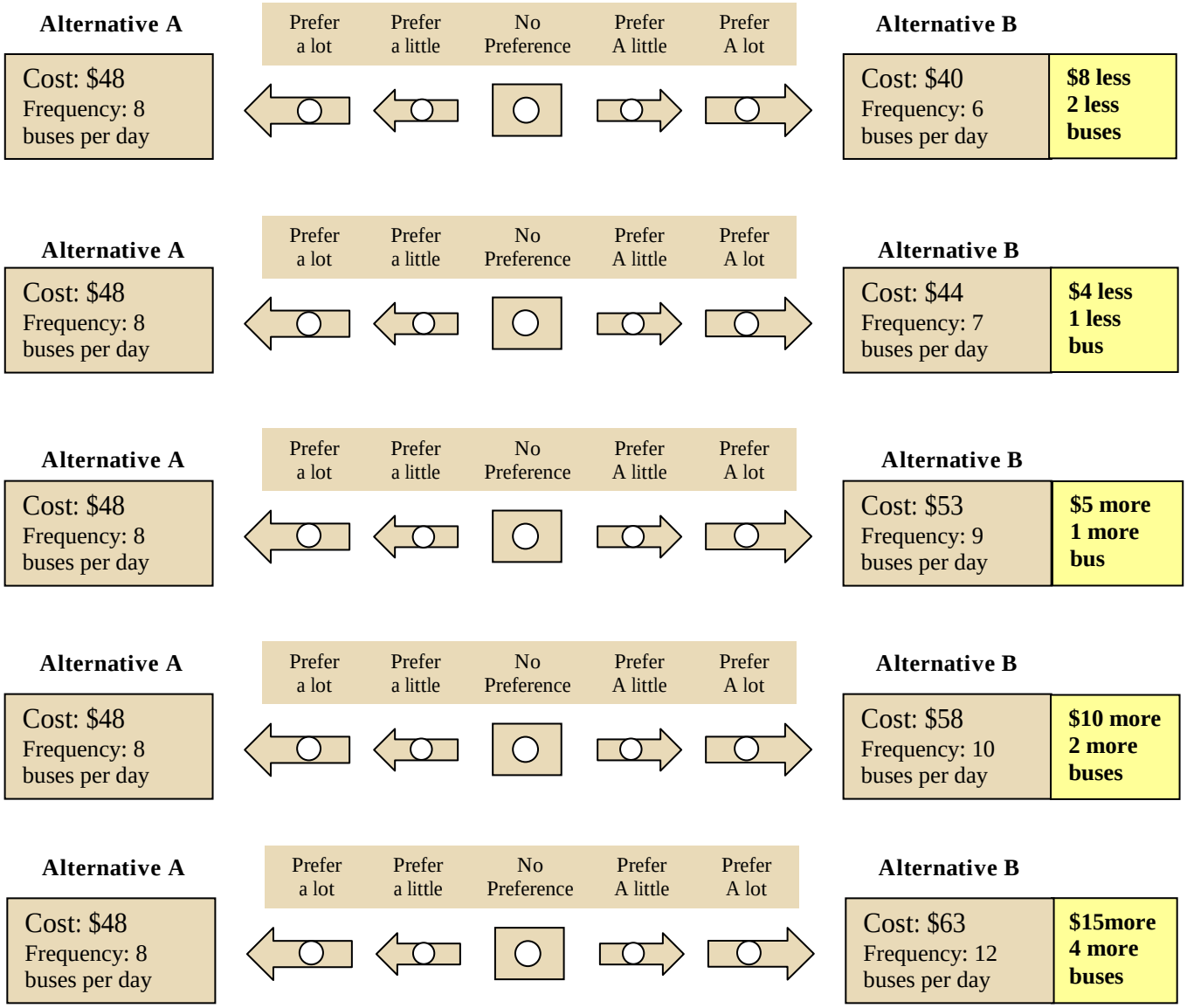
Cost is the cost of a one-way trip
Time is the total travel time to get to your trip destination, including arriving at the terminal, etc.



How important is to you the frequency of service? (Bus)

The following questions about a hypothetical trip (between, for example, Calgary and Edmonton) will help us understand your travel choices. Option A on the left-hand side, presents one method to reach the destination for a given cost and time, while Option B presents trade-offs in cost and time. As shown in the example, please indicate for each pair of choices the degree to which you prefer Alternative A or Alternative B.

Cost is the cost of a one-way trip
Frequency is how often the service operates.



Alberta Travel Survey (Red Arrow)

Dear Respondent: This survey is part of a transportation study being conducted by the Alberta Infrastructure and Transportation Department in order to better understand and serve travel needs for the Province of Alberta. Please take a few minutes to answer the questions on this form and return it to our representatives. The information you provide will be kept strictly confidential. Thank you for your cooperation

7. Could you describe the Origin / Destination of your trip?

Origin City: _____ Postal code _____

Destination City: _____ Postal code _____

Is either place your residence? If yes, is it the ☐ Trip Origin ☐ Trip Destination
If not, please provide the Postal Code of your primary residence _____

8. How frequently do you make such trip?

☐ Once a week ☐ Once a month ☐ Less than once a year
☐ Twice a month ☐ Twice a year

9. How do you complete this trip?

☐ Own Car ☐ Air ☐ Bus
☐ Rental Car ☐ Ride from family/friends ☐ Other _____

10. What is the primary purpose of your travel? (Check one box)

☐ Business ☐ Shop
☐ Personal Business ☐ Attend school/college
☐ Recreation/Vacation ☐ Attend special social event
☐ Visit friends or relatives ☐ Other _____

11. What is your employment status?

☐ Employed full-time ☐ Employed part-time ☐ Other _____

12. The combined annual income of everyone in your household is:

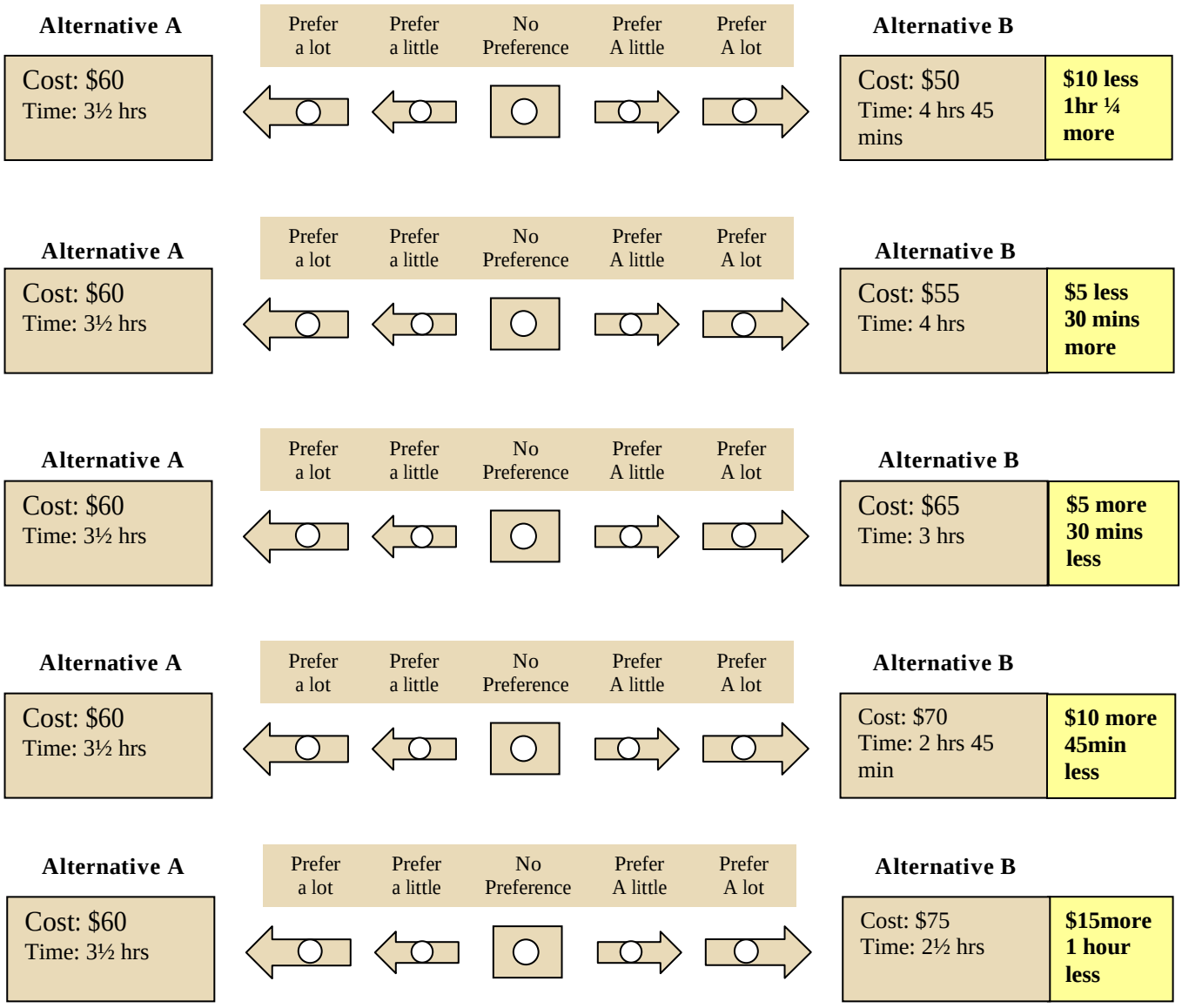
☐ Less than $30,000 ☐ $30,000 to $59,000 ☐ $60,000 to $99,000 ☐ $100,000 or more

(Continue next page)

How much do you value your time when travelling? (Red Arrow)

The following questions about a hypothetical trip (between, for example, Calgary and Edmonton) will help us understand your travel choices. Option A on the left-hand side, presents one method to reach the destination for a given cost and time, while Option B presents trade-offs in cost and time. As shown in the example, please indicate for each pair of choices the degree to which you prefer Alternative A or Alternative B.

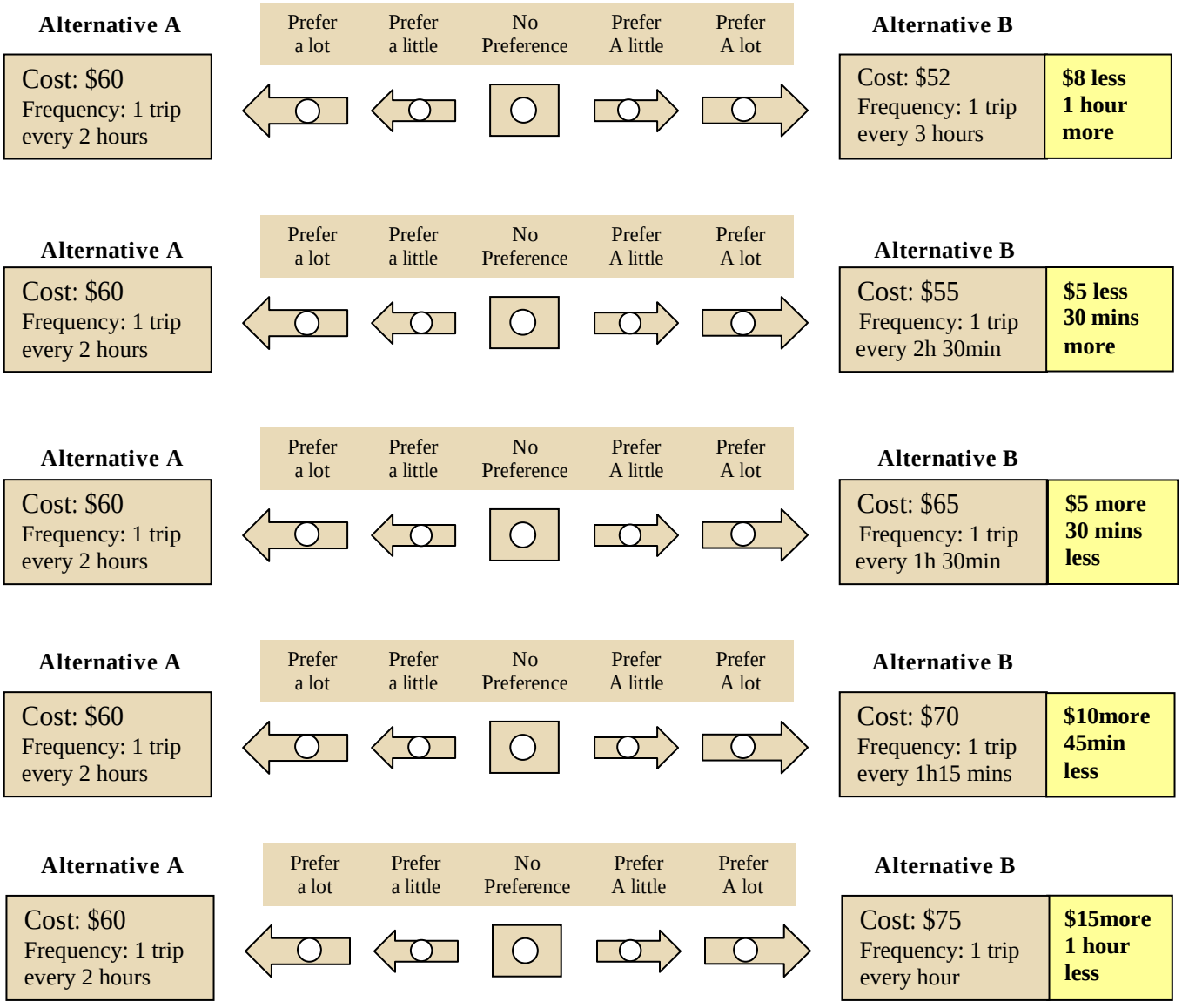
Cost is the cost of a one-way trip
Time is the total travel time to get to your trip destination, including arriving at the terminal, etc.



How important is to you the frequency of service? (Bus)

The following questions about a hypothetical trip (between, for example, Calgary and Edmonton) will help us understand your travel choices. Option A on the left-hand side, presents one method to reach the destination for a given cost and time, while Option B presents trade-offs in cost and time. As shown in the example, please indicate for each pair of choices the degree to which you prefer Alternative A or Alternative B.

Cost is the cost of a one-way trip
Frequency is how often the service operates or the time between trip departures.



Province of Alberta – Travel Survey

Dear Respondent:
This survey is part of a transportation study conducted by Alberta Infrastructure and Transportation in order to better understand and serve travel needs for the Province of Alberta. Please take a few minutes to answer the questions on this form and return it to our representatives. The information you provide will be kept strictly confidential. Thank you for your cooperation.

1. Please describe a recent weekday trip you have made using Highway 2.

   Origin (City): _____ Postal Code _____

   Destination (City): _____ Postal Code _____

   What is the city and state/province of your primary residence? _____

2. Please specify the number of people in the vehicle for this trip, including you. _____

3. How frequently do you travel on Highway 2? (Check one box)

   ☐ 5 times or more per week ☐ Twice a month ☐ Less than once a month
   ☐ Once a week ☐ Once a month

4. How did you complete this trip? (Check one box)

   ☐ Drove directly from home or work to the destination and parked
   ☐ Joined a carpool / vanpool at a park-and-ride facility
   ☐ Drove to a bus/metro station or parking lot and completed the trip on transit
   ☐ Other (specify): _____

5. What was the primary purpose of your trip? (Check one box)

   ☐ Business ☐ Commute to/from work
   ☐ Personal Business ☐ Attend school/college
   ☐ Recreation/Vacation ☐ Attend special social event
   ☐ Visit friends or relatives ☐ Other _____

6. What is your employment status? (Check one box)

   ☐ Employed full-time ☐ Employed part-time ☐ Other _____

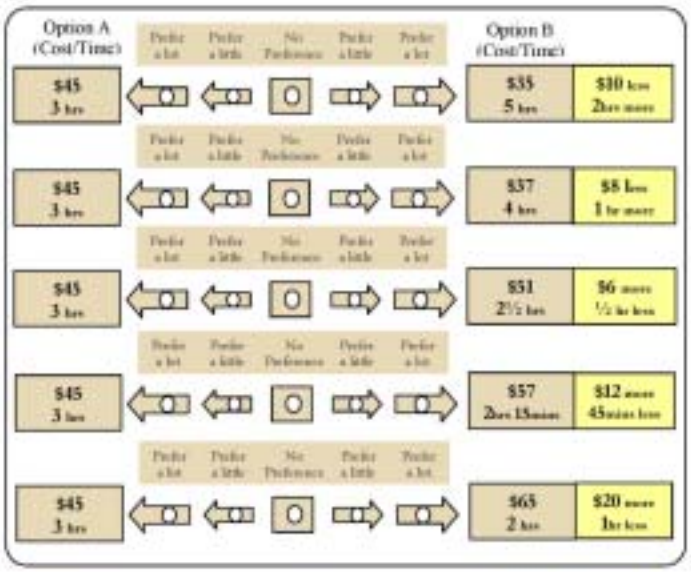
7. The combined annual income of everyone in your household is:

   ☐ Less than $30,000 ☐ $30,000 to $59,000
   ☐ $60,000 to $99,000 ☐ $100,000 or more

How much do you value your time when traveling?

The following questions about a hypothetical trip (between, for example, Calgary and Edmonton) will help us understand your travel choices. *Option A on the left-hand side, presents one method to reach the destination for a given cost and time, while Option B presents trade-offs in cost and time. As shown in the example, please indicate for each pair of choices the degree to which you prefer Alternative A or Alternative B.*

Cost *is the cost of a* ***one-way trip****, including gasoline, parking and any other fee you may incur.*
Time *is the total travel time to get to your trip destination, including getting to your vehicle, etc.*



Thank you! Your participation in this survey is greatly appreciated.

M

C

Alberta Zone System

Exhibit C.1: Zone System Description

Zone #	Description	Census Subdivision	Census Division
1	Central Business District	Edmonton	Division No. 11
2	University	Edmonton	Division No. 11
3	Southgate	Edmonton	Division No. 11
4	Riverbend/Terwillegar	Edmonton	Division No. 11
5	Jasper Place	Edmonton	Division No. 11
6	West Jasper Place	Edmonton	Division No. 11
7	Northwest Industrial	Edmonton	Division No. 11
8	North Central	Edmonton	Division No. 11
9	Calder	Edmonton	Division No. 11
10	Londonderry	Edmonton	Division No. 11
11	Beverly	Edmonton	Division No. 11
12	Clareview	Edmonton	Division No. 11
13	Capilano	Edmonton	Division No. 11
14	Bonnie Doon	Edmonton	Division No. 11
15	Mill Woods	Edmonton	Division No. 11
16	South Industrial	Edmonton	Division No. 11
17	Mistatim	Edmonton	Division No. 11
18	Castle Downs/Palisades	Edmonton	Division No. 11
19	Lake District/Pilot Sound	Edmonton	Division No. 11
20	Southeast Industrial	Edmonton	Division No. 11
21	Meadows	Edmonton	Division No. 11
22	Downtown Fringe	Edmonton	Division No. 11
23	Kaskitayo	Edmonton	Division No. 11
24	Ellerslie	Edmonton	Division No. 11
25	Heritage Valley East	Edmonton	Division No. 11
26	Heritage Valley	Edmonton	Division No. 11

	West/Windermere		
27	West Edmonton	Edmonton	Division No. 11
28	Winterburn	Edmonton	Division No. 11
29	Landbank	Edmonton	Division No. 11
30	Northeast Edmonton	Edmonton	Division No. 11
31	Clover Bar	Edmonton	Division No. 11
32	Rt. 16A and Rt. 14X	Strathcona County	Division No. 11
33	Devon	Devon, Parkland County and Others	Division No. 11
34	St. Albert	St Albert	Division No. 11
35	Josephburg	Strathcona County	Division No. 11
36	Ardrossan	Strathcona County	Division No. 11
37	Sherwood Park	Strathcona County	Division No. 11
38	Whitemud Dr. and Range Rd. 232	Strathcona County	Division No. 11
39	Township Rd. 520 and Range Rd. 224	Strathcona County	Division No. 11
40	Rt. 630 and Range Road 211	Strathcona County	Division No. 11
41	Beaumont	Leduc County and Others	Division No. 11
42	Leduc	Leduc and Leduc County	Division No. 11
43	Wabamun	Parkland County, Wabamun and Others	Division No. 11
44	Wetaskiwin	Wetaskiwin and Wetaskiwin County	Division No. 11
45	Rimbey	Rimbley and Others	Division No. 8
46	Lacombe	Lacombe, Lacombe County and Others	Division No. 8
47	Red Deer	Red Deer, Red Deer County and Others	Division No. 8
48	Innisfail	Innisfail, Red Deer County and Others	Division No. 8
49	Calgary International Airport	Calgary	Division No. 6
50	Dalhousie	Calgary	Division No. 6
51	Sandstone	Calgary	Division No. 6
52	Tarradale - Falconridge	Calgary	Division No. 6
53	Whitehorn - Temple areas	Calgary	Division No. 6
54	Bridgeland	Calgary	Division No. 6
55	Thornecliffe	Calgary	Division No. 6
56	14th St. and 20th Ave.	Calgary	Division No. 6
57	Brentwood - Charleswood	Calgary	Division No. 6
58	Houndsfield Heights - Hillhurst	Calgary	Division No. 6
59	83d St. and 34th. Ave.	Calgary	Division No. 6
60	Scenic Acres	Calgary	Division No. 6
61	Strathcona Heights	Calgary	Division No. 6
62	Rosscarrock - Sunalta	Calgary	Division No. 6

63	Downtown	Calgary	Division No. 6
64	14th ST. and 34th Ave.	Calgary	Division No. 6
65	Elbow Park	Calgary	Division No. 6
66	North Manchester Industrial Park	Calgary	Division No. 6
67	Pembrooke Meadows	Calgary	Division No. 6
68	Forest Lawn	Calgary	Division No. 6
69	Richmond Rd and 37th St.	Calgary	Division No. 6
70	14th St. and Heritage Dr.	Calgary	Division No. 6
71	Fairview Industrial Park	Calgary	Division No. 6
72	Lynnwood Ridge - Ogden Area	Calgary	Division No. 6
73	Bonavista Downs	Calgary	Division No. 6
74	Beltline	Calgary	Division No. 6
75	Deerfoot Trail and 146th Ave.	Calgary	Division No. 6
76	Woodbine - Braeside	Calgary	Division No. 6
77	Medicine Hat	Medicine Hat	Division No. 1
78	Athabasca	Athabasca, Athabasca County and Others	Division No. 13
79	Hawkwood	Calgary	Division No. 6
80	Fort McMurray	All Subdivisions in Division #16	Division No. 16
81	Whitecourt	Whitecourt and Woodland County	Division No. 13
82	Manning	Manning and Northern Lights County	Division No. 17
83	Hines Creek	Hines Creek, Clear Hills County and Others	Division No. 17
84	Peace River	East Peace County and Others	Division No. 17
85	Wabasca	Wabasca # 166 and Others	Division No. 17
86	Grimshaw	Grimshaw, Peace River and Others	Division No. 19
87	Fairview	Fairview and Fairview County	Division No. 19
88	Spirit River	Spirit River, Saddle Hills County and Others	Division No. 19
89	High Level	High Level, Mackenzie County and Others	Division No. 17
90	Eaglesham	Birch Hills County	Division No. 19
91	Falher	Falher, Smoky River County and Others	Division No. 19
92	Valleyview	All Subdivisions in Division #18	Division No. 18
93	High Prairie	High Prairie, Big Lakes and Others	Division No. 17
94	Grande Prairie	Grande Prairie, Grande Prairie County and Others	Division No. 19
95	Spruce Grove	Spruce Grove and Parkland County	Division No. 11
96	Barrhead	Barrhead and Barrhead County	Division No. 13
97	Stoney Plain	Stoney Plain, Parkland County and Others	Division No. 11
98	Westlock	Westlock, Westlock County and Others	Division No. 13
99	Thorhild	Thorhild and Thorhild County	Division No. 13

100	Smoky Lake	Smoky Lake, Smoky Lake County and Others	Division No. 12
101	Slave Lake	Slave Lake and Others	Division No. 17
102	Bonnyville	Bonnyville, Bonnyville County and Others	Division No. 12
103	St. Paul	St. Paul, St. Paul County and Others	Division No. 12
104	Two Hills	Two Hills, Two Hills County and Others	Division No. 10
105	Lamont	Lamont, Lamont County and Others	Division No. 10
106	Morinville	Morinville, Sturgeon County and Others	Division No. 11
107	Edson	All Subdivisions in Division #14	Division No. 14
108	Vermilion	Vermilion, Vermillion County, Lloydminster and Others	Division No. 10
109	Drayton Valley	Drayton Valley, Brazeau County and Others	Division No. 11
110	Tofield	Tofield, Beaver County and Others	Division No. 10
111	Wainwright	Wainwright, Wainwright County and Others	Division No. 7
112	Midnapore - Sundance	Calgary	Division No. 6
113	Tsuu T"ina Indian Reserve	Tsuu T"ina Nation	Division No. 6
114	Banff	Banff and Improvement District # 9	Division No. 15
115	Lethbridge	Lethbridge	Division No. 2
116	Camrose	Camrose, Camrose County and Others	Division No. 10
117	Vegreville	Vegreville, Minburn County and Others	Division No. 10
118	Jasper	Jasper and Improvement District # 12	Division No. 15
119	Ft. Saskatchewan	Fort Saskatchewan	Division No. 11
120	Hobbema	Ermineskin 138 and Louis Bull 138B	Division No. 11
121	Stettler	Stettler, Stettler County and Others	Division No. 7
122	Killam	Killam, Flagstaff County and Others	Division No. 7
123	Caster	Caster, Paintearth County and Others	Division No. 7
124	Provost	Provost, Provost County and Others	Division No. 7
125	Consort	Consort and Others	Division No. 4
126	Oyen	Oyen and Others	Division No. 4
127	Hanna	Hanna and Others	Division No. 4
128	Morrin	Starland County and Others	Division No. 5
129	Three Hills	Three Hills, Kneehill County and Others	Division No. 5
130	Didsbury	Didsbury, Mountain View County and Others	Division No. 6
131	Rocky Mountain House	Rocky Mountain House, Clearwater County and Others	Division No. 9
132	Drumheller	Drumheller	Division No. 5
133	Exshaw	Bighorn County and Others	Division No. 15
134	Rt. 40 and Rt. 541	Kananaskis and Ranchland #66	Division No. 15
135	Mayerthorpe	Mayerthorpe, Lac Ste Anne County and Others	Division No. 13

136	Chestermere	Chestermere and Rocky View County	Division No. 6
137	Strathmore	Strathmore, Wheatland County and Others	Division No. 5
138	Canmore	Canmore	Division No. 15
139	Okotoks	Okotoks, Foothills County and Others	Division No. 6
140	Redcliff	Redcliff and Cypress County	Division No. 1
141	Brooks	Brooks, Newell County and Others	Division No. 2
142	Millrise - Shawnessy - Somerset	Calgary	Division No. 6
143	Vulcan	Vulcan, Vulcan County and Others	Division No. 5
144	Raymond	Raymond, Warner County and Others	Division No. 2
145	Bow Island	Bow Island, Forty Mile County and Others	Division No. 1
146	Claresholm	Claresholm, Willow Creek County and Others	Division No. 3
147	Coaldale	Coaldale, Lethbridge County and Others	Division No. 2
148	Taber	Taber, Taber County and Others	Division No. 2
149	Pincher Creek	Pincher Creek and Pincher Creek County	Division No. 3
150	Rt. 2 and 505	Blood 148	Division No. 3
151	Cardston	Cardston, Cardston County and Others	Division No. 3
152	Edmonton International Airport	Leduc County	Division No. 11
153	Calmar	Calmar, Leduc County and Others	Division No. 11
154	Millet	Millet and Wetaskiwin County	Division No. 11
155	Rt. 771 and Rt. 13	Wetaskiwin County and Others	Division No. 11
156	Cochrane	Cochrane and Rocky View County	Division No. 6
157	Airdrie	Airdrie, Rocky View County and Others	Division No. 6
158	Blairmore	Crowsnest Pass	Division No. 15

D

Alberta Economic Regions Zone Equivalence

Exhibit D.1: Zones Forming Alberta Economic Regions

10	20	30	40	50	60	70	80
77	104	49	107	45	1	78	80
115	105	50	114	46	2	81	100
140	108	51	118	47	3	82	102
141	110	52	131	48	4	83	103
144	111	53	133		5	84	
145	116	54	134		6	85	
146	117	55	138		7	86	
147	121	56	158		8	87	
148	122	57			9	88	
149	123	58			10	89	
150	124	59			11	90	
151	125	60			12	91	
	126	61			13	92	
	127	62			14	93	
	128	63			15	94	
	129	64			16	96	
	132	65			17	98	
	137	66			18	99	
	143	67			19	101	
		68			20	135	
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					155		

Demographic for Economic Regions

D.1 Population – Low Scenario

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
2001	238,558	182,374	1,021,060	80,512	153,049	976,666	222,107	101,333
2006	254,825	188,409	1,163,015	82,382	175,337	1,077,243	239,288	113,070
2011	263,054	190,104	1,262,890	83,747	189,869	1,213,479	253,073	120,190
2016	268,308	189,676	1,332,000	83,695	203,621	1,283,602	264,567	126,161
2021	272,289	188,964	1,349,988	82,858	216,400	1,344,235	275,028	131,527
2026	274,826	186,988	1,357,365	81,211	227,750	1,395,091	284,094	135,765
2031	287,357	190,904	1,404,207	83,560	245,931	1,468,518	300,611	145,351
2036	294,629	191,731	1,424,183	83,898	259,661	1,515,170	313,588	151,505
2041	298,372	190,694	1,522,148	83,721	270,949	1,561,323	323,263	156,575
2046	302,475	189,660	1,573,117	83,659	281,924	1,652,497	332,736	161,545
2051	306,811	188,900	1,624,030	83,422	293,256	1,716,148	342,251	166,605

D.2 Population – Central Case

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
2001	238,558	182,374	1,021,060	80,512	153,049	976,666	222,107	101,333
2006	254,825	188,409	1,163,015	82,382	175,337	1,077,243	239,288	113,070
2011	269,297	194,293	1,304,728	85,705	194,399	1,237,707	259,199	122,818
2016	282,923	199,491	1,432,757	88,202	214,756	1,342,695	279,158	132,383
2021	295,680	204,517	1,511,049	89,902	234,971	1,442,134	298,673	141,583
2026	307,172	208,310	1,580,576	90,678	254,490	1,535,444	317,178	149,875
2031	322,556	214,085	1,638,469	93,819	275,147	1,621,548	336,653	160,625
2036	336,201	218,962	1,696,361	95,828	294,804	1,697,768	356,424	169,540
2041	345,723	221,610	1,847,620	97,179	311,765	1,773,743	372,407	177,196
2046	355,517	224,123	1,942,980	98,592	328,395	1,901,816	388,074	184,693
2051	365,463	226,830	2,038,339	99,729	345,467	1,999,363	403,708	192,247

D.3 Population – High Scenario

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
2001	238,558	182,374	1,021,060	80,512	153,049	976,666	222,107	101,333
2006	254,825	188,409	1,163,015	82,382	175,337	1,077,243	239,288	113,070
2011	275,052	198,302	1,344,986	87,542	198,596	1,260,282	264,766	125,228
2016	295,393	207,970	1,521,130	92,071	224,249	1,393,241	291,417	137,613
2021	315,148	217,621	1,648,837	95,790	250,462	1,524,047	318,098	149,853
2026	333,943	226,066	1,769,538	98,576	276,643	1,652,008	344,221	161,313
2031	351,841	233,548	1,838,363	102,412	299,480	1,749,397	366,256	173,130
2036	370,736	241,780	1,928,136	105,802	324,025	1,850,042	391,553	184,278
2041	385,014	247,478	2,124,366	108,414	345,662	1,950,652	412,665	194,024
2046	399,494	252,927	2,257,114	111,045	366,953	2,109,246	433,368	203,563
2051	414,060	258,506	2,389,908	113,315	388,755	2,234,807	453,979	213,132

D.4 Employment – Low Scenario

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
2001	119,705	94,770	578,010	45,445	81,060	522,470	113,420	53,940
2006	137,500	107,100	705,000	49,600	97,600	582,300	129,000	62,600
2011	147,799	110,010	770,678	51,665	103,263	643,743	136,162	83,330
2016	152,469	112,337	805,416	53,378	106,580	680,160	142,780	90,392
2021	156,167	111,663	828,668	53,525	113,539	706,121	149,601	95,301
2026	159,223	110,488	841,647	53,157	120,439	720,853	155,586	99,213
2031	171,878	117,654	887,469	56,616	128,448	757,988	166,553	114,141
2036	179,264	120,437	919,673	58,187	135,233	788,095	174,730	123,330
2041	183,042	120,344	940,872	58,774	139,530	819,294	180,364	130,336
2046	186,936	120,807	957,193	59,317	143,723	871,862	185,424	137,045
2051	190,623	121,993	973,181	60,116	147,264	907,883	189,815	141,885

D.5 Employment – Central Case

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
2001	119,705	94,770	578,010	45,445	81,060	522,470	113,420	53,940
2006	137,500	107,100	705,000	49,600	97,600	582,300	129,000	62,600
2011	150,187	111,665	790,970	52,555	104,950	652,640	138,367	84,490
2016	158,031	116,262	853,048	55,450	110,527	701,578	147,962	93,197
2021	165,508	118,164	906,814	56,910	120,361	742,587	158,404	100,120
2026	173,352	120,156	955,560	58,038	131,143	776,363	169,093	106,729
2031	186,725	127,805	1,004,000	61,779	139,253	814,316	180,421	122,198
2036	197,013	132,507	1,056,794	64,287	148,128	855,278	191,235	133,134
2041	203,323	134,014	1,096,510	65,691	154,266	897,506	199,239	141,742
2046	209,709	136,077	1,129,913	67,013	160,252	963,430	206,561	150,032
2051	215,812	138,913	1,162,295	68,602	165,472	1,011,380	213,092	156,272

D.6 Employment – High Scenario

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
2001	119,705	94,770	578,010	45,445	81,060	522,470	113,420	53,940
2006	137,500	107,100	705,000	49,600	97,600	582,300	129,000	62,600
2011	152,645	113,427	811,638	53,471	106,684	661,846	140,607	85,715
2016	163,193	119,934	896,393	57,369	114,169	721,426	152,729	95,830
2021	173,723	123,992	975,132	59,863	126,370	774,840	166,126	104,411
2026	185,374	128,479	1,052,611	62,197	140,250	823,765	180,538	113,089
2031	199,655	136,773	1,105,102	66,278	148,667	863,602	192,454	129,245
2036	212,429	143,137	1,175,423	69,587	159,332	913,886	205,516	141,679
2041	220,902	146,026	1,230,879	71,688	167,042	965,587	215,538	151,661
2046	229,417	149,472	1,278,797	73,675	174,561	1,043,004	224,785	161,305
2051	237,585	153,737	1,325,108	75,936	181,216	1,101,204	233,137	168,741

D.7 Average Household Income – Low Scenario

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
2001	59,877	58,271	82,611	65,618	65,553	69,005	64,125	79,376
2006	62,806	61,583	92,353	69,616	70,343	73,501	68,963	88,362
2011	63,416	62,216	96,129	70,987	72,129	74,497	71,470	92,968
2016	64,035	62,865	99,842	72,470	73,919	75,538	74,033	97,612
2021	64,665	63,530	103,500	74,061	75,714	76,411	76,631	102,287
2026	65,302	64,211	107,110	75,757	77,511	77,197	79,245	106,991
2031	65,947	64,906	110,675	77,553	79,310	77,943	81,997	111,717
2036	66,611	65,665	114,319	79,644	81,182	78,988	84,913	116,728
2041	66,936	65,999	116,010	80,468	82,045	79,230	86,289	118,950
2046	67,350	66,459	118,196	81,763	83,177	79,688	88,024	121,954
2051	67,786	66,946	120,465	83,141	84,358	80,153	89,865	125,091

D.8 Average Household Income – Central Case

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
2001	59,877	58,271	82,611	65,618	65,553	69,005	64,125	79,376
2006	62,806	61,583	92,353	69,616	70,343	73,501	68,963	88,362
2011	64,873	63,627	98,381	72,752	73,618	75,649	73,627	95,874
2016	67,546	66,375	105,914	76,729	77,924	79,369	78,674	104,063
2021	70,275	69,146	113,635	80,718	82,426	83,140	83,793	112,224
2026	73,102	71,859	121,399	84,757	86,807	86,905	88,972	120,367
2031	75,657	74,502	127,410	89,153	91,063	89,926	94,287	128,991
2036	78,352	77,195	134,355	93,468	95,425	93,285	99,594	137,016
2041	79,677	78,581	138,117	95,802	97,572	95,180	102,453	141,455
2046	81,346	80,326	142,674	98,627	100,279	97,427	105,943	146,848
2051	83,107	82,177	147,505	101,561	103,119	99,723	109,609	152,532

J.9. Average Household Income – High Scenario

Alberta Economic Region	Lethbridge-Medicine Hat	Camrose-Drumheller	Calgary	Banff-Jasper-Rocky Mountain House	Red Deer	Edmonton	Athabasca - Grand Prarie - Peace River	Wood Buffalo - Cold Lake
Region #	10	20	30	40	50	60	70	80
Scenario	High	High	High	High	High	High	High	High
2001	59,877	58,271	82,611	65,618	65,553	69,005	64,125	79,376
2006	62,806	61,583	92,353	69,616	70,343	73,501	68,963	88,362
2011	67,327	66,052	102,806	75,543	76,868	79,008	76,249	99,701
2016	71,862	70,550	113,212	81,648	83,417	84,883	83,663	111,145
2021	76,410	75,074	123,578	87,911	89,982	90,707	91,176	122,669
2026	80,967	79,620	133,913	94,315	96,559	96,541	98,762	134,255
2031	85,533	84,188	144,222	100,845	103,145	102,308	106,573	145,892
2036	89,656	88,361	154,509	107,488	109,739	107,960	114,268	157,568
2041	92,405	91,143	159,825	111,154	113,120	111,224	118,379	163,735
2046	95,276	94,076	166,356	115,627	117,299	115,046	123,414	171,273
2051	98,266	97,072	172,989	120,010	121,584	118,659	128,447	178,839

E

Socioeconomic Variables by Zone

E.1 Population Forecasts – Low Scenario

Zone #	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	12,697	15,281	16,858	17,707	18,608	19,771	20,486	21,009	22,770	23,828
2	22,306	24,211	23,935	23,424	23,683	24,302	24,483	24,545	25,088	25,403
3	32,699	32,320	32,713	34,520	34,279	34,574	34,355	34,062	35,369	35,802
4	30,808	38,511	41,961	44,809	48,048	51,937	54,574	56,603	61,383	64,655
5	57,067	56,124	55,416	54,461	53,325	53,044	52,126	51,225	51,256	50,826
6	59,845	60,215	60,821	59,853	59,397	59,871	59,461	58,932	59,847	60,019
7	841	812	777	747	718	701	679	659	642	624
8	41,730	41,877	41,189	40,452	39,808	39,797	39,265	38,710	38,870	38,678
9	22,846	25,701	28,593	31,222	32,766	34,773	35,997	36,887	40,086	41,998
10	50,715	50,869	50,209	49,633	48,948	49,039	48,465	47,846	48,232	48,116
11	27,234	26,743	26,073	25,658	25,007	24,762	24,244	23,755	23,645	23,351
12	33,095	33,191	32,827	32,109	31,661	31,714	31,339	30,935	31,076	30,953
13	29,449	29,453	28,739	28,214	27,666	27,562	27,117	26,674	26,670	26,454
14	20,595	21,185	21,270	21,169	21,142	21,442	21,400	21,293	21,773	21,950
15	85,301	82,486	80,139	78,397	75,903	74,652	72,698	70,927	69,972	68,640
16	9	8	7	6	5	5	4	4	3	3
17	246	236	224	214	205	199	192	185	180	175
18	42,635	51,330	55,821	58,453	62,019	66,442	69,311	71,467	77,004	80,688
19	28,034	41,530	46,794	52,368	58,095	64,556	69,380	73,286	81,046	86,641
20	2,169	2,388	2,321	2,265	2,285	2,339	2,353	2,355	2,399	2,423
21	11,452	18,256	23,846	27,821	31,610	35,780	39,037	41,745	47,079	50,895
22	48,025	49,500	51,104	52,099	52,654	54,007	54,392	54,516	56,689	57,776
23	47,037	45,571	45,225	44,251	43,152	42,750	41,873	41,042	40,903	40,421
24	3,668	12,881	20,056	25,793	30,822	36,183	40,680	44,582	51,448	56,526

25	6,090	12,919	17,676	23,586	27,304	31,338	34,583	37,328	42,996	46,953
26	612	5,257	12,074	17,654	21,251	25,074	28,307	31,129	36,724	40,645
27	8,761	18,634	27,765	34,944	40,839	47,197	52,381	56,802	65,226	71,283
28	2,524	2,465	3,136	5,544	5,932	6,401	6,717	6,958	8,188	8,858
29	500	502	490	478	470	470	463	457	451	445
30	2,480	2,531	2,483	2,434	2,411	2,426	2,406	2,382	2,399	2,396
31	44	40	38	36	34	32	30	29	27	26
32	11,144	13,008	14,249	15,377	16,328	18,051	19,179	20,394	21,633	22,826
33	14,052	15,190	15,969	16,661	17,353	18,244	19,126	20,028	20,782	21,579
34	57,719	71,482	75,515	79,407	83,426	88,661	92,546	97,505	103,327	108,120
35	7,601	12,274	11,796	11,323	11,828	9,578	8,872	9,089	9,692	9,595
36	7,508	7,931	8,146	8,427	8,627	9,089	9,348	9,648	9,964	10,266
37	43,215	50,444	55,255	59,630	63,318	69,998	74,373	79,086	83,889	88,517
38	4,898	5,175	5,315	5,498	5,629	5,930	6,099	6,295	6,501	6,698
39	3,826	4,041	4,151	4,294	4,396	4,631	4,763	4,916	5,077	5,231
40	4,319	4,487	4,551	4,666	4,740	4,939	5,041	5,164	5,297	5,424
41	16,664	19,742	21,859	23,512	25,283	27,431	28,838	30,552	32,685	34,466
42	17,235	19,458	21,327	23,164	24,855	26,535	27,814	29,397	31,311	32,914
43	15,790	16,938	17,584	18,118	18,747	19,725	20,708	21,695	22,299	23,087
44	15,078	15,111	15,087	15,053	15,007	15,292	15,398	15,511	15,624	15,753
45	21,565	21,163	21,061	20,644	20,164	20,517	20,433	20,207	20,000	19,810
46	29,709	30,253	31,840	32,674	33,331	35,281	36,431	37,311	38,174	39,101
47	98,780	113,101	124,970	137,361	148,671	163,672	175,979	186,479	196,657	207,104
48	25,283	25,352	25,749	25,721	25,585	26,462	26,818	26,952	27,094	27,240
49	1	1	1	1	1	1	1	1	1	1
50	55,274	60,191	63,653	63,360	63,008	63,930	63,655	68,670	70,569	72,480
51	59,236	70,562	79,312	80,552	81,568	83,466	83,787	94,215	98,531	102,871
52	52,485	68,208	80,695	83,255	85,462	88,000	88,862	102,849	108,817	114,814
53	55,713	52,094	48,445	45,948	43,622	43,261	42,113	40,011	38,694	37,375
54	33,604	33,324	32,706	31,688	30,722	30,790	30,291	30,610	30,532	30,456
55	36,330	34,256	32,116	30,561	29,111	28,918	28,199	27,067	26,317	25,565
56	17,993	17,019	16,003	15,246	14,540	14,453	14,102	13,585	13,233	12,881
57	13,433	12,737	12,005	11,448	10,928	10,868	10,609	10,250	9,999	9,748
58	26,282	25,115	23,844	22,805	21,832	21,743	21,257	20,716	20,299	19,882
59	37,599	37,813	37,561	36,558	35,599	35,755	35,250	36,048	36,161	36,276
60	22,450	22,896	23,010	22,493	21,994	22,135	21,866	22,608	22,795	22,984
61	48,055	56,059	62,172	62,875	63,427	64,178	64,929	72,401	75,456	78,529
62	18,418	17,931	17,315	16,672	16,066	16,053	15,746	15,643	15,475	15,307
63	11,950	12,913	13,579	13,490	13,391	13,575	13,506	14,506	14,879	15,255

64	35,706	34,502	33,093	31,780	30,546	30,483	29,860	29,445	29,022	28,599
65	6,173	5,887	5,579	5,332	5,101	5,078	4,963	4,826	4,724	4,622
66	8,461	11,477	13,891	14,427	14,894	15,375	15,563	18,219	19,363	20,512
67	56,112	53,593	50,856	48,631	46,547	46,353	45,311	44,134	43,232	42,330
68	23,534	21,828	20,139	19,039	18,015	17,836	17,333	16,297	15,674	15,050
69	38,083	38,513	38,437	37,476	36,554	36,744	36,254	37,241	37,436	37,633
70	33,451	31,497	29,489	28,047	26,701	26,517	25,850	24,771	24,063	23,354
71	8,162	7,780	7,369	7,041	6,734	6,704	6,551	6,366	6,229	6,092
72	16,479	16,233	15,840	15,313	14,814	14,832	14,576	14,642	14,563	14,484
73	46,042	42,476	38,983	36,773	34,719	34,334	33,327	31,111	29,806	28,499
74	16,533	18,907	20,694	20,838	20,941	21,352	21,362	23,616	24,524	25,437
75	43,398	82,472	114,498	123,308	131,127	137,146	140,509	173,833	188,589	203,414
76	62,123	79,753	93,718	96,496	98,883	101,739	102,660	118,397	125,091	131,819
77	56,997	60,790	64,422	67,729	70,630	75,314	78,916	81,656	84,308	87,044
78	12,146	12,263	12,254	12,199	12,034	12,432	12,472	12,449	12,430	12,419
79	52,370	51,657	50,467	48,811	47,243	47,308	46,502	46,771	46,547	46,325
80	53,080	58,144	62,682	66,721	69,977	77,165	81,232	85,112	88,905	92,830
81	13,129	13,721	14,132	14,463	14,666	15,448	15,876	16,177	16,468	16,752
82	5,265	5,172	5,034	4,907	4,784	4,723	4,703	4,609	4,522	4,429
83	3,144	3,172	3,171	3,172	3,173	3,206	3,269	3,279	3,290	3,297
84	3,977	3,722	3,440	3,173	2,918	2,826	2,609	2,408	2,216	2,040
85	5,117	5,301	5,430	5,560	5,691	5,749	6,014	6,124	6,235	6,320
86	10,957	10,726	10,489	10,267	10,035	10,081	9,991	9,821	9,663	9,533
87	4,729	4,589	4,491	4,299	4,107	4,104	4,016	3,897	3,785	3,665
88	4,906	4,661	4,389	4,128	3,872	3,744	3,560	3,354	3,157	2,968
89	20,020	23,046	25,779	28,407	30,901	33,692	36,563	38,858	41,095	43,298
90	1,470	1,255	1,049	853	667	504	337	326	312	301
91	4,782	4,485	4,236	3,996	3,759	3,621	3,443	3,241	3,050	2,875
92	14,322	14,746	14,971	15,051	15,078	15,458	15,808	15,928	16,048	16,115
93	12,181	12,537	12,770	13,006	13,224	13,591	14,046	14,279	14,512	14,730
94	71,868	82,114	91,650	100,663	108,954	120,032	129,297	137,134	144,752	152,466
95	25,432	28,804	31,137	33,370	35,259	38,152	39,997	42,615	44,854	47,079
96	10,054	9,851	9,554	9,239	8,880	8,886	8,692	8,449	8,219	7,996
97	16,041	17,725	19,029	20,273	21,349	22,881	23,983	25,401	26,633	27,866
98	12,444	12,341	12,108	11,845	11,514	11,658	11,533	11,338	11,154	10,977
99	3,547	3,399	3,221	3,044	2,858	2,796	2,664	2,524	2,390	2,262
100	4,919	4,878	4,727	4,584	4,433	4,143	4,180	4,045	3,917	3,737
101	9,578	9,969	10,256	10,542	10,809	11,192	11,646	11,914	12,181	12,434
102	39,942	41,812	43,367	44,813	45,984	48,306	50,129	51,401	52,647	53,907

103	15,129	15,355	15,385	15,409	15,372	15,738	15,965	16,018	16,077	16,131
104	4,622	4,670	4,716	4,743	4,763	4,880	4,932	4,937	4,940	4,950
105	8,240	9,067	8,696	8,325	8,026	7,859	7,599	7,341	6,940	6,570
106	33,919	41,618	43,578	45,368	47,235	50,222	52,421	55,221	58,111	60,653
107	27,881	28,520	28,797	28,817	28,535	29,577	29,950	30,074	30,202	30,269
108	29,172	29,661	29,937	30,208	29,939	31,379	31,512	31,592	31,652	31,778
109	14,483	15,212	15,353	15,387	15,085	16,061	16,196	16,318	16,683	16,962
110	9,493	9,363	9,238	9,087	8,935	8,971	8,893	8,738	8,586	8,456
111	10,109	9,855	9,541	9,230	8,878	8,686	8,529	8,252	7,988	7,716
112	26,341	26,126	25,647	24,851	24,096	24,150	23,759	24,015	23,956	23,899
113	2,079	2,532	2,869	3,563	4,011	4,810	5,501	5,815	6,314	6,803
114	7,638	7,053	6,364	5,791	5,240	4,636	4,214	3,698	3,208	2,722
115	74,637	77,333	78,132	78,115	77,332	82,030	83,947	84,124	84,933	85,860
116	25,351	25,216	25,083	24,870	24,642	24,928	24,890	24,628	24,368	24,161
117	9,918	9,654	9,429	9,184	8,962	8,894	8,732	8,497	8,270	8,074
118	4,289	4,425	4,409	4,431	4,445	4,550	4,619	4,633	4,646	4,657
119	14,957	28,581	29,052	29,587	31,224	32,800	33,801	35,244	38,809	40,795
120	2,644	2,842	2,933	2,996	2,987	3,671	3,597	3,722	3,899	4,055
121	11,615	11,961	12,216	12,445	12,582	12,918	13,270	13,420	13,564	13,690
122	8,803	8,806	8,749	8,685	8,568	8,595	8,647	8,570	8,497	8,414
123	4,185	4,307	4,396	4,476	4,523	4,641	4,766	4,818	4,868	4,911
124	5,197	5,254	5,273	5,286	5,264	5,331	5,406	5,401	5,397	5,387
125	2,421	2,544	2,656	2,760	2,820	2,903	2,978	3,056	3,105	3,135
126	3,122	3,100	3,037	2,993	2,911	2,838	2,774	2,735	2,665	2,575
127	5,057	4,930	4,763	4,586	4,375	4,205	4,037	3,903	3,733	3,533
128	3,048	3,126	3,178	3,227	3,272	3,394	3,473	3,519	3,565	3,615
129	11,198	11,076	10,883	10,700	10,521	10,601	10,553	10,415	10,287	10,182
130	29,551	28,724	27,659	26,750	25,801	25,770	25,265	24,833	24,456	24,118
131	20,351	20,682	20,741	20,708	20,527	21,177	21,359	21,385	21,416	21,437
132	7,932	7,900	7,813	7,731	7,650	7,755	7,765	7,708	7,656	7,620
133	3,920	4,299	4,513	4,617	4,635	5,010	5,182	5,316	5,443	5,529
134	515	478	427	383	340	307	272	236	201	167
135	15,652	16,002	16,145	16,214	16,169	16,867	17,051	17,155	17,259	17,375
136	15,914	25,585	33,170	47,690	57,380	73,214	87,346	93,921	104,122	114,095
137	19,305	19,990	20,511	20,931	20,922	22,526	23,326	23,551	23,999	24,568
138	12,039	12,987	13,741	13,929	13,808	15,021	15,437	15,787	16,122	16,322
139	52,075	52,296	51,773	52,660	52,679	55,253	56,753	57,119	58,181	59,269
140	11,825	12,863	13,763	14,597	15,373	16,508	17,408	18,118	18,801	19,493
141	22,452	22,679	22,743	22,793	22,832	23,424	23,721	23,799	23,882	24,005

142	26,402	29,357	31,515	31,531	31,502	32,033	31,964	34,865	36,000	37,143
143	9,621	9,624	9,560	9,498	9,435	9,602	9,650	9,613	9,581	9,567
144	9,228	8,751	8,240	7,754	7,293	7,025	6,676	6,283	5,909	5,558
145	5,728	5,657	5,552	5,446	5,344	5,377	5,342	5,261	5,184	5,119
146	15,014	15,540	15,942	16,310	16,576	17,130	17,550	17,896	18,170	18,407
147	20,559	20,613	20,527	20,436	20,344	20,748	20,893	20,850	20,816	20,820
148	15,553	15,726	15,785	15,832	15,873	16,196	16,374	16,460	16,510	16,559
149	8,613	8,562	8,453	8,341	8,194	8,201	8,150	8,081	7,985	7,872
150	4,177	4,564	4,908	5,230	5,509	5,876	6,192	6,471	6,720	6,956
151	10,042	9,976	9,841	9,704	9,526	9,526	9,460	9,374	9,256	9,119
152	1	1	1	1	1	1	1	1	1	1
153	9,037	9,887	10,482	11,011	11,453	12,220	12,779	13,474	14,022	14,607
154	5,633	5,659	5,612	5,564	5,513	5,584	5,591	5,601	5,623	5,644
155	4,535	4,841	5,040	5,226	5,398	5,684	5,899	6,113	6,340	6,557
156	28,065	35,590	41,281	52,747	60,226	73,217	84,570	89,751	97,941	105,961
157	47,138	44,987	42,616	39,931	37,578	36,223	34,233	32,982	31,525	30,149
158	5,749	5,302	4,703	4,180	3,680	3,282	2,866	2,592	2,422	2,319

E.2 Population Forecasts – Central Case

Zone #	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	12,697	15,587	17,634	18,997	20,480	21,831	22,955	23,867	26,205	27,760
2	22,306	24,694	25,037	25,130	26,066	26,834	27,434	27,885	28,873	29,595
3	32,699	32,966	34,219	37,034	37,728	38,177	38,495	38,697	40,706	41,711
4	30,808	39,279	43,893	48,073	52,882	57,349	61,151	64,304	70,644	75,325
5	57,067	57,245	57,967	58,428	58,690	58,572	58,407	58,194	58,989	59,214
6	59,845	61,418	63,621	64,212	65,372	66,110	66,627	66,949	68,876	69,924
7	841	828	812	802	791	774	761	749	739	727
8	41,730	42,714	43,086	43,399	43,813	43,944	43,997	43,977	44,734	45,061
9	22,846	26,214	29,909	33,496	36,063	38,396	40,335	41,906	46,134	48,929
10	50,715	51,884	52,520	53,248	53,872	54,149	54,306	54,355	55,509	56,057
11	27,234	27,277	27,273	27,526	27,523	27,342	27,165	26,987	27,213	27,205
12	33,095	33,853	34,338	34,448	34,846	35,019	35,116	35,144	35,764	36,062
13	29,449	30,041	30,063	30,268	30,450	30,434	30,385	30,303	30,694	30,820
14	20,595	21,608	22,250	22,711	23,269	23,676	23,979	24,190	25,058	25,573
15	85,301	84,133	83,828	84,106	83,539	82,431	81,459	80,577	80,528	79,968
16	9	8	8	7	6	5	5	4	4	3
17	246	241	235	229	225	219	215	211	207	204
18	42,635	52,355	58,391	62,710	68,259	73,366	77,664	81,190	88,622	94,004
19	28,034	42,359	48,949	56,182	63,940	71,284	77,741	83,257	93,274	100,939

20	2,169	2,435	2,428	2,430	2,514	2,583	2,636	2,676	2,761	2,823
21	11,452	18,620	24,944	29,847	34,790	39,508	43,742	47,425	54,182	59,294
22	48,025	50,488	53,457	55,894	57,951	59,634	60,947	61,932	65,241	67,311
23	47,037	46,481	47,307	47,474	47,493	47,205	46,919	46,626	47,074	47,091
24	3,668	13,138	20,979	27,672	33,923	39,954	45,582	50,648	59,211	65,854
25	6,090	13,177	18,489	25,304	30,051	34,604	38,751	42,407	49,483	54,701
26	612	5,362	12,630	18,940	23,389	27,687	31,718	35,364	42,265	47,353
27	8,761	19,006	29,043	37,489	44,948	52,116	58,694	64,530	75,067	83,046
28	2,524	2,514	3,280	5,948	6,529	7,068	7,526	7,905	9,424	10,320
29	500	512	512	512	517	519	519	519	519	519
30	2,480	2,581	2,598	2,611	2,654	2,679	2,696	2,706	2,761	2,791
31	44	41	40	39	37	35	34	33	31	30
32	11,144	13,268	14,905	16,497	17,971	19,932	21,490	23,169	24,897	26,593
33	14,052	15,493	16,704	17,874	19,099	20,145	21,431	22,753	23,917	25,141
34	57,719	72,910	78,992	85,190	91,819	97,900	103,700	110,771	118,916	125,963
35	7,601	12,519	12,340	12,148	13,018	10,576	9,941	10,326	11,154	11,178
36	7,508	8,090	8,521	9,040	9,495	10,036	10,474	10,960	11,468	11,960
37	43,215	51,451	57,799	63,972	69,688	77,292	83,336	89,846	96,545	103,125
38	4,898	5,278	5,560	5,898	6,195	6,548	6,834	7,151	7,482	7,804
39	3,826	4,122	4,342	4,606	4,838	5,114	5,337	5,585	5,843	6,094
40	4,319	4,576	4,761	5,006	5,216	5,454	5,648	5,867	6,097	6,319
41	16,664	20,136	22,866	25,224	27,826	30,289	32,314	34,709	37,617	40,154
42	17,235	19,846	22,309	24,851	27,355	29,300	31,166	33,397	36,034	38,346
43	15,790	17,276	18,394	19,437	20,634	21,781	23,203	24,646	25,663	26,897
44	15,078	15,413	15,781	16,149	16,517	16,885	17,253	17,621	17,982	18,352
45	21,565	21,668	22,213	22,416	22,531	22,954	23,198	23,251	23,296	23,337
46	29,709	30,975	33,581	35,478	37,244	39,472	41,362	42,931	44,467	46,063
47	98,780	115,800	131,804	149,149	166,126	183,115	199,796	214,570	229,073	243,977
48	25,283	25,957	27,157	27,928	28,588	29,606	30,448	31,012	31,560	32,090
49	1	1	1	1	1	1	1	1	1	1
50	55,274	62,185	68,468	70,919	73,370	74,595	75,820	83,353	87,161	90,970
51	59,236	72,899	85,311	90,163	94,981	97,390	99,800	114,360	121,698	129,114
52	52,485	70,467	86,799	93,188	99,516	102,681	105,845	124,841	134,401	144,104
53	55,713	53,819	52,110	51,430	50,796	50,479	50,162	48,566	47,792	46,910
54	33,604	34,428	35,180	35,468	35,774	35,927	36,080	37,155	37,710	38,226
55	36,330	35,391	34,545	34,207	33,898	33,743	33,588	32,855	32,504	32,087
56	17,993	17,583	17,213	17,065	16,931	16,864	16,796	16,490	16,345	16,167
57	13,433	13,159	12,913	12,814	12,725	12,681	12,636	12,441	12,350	12,234
58	26,282	25,947	25,648	25,526	25,423	25,371	25,319	25,146	25,072	24,954
59	37,599	39,065	40,403	40,920	41,454	41,720	41,987	43,757	44,663	45,530
60	22,450	23,654	24,751	25,177	25,611	25,828	26,044	27,442	28,154	28,847

61	48,055	57,916	66,875	70,376	73,857	75,597	77,337	87,882	93,197	98,563
62	18,418	18,525	18,625	18,661	18,708	18,731	18,755	18,987	19,113	19,212
63	11,950	13,341	14,606	15,099	15,593	15,840	16,087	17,608	18,378	19,147
64	35,706	35,646	35,597	35,572	35,569	35,568	35,567	35,741	35,845	35,895
65	6,173	6,082	6,001	5,968	5,940	5,926	5,911	5,858	5,835	5,801
66	8,461	11,858	14,942	16,148	17,343	17,940	18,537	22,115	23,915	25,744
67	56,112	55,369	54,703	54,433	54,202	54,086	53,971	53,571	53,397	53,129
68	23,534	22,551	21,662	21,310	20,978	20,812	20,646	19,782	19,360	18,890
69	38,083	39,789	41,344	41,947	42,565	42,874	43,183	45,204	46,237	47,234
70	33,451	32,541	31,720	31,393	31,092	30,941	30,790	30,067	29,721	29,312
71	8,162	8,038	7,926	7,881	7,842	7,822	7,802	7,727	7,694	7,646
72	16,479	16,771	17,038	17,140	17,250	17,306	17,361	17,772	17,987	18,180
73	46,042	43,884	41,932	41,160	40,428	40,062	39,696	37,763	36,814	35,770
74	16,533	19,533	22,260	23,325	24,385	24,914	25,444	28,665	30,290	31,926
75	43,398	85,204	123,159	138,019	152,690	160,026	167,362	211,003	232,930	255,308
76	62,123	82,395	100,807	108,008	115,144	118,712	122,280	143,713	154,502	165,447
77	56,997	62,213	67,885	73,506	78,937	84,495	90,028	94,620	99,135	103,771
78	12,146	12,549	12,916	13,240	13,441	13,965	14,253	14,458	14,656	14,854
79	52,370	53,369	54,284	54,634	55,011	55,200	55,389	56,772	57,491	58,143
80	53,080	59,315	65,486	71,313	76,567	84,340	89,738	94,928	100,017	105,251
81	13,129	14,041	14,896	15,697	16,380	17,353	18,143	18,787	19,417	20,036
82	5,265	5,307	5,325	5,342	5,350	5,295	5,344	5,301	5,257	5,199
83	3,144	3,255	3,354	3,454	3,548	3,595	3,715	3,771	3,825	3,870
84	3,977	3,820	3,639	3,455	3,264	3,169	2,964	2,769	2,576	2,394
85	5,117	5,439	5,744	6,054	6,365	6,446	6,834	7,043	7,248	7,418
86	10,957	10,979	11,056	11,132	11,185	11,255	11,315	11,267	11,218	11,188
87	4,729	4,698	4,734	4,661	4,578	4,582	4,548	4,471	4,394	4,302
88	4,906	4,771	4,626	4,476	4,316	4,180	4,032	3,847	3,665	3,484
89	20,020	23,648	27,273	30,928	34,556	37,772	41,547	44,688	47,773	50,824
90	1,470	1,285	1,105	925	744	563	381	374	363	353
91	4,782	4,590	4,465	4,333	4,190	4,043	3,899	3,719	3,541	3,375
92	14,322	15,115	15,818	16,414	16,916	17,471	18,184	18,624	19,054	19,410
93	12,181	12,865	13,510	14,160	14,788	15,237	15,960	16,421	16,871	17,291
94	71,868	84,047	96,602	109,143	121,440	134,016	146,431	157,332	168,049	178,937
95	25,432	29,379	32,570	35,801	38,806	42,128	44,818	48,413	51,621	54,849
96	10,054	10,080	10,070	10,028	9,918	9,982	9,933	9,812	9,691	9,564
97	16,041	18,079	19,905	21,749	23,497	25,265	26,873	28,857	30,652	32,465
98	12,444	12,629	12,763	12,856	12,861	13,096	13,179	13,167	13,151	13,129
99	3,547	3,478	3,395	3,304	3,193	3,140	3,045	2,931	2,818	2,705
100	4,919	4,992	4,981	4,970	4,939	4,635	4,747	4,656	4,565	4,407
101	9,578	10,229	10,850	11,477	12,087	12,548	13,233	13,702	14,160	14,595

102	39,942	42,795	45,703	48,592	51,240	54,044	56,926	59,172	61,370	63,567
103	15,129	15,716	16,214	16,708	17,129	17,607	18,129	18,439	18,740	19,022
104	4,622	4,767	4,946	5,117	5,288	5,459	5,625	5,739	5,849	5,969
105	8,240	9,254	9,121	8,983	8,911	8,792	8,668	8,533	8,218	7,922
106	33,919	42,449	45,584	48,672	51,988	55,456	58,738	62,734	66,879	70,663
107	27,881	29,225	30,391	31,322	31,943	33,290	34,288	34,981	35,654	36,233
108	29,172	30,273	31,400	32,596	33,243	35,105	35,942	36,722	37,480	38,320
109	14,483	15,516	16,060	16,508	16,603	17,735	18,148	18,538	19,200	19,761
110	9,493	9,556	9,690	9,805	9,921	10,037	10,143	10,157	10,167	10,197
111	10,109	10,092	10,074	10,038	9,947	9,810	9,815	9,665	9,514	9,339
112	26,341	26,992	27,587	27,816	28,058	28,179	28,300	29,150	29,589	29,996
113	2,079	2,616	3,086	3,988	4,671	5,612	6,553	7,058	7,798	8,538
114	7,638	7,215	6,709	6,288	5,860	5,215	4,828	4,311	3,802	3,277
115	74,637	79,174	82,402	84,833	86,435	92,055	95,744	97,397	99,716	102,124
116	25,351	25,736	26,309	26,836	27,362	27,888	28,389	28,628	28,856	29,135
117	9,918	9,853	9,889	9,910	9,951	9,950	9,959	9,877	9,793	9,736
118	4,289	4,527	4,649	4,812	4,970	5,119	5,292	5,401	5,507	5,607
119	14,957	29,152	30,390	31,742	34,365	36,218	37,875	40,040	44,664	47,527
120	2,644	2,899	3,068	3,214	3,288	4,053	4,030	4,228	4,488	4,724
121	11,615	12,247	12,899	13,535	14,097	14,589	15,269	15,718	16,156	16,569
122	8,803	9,017	9,238	9,445	9,600	9,707	9,949	10,037	10,121	10,183
123	4,185	4,410	4,642	4,868	5,067	5,242	5,484	5,643	5,798	5,944
124	5,197	5,380	5,568	5,749	5,898	6,020	6,221	6,326	6,429	6,520
125	2,421	2,602	2,801	2,996	3,162	3,290	3,449	3,614	3,748	3,861
126	3,122	3,171	3,203	3,249	3,263	3,216	3,213	3,234	3,217	3,172
127	5,057	5,043	5,023	4,978	4,905	4,765	4,674	4,616	4,506	4,352
128	3,048	3,197	3,346	3,495	3,644	3,793	3,942	4,052	4,159	4,270
129	11,198	11,328	11,458	11,588	11,718	11,848	11,978	11,992	12,002	12,025
130	29,551	29,676	29,752	29,942	30,044	30,069	30,094	30,142	30,206	30,270
131	20,351	21,140	21,801	22,386	22,786	23,622	24,202	24,589	24,963	25,309
132	7,932	8,079	8,226	8,373	8,520	8,667	8,814	8,875	8,932	9,000
133	3,920	4,398	4,758	5,013	5,183	5,636	5,937	6,197	6,451	6,657
134	515	489	450	416	381	346	312	275	238	201
135	15,652	16,375	17,018	17,597	18,059	18,946	19,485	19,923	20,350	20,781
136	15,914	26,432	35,680	53,380	66,816	85,428	104,039	114,003	128,603	143,202
137	19,305	20,444	21,594	22,668	23,303	25,176	26,475	27,115	27,999	29,017
138	12,039	13,286	14,486	15,125	15,440	16,898	17,686	18,404	19,107	19,652
139	52,075	54,028	55,689	58,943	61,342	64,471	67,599	69,333	71,861	74,389
140	11,825	13,164	14,503	15,842	17,181	18,520	19,859	20,994	22,107	23,239
141	22,452	23,219	23,986	24,753	25,520	26,287	27,054	27,554	28,038	28,552
142	26,402	30,329	33,899	35,292	36,682	37,377	38,072	42,320	44,465	46,618

143	9,621	9,843	10,065	10,287	10,509	10,731	10,953	11,068	11,178	11,299
144	9,228	8,959	8,690	8,421	8,152	7,883	7,614	7,274	6,938	6,611
145	5,728	5,789	5,850	5,911	5,972	6,033	6,094	6,096	6,096	6,103
146	15,014	15,915	16,825	17,727	18,528	19,271	20,077	20,792	21,419	21,992
147	20,559	21,104	21,649	22,194	22,739	23,284	23,829	24,140	24,439	24,765
148	15,553	16,100	16,647	17,194	17,741	18,176	18,675	19,057	19,384	19,696
149	8,613	8,769	8,921	9,066	9,160	9,226	9,323	9,389	9,412	9,405
150	4,177	4,674	5,179	5,685	6,158	6,610	7,083	7,518	7,921	8,311
151	10,042	10,216	10,386	10,547	10,648	10,716	10,822	10,891	10,911	10,895
152	1	1	1	1	1	1	1	1	1	1
153	9,037	10,084	10,964	11,813	12,605	13,493	14,319	15,307	16,138	17,017
154	5,633	5,772	5,870	5,969	6,067	6,166	6,264	6,363	6,472	6,576
155	4,535	4,938	5,272	5,607	5,941	6,276	6,610	6,945	7,297	7,639
156	28,065	36,769	44,404	59,040	70,130	85,431	100,733	108,942	120,968	132,993
157	47,138	46,477	45,840	44,695	43,757	42,266	40,775	40,034	38,937	37,841
158	5,749	5,424	4,958	4,539	4,115	3,692	3,283	3,021	2,870	2,792

E.3 Population Forecasts – High Scenario

Zone #	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	12,697	15,871	18,298	20,076	22,035	23,552	25,014	26,248	29,063	31,029
2	22,306	25,145	25,980	26,557	28,045	28,950	29,894	30,666	32,023	33,081
3	32,699	33,567	35,507	39,138	40,592	41,187	41,948	42,556	45,145	46,622
4	30,808	39,996	45,545	50,803	56,896	61,871	66,636	70,718	78,349	84,195
5	57,067	58,289	60,150	61,747	63,145	63,190	63,646	63,998	65,423	66,187
6	59,845	62,538	66,016	67,859	70,335	71,322	72,603	73,627	76,388	78,159
7	841	843	843	847	851	835	829	823	820	813
8	41,730	43,493	44,708	45,864	47,139	47,409	47,943	48,363	49,613	50,368
9	22,846	26,692	31,035	35,399	38,801	41,423	43,953	46,085	51,166	54,690
10	50,715	52,831	54,497	56,272	57,962	58,418	59,177	59,776	61,563	62,658
11	27,234	27,774	28,300	29,090	29,613	29,498	29,602	29,679	30,181	30,408
12	33,095	34,471	35,630	36,405	37,492	37,780	38,266	38,649	39,665	40,308
13	29,449	30,589	31,194	31,987	32,761	32,833	33,110	33,325	34,041	34,449
14	20,595	22,002	23,087	24,001	25,035	25,543	26,130	26,603	27,791	28,584
15	85,301	85,667	86,984	88,884	89,881	88,930	88,765	88,613	89,312	89,385
16	9	8	8	7	6	6	5	5	4	3
17	246	245	244	242	242	237	234	232	230	228
18	42,635	53,310	60,589	66,272	73,441	79,150	84,630	89,288	98,288	105,074
19	28,034	43,132	50,791	59,373	68,794	76,904	84,713	91,560	103,447	112,826

20	2,169	2,480	2,519	2,568	2,705	2,787	2,873	2,943	3,062	3,156
21	11,452	18,960	25,883	31,543	37,431	42,623	47,665	52,155	60,092	66,277
22	48,025	51,409	55,469	59,068	62,351	64,336	66,413	68,109	72,357	75,237
23	47,037	47,329	49,088	50,170	51,098	50,926	51,127	51,277	52,208	52,636
24	3,668	13,378	21,769	29,243	36,498	43,104	49,671	55,699	65,669	73,609
25	6,090	13,417	19,185	26,741	32,332	37,332	42,227	46,636	54,880	61,143
26	612	5,460	13,105	20,016	25,165	29,870	34,563	38,891	46,874	52,929
27	8,761	19,352	30,137	39,619	48,360	56,225	63,958	70,966	83,255	92,826
28	2,524	2,560	3,404	6,286	7,025	7,626	8,201	8,693	10,452	11,535
29	500	522	531	542	557	560	566	571	576	580
30	2,480	2,628	2,696	2,760	2,855	2,891	2,938	2,976	3,062	3,120
31	44	42	41	41	40	38	37	36	34	34
32	11,144	13,510	15,466	17,434	19,335	21,503	23,418	25,480	27,612	29,725
33	14,052	15,775	17,333	18,889	20,549	21,733	23,353	25,022	26,526	28,101
34	57,719	74,239	81,966	90,029	98,790	105,619	113,000	121,819	131,887	140,796
35	7,601	12,747	12,804	12,838	14,007	11,410	10,833	11,356	12,370	12,495
36	7,508	8,237	8,842	9,554	10,216	10,828	11,414	12,053	12,718	13,369
37	43,215	52,390	59,975	67,606	74,978	83,386	90,810	98,807	107,076	115,269
38	4,898	5,374	5,769	6,233	6,665	7,065	7,447	7,864	8,298	8,722
39	3,826	4,197	4,505	4,868	5,206	5,517	5,816	6,142	6,481	6,812
40	4,319	4,660	4,940	5,291	5,612	5,884	6,155	6,452	6,762	7,063
41	16,664	20,503	23,726	26,657	29,939	32,678	35,212	38,171	41,719	44,882
42	17,235	20,208	23,149	26,263	29,432	31,610	33,961	36,727	39,965	42,862
43	15,790	17,592	19,086	20,541	22,200	23,498	25,284	27,104	28,462	30,065
44	15,078	15,694	16,375	17,066	17,771	18,216	18,801	19,379	19,943	20,514
45	21,565	22,135	23,195	23,894	24,492	24,984	25,498	25,779	26,031	26,261
46	29,709	31,643	35,066	37,817	40,486	42,963	45,462	47,599	49,688	51,835
47	98,780	118,300	137,630	158,982	180,588	199,309	219,599	237,900	255,969	274,548
48	25,283	26,517	28,358	29,769	31,077	32,224	33,466	34,384	35,265	36,111
49	1	1	1	1	1	1	1	1	1	1
50	55,274	64,104	72,691	77,386	82,141	83,696	86,180	95,838	101,253	106,661
51	59,236	75,149	90,573	98,384	106,337	109,272	113,435	131,490	141,373	151,384
52	52,485	72,642	92,153	101,685	111,414	115,208	120,306	143,540	156,130	168,959
53	55,713	55,480	55,324	56,120	56,869	56,637	57,015	55,841	55,519	55,001
54	33,604	35,490	37,349	38,703	40,051	40,310	41,009	42,720	43,807	44,819
55	36,330	36,483	36,676	37,327	37,950	37,859	38,177	37,776	37,759	37,622
56	17,993	18,125	18,275	18,621	18,955	18,921	19,091	18,960	18,987	18,955
57	13,433	13,565	13,709	13,983	14,246	14,228	14,363	14,305	14,346	14,345

58	26,282	26,748	27,230	27,854	28,462	28,466	28,778	28,912	29,125	29,257
59	37,599	40,271	42,895	44,651	46,409	46,810	47,724	50,311	51,884	53,383
60	22,450	24,384	26,278	27,473	28,672	28,978	29,603	31,552	32,706	33,823
61	48,055	59,703	71,000	76,794	82,687	85,295	87,904	101,045	108,265	115,563
62	18,418	19,096	19,774	20,362	20,944	21,017	21,317	21,831	22,203	22,526
63	11,950	13,753	15,507	16,476	17,457	17,772	18,285	20,246	21,349	22,449
64	35,706	36,745	37,792	38,815	39,822	39,907	40,426	41,094	41,640	42,086
65	6,173	6,270	6,371	6,513	6,650	6,649	6,719	6,736	6,778	6,801
66	8,461	12,223	15,863	17,621	19,416	20,129	21,070	25,428	27,782	30,185
67	56,112	57,077	58,077	59,396	60,682	60,685	61,345	61,595	62,030	62,293
68	23,534	23,246	22,998	23,253	23,486	23,351	23,467	22,745	22,490	22,148
69	38,083	41,017	43,894	45,772	47,654	48,105	49,083	51,975	53,713	55,381
70	33,451	33,545	33,677	34,256	34,809	34,716	34,997	34,571	34,526	34,368
71	8,162	8,286	8,415	8,600	8,779	8,776	8,868	8,885	8,938	8,965
72	16,479	17,288	18,089	18,703	19,313	19,417	19,733	20,434	20,895	21,315
73	46,042	45,238	44,519	44,913	45,261	44,950	45,120	43,419	42,766	41,939
74	16,533	20,136	23,633	25,451	27,300	27,954	28,921	32,959	35,187	37,433
75	43,398	87,833	130,756	150,605	170,945	179,549	190,229	242,608	270,589	299,343
76	62,123	84,937	107,024	117,857	128,910	133,195	138,987	165,239	179,481	193,983
77	56,997	63,539	70,868	78,344	85,842	92,173	99,306	105,433	111,489	117,698
78	12,146	12,813	13,479	14,103	14,603	15,236	15,726	16,117	16,494	16,862
79	52,370	55,015	57,632	59,616	61,588	61,935	62,957	65,275	66,785	68,171
80	53,080	60,361	67,802	75,085	81,883	90,182	96,653	102,898	109,030	115,318
81	13,129	14,337	15,545	16,721	17,796	18,931	20,018	20,944	21,852	22,745
82	5,265	5,424	5,564	5,691	5,802	5,755	5,858	5,855	5,846	5,816
83	3,144	3,327	3,504	3,679	3,848	3,907	4,073	4,165	4,253	4,329
84	3,977	3,904	3,802	3,680	3,539	3,444	3,250	3,059	2,865	2,678
85	5,117	5,559	6,002	6,449	6,902	7,005	7,492	7,780	8,060	8,298
86	10,957	11,213	11,535	11,849	12,131	12,227	12,408	12,460	12,500	12,551
87	4,729	4,797	4,939	4,961	4,965	4,978	4,987	4,944	4,896	4,826
88	4,906	4,872	4,826	4,764	4,681	4,541	4,422	4,255	4,084	3,908
89	20,020	24,169	28,494	32,946	37,475	41,051	45,548	49,364	53,124	56,853
90	1,470	1,312	1,153	985	806	611	418	413	404	396
91	4,782	4,688	4,659	4,612	4,545	4,392	4,276	4,112	3,945	3,786
92	14,322	15,456	16,550	17,530	18,433	19,124	20,132	20,834	21,515	22,106
93	12,181	13,148	14,115	15,084	16,038	16,560	17,497	18,139	18,760	19,342
94	71,868	85,835	100,788	116,177	131,712	145,586	160,583	173,993	187,248	200,734
95	25,432	29,915	33,796	37,834	41,752	45,449	48,837	53,242	57,251	61,308

96	10,054	10,293	10,508	10,682	10,776	10,890	10,960	10,939	10,906	10,857
97	16,041	18,409	20,654	22,985	25,280	27,257	29,283	31,735	33,995	36,288
98	12,444	12,895	13,318	13,694	13,972	14,287	14,541	14,678	14,800	14,904
99	3,547	3,551	3,543	3,519	3,468	3,426	3,359	3,267	3,171	3,071
100	4,919	5,100	5,198	5,288	5,352	5,039	5,212	5,157	5,097	4,955
101	9,578	10,454	11,336	12,226	13,109	13,637	14,508	15,135	15,746	16,326
102	39,942	43,714	47,693	51,702	55,519	58,764	62,507	65,544	68,514	71,472
103	15,129	16,053	16,920	17,778	18,559	19,145	19,907	20,425	20,922	21,387
104	4,622	4,861	5,149	5,436	5,731	5,951	6,213	6,417	6,618	6,830
105	8,240	9,437	9,494	9,542	9,658	9,585	9,573	9,542	9,298	9,064
106	33,919	43,223	47,300	51,437	55,934	59,828	64,006	68,991	74,173	78,984
107	27,881	29,865	31,752	33,400	34,741	36,365	37,874	39,032	40,151	41,149
108	29,172	30,870	32,685	34,626	36,029	38,270	39,697	41,064	42,407	43,845
109	14,483	15,799	16,664	17,445	17,863	19,133	19,775	20,387	21,294	22,088
110	9,493	9,745	10,086	10,416	10,752	10,942	11,203	11,358	11,504	11,667
111	10,109	10,312	10,524	10,711	10,825	10,741	10,878	10,833	10,775	10,678
112	26,341	27,825	29,289	30,353	31,413	31,617	32,167	33,516	34,373	35,170
113	2,079	2,696	3,276	4,352	5,229	6,297	7,448	8,115	9,059	10,011
114	7,638	7,372	7,007	6,709	6,385	5,709	5,349	4,831	4,305	3,747
115	74,637	80,876	86,045	90,445	93,999	100,427	105,580	108,451	112,017	115,647
116	25,351	26,244	27,385	28,507	29,655	30,403	31,355	32,013	32,649	33,336
117	9,918	10,047	10,294	10,527	10,785	10,847	11,000	11,045	11,080	11,140
118	4,289	4,626	4,855	5,134	5,416	5,603	5,864	6,052	6,235	6,411
119	14,957	29,684	31,534	33,545	36,974	39,074	41,272	44,033	49,536	53,124
120	2,644	2,952	3,183	3,397	3,537	4,373	4,392	4,650	4,977	5,281
121	11,615	12,515	13,475	14,442	15,342	15,974	16,924	17,618	18,297	18,944
122	8,803	9,214	9,651	10,078	10,448	10,629	11,028	11,250	11,462	11,643
123	4,185	4,506	4,849	5,194	5,515	5,739	6,078	6,325	6,566	6,796
124	5,197	5,498	5,817	6,134	6,419	6,592	6,895	7,091	7,281	7,454
125	2,421	2,659	2,927	3,200	3,446	3,616	3,844	4,082	4,287	4,470
126	3,122	3,240	3,346	3,469	3,556	3,535	3,581	3,653	3,680	3,672
127	5,057	5,152	5,248	5,316	5,346	5,237	5,210	5,214	5,155	5,038
128	3,048	3,264	3,490	3,719	3,951	4,125	4,331	4,493	4,650	4,811
129	11,198	11,566	11,951	12,330	12,706	12,885	13,161	13,298	13,421	13,550
130	29,551	30,591	31,587	32,672	33,636	33,737	34,206	34,657	35,090	35,491
131	20,351	21,570	22,708	23,772	24,662	25,651	26,557	27,238	27,893	28,504
132	7,932	8,249	8,580	8,909	9,238	9,426	9,684	9,842	9,989	10,141
133	3,920	4,493	4,970	5,349	5,648	6,169	6,578	6,944	7,305	7,611

134	515	500	470	444	415	378	346	308	270	230
135	15,652	16,720	17,759	18,745	19,620	20,670	21,499	22,210	22,901	23,591
136	15,914	27,248	37,880	58,247	74,804	95,850	118,254	131,079	149,395	167,901
137	19,305	20,873	22,522	24,120	25,268	27,380	29,090	30,069	31,310	32,695
138	12,039	13,575	15,130	16,139	16,825	18,496	19,596	20,623	21,636	22,470
139	52,075	55,695	59,124	64,317	68,676	72,336	76,835	79,718	83,479	87,220
140	11,825	13,444	15,140	16,885	18,684	20,203	21,906	23,393	24,863	26,358
141	22,452	23,718	25,047	26,390	27,753	28,678	29,833	30,681	31,497	32,333
142	26,402	31,265	35,990	38,511	41,068	41,937	43,274	48,659	51,654	54,659
143	9,621	10,050	10,498	10,946	11,395	11,670	12,035	12,273	12,499	12,732
144	9,228	9,152	9,074	8,978	8,865	8,600	8,396	8,100	7,794	7,486
145	5,728	5,912	6,107	6,300	6,494	6,581	6,722	6,792	6,856	6,922
146	15,014	16,250	17,562	18,875	20,106	21,006	22,121	23,135	24,044	24,889
147	20,559	21,558	22,606	23,662	24,729	25,402	26,277	26,879	27,454	28,044
148	15,553	16,446	17,383	18,331	19,294	19,829	20,593	21,220	21,775	22,304
149	8,613	8,954	9,312	9,653	9,939	10,057	10,273	10,447	10,566	10,644
150	4,177	4,773	5,406	6,053	6,682	7,205	7,805	8,365	8,892	9,405
151	10,042	10,431	10,841	11,230	11,555	11,681	11,924	12,118	12,248	12,330
152	1	1	1	1	1	1	1	1	1	1
153	9,037	10,268	11,377	12,484	13,562	14,557	15,603	16,834	17,898	19,021
154	5,633	5,877	6,091	6,308	6,528	6,652	6,826	6,998	7,178	7,350
155	4,535	5,028	5,471	5,925	6,392	6,771	7,203	7,638	8,093	8,539
156	28,065	37,904	47,143	64,424	78,514	95,854	114,496	125,260	140,526	155,931
157	47,138	47,911	48,668	48,771	48,988	47,422	46,346	46,031	45,232	44,367
158	5,749	5,542	5,178	4,843	4,484	4,041	3,638	3,386	3,250	3,193

E.4 Employment Forecasts – Low Scenario

Zone #	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	60,732	62,479	65,004	67,546	67,090	68,667	71,043	73,091	76,628	79,019
2	22,922	22,994	23,209	23,433	22,972	23,181	23,473	23,688	24,135	24,361
3	18,724	19,564	20,537	21,211	21,652	22,741	23,324	24,033	25,356	26,289
4	4,853	5,293	5,941	6,484	6,756	7,174	7,645	8,111	8,895	9,472
5	17,464	17,610	17,773	17,894	17,676	17,798	18,005	18,164	18,504	18,676
6	18,701	19,608	20,454	21,385	21,103	21,331	22,279	23,000	24,181	24,976
7	44,800	46,931	49,708	52,156	52,484	54,563	56,812	58,944	62,624	65,220
8	26,124	26,938	27,945	28,804	28,927	30,365	31,045	31,861	33,406	34,475
9	3,779	4,073	4,525	4,754	5,044	5,254	5,511	5,777	6,239	6,575

10	10,257	10,322	10,451	10,608	10,431	10,564	10,728	10,860	11,121	11,269
11	6,119	6,067	6,023	5,998	5,860	5,921	5,911	5,903	5,927	5,914
12	6,103	6,870	7,302	7,687	7,710	8,099	8,472	8,831	9,445	9,883
13	16,059	17,016	18,265	19,286	19,626	20,696	21,588	22,508	24,112	25,266
14	25,726	26,245	26,752	27,269	27,036	27,902	28,331	28,808	29,756	30,363
15	12,136	12,327	12,641	12,914	12,787	13,011	13,301	13,551	14,010	14,301
16	16,890	17,900	19,332	20,394	20,903	22,181	23,116	24,127	25,909	27,198
17	11,906	13,002	14,586	15,919	16,523	17,847	18,954	20,111	22,087	23,549
18	6,925	7,977	9,389	10,392	11,264	12,162	13,061	14,009	15,620	16,823
19	3,707	4,329	5,350	6,153	6,740	7,618	8,238	8,943	10,151	11,066
20	16,769	19,516	23,501	25,673	28,917	33,268	34,972	37,480	42,040	45,514
21	1,916	2,472	3,231	3,752	4,285	4,750	5,222	5,726	6,573	7,215
22	34,507	35,015	35,529	36,093	35,542	35,756	36,446	36,950	37,886	38,422
23	10,190	10,304	10,379	10,514	10,269	10,393	10,540	10,649	10,869	10,985
24	5,154	7,922	10,500	12,489	14,262	16,338	18,072	19,968	23,169	25,606
25	1,884	2,361	3,286	3,817	4,854	5,606	6,046	6,641	7,694	8,504
26	1,503	2,501	3,641	4,312	5,469	6,566	7,120	7,881	9,227	10,267
27	2,279	3,363	4,727	5,602	6,956	8,058	8,802	9,727	11,335	12,569
28	5,496	5,940	7,376	8,335	9,408	10,903	11,595	12,531	14,198	15,471
29	529	522	513	503	491	492	487	483	479	475
30	1,739	1,848	1,976	2,065	2,127	2,279	2,351	2,442	2,610	2,732
31	2,970	3,118	3,567	3,767	4,171	4,742	4,884	5,150	5,658	6,044
32	4,857	5,183	5,953	6,803	7,717	8,958	10,628	12,527	12,728	13,680
33	4,229	4,987	5,683	5,875	5,945	6,155	6,290	6,463	7,030	7,270
34	17,047	17,463	18,207	18,922	19,375	20,270	20,872	21,651	22,500	23,068
35	10,429	19,065	17,476	13,168	7,622	6,366	5,433	4,607	2,952	1,375
36	2,061	2,093	2,171	2,242	2,297	2,409	2,581	2,748	2,789	2,871
37	15,839	15,865	16,019	16,095	16,049	16,378	17,081	17,699	17,745	17,942
38	1,105	1,113	1,135	1,152	1,160	1,196	1,259	1,318	1,328	1,353
39	831	894	1,044	1,214	1,401	1,655	1,997	2,395	2,423	2,617
40	1,186	1,204	1,249	1,290	1,321	1,386	1,485	1,581	1,604	1,651
41	3,910	5,034	6,276	6,885	7,431	7,951	8,244	8,507	9,691	10,245
42	16,222	20,246	23,291	25,205	26,672	28,086	28,919	29,547	33,124	34,687
43	3,758	3,883	3,952	3,914	3,864	3,914	3,922	3,938	4,032	4,041
44	7,370	9,017	9,681	9,646	9,436	10,250	10,518	10,488	11,320	11,630
45	9,927	9,779	9,367	9,185	9,038	8,985	8,852	8,538	8,262	8,209
46	16,388	16,752	16,969	17,460	18,018	18,753	19,316	19,490	19,699	20,004
47	57,398	62,753	66,579	73,246	79,690	86,833	93,129	97,773	102,206	105,442

48	13,887	13,979	13,665	13,647	13,693	13,876	13,935	13,730	13,556	13,609
49	18,216	23,888	27,451	30,710	31,925	34,579	36,920	38,548	40,325	41,712
50	13,462	14,212	14,537	14,676	14,764	15,419	15,816	16,065	16,217	16,392
51	7,409	14,418	19,019	23,446	25,046	27,909	30,682	32,648	34,957	36,682
52	6,180	17,343	24,745	31,946	34,530	38,936	43,309	46,422	50,143	52,894
53	24,659	25,099	25,070	24,708	24,651	25,497	25,863	26,061	26,024	26,115
54	51,337	50,057	48,522	46,320	45,682	46,611	46,521	46,324	45,506	45,153
55	9,770	9,518	9,221	8,796	8,673	8,846	8,826	8,786	8,628	8,559
56	7,769	7,194	6,706	6,121	5,935	5,931	5,770	5,634	5,382	5,235
57	6,032	5,916	5,759	5,522	5,455	5,577	5,580	5,566	5,482	5,449
58	35,635	36,274	36,232	35,711	35,628	36,852	37,381	37,667	37,615	37,747
59	10,259	10,884	11,169	11,310	11,390	11,909	12,233	12,438	12,572	12,719
60	1,512	1,588	1,618	1,628	1,636	1,706	1,747	1,772	1,786	1,804
61	7,984	8,432	8,627	8,711	8,764	9,154	9,390	9,539	9,630	9,735
62	8,556	8,221	7,884	7,436	7,301	7,410	7,347	7,281	7,103	7,014
63	132,064	136,547	137,812	137,275	137,465	142,803	145,585	147,232	147,752	148,764
64	14,750	13,687	12,781	11,690	11,343	11,347	11,052	10,803	10,333	10,060
65	2,880	2,712	2,562	2,375	2,317	2,332	2,290	2,252	2,174	2,131
66	33,089	34,569	35,125	35,225	35,357	36,829	37,664	38,176	38,427	38,768
67	19,040	18,519	17,918	17,070	16,823	17,149	17,098	17,011	16,692	16,550
68	9,887	11,039	11,681	12,179	12,386	13,095	13,619	13,969	14,283	14,561
69	11,654	12,966	13,692	14,249	14,481	15,300	15,900	16,300	16,655	16,970
70	30,736	30,501	29,938	28,970	28,713	29,470	29,623	29,652	29,341	29,261
71	21,700	22,069	22,030	21,700	21,645	22,382	22,697	22,866	22,828	22,903
72	37,126	45,538	50,688	55,254	56,989	61,203	64,755	67,201	69,760	71,810
73	10,775	10,225	9,715	9,067	8,867	8,955	8,827	8,708	8,442	8,298
74	24,290	26,225	27,202	27,836	28,131	29,535	30,476	31,087	31,557	32,017
75	6,493	14,808	20,296	25,609	27,521	30,855	34,126	36,451	39,208	41,256
76	15,422	17,251	18,273	19,071	19,400	20,519	21,349	21,903	22,404	22,845
77	30,795	33,856	35,895	37,696	39,556	43,114	45,630	47,328	48,939	50,185
78	6,897	6,976	7,006	7,001	6,943	7,312	7,454	7,421	7,420	7,485
79	8,549	9,532	10,078	10,500	10,676	11,284	11,732	12,031	12,298	12,535
80	32,033	43,395	48,026	51,740	54,862	63,789	69,661	74,153	78,558	81,659
81	7,746	8,110	8,395	8,554	8,663	9,303	9,656	9,804	9,966	10,135
82	2,927	2,927	2,906	2,907	2,879	2,929	2,945	2,944	2,923	2,945
83	1,781	1,829	1,865	1,905	1,927	2,000	2,051	2,089	2,111	2,145
84	1,682	1,602	1,511	1,517	1,475	1,474	1,457	1,411	1,371	1,365
85	1,698	1,790	1,871	1,892	1,920	1,999	2,055	2,113	2,146	2,185

86	6,834	6,845	6,903	7,008	7,117	7,394	7,577	7,629	7,678	7,782
87	3,126	3,131	3,158	3,206	3,256	3,382	3,466	3,490	3,512	3,560
88	3,530	3,536	3,565	3,620	3,676	3,819	3,914	3,940	3,966	4,019
89	8,365	9,802	11,186	12,471	13,625	15,116	16,428	17,625	18,657	19,373
90	1,097	1,099	1,109	1,125	1,143	1,187	1,217	1,225	1,233	1,250
91	2,913	2,918	2,942	2,987	3,034	3,151	3,229	3,252	3,273	3,317
92	7,813	8,125	8,359	8,469	8,521	8,976	9,230	9,370	9,474	9,613
93	5,753	6,027	6,263	6,507	6,687	7,041	7,315	7,540	7,708	7,875
94	39,479	43,792	48,013	52,715	57,218	62,715	67,488	71,340	74,841	77,354
95	9,764	11,507	12,667	13,142	13,699	14,562	15,297	16,109	17,207	17,921
96	5,260	5,163	5,033	4,875	4,697	4,808	4,770	4,620	4,499	4,479
97	6,312	7,588	8,091	8,161	8,162	8,354	8,445	8,585	9,191	9,400
98	6,680	6,637	6,544	6,408	6,241	6,459	6,476	6,344	6,244	6,251
99	1,981	1,902	1,812	1,724	1,627	1,631	1,584	1,497	1,424	1,401
100	2,242	2,807	2,817	2,657	2,547	2,734	2,770	2,813	2,819	2,851
101	5,238	5,550	5,825	6,100	6,314	6,693	6,994	7,250	7,447	7,626
102	20,925	27,649	29,709	30,859	31,673	36,211	38,829	40,825	42,684	44,041
103	7,400	9,480	9,840	10,045	10,131	11,406	12,070	12,545	12,984	13,334
104	2,463	2,563	2,661	2,629	2,601	2,805	2,886	2,891	2,910	2,943
105	4,206	4,202	4,132	3,938	3,751	3,864	3,824	3,687	3,650	3,594
106	21,861	29,675	22,794	21,644	24,163	24,832	26,611	28,715	27,700	28,118
107	15,928	16,741	17,398	17,536	17,504	18,809	19,444	19,713	19,987	20,306
108	18,115	18,970	19,683	19,893	19,927	21,732	22,583	22,757	23,089	23,435
109	7,527	9,917	10,258	10,525	10,613	11,858	12,482	12,775	13,769	14,328
110	5,300	5,384	5,461	5,303	5,158	5,470	5,540	5,460	5,417	5,439
111	5,844	5,772	5,680	5,529	5,354	5,429	5,381	5,258	5,131	5,112
112	4,017	3,878	3,732	3,534	3,475	3,533	3,511	3,485	3,408	3,370
113	948	5,308	8,218	11,057	12,094	13,787	15,493	16,711	18,171	19,248
114	6,414	6,061	5,677	5,123	4,590	4,348	3,983	3,594	3,205	3,040
115	41,461	44,847	46,141	47,685	48,565	52,903	55,410	56,621	57,985	59,220
116	14,185	14,531	14,859	14,521	14,211	15,164	15,446	15,316	15,279	15,383
117	5,158	5,171	5,192	4,998	4,818	5,065	5,087	4,967	4,887	4,887
118	3,133	3,308	3,422	3,476	3,485	3,707	3,824	3,890	3,941	3,999
119	8,990	10,320	10,929	11,098	11,194	11,569	11,750	11,984	12,740	13,042
120	658	934	938	1,140	1,245	1,486	1,654	1,736	1,918	2,052
121	6,672	6,961	7,226	7,351	7,439	7,867	8,115	8,255	8,363	8,486
122	5,007	5,075	5,125	5,098	5,048	5,230	5,294	5,286	5,265	5,298
123	2,492	2,598	2,696	2,741	2,772	2,931	3,022	3,073	3,112	3,157

124	3,011	3,084	3,147	3,158	3,154	3,295	3,361	3,381	3,391	3,424
125	1,507	1,612	1,724	1,781	1,821	1,941	2,021	2,083	2,128	2,165
126	2,011	2,033	2,040	2,006	1,955	1,992	1,989	1,972	1,942	1,941
127	3,092	3,069	3,037	2,953	2,843	2,863	2,825	2,764	2,690	2,672
128	1,763	1,845	1,910	1,905	1,899	2,053	2,123	2,141	2,167	2,202
129	6,214	6,272	6,276	6,100	5,921	6,242	6,304	6,201	6,141	6,172
130	19,699	20,742	21,182	21,417	21,430	22,297	22,800	23,110	23,340	23,570
131	11,523	12,140	12,697	12,749	12,691	13,717	14,204	14,400	14,616	14,867
132	4,198	4,266	4,297	4,198	4,097	4,342	4,407	4,358	4,337	4,369
133	1,243	1,395	1,520	1,609	1,674	1,840	1,953	2,040	2,117	2,171
134	428	406	377	349	318	307	287	263	240	230
135	8,199	8,399	8,516	8,609	8,622	9,165	9,424	9,460	9,532	9,653
136	3,759	5,367	6,395	7,243	7,769	8,601	9,349	9,872	10,343	10,760
137	11,377	12,022	12,561	13,020	13,270	14,639	15,415	15,720	16,140	16,505
138	8,110	8,952	9,834	10,423	10,853	11,939	12,687	13,242	13,741	14,100
139	36,455	38,394	39,213	38,923	40,057	42,429	43,975	44,978	45,127	45,700
140	7,052	7,907	8,465	8,971	9,488	10,411	11,083	11,562	12,011	12,344
141	13,542	14,281	14,584	14,596	14,567	15,575	16,042	16,187	16,354	16,595
142	7,937	9,161	9,877	10,475	10,710	11,394	11,931	12,294	12,648	12,944
143	4,486	4,580	4,633	4,541	4,447	4,728	4,814	4,776	4,767	4,810
144	4,302	4,259	4,084	3,886	3,680	3,737	3,662	3,505	3,371	3,337
145	2,947	3,000	2,945	2,923	2,903	3,009	3,043	3,017	2,998	3,016
146	8,014	8,732	9,038	9,220	9,415	10,152	10,587	10,830	11,064	11,280
147	10,816	11,321	11,481	11,429	11,346	12,072	12,376	12,430	12,507	12,666
148	8,201	8,657	8,849	8,788	8,737	9,309	9,556	9,630	9,707	9,839
149	4,519	4,729	4,710	4,675	4,644	4,882	4,973	4,969	4,971	5,018
150	920	1,058	1,148	1,209	1,271	1,407	1,501	1,569	1,633	1,680
151	4,929	5,154	5,130	5,089	5,052	5,306	5,402	5,395	5,394	5,444
152	3,600	4,499	4,468	4,617	4,688	5,272	5,580	5,743	6,089	6,324
153	10,276	13,895	17,434	19,115	20,388	21,541	22,192	22,594	26,073	27,524
154	3,024	3,415	3,413	3,402	3,375	3,435	3,441	3,451	3,595	3,624
155	2,582	3,525	3,619	3,656	3,702	3,879	4,036	4,188	4,473	4,621
156	15,092	18,514	20,608	22,497	23,156	24,837	26,256	27,233	28,285	29,113
157	29,858	30,084	29,841	28,413	29,465	31,196	32,179	32,794	32,345	32,537
158	2,821	2,663	2,452	2,258	2,040	1,950	1,805	1,632	1,470	1,402

E.5 Employment Forecasts – Central Case

Zone #	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	60,732	63,342	67,051	71,034	72,257	73,769	77,100	80,069	84,675	88,027
2	22,922	23,312	23,940	24,644	24,741	24,903	25,474	25,949	26,669	27,138
3	18,724	19,834	21,184	22,306	23,319	24,431	25,312	26,327	28,019	29,286
4	4,853	5,366	6,129	6,818	7,277	7,707	8,297	8,885	9,829	10,552
5	17,464	17,854	18,332	18,818	19,037	19,121	19,539	19,898	20,447	20,805
6	18,701	19,879	21,098	22,489	22,728	22,916	24,178	25,196	26,720	27,823
7	44,800	47,580	51,273	54,849	56,526	58,618	61,656	64,571	69,202	72,655
8	26,124	27,310	28,825	30,292	31,155	32,622	33,692	34,903	36,915	38,405
9	3,779	4,129	4,668	5,000	5,433	5,645	5,980	6,329	6,895	7,325
10	10,257	10,464	10,780	11,156	11,234	11,349	11,642	11,897	12,289	12,553
11	6,119	6,151	6,212	6,308	6,311	6,361	6,415	6,466	6,549	6,588
12	6,103	6,965	7,532	8,084	8,303	8,701	9,195	9,674	10,437	11,010
13	16,059	17,251	18,840	20,282	21,137	22,234	23,429	24,656	26,644	28,146
14	25,726	26,608	27,594	28,677	29,118	29,976	30,746	31,558	32,881	33,824
15	12,136	12,497	13,039	13,581	13,772	13,978	14,435	14,845	15,482	15,931
16	16,890	18,147	19,940	21,447	22,513	23,829	25,087	26,430	28,630	30,299
17	11,906	13,182	15,045	16,742	17,795	19,174	20,570	22,030	24,407	26,234
18	6,925	8,088	9,685	10,929	12,131	13,065	14,175	15,347	17,260	18,741
19	3,707	4,389	5,518	6,471	7,259	8,184	8,941	9,796	11,217	12,328
20	16,769	19,785	24,241	26,999	31,144	35,740	37,954	41,057	46,455	50,703
21	1,916	2,506	3,333	3,946	4,615	5,103	5,668	6,272	7,264	8,038
22	34,507	35,498	36,648	37,957	38,279	38,413	39,552	40,477	41,865	42,802
23	10,190	10,447	10,706	11,057	11,060	11,166	11,438	11,665	12,010	12,238
24	5,154	8,032	10,831	13,134	15,361	17,552	19,612	21,874	25,602	28,525
25	1,884	2,393	3,389	4,014	5,228	6,023	6,562	7,275	8,502	9,473
26	1,503	2,536	3,756	4,534	5,890	7,054	7,727	8,633	10,197	11,438
27	2,279	3,410	4,876	5,891	7,492	8,657	9,552	10,656	12,525	14,002
28	5,496	6,022	7,609	8,765	10,132	11,713	12,584	13,727	15,689	17,234
29	529	529	529	529	529	529	529	529	529	529
30	1,739	1,873	2,038	2,172	2,290	2,448	2,551	2,675	2,884	3,043
31	2,970	3,161	3,679	3,961	4,492	5,094	5,300	5,642	6,253	6,733
32	4,857	5,254	6,140	7,155	8,311	9,624	11,534	13,723	14,065	15,239
33	4,229	5,056	5,862	6,178	6,403	6,612	6,826	7,080	7,768	8,099
34	17,047	17,704	18,781	19,900	20,867	21,777	22,651	23,718	24,864	25,698
35	10,429	19,328	18,026	13,848	8,209	6,839	5,896	5,047	3,262	1,532

36	2,061	2,122	2,240	2,357	2,474	2,588	2,801	3,011	3,081	3,198
37	15,839	16,084	16,524	16,926	17,285	17,595	18,537	19,389	19,608	19,987
38	1,105	1,128	1,171	1,211	1,249	1,284	1,367	1,444	1,468	1,507
39	831	906	1,077	1,277	1,509	1,778	2,168	2,624	2,678	2,916
40	1,186	1,220	1,288	1,356	1,423	1,488	1,611	1,732	1,773	1,840
41	3,910	5,104	6,473	7,241	8,003	8,541	8,947	9,319	10,708	11,412
42	16,222	20,526	24,024	26,507	28,725	30,174	31,385	32,367	36,602	38,641
43	3,758	3,937	4,077	4,116	4,162	4,205	4,256	4,314	4,455	4,502
44	7,370	9,142	9,986	10,144	10,163	11,011	11,414	11,489	12,508	12,956
45	9,927	9,939	9,714	9,737	9,841	9,741	9,696	9,439	9,212	9,224
46	16,388	17,026	17,597	18,509	19,620	20,331	21,158	21,548	21,964	22,477
47	57,398	63,778	69,045	77,648	86,772	94,138	102,010	108,099	113,960	118,480
48	13,887	14,207	14,171	14,468	14,910	15,044	15,264	15,179	15,115	15,291
49	18,216	24,517	29,074	33,606	36,246	39,119	42,424	44,924	47,601	49,818
50	13,462	14,586	15,397	16,059	16,762	17,444	18,174	18,723	19,143	19,578
51	7,409	14,798	20,144	25,657	28,436	31,574	35,257	38,048	41,265	43,810
52	6,180	17,800	26,209	34,958	39,204	44,049	49,766	54,101	59,191	63,173
53	24,659	25,760	26,553	27,038	27,987	28,845	29,719	30,372	30,720	31,190
54	51,337	51,375	51,392	50,688	51,865	52,731	53,457	53,987	53,717	53,928
55	9,770	9,769	9,766	9,625	9,847	10,008	10,142	10,240	10,185	10,222
56	7,769	7,383	7,103	6,699	6,739	6,710	6,630	6,566	6,353	6,252
57	6,032	6,072	6,099	6,043	6,194	6,310	6,412	6,487	6,471	6,508
58	35,635	37,229	38,375	39,078	40,450	41,691	42,954	43,898	44,403	45,082
59	10,259	11,171	11,829	12,376	12,931	13,473	14,057	14,495	14,840	15,190
60	1,512	1,629	1,714	1,781	1,857	1,930	2,007	2,066	2,109	2,154
61	7,984	8,654	9,137	9,532	9,950	10,356	10,790	11,117	11,368	11,626
62	8,556	8,438	8,350	8,137	8,289	8,383	8,443	8,485	8,385	8,377
63	132,064	140,142	145,963	150,221	156,070	161,554	167,291	171,587	174,414	177,673
64	14,750	14,048	13,537	12,792	12,879	12,837	12,700	12,590	12,198	12,016
65	2,880	2,784	2,713	2,599	2,630	2,638	2,631	2,625	2,566	2,545
66	33,089	35,479	37,202	38,547	40,142	41,665	43,280	44,491	45,361	46,302
67	19,040	19,006	18,978	18,680	19,099	19,401	19,647	19,825	19,704	19,766
68	9,887	11,330	12,372	13,328	14,062	14,814	15,650	16,280	16,861	17,390
69	11,654	13,308	14,502	15,593	16,441	17,309	18,271	18,996	19,660	20,268
70	30,736	31,304	31,709	31,702	32,599	33,340	34,039	34,557	34,636	34,947
71	21,700	22,650	23,333	23,746	24,574	25,321	26,081	26,649	26,947	27,354
72	37,126	46,737	53,685	60,465	64,702	69,240	74,410	78,317	82,348	85,765
73	10,775	10,494	10,289	9,922	10,067	10,131	10,144	10,149	9,965	9,911

74	24,290	26,916	28,811	30,461	31,939	33,413	35,020	36,229	37,252	38,239
75	6,493	15,197	21,496	28,024	31,246	34,906	39,215	42,481	46,283	49,273
76	15,422	17,705	19,354	20,870	22,026	23,213	24,532	25,527	26,447	27,284
77	30,795	34,410	37,228	39,998	43,138	46,916	50,251	52,702	55,062	57,008
78	6,897	7,088	7,261	7,420	7,561	7,952	8,207	8,265	8,353	8,513
79	8,549	9,783	10,674	11,491	12,120	12,766	13,482	14,021	14,518	14,971
80	32,033	43,952	49,386	54,099	58,627	67,780	74,538	79,834	85,041	88,833
81	7,746	8,241	8,700	9,065	9,433	10,117	10,631	10,919	11,220	11,526
82	2,927	2,977	3,013	3,077	3,126	3,166	3,213	3,237	3,237	3,282
83	1,781	1,861	1,933	2,016	2,092	2,162	2,237	2,297	2,338	2,391
84	1,682	1,630	1,566	1,605	1,602	1,594	1,589	1,551	1,518	1,522
85	1,698	1,821	1,940	2,002	2,085	2,161	2,242	2,324	2,376	2,435
86	6,834	6,953	7,151	7,415	7,728	7,996	8,275	8,406	8,528	8,707
87	3,126	3,181	3,272	3,392	3,535	3,658	3,786	3,845	3,901	3,983
88	3,530	3,591	3,694	3,830	3,991	4,130	4,274	4,342	4,405	4,497
89	8,365	9,971	11,595	13,200	14,794	16,342	17,921	19,379	20,660	21,589
90	1,097	1,117	1,148	1,191	1,241	1,284	1,329	1,350	1,370	1,398
91	2,913	2,964	3,048	3,161	3,294	3,408	3,527	3,583	3,635	3,711
92	7,813	8,255	8,670	9,000	9,298	9,789	10,190	10,461	10,687	10,948
93	5,753	6,131	6,492	6,888	7,261	7,612	7,979	8,291	8,535	8,775
94	39,479	44,484	49,740	55,778	62,125	67,821	73,704	78,604	83,125	86,545
95	9,764	11,666	13,066	13,821	14,753	15,644	16,601	17,646	19,014	19,964
96	5,260	5,246	5,216	5,166	5,114	5,229	5,252	5,146	5,065	5,094
97	6,312	7,693	8,346	8,583	8,791	8,975	9,165	9,405	10,156	10,471
98	6,680	6,743	6,782	6,791	6,796	7,024	7,130	7,065	7,029	7,108
99	1,981	1,933	1,878	1,827	1,772	1,774	1,744	1,668	1,604	1,593
100	2,242	2,849	2,913	2,807	2,763	2,955	3,025	3,099	3,133	3,193
101	5,238	5,646	6,038	6,456	6,856	7,236	7,630	7,972	8,247	8,499
102	20,925	28,066	30,722	32,602	34,351	39,136	42,393	44,985	47,431	49,315
103	7,400	9,623	10,175	10,612	10,988	12,327	13,179	13,824	14,428	14,931
104	2,463	2,600	2,751	2,780	2,826	3,046	3,176	3,223	3,284	3,361
105	4,206	4,263	4,273	4,166	4,076	4,196	4,209	4,110	4,119	4,104
106	21,861	30,085	23,512	22,762	26,023	26,677	28,880	31,456	30,609	31,324
107	15,928	17,022	18,037	18,605	19,094	20,476	21,423	21,963	22,499	23,079
108	18,115	19,247	20,352	21,042	21,650	23,600	24,854	25,369	26,058	26,763
109	7,527	10,054	10,581	11,069	11,430	12,739	13,546	13,995	15,215	15,961
110	5,300	5,462	5,646	5,610	5,604	5,940	6,097	6,086	6,113	6,211
111	5,844	5,862	5,887	5,862	5,840	5,921	5,947	5,885	5,813	5,856

112	4,017	3,980	3,953	3,867	3,945	3,997	4,034	4,061	4,023	4,025
113	948	5,448	8,704	12,100	13,731	15,597	17,803	19,475	21,449	22,989
114	6,414	6,176	5,925	5,478	5,040	4,783	4,443	4,062	3,667	3,519
115	41,461	45,571	47,820	50,514	52,837	57,417	60,816	62,787	64,911	66,875
116	14,185	14,743	15,365	15,359	15,440	16,467	16,999	17,074	17,244	17,567
117	5,158	5,246	5,368	5,287	5,234	5,500	5,598	5,537	5,516	5,581
118	3,133	3,371	3,571	3,717	3,827	4,078	4,266	4,396	4,509	4,629
119	8,990	10,463	11,273	11,671	12,056	12,429	12,752	13,128	14,078	14,529
120	658	947	967	1,199	1,340	1,597	1,795	1,901	2120	2286
121	6,672	7,069	7,491	7,794	8,114	8,579	8,969	9,239	9,474	9,722
122	5,007	5,154	5,312	5,405	5,505	5,704	5,851	5,916	5,964	6,070
123	2,492	2,639	2,794	2,906	3,024	3,196	3,340	3,439	3,526	3,617
124	3,011	3,132	3,262	3,348	3,440	3,593	3,714	3,784	3,841	3,923
125	1,507	1,637	1,788	1,889	1,991	2,126	2,247	2,350	2,435	2,511
126	2,011	2,066	2,117	2,127	2,137	2,182	2,212	2,225	2,222	2,252
127	3,092	3,118	3,151	3,132	3,108	3,135	3,140	3,118	3,078	3,099
128	1,763	1,873	1,976	2,014	2,061	2,221	2,321	2,364	2,415	2,475
129	6,214	6,368	6,493	6,447	6,427	6,752	6,893	6,848	6,844	6,936
130	19,699	21,288	22,434	23,436	24,330	25,225	26,200	26,933	27,552	28,150
131	11,523	12,314	13,115	13,455	13,733	14,803	15,490	15,857	16,238	16,654
132	4,198	4,331	4,446	4,437	4,447	4,697	4,819	4,812	4,833	4,910
133	1,243	1,421	1,587	1,721	1,838	2,024	2,179	2,306	2,422	2,513
134	428	414	393	374	349	337	320	297	274	267
135	8,199	8,533	8,825	9,124	9,389	9,966	10,376	10,536	10,731	10,977
136	3,759	5,508	6,773	7,926	8,820	9,730	10,743	11,506	12,210	12,851
137	11,377	12,205	12,997	13,761	14,403	15,836	16,856	17,360	17,986	18,549
138	8,110	9,123	10,263	11,145	11,917	13,133	14,152	14,966	15,722	16,319
139	36,455	39,405	41,532	42,593	45,479	48,000	50,531	52,418	53,270	54,581
140	7,052	8,037	8,779	9,519	10,347	11,329	12,205	12,874	13,514	14,022
141	13,542	14,511	15,114	15,462	15,848	16,905	17,607	17,949	18,308	18,741
142	7,937	9,402	10,461	11,462	12,160	12,890	13,709	14,328	14,930	15,460
143	4,486	4,650	4,793	4,800	4,827	5,114	5,264	5,274	5,312	5,405
144	4,302	4,328	4,232	4,116	4,004	4,056	4,019	3,887	3,773	3,768
145	2,947	3,049	3,055	3,101	3,165	3,274	3,351	3,360	3,373	3,426
146	8,014	8,868	9,357	9,763	10,238	11,027	11,637	12,038	12,425	12,791
147	10,816	11,504	11,898	12,107	12,344	13,102	13,583	13,784	14,001	14,303
148	8,201	8,797	9,171	9,309	9,505	10,103	10,488	10,679	10,867	11,111
149	4,519	4,803	4,876	4,951	5,050	5,303	5,467	5,523	5,583	5,690

150	920	1,075	1,189	1,280	1,382	1,528	1,650	1,744	1,834	1,905
151	4,929	5,235	5,311	5,388	5,493	5,764	5,938	5,996	6,058	6,173
152	3,600	4,561	4,609	4,856	5,049	5,663	6,056	6,291	6,728	7,045
153	10,276	14,088	17,983	20,102	21,958	23,142	24,084	24,751	28,811	30,662
154	3,024	3,462	3,520	3,578	3,634	3,691	3,735	3,781	3,972	4,037
155	2,582	3,573	3,733	3,845	3,987	4,168	4,380	4,588	4,942	5,148
156	15,092	19,001	21,827	24,619	26,290	28,099	30,171	31,737	33,389	34,770
157	29,858	30,876	31,606	31,093	33,453	35,292	36,977	38,219	38,182	38,859
158	2,821	2,714	2,559	2,415	2,240	2,145	2,013	1,845	1,682	1,623

E.6 Employment Forecasts – High Scenario

Zone #	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	60,732	64,236	68,948	74,119	76,669	78,234	82,383	86,142	91,669	95,845
2	22,922	23,640	24,617	25,714	26,251	26,411	27,220	27,918	28,872	29,548
3	18,724	20,114	21,783	23,275	24,743	25,909	27,047	28,324	30,333	31,887
4	4,853	5,441	6,302	7,114	7,721	8,174	8,865	9,559	10,641	11,489
5	17,464	18,105	18,851	19,635	20,199	20,278	20,878	21,408	22,136	22,653
6	18,701	20,159	21,695	23,466	24,116	24,303	25,835	27,107	28,927	30,295
7	44,800	48,251	52,724	57,231	59,977	62,166	65,880	69,469	74,917	79,107
8	26,124	27,695	29,640	31,608	33,057	34,596	36,001	37,551	39,964	41,816
9	3,779	4,187	4,800	5,217	5,764	5,986	6,390	6,809	7,464	7,975
10	10,257	10,612	11,085	11,640	11,920	12,036	12,440	12,800	13,304	13,668
11	6,119	6,237	6,388	6,582	6,696	6,746	6,854	6,957	7,090	7,173
12	6,103	7,063	7,745	8,435	8,810	9,227	9,825	10,407	11,299	11,987
13	16,059	17,494	19,373	21,163	22,428	23,579	25,034	26,527	28,845	30,646
14	25,726	26,983	28,375	29,923	30,896	31,790	32,853	33,952	35,597	36,828
15	12,136	12,673	13,408	14,171	14,613	14,824	15,425	15,971	16,761	17,346
16	16,890	18,403	20,504	22,379	23,888	25,272	26,806	28,435	30,994	32,990
17	11,906	13,368	15,471	17,469	18,882	20,334	21,980	23,702	26,423	28,564
18	6,925	8,202	9,958	11,404	12,872	13,856	15,146	16,511	18,686	20,405
19	3,707	4,450	5,674	6,752	7,702	8,680	9,553	10,539	12,144	13,422
20	16,769	20,064	24,927	28,172	33,046	37,903	40,555	44,172	50,292	55,206
21	1,916	2,541	3,427	4,117	4,896	5,412	6,056	6,748	7,864	8,752
22	34,507	35,999	37,685	39,605	40,616	40,738	42,263	43,547	45,322	46,603
23	10,190	10,594	11,009	11,537	11,735	11,842	12,222	12,550	13,002	13,325
24	5,154	8,145	11,137	13,705	16,298	18,615	20,956	23,533	27,717	31,059
25	1,884	2,427	3,485	4,189	5,547	6,387	7,011	7,827	9,204	10,315

26	1,503	2,572	3,862	4,731	6,250	7,481	8,257	9,288	11,039	12,453
27	2,279	3,458	5,013	6,147	7,949	9,181	10,207	11,464	13,560	15,246
28	5,496	6,107	7,824	9,146	10,751	12,422	13,446	14,768	16,985	18,765
29	529	536	544	552	561	561	565	569	573	576
30	1,739	1,900	2,096	2,266	2,430	2,597	2,726	2,878	3,122	3,314
31	2,970	3,205	3,784	4,133	4,766	5,403	5,664	6,070	6,769	7,331
32	4,857	5,329	6,314	7,466	8,819	10,206	12,324	14,763	15,227	16,592
33	4,229	5,128	6,028	6,446	6,794	7,013	7,294	7,617	8,410	8,818
34	17,047	17,954	19,312	20,764	22,141	23,095	24,204	25,517	26,917	27,980
35	10,429	19,601	18,536	14,450	8,710	7,252	6,300	5,430	3,532	1,668
36	2,061	2,152	2,303	2,460	2,625	2,744	2,993	3,239	3,336	3,482
37	15,839	16,311	16,991	17,661	18,341	18,660	19,808	20,860	21,228	21,762
38	1,105	1,144	1,204	1,264	1,326	1,362	1,461	1,554	1,589	1,641
39	831	919	1,108	1,332	1,601	1,885	2,316	2,823	2,899	3,175
40	1,186	1,238	1,325	1,415	1,510	1,579	1,722	1,863	1,919	2,003
41	3,910	5,176	6,657	7,555	8,491	9,058	9,560	10,026	11,593	12,426
42	16,222	20,815	24,704	27,658	30,479	32,000	33,535	34,823	39,626	42,073
43	3,758	3,992	4,192	4,295	4,416	4,459	4,548	4,641	4,823	4,902
44	7,370	9,271	10,268	10,585	10,783	11,678	12,196	12,360	13,542	14,107
45	9,927	10,103	10,034	10,223	10,525	10,399	10,430	10,221	10,035	10,102
46	16,388	17,307	18,177	19,433	20,982	21,705	22,758	23,332	23,926	24,616
47	57,398	64,832	71,321	81,524	92,798	100,502	109,725	117,052	124,135	129,752
48	13,887	14,442	14,638	15,190	15,945	16,061	16,419	16,437	16,465	16,746
49	18,216	25,158	30,551	36,138	39,927	43,058	47,187	50,430	53,874	56,796
50	13,462	14,967	16,179	17,269	18,464	19,200	20,214	21,017	21,666	22,320
51	7,409	15,184	21,167	27,590	31,324	34,753	39,215	42,711	46,702	49,947
52	6,180	18,265	27,540	37,592	43,185	48,484	55,352	60,731	66,990	72,022
53	24,659	26,433	27,902	29,075	30,829	31,750	33,055	34,093	34,768	35,559
54	51,337	52,717	54,003	54,506	57,133	58,041	59,458	60,602	60,796	61,482
55	9,770	10,024	10,262	10,351	10,847	11,016	11,281	11,495	11,527	11,654
56	7,769	7,576	7,464	7,203	7,423	7,386	7,375	7,371	7,190	7,128
57	6,032	6,231	6,409	6,498	6,823	6,945	7,132	7,282	7,324	7,419
58	35,635	38,201	40,325	42,022	44,558	45,889	47,776	49,278	50,253	51,397
59	10,259	11,463	12,430	13,309	14,244	14,830	15,635	16,271	16,796	17,318
60	1,512	1,672	1,801	1,915	2,045	2,124	2,233	2,319	2,387	2,456
61	7,984	8,880	9,601	10,250	10,961	11,398	12,002	12,479	12,865	13,255
62	8,556	8,658	8,774	8,750	9,131	9,227	9,391	9,525	9,490	9,551
63	132,064	143,804	153,379	161,538	171,921	177,823	186,070	192,614	197,395	202,561

64	14,750	14,415	14,225	13,756	14,187	14,129	14,125	14,132	13,805	13,699
65	2,880	2,856	2,851	2,795	2,897	2,904	2,927	2,947	2,904	2,901
66	33,089	36,406	39,092	41,451	44,219	45,861	48,138	49,943	51,338	52,788
67	19,040	19,503	19,942	20,087	21,039	21,354	21,852	22,255	22,300	22,534
68	9,887	11,626	13,001	14,332	15,490	16,306	17,407	18,275	19,082	19,826
69	11,654	13,655	15,239	16,768	18,111	19,052	20,322	21,324	22,251	23,107
70	30,736	32,122	33,320	34,090	35,910	36,697	37,860	38,791	39,199	39,842
71	21,700	23,242	24,519	25,535	27,070	27,871	29,009	29,914	30,497	31,185
72	37,126	47,958	56,413	65,020	71,274	76,212	82,763	87,914	93,199	97,778
73	10,775	10,769	10,812	10,669	11,090	11,151	11,282	11,392	11,278	11,299
74	24,290	27,619	30,275	32,755	35,183	36,777	38,951	40,669	42,160	43,596
75	6,493	15,595	22,588	30,135	34,419	38,421	43,617	47,686	52,381	56,175
76	15,422	18,168	20,337	22,442	24,263	25,551	27,286	28,655	29,932	31,106
77	30,795	34,979	38,463	42,024	46,188	50,225	54,264	57,361	60,361	62,907
78	6,897	7,200	7,494	7,787	8,086	8,508	8,860	8,995	9,159	9,399
79	8,549	10,039	11,217	12,356	13,351	14,051	14,995	15,739	16,431	17,068
80	32,033	44,532	50,636	56,193	61,789	71,238	78,749	84,728	90,617	94,994
81	7,746	8,371	8,980	9,515	10,088	10,824	11,476	11,883	12,303	12,726
82	2,927	3,026	3,109	3,224	3,332	3,370	3,442	3,487	3,504	3,568
83	1,781	1,891	1,995	2,112	2,230	2,301	2,396	2,474	2,531	2,600
84	1,682	1,657	1,616	1,682	1,707	1,696	1,702	1,671	1,643	1,655
85	1,698	1,851	2,002	2,098	2,222	2,300	2,401	2,503	2,572	2,648
86	6,834	7,066	7,381	7,775	8,247	8,520	8,881	9,079	9,263	9,505
87	3,126	3,232	3,377	3,557	3,773	3,898	4,063	4,153	4,237	4,348
88	3,530	3,650	3,812	4,016	4,259	4,401	4,587	4,689	4,784	4,910
89	8,365	10,134	11,967	13,828	15,767	17,393	19,197	20,876	22,366	23,474
90	1,097	1,135	1,185	1,249	1,324	1,368	1,426	1,458	1,488	1,526
91	2,913	3,012	3,146	3,314	3,515	3,631	3,785	3,870	3,948	4,051
92	7,813	8,397	8,967	9,469	9,974	10,501	11,027	11,411	11,742	12,109
93	5,753	6,231	6,700	7,215	7,738	8,102	8,547	8,932	9,240	9,542
94	39,479	45,204	51,337	58,479	66,296	72,269	79,103	84,898	90,290	94,483
95	9,764	11,830	13,436	14,421	15,654	16,591	17,739	18,985	20,584	21,737
96	5,260	5,329	5,383	5,423	5,470	5,595	5,669	5,600	5,554	5,624
97	6,312	7,801	8,582	8,956	9,328	9,518	9,793	10,118	10,995	11,401
98	6,680	6,850	7,000	7,128	7,268	7,515	7,696	7,689	7,708	7,848
99	1,981	1,963	1,938	1,917	1,895	1,898	1,883	1,815	1,758	1,759
100	2,242	2,894	3,005	2,941	2,946	3,150	3,248	3,351	3,407	3,491
101	5,238	5,738	6,231	6,764	7,307	7,701	8,173	8,587	8,928	9,241

102	20,925	28,513	31,692	34,159	36,635	41,717	45,529	48,636	51,588	53,928
103	7,400	9,776	10,497	11,119	11,718	13,140	14,153	14,946	15,692	16,327
104	2,463	2,640	2,836	2,916	3,022	3,260	3,432	3,515	3,614	3,729
105	4,206	4,328	4,405	4,369	4,357	4,490	4,549	4,483	4,533	4,553
106	21,861	30,509	24,177	23,750	27,612	28,292	30,859	33,842	33,137	34,106
107	15,928	17,301	18,637	19,542	20,434	21,929	23,144	23,915	24,675	25,478
108	18,115	19,540	20,980	22,069	23,145	25,256	26,863	27,674	28,673	29,692
109	7,527	10,196	10,880	11,550	12,128	13,510	14,474	15,056	16,472	17,379
110	5,300	5,546	5,821	5,883	5,991	6,357	6,590	6,639	6,727	6,891
111	5,844	5,958	6,079	6,159	6,253	6,352	6,443	6,433	6,407	6,505
112	4,017	4,084	4,153	4,159	4,346	4,399	4,487	4,559	4,553	4,589
113	948	5,590	9,146	13,012	15,125	17,168	19,801	21,862	24,276	26,209
114	6,414	6,297	6,150	5,784	5,423	5,159	4,840	4,465	4,063	3,929
115	41,461	46,318	49,375	53,005	56,473	61,355	65,517	68,137	70,911	73,497
116	14,185	14,968	15,839	16,109	16,507	17,623	18,373	18,625	18,975	19,490
117	5,158	5,326	5,534	5,545	5,596	5,886	6,051	6,040	6,069	6,192
118	3,133	3,437	3,707	3,925	4,117	4,399	4,647	4,831	4,997	5,168
119	8,990	10,611	11,592	12,178	12,792	13,181	13,625	14,124	15,241	15,820
120	658	960	995	1,251	1,422	1,694	1,918	2,045	2,295	2,489
121	6,672	7,185	7,734	8,188	8,688	9,204	9,717	10,100	10,442	10,799
122	5,007	5,238	5,485	5,679	5,895	6,120	6,339	6,467	6,574	6,743
123	2,492	2,682	2,885	3,053	3,238	3,429	3,619	3,760	3,886	4,018
124	3,011	3,183	3,368	3,518	3,684	3,855	4,024	4,136	4,234	4,358
125	1,507	1,665	1,849	1,988	2,137	2,289	2,445	2,584	2,703	2,813
126	2,011	2,101	2,188	2,239	2,293	2,349	2,407	2,446	2,467	2,522
127	3,092	3,171	3,257	3,296	3,336	3,375	3,418	3,429	3,417	3,472
128	1,763	1,903	2,039	2,111	2,201	2,369	2,496	2,560	2,633	2,713
129	6,214	6,469	6,698	6,759	6,861	7,202	7,411	7,415	7,459	7,604
130	19,699	21,844	23,574	25,202	26,801	27,765	29,141	30,234	31,182	32,093
131	11,523	12,496	13,512	14,082	14,639	15,765	16,627	17,141	17,667	18,226
132	4,198	4,400	4,586	4,652	4,748	5,010	5,181	5,211	5,267	5,383
133	1,243	1,449	1,647	1,817	1,978	2,183	2,373	2,534	2,683	2,806
134	428	422	408	394	376	364	348	326	304	298
135	8,199	8,668	9,109	9,576	10,041	10,663	11,200	11,466	11,767	12,120
136	3,759	5,652	7,117	8,523	9,716	10,710	11,948	12,915	13,819	14,652
137	11,377	12,400	13,407	14,427	15,375	16,891	18,122	18,798	19,602	20,335
138	8,110	9,302	10,653	11,769	12,822	14,166	15,416	16,448	17,421	18,220
139	36,455	40,434	43,642	45,802	50,098	52,834	56,203	58,841	60,289	62,227

140	7,052	8,170	9,070	10,001	11,079	12,128	13,180	14,013	14,815	15,473
141	13,542	14,749	15,606	16,225	16,939	18,064	18,968	19,479	20,000	20,597
142	7,937	9,648	10,993	12,326	13,395	14,188	15,248	16,084	16,897	17,625
143	4,486	4,724	4,945	5,032	5,153	5,455	5,659	5,711	5,790	5,925
144	4,302	4,399	4,370	4,319	4,279	4,335	4,330	4,218	4,122	4,141
145	2,947	3,099	3,156	3,258	3,389	3,505	3,618	3,657	3,697	3,780
146	8,014	9,009	9,657	10,237	10,935	11,786	12,545	13,079	13,598	14,091
147	10,816	11,692	12,285	12,704	13,194	14,000	14,633	14,958	15,295	15,720
148	8,201	8,941	9,469	9,768	10,160	10,796	11,299	11,589	11,871	12,211
149	4,519	4,879	5,033	5,191	5,394	5,667	5,893	6,001	6,110	6,268
150	920	1,092	1,227	1,342	1,477	1,633	1,779	1,895	2,007	2,098
151	4,929	5,318	5,482	5,649	5,867	6,160	6,402	6,515	6,630	6,800
152	3,600	4,625	4,739	5,067	5,358	6,006	6,471	6,768	7,284	7,671
153	10,276	14,286	18,491	20,976	23,298	24,543	25,734	26,628	31,191	33,385
154	3,024	3,511	3,620	3,733	3,856	3,914	3,991	4,068	4,300	4,395
155	2,582	3,624	3,838	4,012	4,231	4,420	4,680	4,936	5,351	5,605
156	15,092	19,498	22,936	26,473	28,960	30,928	33,557	35,627	37,789	39,641
157	29,858	31,682	33,212	33,435	36,851	38,846	41,127	42,902	43,213	44,303
158	2,821	2,767	2,656	2,550	2,410	2,313	2,193	2,028	1,864	1,812

E.7 Average Household Income Forecasts – Low Scenario

Zone	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	$69,161	$69,093	$69,026	$68,959	$68,892	$68,824	$68,757	$68,723	$68,681	$68,637
2	$58,326	$58,269	$58,213	$58,156	$58,099	$58,042	$57,986	$57,957	$57,922	$57,885
3	$63,613	$63,551	$63,490	$63,428	$63,366	$63,304	$63,242	$63,211	$63,172	$63,132
4	$132,635	$132,506	$132,377	$132,248	$132,119	$131,990	$131,861	$131,796	$131,715	$131,631
5	$65,083	$65,020	$64,957	$64,893	$64,830	$64,767	$64,703	$64,672	$64,632	$64,591
6	$78,663	$78,587	$78,510	$78,434	$78,357	$78,281	$78,204	$78,166	$78,118	$78,068
7	$50,934	$50,884	$50,835	$50,785	$50,736	$50,686	$50,637	$50,612	$50,581	$50,549
8	$45,660	$45,616	$45,571	$45,527	$45,482	$45,438	$45,394	$45,371	$45,344	$45,315
9	$55,133	$55,080	$55,026	$54,972	$54,919	$54,865	$54,811	$54,785	$54,751	$54,716
10	$57,552	$57,496	$57,440	$57,384	$57,329	$57,273	$57,217	$57,189	$57,154	$57,117
11	$53,661	$53,609	$53,557	$53,504	$53,452	$53,400	$53,348	$53,322	$53,289	$53,255
12	$60,844	$60,784	$60,725	$60,666	$60,607	$60,548	$60,489	$60,459	$60,422	$60,383
13	$66,778	$66,713	$66,648	$66,583	$66,518	$66,453	$66,388	$66,356	$66,315	$66,273
14	$57,458	$57,402	$57,346	$57,290	$57,234	$57,178	$57,122	$57,094	$57,059	$57,023
15	$69,285	$69,218	$69,150	$69,083	$69,015	$68,948	$68,881	$68,847	$68,805	$68,761
16	$45,380	$45,336	$45,292	$45,248	$45,203	$45,159	$45,115	$45,093	$45,065	$45,037

17	$53,136	$53,084	$53,033	$52,981	$52,929	$52,878	$52,826	$52,800	$52,768	$52,734
18	$72,001	$71,931	$71,861	$71,791	$71,721	$71,651	$71,581	$71,546	$71,502	$71,456
19	$87,741	$87,656	$87,571	$87,485	$87,400	$87,315	$87,229	$87,187	$87,133	$87,078
20	$52,929	$52,878	$52,827	$52,775	$52,724	$52,672	$52,621	$52,595	$52,563	$52,529
21	$95,617	$95,524	$95,431	$95,338	$95,245	$95,152	$95,059	$95,012	$94,954	$94,893
22	$43,696	$43,654	$43,611	$43,569	$43,526	$43,484	$43,441	$43,420	$43,393	$43,366
23	$76,912	$76,837	$76,762	$76,687	$76,612	$76,537	$76,463	$76,425	$76,379	$76,330
24	$80,827	$80,748	$80,670	$80,591	$80,512	$80,434	$80,355	$80,316	$80,267	$80,215
25	$121,777	$121,659	$121,541	$121,422	$121,304	$121,185	$121,067	$121,007	$120,933	$120,856
26	$121,777	$121,659	$121,541	$121,422	$121,304	$121,185	$121,067	$121,007	$120,933	$120,856
27	$102,605	$102,506	$102,406	$102,306	$102,206	$102,106	$102,007	$101,957	$101,894	$101,829
28	$57,091	$57,036	$56,980	$56,925	$56,869	$56,814	$56,758	$56,730	$56,696	$56,659
29	$70,095	$70,027	$69,959	$69,891	$69,823	$69,754	$69,686	$69,652	$69,609	$69,565
30	$60,821	$60,762	$60,702	$60,643	$60,584	$60,525	$60,466	$60,436	$60,399	$60,361
31	$63,849	$63,787	$63,725	$63,663	$63,601	$63,538	$63,476	$63,445	$63,406	$63,366
32	$89,339	$90,523	$91,707	$92,892	$94,076	$95,261	$96,445	$97,037	$97,778	$98,551
33	$82,084	$83,533	$84,982	$86,431	$87,881	$89,330	$90,779	$91,504	$92,410	$93,356
34	$99,365	$101,237	$103,108	$104,980	$106,851	$108,723	$110,595	$111,531	$112,700	$113,922
35	$88,402	$87,375	$86,348	$85,321	$84,294	$83,267	$82,240	$81,727	$81,085	$80,415
36	$91,742	$92,238	$92,734	$93,231	$93,727	$94,223	$94,719	$94,967	$95,278	$95,601
37	$100,388	$101,974	$103,561	$105,147	$106,733	$108,319	$109,905	$110,698	$111,689	$112,724
38	$120,954	$124,072	$127,189	$130,307	$133,424	$136,542	$139,659	$141,218	$143,166	$145,201
39	$99,799	$100,766	$101,733	$102,701	$103,668	$104,635	$105,603	$106,086	$106,691	$107,322
40	$75,452	$73,475	$71,498	$69,521	$67,544	$65,567	$63,590	$62,602	$61,366	$60,076
41	$87,732	$90,257	$92,781	$95,306	$97,831	$100,356	$102,880	$104,143	$105,721	$107,369
42	$76,362	$76,578	$76,793	$77,008	$77,223	$77,438	$77,654	$77,761	$77,896	$78,036
43	$73,479	$74,031	$74,583	$75,134	$75,686	$76,238	$76,790	$77,066	$77,410	$77,771
44	$51,800	$50,311	$48,821	$47,331	$45,842	$44,352	$42,863	$42,118	$41,187	$40,214
45	$59,124	$59,522	$59,919	$60,316	$60,714	$61,111	$61,508	$61,707	$61,955	$62,215
46	$70,412	$72,539	$74,667	$76,794	$78,922	$81,049	$83,177	$84,241	$85,570	$86,959
47	$73,121	$74,931	$76,742	$78,552	$80,363	$82,174	$83,984	$84,889	$86,021	$87,203
48	$68,978	$69,880	$70,781	$71,683	$72,584	$73,486	$74,388	$74,838	$75,402	$75,990
49	$56,502	$57,429	$58,356	$59,282	$60,209	$61,136	$62,062	$62,526	$63,105	$63,710
50	$110,681	$114,803	$118,924	$123,046	$127,167	$131,288	$135,410	$137,471	$140,047	$142,737
51	$89,307	$91,554	$93,801	$96,047	$98,294	$100,541	$102,788	$103,911	$105,315	$106,782
52	$72,891	$75,071	$77,250	$79,430	$81,609	$83,788	$85,968	$87,058	$88,420	$89,842
53	$75,937	$77,697	$79,458	$81,218	$82,978	$84,739	$86,499	$87,379	$88,479	$89,628
54	$56,502	$57,429	$58,356	$59,282	$60,209	$61,136	$62,062	$62,526	$63,105	$63,710
55	$69,710	$70,920	$72,129	$73,339	$74,549	$75,759	$76,968	$77,573	$78,329	$79,119
56	$88,397	$94,634	$100,872	$107,109	$113,346	$119,584	$125,821	$128,940	$132,838	$136,910
57	$83,681	$84,878	$86,075	$87,273	$88,470	$89,667	$90,865	$91,463	$92,212	$92,993

58	$76,240	$78,681	$81,123	$83,564	$86,006	$88,447	$90,889	$92,110	$93,636	$95,230
59	$88,738	$91,727	$94,716	$97,705	$100,694	$103,682	$106,671	$108,166	$110,034	$111,985
60	$134,753	$139,205	$143,658	$148,111	$152,564	$157,017	$161,469	$163,696	$166,479	$169,385
61	$147,004	$154,743	$162,482	$170,222	$177,961	$185,700	$193,440	$197,310	$202,147	$207,199
62	$65,784	$68,031	$70,279	$72,526	$74,773	$77,020	$79,268	$80,391	$81,796	$83,263
63	$80,187	$88,103	$96,019	$103,935	$111,851	$119,767	$127,683	$131,641	$136,589	$141,756
64	$80,480	$84,248	$88,015	$91,782	$95,549	$99,316	$103,084	$104,967	$107,322	$109,781
65	$100,166	$104,065	$107,964	$111,863	$115,762	$119,661	$123,560	$125,510	$127,947	$130,492
66	$43,469	$43,658	$43,846	$44,035	$44,224	$44,412	$44,601	$44,695	$44,813	$44,936
67	$63,367	$64,613	$65,858	$67,104	$68,349	$69,595	$70,840	$71,463	$72,241	$73,054
68	$62,099	$63,849	$65,599	$67,348	$69,098	$70,847	$72,597	$73,472	$74,565	$75,707
69	$77,504	$79,889	$82,275	$84,661	$87,046	$89,432	$91,818	$93,011	$94,502	$96,059
70	$109,264	$114,266	$119,268	$124,271	$129,273	$134,275	$139,278	$141,779	$144,905	$148,171
71	$64,235	$65,580	$66,925	$68,270	$69,615	$70,960	$72,305	$72,977	$73,818	$74,696
72	$89,176	$93,982	$98,787	$103,593	$108,398	$113,204	$118,009	$120,412	$123,416	$126,553
73	$105,322	$108,192	$111,062	$113,931	$116,801	$119,671	$122,540	$123,975	$125,769	$127,642
74	$52,058	$54,313	$56,569	$58,824	$61,079	$63,335	$65,590	$66,718	$68,127	$69,600
75	$118,266	$120,037	$121,808	$123,579	$125,350	$127,121	$128,892	$129,778	$130,885	$132,041
76	$99,346	$102,479	$105,611	$108,744	$111,876	$115,009	$118,141	$119,708	$121,665	$123,710
77	$62,206	$62,905	$63,604	$64,303	$65,002	$65,701	$66,400	$66,749	$67,186	$67,642
78	$66,756	$70,076	$73,395	$76,715	$80,035	$83,354	$86,674	$88,334	$90,408	$92,575
79	$105,490	$108,373	$111,255	$114,138	$117,021	$119,903	$122,786	$124,227	$126,029	$127,911
80	$112,450	$118,950	$125,450	$131,950	$138,450	$144,951	$151,451	$154,701	$158,763	$163,006
81	$76,734	$77,256	$77,778	$78,300	$78,822	$79,343	$79,865	$80,126	$80,452	$80,793
82	$67,763	$70,438	$73,113	$75,788	$78,462	$81,137	$83,812	$85,149	$86,821	$88,567
83	$62,686	$64,088	$65,490	$66,892	$68,294	$69,696	$71,098	$71,799	$72,676	$73,591
84	$67,648	$72,544	$77,440	$82,336	$87,232	$92,128	$97,024	$99,472	$102,532	$105,728
85	$58,672	$65,005	$71,338	$77,672	$84,005	$90,338	$96,672	$99,838	$103,797	$107,931
86	$70,230	$69,971	$70,159	$70,680	$71,443	$71,273	$71,641	$71,787	$71,968	$72,157
87	$75,235	$74,958	$75,159	$75,717	$76,535	$76,353	$76,747	$76,903	$77,097	$77,300
88	$70,452	$70,193	$70,381	$70,904	$71,669	$71,499	$71,869	$72,014	$72,196	$72,386
89	$69,158	$71,389	$73,620	$75,851	$78,081	$80,312	$82,543	$83,659	$85,053	$86,509
90	$55,376	$55,173	$55,321	$55,731	$56,333	$56,199	$56,490	$56,604	$56,747	$56,896
91	$59,101	$58,883	$59,042	$59,480	$60,122	$59,979	$60,289	$60,411	$60,564	$60,723
92	$68,254	$67,831	$67,409	$66,986	$66,563	$66,141	$65,718	$65,507	$65,243	$64,967
93	$58,649	$58,837	$59,025	$59,212	$59,400	$59,587	$59,775	$59,869	$59,986	$60,108
94	$79,333	$83,451	$87,355	$91,099	$94,728	$98,803	$102,621	$104,548	$106,957	$109,474
95	$77,570	$77,243	$76,916	$76,589	$76,262	$75,935	$75,608	$75,445	$75,241	$75,027
96	$57,309	$58,605	$59,901	$61,198	$62,494	$63,790	$65,086	$65,734	$66,544	$67,390
97	$71,760	$71,875	$71,990	$72,105	$72,220	$72,335	$72,450	$72,508	$72,580	$72,655
98	$55,175	$55,805	$56,435	$57,065	$57,695	$58,325	$58,955	$59,270	$59,664	$60,075

99	$55,364	$57,594	$59,824	$62,054	$64,283	$66,513	$68,743	$69,858	$71,252	$72,708
100	$49,405	$49,827	$50,250	$50,673	$51,095	$51,518	$51,940	$52,152	$52,416	$52,692
101	$60,052	$57,434	$54,816	$52,197	$49,579	$46,961	$44,343	$43,034	$41,398	$39,688
102	$70,405	$71,763	$73,122	$74,480	$75,839	$77,197	$78,556	$79,235	$80,084	$80,971
103	$63,928	$66,475	$69,021	$71,567	$74,113	$76,659	$79,206	$80,479	$82,070	$83,732
104	$47,195	$47,521	$47,847	$48,173	$48,499	$48,825	$49,151	$49,314	$49,517	$49,730
105	$60,568	$62,546	$64,523	$66,501	$68,478	$70,456	$72,434	$73,422	$74,658	$75,949
106	$80,547	$82,274	$84,001	$85,728	$87,456	$89,183	$90,910	$91,774	$92,853	$93,981
107	$74,170	$75,548	$76,925	$78,303	$79,680	$81,058	$82,435	$83,124	$83,985	$84,884
108	$73,827	$76,518	$79,209	$81,899	$84,590	$87,280	$89,971	$91,316	$92,998	$94,754
109	$73,084	$74,129	$75,173	$76,218	$77,262	$78,307	$79,351	$79,873	$80,526	$81,208
110	$56,678	$56,474	$56,271	$56,068	$55,865	$55,662	$55,458	$55,357	$55,230	$55,097
111	$61,917	$62,334	$62,751	$63,168	$63,585	$64,002	$64,418	$64,627	$64,887	$65,160
112	$115,668	$121,637	$127,606	$133,574	$139,543	$145,512	$151,481	$154,465	$158,196	$162,092
113	$90,789	$90,659	$90,529	$90,399	$90,270	$90,140	$90,010	$89,945	$89,864	$89,779
114	$63,847	$60,855	$57,863	$54,870	$51,878	$48,886	$45,894	$44,397	$42,527	$40,574
115	$61,065	$60,831	$60,597	$60,362	$60,128	$59,894	$59,660	$59,543	$59,396	$59,243
116	$56,960	$56,504	$56,047	$55,591	$55,134	$54,677	$54,221	$53,992	$53,707	$53,409
117	$51,557	$50,744	$49,931	$49,117	$48,304	$47,491	$46,677	$46,271	$45,762	$45,231
118	$72,549	$71,892	$71,234	$70,577	$69,920	$69,263	$68,606	$68,277	$67,866	$67,437
119	$75,939	$74,169	$72,399	$70,629	$68,859	$67,089	$65,319	$64,434	$63,327	$62,172
120	$19,620	$18,430	$17,241	$16,051	$14,862	$13,672	$12,483	$11,888	$11,145	$10,368
121	$61,803	$62,514	$63,226	$63,937	$64,648	$65,359	$66,071	$66,426	$66,871	$67,335
122	$60,268	$59,820	$59,373	$58,926	$58,479	$58,031	$57,584	$57,360	$57,081	$56,789
123	$51,837	$49,812	$47,786	$45,761	$43,736	$41,710	$39,685	$38,672	$37,406	$36,084
124	$69,216	$70,480	$71,745	$73,009	$74,273	$75,538	$76,802	$77,434	$78,224	$79,050
125	$57,514	$57,639	$57,765	$57,891	$58,016	$58,142	$58,267	$58,330	$58,409	$58,491
126	$52,825	$48,522	$44,219	$39,915	$35,612	$31,309	$27,006	$24,854	$22,165	$19,356
127	$59,378	$58,616	$57,855	$57,093	$56,331	$55,570	$54,808	$54,427	$53,951	$53,454
128	$76,751	$81,430	$86,108	$90,786	$95,464	$100,142	$104,820	$107,159	$110,083	$113,137
129	$53,656	$52,999	$52,342	$51,685	$51,028	$50,371	$49,714	$49,386	$48,975	$48,546
130	$63,155	$63,551	$63,947	$64,343	$64,739	$65,135	$65,531	$65,729	$65,977	$66,236
131	$67,528	$70,506	$73,484	$76,463	$79,441	$82,419	$85,397	$86,886	$88,748	$90,692
132	$58,886	$58,759	$58,631	$58,504	$58,376	$58,249	$58,121	$58,058	$57,978	$57,895
133	$52,157	$51,264	$50,370	$49,477	$48,583	$47,690	$46,796	$46,349	$45,791	$45,208
134	$38,703	$38,086	$37,470	$36,854	$36,238	$35,622	$35,006	$34,697	$34,312	$33,910
135	$58,348	$59,940	$61,531	$63,123	$64,714	$66,306	$67,897	$68,693	$69,687	$70,726
136	$143,766	$151,928	$160,089	$168,250	$176,412	$184,573	$192,735	$196,815	$201,916	$207,244
137	$69,591	$70,568	$71,546	$72,524	$73,501	$74,479	$75,457	$75,946	$76,557	$77,195
138	$81,678	$84,350	$87,021	$89,693	$92,365	$95,036	$97,708	$99,043	$100,713	$102,457
139	$89,047	$91,270	$93,492	$95,714	$97,937	$100,159	$102,382	$103,493	$104,882	$106,333

140	$71,056	$73,489	$75,922	$78,355	$80,788	$83,221	$85,654	$86,870	$88,391	$89,979
141	$75,469	$77,999	$80,530	$83,061	$85,591	$88,122	$90,653	$91,918	$93,500	$95,152
142	$107,199	$111,149	$115,099	$119,049	$122,999	$126,949	$130,899	$132,874	$135,342	$137,921
143	$55,901	$57,311	$58,721	$60,131	$61,541	$62,951	$64,361	$65,066	$65,948	$66,868
144	$57,719	$57,627	$57,535	$57,443	$57,351	$57,259	$57,167	$57,121	$57,063	$57,003
145	$60,655	$60,256	$59,858	$59,460	$59,061	$58,663	$58,265	$58,065	$57,817	$57,556
146	$59,064	$60,086	$61,107	$62,128	$63,150	$64,171	$65,193	$65,704	$66,342	$67,009
147	$67,239	$69,200	$71,161	$73,121	$75,082	$77,043	$79,004	$79,984	$81,209	$82,489
148	$63,199	$64,257	$65,316	$66,374	$67,433	$68,491	$69,549	$70,079	$70,740	$71,431
149	$57,704	$57,166	$56,628	$56,089	$55,551	$55,013	$54,475	$54,205	$53,869	$53,518
150	$37,218	$35,756	$34,294	$32,832	$31,370	$29,908	$28,446	$27,715	$26,801	$25,847
151	$57,961	$56,887	$55,813	$54,739	$53,664	$52,590	$51,516	$50,979	$50,308	$49,606
152	$76,362	$76,578	$76,793	$77,008	$77,223	$77,438	$77,654	$77,761	$77,896	$78,036
153	$70,128	$72,071	$74,013	$75,956	$77,899	$79,842	$81,784	$82,756	$83,970	$85,238
154	$65,078	$65,587	$66,097	$66,606	$67,115	$67,625	$68,134	$68,389	$68,707	$69,040
155	$60,622	$59,657	$58,692	$57,727	$56,763	$55,798	$54,833	$54,351	$53,748	$53,118
156	$119,551	$125,987	$132,423	$138,859	$145,296	$151,732	$158,168	$161,386	$165,408	$169,610
157	$105,443	$111,270	$117,098	$122,925	$128,752	$134,580	$140,407	$143,321	$146,963	$150,767
158	$49,814	$47,530	$45,245	$42,961	$40,677	$38,393	$36,109	$34,966	$33,539	$32,048

E.8 Average Household Income Forecasts – Central Case

Zone	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	$69,161	$70,006	$72,265	$74,688	$77,189	$78,824	$80,891	$81,929	$83,220	$84,567
2	$58,326	$59,039	$60,944	$62,988	$65,097	$66,476	$68,219	$69,094	$70,183	$71,319
3	$63,613	$64,391	$66,469	$68,697	$70,998	$72,502	$74,402	$75,358	$76,545	$77,784
4	$132,635	$134,256	$138,589	$143,235	$148,032	$151,167	$155,130	$157,122	$159,598	$162,180
5	$65,083	$65,879	$68,005	$70,285	$72,639	$74,177	$76,122	$77,099	$78,314	$79,581
6	$78,663	$79,625	$82,195	$84,950	$87,795	$89,655	$92,005	$93,186	$94,655	$96,186
7	$50,934	$51,557	$53,220	$55,005	$56,847	$58,051	$59,573	$60,338	$61,288	$62,280
8	$45,660	$46,218	$47,710	$49,309	$50,961	$52,040	$53,404	$54,090	$54,942	$55,831
9	$55,133	$55,807	$57,608	$59,539	$61,534	$62,837	$64,484	$65,312	$66,341	$67,414
10	$57,552	$58,256	$60,136	$62,152	$64,234	$65,594	$67,314	$68,178	$69,252	$70,373
11	$53,661	$54,317	$56,070	$57,950	$59,890	$61,159	$62,762	$63,568	$64,570	$65,614
12	$60,844	$61,588	$63,575	$65,706	$67,907	$69,345	$71,163	$72,077	$73,212	$74,397
13	$66,778	$67,594	$69,776	$72,115	$74,530	$76,109	$78,104	$79,106	$80,353	$81,653
14	$57,458	$58,160	$60,037	$62,050	$64,128	$65,486	$67,203	$68,066	$69,138	$70,257
15	$69,285	$70,132	$72,395	$74,822	$77,328	$78,966	$81,036	$82,077	$83,370	$84,719
16	$45,380	$45,935	$47,417	$49,007	$50,648	$51,721	$53,077	$53,758	$54,605	$55,489

17	$53,136	$53,786	$55,521	$57,383	$59,305	$60,561	$62,148	$62,946	$63,938	$64,972
18	$72,001	$72,881	$75,233	$77,756	$80,360	$82,062	$84,213	$85,294	$86,638	$88,040
19	$87,741	$88,814	$91,680	$94,754	$97,927	$100,001	$102,623	$103,940	$105,578	$107,286
20	$52,929	$53,577	$55,306	$57,160	$59,074	$60,325	$61,907	$62,701	$63,689	$64,720
21	$95,617	$96,786	$99,909	$103,259	$106,717	$108,977	$111,834	$113,270	$115,054	$116,916
22	$43,696	$44,230	$45,658	$47,188	$48,769	$49,802	$51,107	$51,763	$52,579	$53,430
23	$76,912	$77,852	$80,364	$83,059	$85,840	$87,658	$89,956	$91,111	$92,547	$94,044
24	$80,827	$81,815	$84,455	$87,287	$90,210	$92,121	$94,536	$95,749	$97,258	$98,832
25	$121,777	$123,266	$127,244	$131,510	$135,915	$138,793	$142,431	$144,260	$146,533	$148,904
26	$121,777	$123,266	$127,244	$131,510	$135,915	$138,793	$142,431	$144,260	$146,533	$148,904
27	$102,605	$103,860	$107,211	$110,806	$114,517	$116,942	$120,008	$121,549	$123,464	$125,462
28	$57,091	$57,789	$59,654	$61,654	$63,719	$65,069	$66,774	$67,632	$68,697	$69,809
29	$70,095	$70,952	$73,242	$75,697	$78,233	$79,889	$81,984	$83,036	$84,345	$85,709
30	$60,821	$61,564	$63,551	$65,682	$67,881	$69,319	$71,136	$72,050	$73,185	$74,369
31	$63,849	$64,630	$66,715	$68,952	$71,261	$72,770	$74,678	$75,637	$76,829	$78,072
32	$89,339	$91,829	$96,069	$100,463	$104,915	$109,208	$113,465	$115,394	$117,948	$120,648
33	$82,084	$85,000	$89,488	$94,094	$98,732	$102,545	$106,799	$108,915	$111,560	$114,322
34	$99,365	$103,079	$108,686	$114,427	$120,202	$124,841	$130,111	$132,769	$136,064	$139,498
35	$88,402	$88,593	$90,640	$92,933	$95,354	$95,356	$96,754	$97,757	$98,781	$99,797
36	$91,742	$93,388	$96,880	$100,567	$104,343	$107,906	$111,434	$112,991	$115,087	$117,311
37	$100,388	$103,605	$108,764	$114,080	$119,447	$124,262	$129,300	$131,691	$134,766	$137,998
38	$120,954	$126,045	$133,407	$140,911	$148,437	$156,675	$164,305	$167,658	$172,181	$176,982
39	$99,799	$101,969	$106,125	$110,480	$114,918	$119,824	$124,238	$126,060	$128,620	$131,359
40	$75,452	$74,013	$74,247	$74,755	$75,423	$74,810	$74,812	$74,861	$74,888	$74,909
41	$87,732	$91,775	$97,446	$103,205	$108,969	$115,201	$121,036	$123,636	$127,112	$130,796
42	$76,362	$77,575	$80,334	$83,261	$86,267	$88,696	$91,357	$92,608	$94,227	$95,931
43	$73,479	$75,195	$78,367	$81,681	$85,052	$87,429	$90,341	$91,833	$93,666	$95,573
44	$51,800	$50,444	$50,257	$50,272	$50,410	$50,486	$50,427	$50,228	$50,110	$50,016
45	$59,124	$60,388	$62,574	$64,894	$67,128	$69,938	$72,363	$73,309	$74,677	$76,149
46	$70,412	$74,096	$78,820	$83,666	$88,362	$93,106	$97,855	$100,085	$102,962	$105,988
47	$73,121	$76,531	$81,033	$85,668	$90,157	$94,375	$98,805	$100,942	$103,653	$106,493
48	$68,978	$71,100	$74,282	$77,608	$80,821	$84,228	$87,515	$88,967	$90,909	$92,966
49	$56,502	$58,765	$62,003	$65,310	$68,632	$70,338	$73,015	$74,641	$76,464	$78,319
50	$110,681	$117,866	$126,884	$135,984	$145,070	$151,325	$159,306	$163,802	$169,051	$174,446
51	$89,307	$93,798	$99,805	$105,903	$112,010	$115,759	$120,927	$123,927	$127,373	$130,902
52	$72,891	$76,972	$82,278	$87,651	$93,024	$96,512	$101,139	$103,786	$106,851	$109,995
53	$75,937	$79,637	$84,628	$89,699	$94,781	$97,577	$101,763	$104,277	$107,111	$109,999
54	$56,502	$58,765	$62,003	$65,310	$68,632	$70,338	$73,015	$74,641	$76,464	$78,319

55	$69,710	$72,639	$76,767	$80,977	$85,203	$87,198	$90,551	$92,642	$94,951	$97,293
56	$88,397	$97,351	$107,682	$118,016	$128,286	$138,008	$148,025	$153,053	$159,324	$165,871
57	$83,681	$86,945	$91,655	$96,469	$101,307	$103,203	$106,900	$109,306	$111,904	$114,523
58	$76,240	$80,420	$85,884	$91,419	$96,957	$101,760	$106,928	$109,566	$112,830	$116,230
59	$88,738	$94,118	$100,978	$107,911	$114,838	$119,469	$125,496	$128,918	$132,896	$136,980
60	$134,753	$142,632	$152,767	$163,019	$173,267	$180,824	$189,964	$194,964	$200,902	$207,031
61	$147,004	$158,638	$172,650	$186,731	$200,758	$213,990	$227,576	$234,351	$242,840	$251,711
62	$65,784	$69,705	$74,726	$79,802	$84,875	$88,701	$93,256	$95,729	$98,678	$101,726
63	$80,187	$91,085	$103,155	$115,174	$127,091	$138,487	$150,215	$156,123	$163,472	$171,139
64	$80,480	$86,523	$93,877	$101,274	$108,648	$114,508	$121,275	$124,902	$129,258	$133,765
65	$100,166	$106,460	$114,420	$122,458	$130,486	$137,743	$145,365	$149,206	$153,992	$158,987
66	$43,469	$44,521	$46,341	$48,228	$50,138	$51,004	$52,471	$53,375	$54,382	$55,406
67	$63,367	$66,199	$70,116	$74,105	$78,105	$80,118	$83,341	$85,321	$87,526	$89,765
68	$62,099	$65,488	$69,923	$74,417	$78,912	$81,613	$85,408	$87,635	$90,176	$92,775
69	$77,504	$81,876	$87,550	$93,294	$99,038	$102,996	$108,021	$110,836	$114,134	$117,528
70	$109,264	$117,357	$127,233	$137,170	$147,076	$154,814	$163,856	$168,735	$174,572	$180,607
71	$64,235	$67,150	$71,164	$75,249	$79,347	$81,673	$85,064	$87,075	$89,359	$91,690
72	$89,176	$96,512	$105,284	$114,091	$122,861	$130,533	$138,835	$143,123	$148,385	$153,857
73	$105,322	$110,884	$118,225	$125,669	$133,120	$137,810	$144,165	$147,830	$152,055	$156,385
74	$52,058	$55,612	$60,023	$64,469	$68,906	$72,936	$77,165	$79,298	$81,954	$84,725
75	$118,266	$122,884	$129,546	$136,355	$143,196	$146,277	$151,638	$155,013	$158,724	$162,481
76	$99,346	$105,050	$112,419	$119,877	$127,334	$132,466	$138,990	$142,649	$146,933	$151,340
77	$62,206	$64,447	$67,215	$69,930	$72,623	$75,386	$78,117	$79,412	$81,075	$82,823
78	$66,756	$72,432	$78,420	$84,397	$90,366	$96,084	$101,969	$104,935	$108,621	$112,466
79	$105,490	$111,110	$118,512	$126,015	$133,524	$138,099	$144,454	$148,162	$152,408	$156,752
80	$112,450	$123,430	$134,379	$145,329	$156,278	$167,228	$178,177	$183,656	$190,502	$197,652
81	$76,734	$79,248	$82,145	$85,049	$87,962	$91,016	$93,959	$95,347	$97,140	$99,028
82	$67,763	$72,882	$78,031	$83,176	$88,318	$93,461	$98,602	$101,172	$104,386	$107,742
83	$62,686	$65,791	$68,929	$72,068	$75,209	$79,970	$83,645	$85,095	$87,199	$89,464
84	$67,648	$75,528	$83,428	$91,316	$99,195	$106,465	$114,146	$118,134	$123,009	$128,074
85	$58,672	$67,754	$76,847	$85,922	$94,984	$104,506	$113,731	$118,240	$123,953	$129,938
86	$70,230	$72,068	$74,564	$77,290	$80,183	$81,923	$84,262	$85,556	$87,083	$88,658
87	$75,235	$77,204	$79,879	$82,798	$85,898	$87,762	$90,267	$91,653	$93,290	$94,976
88	$70,452	$72,296	$74,801	$77,534	$80,437	$82,183	$84,529	$85,827	$87,359	$88,939
89	$69,158	$73,709	$78,292	$82,873	$87,453	$92,408	$97,110	$99,370	$102,264	$105,303
90	$55,376	$56,826	$58,795	$60,943	$63,225	$64,597	$66,441	$67,461	$68,666	$69,907
91	$59,101	$60,648	$62,749	$65,042	$67,477	$68,942	$70,910	$71,999	$73,284	$74,609
92	$68,254	$69,631	$71,168	$72,705	$74,242	$75,779	$77,316	$78,061	$79,008	$80,000

93	$58,649	$60,833	$63,050	$65,271	$67,494	$68,509	$70,323	$71,515	$72,792	$74,076
94	$79,333	$85,952	$92,840	$99,619	$106,317	$113,567	$120,530	$123,869	$128,138	$132,618
95	$77,570	$78,134	$80,305	$82,675	$85,146	$86,897	$88,951	$89,918	$91,168	$92,485
96	$57,309	$60,363	$63,694	$67,026	$70,359	$73,357	$76,571	$78,223	$80,251	$82,360
97	$71,760	$72,753	$75,208	$77,827	$80,524	$82,820	$85,236	$86,333	$87,783	$89,317
98	$55,175	$57,241	$59,580	$61,923	$64,271	$66,921	$69,359	$70,470	$71,938	$73,488
99	$55,364	$59,508	$63,913	$68,313	$72,708	$76,637	$80,874	$83,073	$85,758	$88,548
100	$49,405	$50,710	$52,885	$55,081	$57,293	$59,064	$61,106	$62,108	$63,362	$64,673
101	$60,052	$58,700	$57,395	$56,104	$54,826	$53,484	$52,168	$51,518	$50,701	$49,847
102	$70,405	$73,145	$77,100	$81,064	$85,035	$88,600	$92,418	$94,256	$96,588	$99,032
103	$63,928	$68,109	$73,343	$78,547	$83,726	$88,218	$93,183	$95,693	$98,791	$102,018
104	$47,195	$48,519	$50,511	$52,509	$54,512	$56,004	$57,824	$58,765	$59,908	$61,095
105	$60,568	$63,991	$68,233	$72,448	$76,641	$80,968	$85,216	$87,206	$89,780	$92,489
106	$80,547	$83,653	$88,287	$93,027	$97,791	$102,355	$106,953	$109,101	$111,890	$114,828
107	$74,170	$77,237	$81,186	$85,135	$89,084	$93,033	$96,983	$98,831	$101,221	$103,735
108	$73,827	$78,379	$83,918	$89,419	$94,886	$100,360	$105,848	$108,469	$111,821	$115,339
109	$73,084	$75,314	$78,964	$82,733	$86,542	$89,828	$93,354	$95,051	$97,215	$99,485
110	$56,678	$57,675	$59,490	$61,323	$63,173	$63,821	$65,245	$66,128	$67,093	$68,069
111	$61,917	$63,921	$66,446	$68,968	$71,488	$73,458	$75,786	$77,015	$78,496	$80,030
112	$115,668	$124,957	$136,114	$147,322	$158,486	$167,802	$178,213	$183,696	$190,348	$197,247
113	$90,789	$91,967	$94,778	$97,748	$100,782	$103,262	$105,894	$107,171	$108,810	$110,531
114	$63,847	$61,612	$59,944	$58,328	$56,758	$55,498	$53,992	$53,068	$52,033	$50,982
115	$61,065	$62,138	$63,758	$65,476	$67,324	$68,613	$70,188	$70,983	$71,965	$72,989
116	$56,960	$57,436	$58,744	$60,082	$61,445	$62,546	$63,789	$64,353	$65,090	$65,868
117	$51,557	$51,645	$52,495	$53,378	$54,289	$54,329	$54,915	$55,303	$55,708	$56,112
118	$72,549	$73,313	$74,663	$76,016	$77,374	$79,200	$80,712	$81,271	$82,106	$83,011
119	$75,939	$74,662	$75,060	$75,726	$76,549	$76,536	$76,846	$76,943	$77,109	$77,293
120	$19,620	$19,015	$18,858	$18,781	$18,754	$15,769	$14,686	$14,778	$14,418	$13,933
121	$61,803	$63,992	$66,700	$69,404	$72,104	$74,979	$77,730	$78,999	$80,658	$82,408
122	$60,268	$61,181	$62,611	$64,046	$65,486	$66,472	$67,746	$68,423	$69,233	$70,071
123	$51,837	$50,646	$49,915	$49,204	$48,510	$47,509	$46,688	$46,286	$45,772	$45,233
124	$69,216	$72,445	$76,249	$80,043	$83,828	$86,834	$90,355	$92,231	$94,481	$96,810
125	$57,514	$59,367	$61,267	$63,185	$65,120	$66,743	$68,550	$69,522	$70,688	$71,895
126	$52,825	$49,360	$45,895	$42,401	$38,880	$35,299	$31,772	$30,038	$27,850	$25,559
127	$59,378	$60,255	$61,171	$62,097	$63,032	$63,664	$64,480	$64,959	$65,507	$66,067
128	$76,751	$84,338	$92,709	$101,023	$109,287	$115,658	$123,318	$127,516	$132,475	$137,587
129	$53,656	$53,958	$54,877	$55,815	$56,768	$57,601	$58,487	$58,875	$59,394	$59,945
130	$63,155	$64,786	$67,532	$70,372	$73,243	$74,799	$77,096	$78,444	$79,987	$81,566

131	$67,528	$72,667	$78,227	$83,787	$89,347	$94,907	$100,467	$103,187	$106,625	$110,224
132	$58,886	$59,935	$61,650	$63,378	$65,117	$66,711	$68,378	$69,157	$70,164	$71,224
133	$52,157	$52,267	$52,806	$53,354	$53,912	$54,495	$55,054	$55,263	$55,569	$55,900
134	$38,703	$38,807	$39,229	$39,658	$40,094	$40,696	$41,183	$41,338	$41,593	$41,873
135	$58,348	$61,876	$65,685	$69,492	$73,298	$76,335	$79,879	$81,799	$84,085	$86,446
136	$143,766	$155,648	$169,842	$184,092	$198,283	$212,658	$226,747	$233,547	$242,237	$251,357
137	$69,591	$72,220	$75,619	$79,016	$82,411	$85,496	$88,773	$90,388	$92,414	$94,533
138	$81,678	$86,858	$92,620	$98,315	$103,950	$109,342	$114,950	$117,748	$121,236	$124,876
139	$89,047	$93,034	$98,545	$104,157	$109,786	$115,090	$120,449	$123,058	$126,381	$129,866
140	$71,056	$75,768	$81,039	$86,205	$91,310	$95,815	$100,769	$103,346	$106,482	$109,736
141	$75,469	$80,034	$85,213	$90,471	$95,873	$101,314	$106,651	$109,167	$112,418	$115,836
142	$107,199	$113,817	$122,220	$130,710	$139,190	$146,178	$153,998	$158,099	$163,090	$168,272
143	$55,901	$58,761	$62,229	$65,687	$69,135	$72,353	$75,719	$77,383	$79,470	$81,650
144	$57,719	$58,946	$60,685	$62,515	$64,466	$65,642	$67,255	$68,128	$69,164	$70,233
145	$60,655	$61,448	$62,783	$64,094	$65,408	$67,110	$68,547	$69,107	$69,919	$70,793
146	$59,064	$61,369	$64,453	$67,492	$70,491	$73,614	$76,697	$78,107	$79,949	$81,891
147	$67,239	$71,017	$75,346	$79,751	$84,285	$88,568	$92,945	$95,066	$97,760	$100,584
148	$63,199	$65,840	$69,017	$72,276	$75,662	$78,647	$81,823	$83,382	$85,346	$87,400
149	$57,704	$58,094	$59,310	$60,537	$61,775	$62,892	$64,088	$64,588	$65,270	$65,996
150	$37,218	$35,967	$35,300	$34,686	$34,119	$33,940	$33,466	$33,034	$32,631	$32,243
151	$57,961	$57,604	$58,102	$58,635	$59,198	$59,988	$60,607	$60,725	$61,001	$61,319
152	$76,362	$77,575	$80,334	$83,261	$86,267	$88,696	$91,357	$92,608	$94,227	$95,931
153	$70,128	$73,301	$77,780	$82,331	$86,888	$91,659	$96,217	$98,279	$101,011	$103,900
154	$65,078	$66,499	$69,215	$72,060	$74,959	$77,496	$80,158	$81,396	$83,009	$84,708
155	$60,622	$60,172	$61,028	$62,074	$63,228	$63,739	$64,510	$64,852	$65,313	$65,802
156	$119,551	$129,291	$140,957	$152,673	$164,341	$174,915	$186,080	$191,756	$198,786	$206,113
157	$105,443	$114,303	$124,855	$135,446	$145,990	$155,202	$165,185	$170,348	$176,678	$183,259
158	$49,814	$48,386	$47,395	$46,439	$45,514	$43,721	$42,481	$41,993	$41,278	$40,507

E.9 Average Household Income Forecasts – High Scenario

Zone	2006	2011	2016	2021	2026	2031	2036	2041	2046	2051
1	$69,161	$73,138	$77,115	$81,092	$85,070	$89,047	$93,024	$95,013	$97,499	$100,095
2	$58,326	$61,680	$65,035	$68,389	$71,743	$75,097	$78,451	$80,128	$82,225	$84,414
3	$63,613	$67,272	$70,930	$74,588	$78,246	$81,904	$85,563	$87,392	$89,678	$92,066
4	$132,635	$140,262	$147,890	$155,517	$163,145	$170,772	$178,400	$182,213	$186,980	$191,960
5	$65,083	$68,826	$72,569	$76,311	$80,054	$83,797	$87,540	$89,411	$91,750	$94,194
6	$78,663	$83,187	$87,711	$92,234	$96,758	$101,282	$105,806	$108,068	$110,895	$113,848

7	$50,934	$53,863	$56,792	$59,721	$62,650	$65,579	$68,508	$69,973	$71,804	$73,716
8	$45,660	$48,286	$50,912	$53,538	$56,163	$58,789	$61,415	$62,728	$64,369	$66,083
9	$55,133	$58,304	$61,474	$64,645	$67,815	$70,986	$74,157	$75,742	$77,723	$79,793
10	$57,552	$60,862	$64,172	$67,482	$70,791	$74,101	$77,411	$79,065	$81,134	$83,295
11	$53,661	$56,747	$59,833	$62,919	$66,005	$69,091	$72,176	$73,719	$75,648	$77,662
12	$60,844	$64,343	$67,842	$71,341	$74,839	$78,338	$81,837	$83,587	$85,774	$88,058
13	$66,778	$70,618	$74,458	$78,298	$82,139	$85,979	$89,819	$91,739	$94,139	$96,646
14	$57,458	$60,762	$64,066	$67,370	$70,675	$73,979	$77,283	$78,935	$81,000	$83,157
15	$69,285	$73,269	$77,254	$81,238	$85,223	$89,207	$93,191	$95,184	$97,674	$100,275
16	$45,380	$47,990	$50,599	$53,209	$55,819	$58,428	$61,038	$62,343	$63,974	$65,678
17	$53,136	$56,192	$59,247	$62,303	$65,359	$68,415	$71,470	$72,998	$74,908	$76,903
18	$72,001	$76,142	$80,282	$84,423	$88,563	$92,704	$96,845	$98,915	$101,503	$104,206
19	$87,741	$92,787	$97,833	$102,879	$107,925	$112,970	$118,016	$120,539	$123,693	$126,986
20	$52,929	$55,973	$59,017	$62,061	$65,105	$68,149	$71,193	$72,714	$74,617	$76,604
21	$95,617	$101,115	$106,614	$112,113	$117,612	$123,110	$128,609	$131,358	$134,795	$138,384
22	$43,696	$46,209	$48,722	$51,235	$53,748	$56,260	$58,773	$60,030	$61,600	$63,241
23	$76,912	$81,335	$85,758	$90,181	$94,604	$99,027	$103,449	$105,661	$108,425	$111,313
24	$80,827	$85,475	$90,123	$94,771	$99,420	$104,068	$108,716	$111,040	$113,945	$116,979
25	$121,777	$128,781	$135,784	$142,787	$149,790	$156,793	$163,796	$167,298	$171,675	$176,246
26	$121,777	$128,781	$135,784	$142,787	$149,790	$156,793	$163,796	$167,298	$171,675	$176,246
27	$102,605	$108,506	$114,407	$120,307	$126,208	$132,108	$138,009	$140,959	$144,647	$148,499
28	$57,091	$60,375	$63,658	$66,941	$70,224	$73,507	$76,790	$78,432	$80,484	$82,627
29	$70,095	$74,126	$78,157	$82,188	$86,219	$90,250	$94,281	$96,297	$98,816	$101,447
30	$60,821	$64,318	$67,816	$71,314	$74,811	$78,309	$81,807	$83,556	$85,742	$88,025
31	$63,849	$67,521	$71,193	$74,864	$78,536	$82,208	$85,880	$87,716	$90,011	$92,407
32	$89,339	$96,196	$103,054	$109,912	$116,769	$123,627	$130,484	$133,913	$138,199	$142,676
33	$82,084	$88,873	$95,662	$102,451	$109,240	$116,030	$122,819	$126,214	$130,457	$134,889
34	$99,365	$107,742	$116,119	$124,497	$132,874	$141,251	$149,628	$153,817	$159,052	$164,521
35	$88,402	$92,212	$96,023	$99,834	$103,645	$107,456	$111,267	$113,172	$115,554	$118,041
36	$91,742	$97,810	$103,878	$109,946	$116,014	$122,082	$128,150	$131,184	$134,976	$138,937
37	$100,388	$108,439	$116,491	$124,542	$132,593	$140,644	$148,695	$152,720	$157,752	$163,008
38	$120,954	$132,287	$143,620	$154,953	$166,285	$177,618	$188,951	$194,617	$201,700	$209,098
39	$99,799	$106,978	$114,157	$121,336	$128,516	$135,695	$142,874	$146,464	$150,951	$155,637
40	$75,452	$77,216	$78,979	$80,743	$82,507	$84,270	$86,034	$86,916	$88,018	$89,169
41	$87,732	$96,308	$104,885	$113,462	$122,038	$130,615	$139,191	$143,479	$148,840	$154,438
42	$76,362	$81,145	$85,929	$90,712	$95,495	$100,278	$105,061	$107,452	$110,442	$113,564
43	$73,479	$78,548	$83,617	$88,686	$93,754	$98,823	$103,892	$106,426	$109,594	$112,903
44	$51,800	$52,832	$53,864	$54,895	$55,927	$56,959	$57,991	$58,506	$59,151	$59,825

45	$59,124	$63,140	$67,155	$71,171	$75,186	$79,202	$83,217	$85,225	$87,735	$90,356
46	$70,412	$77,432	$84,452	$91,473	$98,493	$105,513	$112,533	$116,043	$120,431	$125,014
47	$73,121	$79,871	$86,622	$93,373	$100,124	$106,875	$113,626	$117,001	$121,220	$125,627
48	$68,978	$74,256	$79,533	$84,810	$90,087	$95,365	$100,642	$103,281	$106,579	$110,024
49	$56,502	$61,080	$65,657	$70,234	$74,812	$79,389	$83,967	$86,255	$89,116	$92,104
50	$110,681	$122,768	$134,855	$146,941	$159,028	$171,115	$183,202	$189,245	$196,799	$204,689
51	$89,307	$97,600	$105,893	$114,186	$122,480	$130,773	$139,066	$143,212	$148,395	$153,809
52	$72,891	$80,128	$87,364	$94,600	$101,837	$109,073	$116,309	$119,928	$124,450	$129,174
53	$75,937	$82,786	$89,634	$96,483	$103,331	$110,179	$117,028	$120,452	$124,732	$129,203
54	$56,502	$61,080	$65,657	$70,234	$74,812	$79,389	$83,967	$86,255	$89,116	$92,104
55	$69,710	$75,447	$81,185	$86,922	$92,659	$98,396	$104,134	$107,002	$110,588	$114,333
56	$88,397	$102,035	$115,674	$129,313	$142,951	$156,590	$170,229	$177,048	$185,572	$194,475
57	$83,681	$90,223	$96,765	$103,308	$109,850	$116,392	$122,935	$126,206	$130,295	$134,566
58	$76,240	$84,028	$91,816	$99,604	$107,392	$115,180	$122,968	$126,862	$131,729	$136,813
59	$88,738	$98,002	$107,265	$116,529	$125,793	$135,056	$144,320	$148,952	$154,741	$160,789
60	$134,753	$148,704	$162,655	$176,606	$190,557	$204,508	$218,459	$225,434	$234,153	$243,260
61	$147,004	$166,122	$185,240	$204,358	$223,476	$242,595	$261,713	$271,272	$283,221	$295,701
62	$65,784	$72,694	$79,604	$86,514	$93,424	$100,335	$107,245	$110,700	$115,019	$119,529
63	$80,187	$95,614	$111,040	$126,467	$141,894	$157,321	$172,748	$180,461	$190,103	$200,173
64	$80,480	$90,311	$100,142	$109,973	$119,804	$129,635	$139,466	$144,382	$150,526	$156,943
65	$100,166	$111,333	$122,500	$133,668	$144,835	$156,003	$167,170	$172,754	$179,733	$187,023
66	$43,469	$46,281	$49,094	$51,906	$54,718	$57,530	$60,342	$61,748	$63,506	$65,342
67	$63,367	$68,780	$74,192	$79,605	$85,017	$90,430	$95,843	$98,549	$101,932	$105,465
68	$62,099	$68,119	$74,139	$80,159	$86,179	$92,199	$98,219	$101,229	$104,992	$108,922
69	$77,504	$85,290	$93,077	$100,864	$108,651	$116,437	$124,224	$128,117	$132,984	$138,067
70	$109,264	$122,459	$135,654	$148,849	$162,044	$175,239	$188,434	$195,032	$203,279	$211,892
71	$64,235	$69,833	$75,431	$81,029	$86,628	$92,226	$97,824	$100,623	$104,122	$107,776
72	$89,176	$100,924	$112,671	$124,418	$136,165	$147,913	$159,660	$165,533	$172,876	$180,544
73	$105,322	$115,400	$125,478	$135,556	$145,634	$155,712	$165,790	$170,829	$177,127	$183,706
74	$52,058	$58,172	$64,285	$70,399	$76,512	$82,626	$88,740	$91,796	$95,617	$99,608
75	$118,266	$127,619	$136,972	$146,325	$155,678	$165,031	$174,384	$179,060	$184,906	$191,011
76	$99,346	$109,428	$119,510	$129,592	$139,674	$149,756	$159,838	$164,879	$171,181	$177,762
77	$62,206	$66,810	$71,415	$76,020	$80,625	$85,230	$89,835	$92,137	$95,015	$98,021
78	$66,756	$75,174	$83,592	$92,010	$100,428	$108,846	$117,264	$121,473	$126,735	$132,230
79	$105,490	$115,596	$125,701	$135,806	$145,911	$156,017	$166,122	$171,175	$177,491	$184,087
80	$112,450	$127,859	$143,268	$158,677	$174,086	$189,495	$204,904	$212,608	$222,239	$232,297
81	$76,734	$81,954	$87,174	$92,394	$97,613	$102,833	$108,053	$110,663	$113,925	$117,333
82	$67,763	$75,368	$82,973	$90,578	$98,183	$105,788	$113,393	$117,195	$121,948	$126,913

83	$62,686	$68,271	$73,855	$79,439	$85,023	$90,608	$96,192	$98,984	$102,474	$106,119
84	$67,648	$78,252	$88,855	$99,458	$110,061	$120,665	$131,268	$136,570	$143,197	$150,118
85	$58,672	$70,692	$82,711	$94,731	$106,751	$118,771	$130,791	$136,801	$144,313	$152,160
86	$70,230	$74,724	$79,377	$84,164	$89,053	$92,573	$97,636	$99,914	$102,762	$105,737
87	$75,235	$80,050	$85,034	$90,162	$95,399	$99,171	$104,594	$107,035	$110,086	$113,273
88	$70,452	$74,961	$79,628	$84,431	$89,335	$92,867	$97,945	$100,231	$103,088	$106,072
89	$69,158	$76,245	$83,331	$90,417	$97,503	$104,590	$111,676	$115,219	$119,648	$124,274
90	$55,376	$58,921	$62,589	$66,364	$70,219	$72,995	$76,986	$78,783	$81,029	$83,374
91	$59,101	$62,884	$66,799	$70,827	$74,941	$77,904	$82,164	$84,082	$86,479	$88,982
92	$68,254	$71,697	$75,140	$78,583	$82,027	$85,470	$88,913	$90,635	$92,787	$95,035
93	$58,649	$62,353	$66,057	$69,761	$73,464	$77,168	$80,872	$82,724	$85,038	$87,456
94	$79,333	$89,120	$98,832	$108,479	$118,077	$128,330	$137,845	$142,724	$148,822	$155,192
95	$77,570	$81,691	$85,811	$89,932	$94,053	$98,173	$102,294	$104,354	$106,929	$109,619
96	$57,309	$62,434	$67,559	$72,683	$77,808	$82,932	$88,057	$90,619	$93,822	$97,168
97	$71,760	$76,136	$80,513	$84,890	$89,267	$93,644	$98,021	$100,210	$102,945	$105,802
98	$55,175	$59,273	$63,371	$67,469	$71,567	$75,665	$79,763	$81,812	$84,373	$87,048
99	$55,364	$61,637	$67,911	$74,185	$80,458	$86,732	$93,006	$96,142	$100,063	$104,159
100	$49,405	$52,883	$56,361	$59,838	$63,316	$66,794	$70,272	$72,011	$74,185	$76,455
101	$60,052	$60,042	$60,032	$60,023	$60,013	$60,003	$59,993	$59,989	$59,982	$59,976
102	$70,405	$76,384	$82,363	$88,343	$94,322	$100,302	$106,281	$109,271	$113,008	$116,911
103	$63,928	$71,134	$78,339	$85,544	$92,750	$99,955	$107,161	$110,763	$115,267	$119,970
104	$47,195	$50,412	$53,630	$56,847	$60,064	$63,281	$66,498	$68,107	$70,117	$72,217
105	$60,568	$66,807	$73,045	$79,283	$85,522	$91,760	$97,998	$101,118	$105,016	$109,089
106	$80,547	$87,622	$94,697	$101,771	$108,846	$115,921	$122,996	$126,533	$130,955	$135,574
107	$74,170	$80,397	$86,623	$92,850	$99,077	$105,303	$111,530	$114,643	$118,535	$122,600
108	$73,827	$81,810	$89,793	$97,777	$105,760	$113,743	$121,726	$125,717	$130,706	$135,918
109	$73,084	$78,796	$84,509	$90,221	$95,933	$101,645	$107,357	$110,213	$113,784	$117,512
110	$56,678	$59,737	$62,796	$65,855	$68,914	$71,973	$75,032	$76,561	$78,473	$80,470
111	$61,917	$66,123	$70,330	$74,536	$78,742	$82,948	$87,154	$89,257	$91,886	$94,632
112	$115,668	$130,547	$145,427	$160,306	$175,186	$190,065	$204,945	$212,385	$221,684	$231,397
113	$90,789	$95,954	$101,119	$106,284	$111,448	$116,613	$121,778	$124,361	$127,589	$130,960
114	$63,847	$63,554	$63,262	$62,969	$62,677	$62,384	$62,091	$61,945	$61,762	$61,571
115	$61,065	$64,340	$67,615	$70,891	$74,166	$77,441	$80,716	$82,354	$84,401	$86,539
116	$56,960	$59,693	$62,426	$65,159	$67,892	$70,625	$73,358	$74,724	$76,432	$78,216
117	$51,557	$53,490	$55,422	$57,355	$59,287	$61,219	$63,152	$64,118	$65,326	$66,587
118	$72,549	$75,927	$79,306	$82,684	$86,062	$89,441	$92,819	$94,508	$96,620	$98,825
119	$75,939	$78,011	$80,083	$82,155	$84,228	$86,300	$88,372	$89,409	$90,704	$92,056
120	$19,620	$19,165	$18,709	$18,254	$17,799	$17,344	$16,889	$16,661	$16,377	$16,079

121	$61,803	$66,401	$70,999	$75,596	$80,194	$84,792	$89,390	$91,688	$94,562	$97,563
122	$60,268	$63,208	$66,148	$69,088	$72,028	$74,968	$77,908	$79,378	$81,215	$83,135
123	$51,837	$52,146	$52,455	$52,764	$53,073	$53,382	$53,691	$53,846	$54,039	$54,241
124	$69,216	$74,998	$80,780	$86,562	$92,344	$98,126	$103,908	$106,799	$110,413	$114,188
125	$57,514	$61,067	$64,620	$68,173	$71,726	$75,279	$78,832	$80,609	$82,829	$85,149
126	$52,825	$50,110	$47,396	$44,681	$41,967	$39,252	$36,537	$35,180	$33,483	$31,711
127	$59,378	$61,840	$64,303	$66,765	$69,227	$71,690	$74,152	$75,383	$76,922	$78,530
128	$76,751	$87,595	$98,440	$109,284	$120,128	$130,972	$141,816	$147,238	$154,015	$161,094
129	$53,656	$55,923	$58,190	$60,458	$62,725	$64,993	$67,260	$68,394	$69,811	$71,291
130	$63,155	$67,406	$71,657	$75,907	$80,158	$84,409	$88,660	$90,786	$93,442	$96,217
131	$67,528	$75,529	$83,531	$91,533	$99,534	$107,536	$115,537	$119,538	$124,539	$129,762
132	$58,886	$62,178	$65,469	$68,760	$72,052	$75,343	$78,635	$80,281	$82,338	$84,486
133	$52,157	$54,017	$55,876	$57,735	$59,594	$61,453	$63,312	$64,242	$65,404	$66,618
134	$38,703	$40,146	$41,588	$43,031	$44,474	$45,917	$47,360	$48,082	$48,984	$49,926
135	$58,348	$63,934	$69,519	$75,105	$80,690	$86,275	$91,861	$94,653	$98,144	$101,790
136	$143,766	$163,265	$182,764	$202,262	$221,761	$241,260	$260,759	$270,508	$282,695	$295,423
137	$69,591	$75,007	$80,423	$85,840	$91,256	$96,672	$102,089	$104,797	$108,182	$111,718
138	$81,678	$90,097	$98,516	$106,936	$115,355	$123,774	$132,193	$136,402	$141,664	$147,160
139	$89,047	$97,292	$105,537	$113,782	$122,027	$130,272	$138,516	$142,639	$147,792	$153,174
140	$71,056	$78,528	$85,999	$93,470	$100,942	$108,413	$115,885	$119,620	$124,290	$129,167
141	$75,469	$83,332	$91,195	$99,058	$106,922	$114,785	$122,648	$126,580	$131,494	$136,627
142	$107,199	$118,849	$130,499	$142,149	$153,798	$165,448	$177,098	$182,923	$190,204	$197,809
143	$55,901	$61,097	$66,293	$71,489	$76,685	$81,881	$87,077	$89,675	$92,923	$96,314
144	$57,719	$60,990	$64,260	$67,531	$70,802	$74,073	$77,344	$78,979	$81,023	$83,158
145	$60,655	$63,684	$66,713	$69,742	$72,771	$75,800	$78,829	$80,343	$82,236	$84,213
146	$59,064	$63,920	$68,777	$73,633	$78,489	$83,346	$88,202	$90,630	$93,665	$96,836
147	$67,239	$73,847	$80,455	$87,063	$93,671	$100,279	$106,887	$110,191	$114,321	$118,635
148	$63,199	$68,348	$73,498	$78,648	$83,797	$88,947	$94,096	$96,671	$99,889	$103,251
149	$57,704	$60,370	$63,036	$65,702	$68,369	$71,035	$73,701	$75,034	$76,700	$78,441
150	$37,218	$37,429	$37,640	$37,852	$38,063	$38,274	$38,486	$38,591	$38,724	$38,862
151	$57,961	$59,917	$61,873	$63,830	$65,786	$67,742	$69,698	$70,676	$71,899	$73,176
152	$76,362	$81,145	$85,929	$90,712	$95,495	$100,278	$105,061	$107,452	$110,442	$113,564
153	$70,128	$76,882	$83,635	$90,389	$97,142	$103,896	$110,649	$114,026	$118,247	$122,656
154	$65,078	$69,595	$74,112	$78,630	$83,147	$87,664	$92,181	$94,440	$97,263	$100,212
155	$60,622	$62,883	$65,143	$67,404	$69,665	$71,925	$74,186	$75,316	$76,729	$78,205
156	$119,551	$135,291	$151,031	$166,771	$182,511	$198,252	$213,992	$221,862	$231,699	$241,974
157	$105,443	$119,529	$133,616	$147,703	$161,789	$175,876	$189,963	$197,006	$205,810	$215,006
158	$49,814	$49,654	$49,494	$49,333	$49,173	$49,013	$48,853	$48,773	$48,673	$48,568

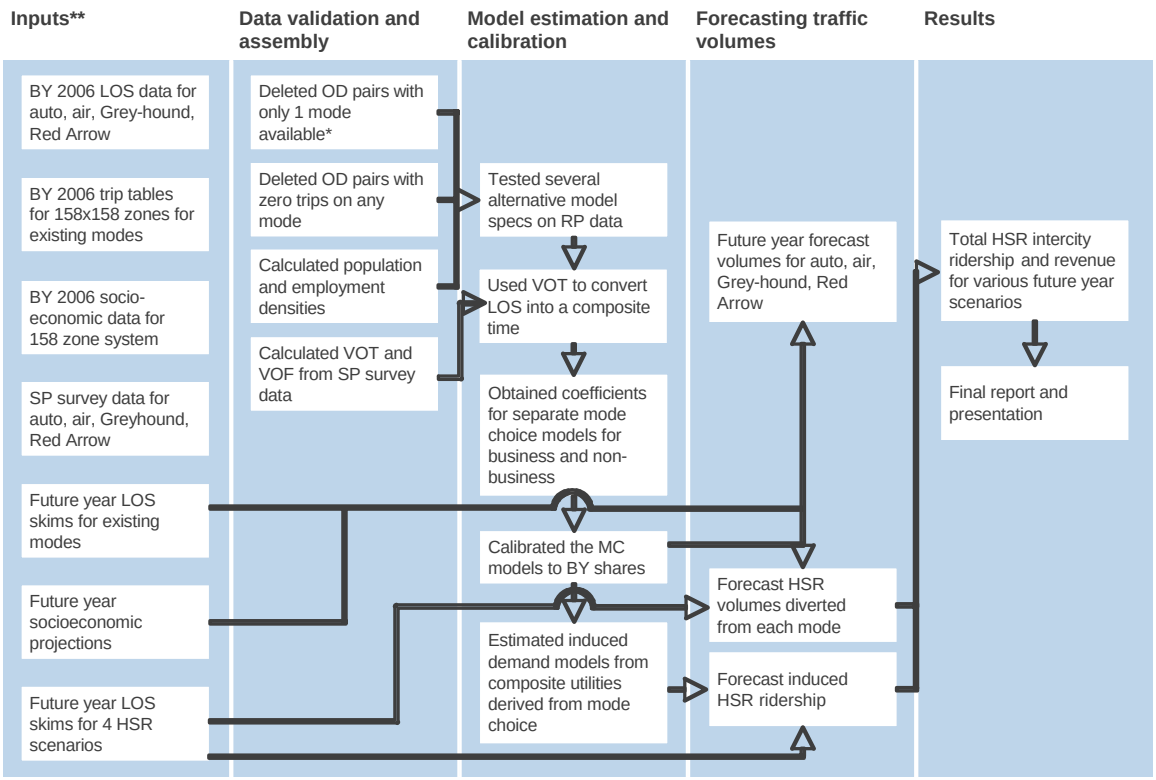
F

Oliver Wyman Modeling Methodology

F.1 Model Development

This section includes an overview of the assumptions, inputs, and results of the mode choice models developed as part of the HSR intercity ridership and revenue forecast study. Exhibit F.1 outlines the process and the various steps involved. The following subsections describe each step of the process in detail.

Exhibit F.1: Flowchart of Intercity HSR Ridership and Passenger Revenue Forecasting Process



*Availability of non-auto modes decided by frequency. A mode is not available between an OD pair if frequency of that mode is zero between the OD pair.
**Most of the input data, skims, total demand model outputs were obtained from TEMS.

Model approach

The mode choice model was developed using the observed travel patterns in the Alberta province, referred to as the Revealed Preference (RP) data. The Origin-Destination (OD) level trip tables developed by TEMS in collaboration with AIT were used as the basis for the RP.

F.1.1 Data Synthesis

Data for the mode choice model development effort was provided by TEMS. Four categories of data were used as input to the effort:

1. OD trip tables – 2006 Daily business and non-business trips for auto, air, Greyhound and Red Arrow for each OD pair in the Alberta 158-zone system.
2. OD Level of Service (LOS) skims – Time, cost and other LOS attribute information for auto, air, Greyhound and Red Arrow for each OD pair in the Alberta 158-zone system.
3. Socioeconomic data – 2006 population, employment and land areas for each zone in the Alberta 158-zone system.
4. Stated Preference survey data – Derived Value of Time / Value of Frequency (VOT / VOF) information used to validate or enhance the mode choice models.

Each of these datasets were inspected and cleaned (see Section F.2) before they were assembled together for mode choice model estimation.

1. **Origin-Destination Trip Tables** For each existing mode (i.e., auto, air, Greyhound and Red Arrow) TEMS developed base year trip information for each origin-destination pair in the 158 Alberta zone system. Trip tables were developed for two trip purposes: business and non-business. Exhibit F.2 summarizes the raw trip tables obtained from TEMS.

Exhibit F.2: Summary of TEMS Trip Tables

Travel mode	Daily business trips	Share of Business travel	Daily non-business trips	Share of Non-business travel
Auto	1,035,094	99.2%	2,618,829	99.6%
Air	1,229	0.1%	2,842	0.1%
Greyhound	4,445	0.4%	5,416	0.2%
Red Arrow	2,853	0.3%	3,365	0.1%

OD pairs with zero trips on all modes were removed from the dataset since they would have no impact on ridership forecasts. In addition, OD pairs with only one mode available were removed since the lack of mode competition effectively prevents mode share estimation and its use in the ridership model. A detailed description of the data cleaning process is included in section F. 2. Exhibit F.3 summarizes the trip tables after cleaning.

Exhibit F.3: Summary of Processed Daily Trip Tables

Travel mode	Business trips	Share of Business travel	Non-business trips	Share of Non-business travel
Auto	545,485	98.5%	1,357,019	99.2%
Air	1,229	0.2%	2,842	0.2%
Greyhound	4,445	0.8%	5,416	0.4%
Red Arrow	2,853	0.5%	3,365	0.2%

2. **Origin-Destination Level of Service Skims.** Base year (2006) skims were provided for all existing modes. The skim attributes included in-vehicle travel time, access/egress time (out-of-vehicle travel time), in-vehicle cost, and access/egress cost for all modes. Frequency and wait time were also available for the non-auto modes.

Exhibit F.4 outlines the attributes used in the mode choice model.

Exhibit F.4: Parameters Used in Mode Choice Models

Variable	Auto	Air	Greyhound	Red Arrow
In-vehicle travel time	X	X	X	X
In-vehicle travel cost	X	X	X	X
Access/egress time	X	X	X	X
Access/egress cost	X	X	X	X
Frequency	N/A	X	X	X
Wait time	N/A	X	X	X

3. **Base Year Socioeconomic Data.** TEMS developed estimates of population, total employment, and household income for each zone in the Alberta zone system using data from the 2006 Statistics Canada census as a starting point. Historical data on population, employment, average household income and number of households was obtained from the 1991, 1996, 2001 and 2006 Census of Canada[1] (Statistics Canada). Data for Edmonton zones (which correspond to the Edmonton traffic districts) was obtained from the City of Edmonton demographic database. Exhibit F.5 summarizes the socioeconomic estimates.

Exhibit F.5: Summary of BY 2006 Socioeconomic Data

City	Population	Total Employment	Avg. household income
Edmonton	731,512	418,864	70,679
Calgary	988,194	599,190	89,647
Alberta	3,293,568	1,872,706	72,970

Additionally, zone areas were obtained from TEMS and the zonal population and employment were converted into densities in order to test the hypothesis in the choice model that travel between denser neighbourhoods increases the likelihood of transit use. Exhibit F.6 summarizes the population and employment densities.

Exhibit F.6: Summary of Population and Employment Density

City	Average Population density	Average Employment density
Edmonton	1,068.9 per sq km	612.0 per sq km
Calgary	1,360.2 per sq km	824.8 per sq km
Alberta	5.1 per sq km	2.9 per sq km

4. **Stated Preference Survey Data.** TEMS conducted stated-preference surveys throughout the Calgary-Edmonton corridor in a manner designed to reach a broad sample of potential users of the proposed HSR system: commuters, business travellers, tourists, and social/recreational travellers. Weekday and weekend travel data was collected and analyzed separately to test the hypothesis that their travel behaviours and preferences are different. Approximately 6,600 surveys were completed using self-administered mail-out, handout, and interview approaches. Each form collected information on origin-destination, trip purpose, and demographics. In addition, each survey included a trade-off of travel options based on travel time and cost. Greyhound and Red Arrow respondents were also given trade-off exercises of cost and frequency. The goal of the trade-off exercises was to provide VOT (Value of time) and VOF (Value of frequency) estimates for enhancement of the mode choice models as well as model application. The VOTs and VOFs are derived from the trade-off exercises by estimating binary mode choice models as described in section C3 below.

F.2 Data Assembly

The following steps were involved in the cleaning and preparation of the data for input into the mode choice model.

i. OD pairs that had only one mode available were removed from the analysis – there is no modal choice to be examined on these OD pairs.
ii. OD pairs that had no trips on any mode were removed from the analysis – OD pairs with no trips do not carry any weight and, therefore, do not affect model results.
iii. OD pairs that were 10 miles or less apart were removed - such short distance trips are not likely to constitute the potential market for HSR.
iv. A master dataset was created after thorough inspection and cleaning, by merging the socioeconomic, level of service and trip data. Separate business and non-business datasets were assembled at the OD level – these provided the data for inputs into the mode choice models. These datasets were then restructured and reformatted to estimate the models.

F.3 Model Structure and Estimation

The following paragraphs describe in detail the structure and estimation methodology of the mode choice models.

1. **Estimation of VOT and VOF from Stated Preference Survey Data.** As mentioned earlier, stated preference surveys conduced by TEMS required respondents to make trade-offs between two combinations of travel time and travel cost and two combinations of travel time and frequency in the case of public transit modes. For example, a respondent in the mail-out car survey was given

the choices of Alternative A – drive to their destination in 3 hours and spend $45 (including gasoline, parking and other costs) and Alternative B – drive in 2.5 hours and spend $51. The choice was captured in the form of a five-point scale ranging from "prefer Alternative A a lot," "prefer Alternative A a little," "Not sure," "prefer Alternative B a little," and "prefer Alternative B a lot." Each respondent was presented 4 or 5 such trade-off questions. The license plate surveys were conducted separately on samples from the matched and unmatched license plate samples. All four surveys included separate samples from weekday and weekend travellers.

i. The first step was to aggregate the survey data from weekday and weekend samples.
ii. Each question in the survey was made into a separate observation or record in the final dataset, as the questions were positioned as independent trade-offs. This effectively yielded a data set for model estimation that was about four times the sample size (see Exhibit F.7).
iii. Respondents who selected the middle option (i.e., not sure) were removed.
iv. Scaled choice was then translated into a binary choice variable. If a respondent answered, "prefer Alternative A a little" or "prefer Alternative A a lot," then the response was assigned to be Alternative A. If a respondent answered "prefer Alternative B a little" or "prefer Alternative B a lot," then the response was assigned to be Alternative B.
v. Four different datasets were prepared, one for each mode. Additionally, in the auto dataset, the group size variable was used to derive travel cost per person. Since the cost presented in the survey included gasoline, tolls, and other related fees/costs that could potentially be divided and/or shared by everyone traveling in a group, the travel cost per person[1] is a better and more realistic attribute to gauge the sensitivity of a traveller compared to the total cost.
vi. A binary logit model was estimated for each mode, with the new binary choice variable as the dependent variable and travel time and cost as independent variables.
vii. Initial model estimation indicated that there could be a significant difference between the VOT for auto and air for trips originating in the "high-speed rail corridor of interest" i.e., economic regions 30 (Calgary), 50 (Red Deer) and 60 (Edmonton). Therefore, separate cost coefficients were estimated within the corridor and outside the corridor for auto and air.
viii. The VOT and VOF were calculated as the ratio of the time coefficient to the cost coefficient or frequency coefficient from the binary logit models. Exhibit F.8 shows the VOT for each mode and trip purpose.
ix. The VOT were compared with the average self-reported income information of the respondents. Wage rates were derived from the annual household income[2], which was one of the demographics gathered in the survey. The VOT seem to be reasonable, when compared with the average wage rates of the survey samples. Respondents tend to over estimate their VOT in comparison to their incomes, especially for premium modes like Air, as seen in the VOT derivations.

[1] In the raw data from license plate surveys, the size of the group was capped at 10 and missing values or zero were recoded as 1.
[2] Self-reported annual household income categories from the SP surveys was converted into the midpoints of the ranges. 'Less than $30,000' was coded as $20,000, '$30,000-$59,999' was coded as $45,000, '$60,000-$99,999' was coded as $80,000, and '$100,000 or more' was coded as $120,000. A 52-week year and 40-hour week (i.e., 2080 hours) was assumed in order to convert annual household income into hourly wage rate.

Exhibit F.7: SP Survey Sample Sizes

Survey	Trip Purpose	Sample Size
Auto	Business	5,480
	Non-business	15,293
Air	Business	1,600
	Non-business	1,288
Greyhound	Business	254
	Non-business	1,249
Red Arrow	Business	361
	Non-business	469

Exhibit F.8: VOT from SP Survey

Mode	Trip Purpose	Description	Time coefficient	Cost coefficient	VOT ($/hour)
Auto	Business	Within corridor	-0.030	-0.045	40.54
		Outside corridor		-0.060	30.00
	Non-business	Within corridor	-0.023	-0.085	16.00
		Outside corridor		-0.109	12.50
Air	Business	Within corridor	-0.047	-0.032	86.75
		Outside corridor		-0.042	66.56
	Non-business	Within corridor	-0.030	-0.034	53.00
		Outside corridor		-0.039	45.20
Greyhound	Business		-0.027	-0.086	18.79
	Non-business		-0.031	-0.121	15.12
Red Arrow	Business		-0.098	-0.298	19.68
	Non-business		-0.047	-0.157	18.03

2. Setting up the Mode Choice Model. Logit modelling techniques were used to estimate the mode choice model. Both multinomial and nested structures were tested as part of the model estimation process. The multinomial logit model is limited by the IIA (independence from irrelevant alternatives) assumption – this means that adding a new mode such as high-speed rail will not affect the odds or relative shares among the existing modes. The IIA property is a major limitation of the MNL model as it implies equal competition between all pairs of alternatives (Koppelman and Bhat, 2006).

A nested logit model structure was considered appropriate, particularly since it would provide the advantage of testing relative similarities of certain types of existing modes more than the others. In addition, it would provide the ability to fit high-speed rail into different nests or levels in the decision framework or hierarchy depending on the HSR scenario, speed and technology. Model estimation was an iterative process.

i. Many different model specifications with various combinations of explanatory variables and model structures of different complexity were tested until a set of final models was developed. Standard maximum likelihood-based logit estimation procedures were applied.
ii. The data was weighted by the total number of trips by all modes on each OD pair.
iii. We found that models that used VOT, described above to convert cost measures into a composite time variable yielded better results than did models that used separate time and cost variables in the mode utility equations.
iv. We tested a couple of different ratios for access/egress time (i.e., out-of-vehicle travel time) to in-vehicle travel time in the computation of a composite time variable for the air mode. Typically, mode choice studies have used a ratio ranging from 1.5-2.0. However, we felt that the model coefficients were more reasonable when we used a ratio of 1.5 for the air utility equation. This lower ratio makes sense in the context of the Calgary-Edmonton high-speed corridor since the two end points are the only airports in the region and access/egress times for the bulk of the zone system tends to be very high.
v. A Central Business District (CBD) indicator was created as a dummy variable to represent the two major downtown zones (i.e., Calgary and Edmonton) in the high-speed corridor. This variable was hypothesized to be a key influencer in mode choice, based on past studies. The hypothesis was later confirmed and the CBD dummy variable was retained in the utility equation for Greyhound and Red Arrow in the intercity business model and for Greyhound only in the non-business model.
vi. Simple models were estimated and evaluated using measures such as likelihood ratios and rho-squared. The best model was the one with behaviourally reasonable and statistically significant coefficients with the correct sign. Several nested models were developed and tested as part of the process. Exhibit F.11 shows the final nested model structure that produced the best results.
vii. Nested model in Exhibit F.11 was selected as the best model because it produced intuitive parameter estimates and was the only model that estimated a nesting coefficient between 0 and 1. The logsum parameter for Business model is 0.6324, and is 0.2146 for Non-Business model.
viii. The modal intercepts were calibrated to match by 2006 mode shares. Exhibits F.9 and F.10 present the model coefficients for business and non-business intercity trips respectively.

Exhibit F.9: Intercity Business Model Coefficients

Parameter	Auto	Air	Greyhound	Red Arrow
Intercept	4.612	2.345	2.236	0.323
Composite in-vehicle travel time[a]	-0.0047	-0.0111	-0.0047	-0.0047
Composite access/egress time[b]			-0.0139	-0.0050
Frequency				0.0512
CBD Dummy			0.4094	0.4094

Exhibit F.10: Intercity Non-business Model Coefficients

Parameter	Auto	Air	Greyhound	Red Arrow
Intercept	5.961	0.700	1.948	-1.810
Composite in-vehicle travel time	-0.0081	-0.0079	-0.0081	-0.0081
Composite access/egress time			-0.0214	-0.0045
Frequency				0.0656
CBD dummy			0.5057	

F.4 Induced Demand Model

It is reasonable to assume that improved mobility and access in the corridor due to the new HSR line would lead to some new trips that would not have occurred otherwise. Typically, demand forecasting studies derive induced demand as an independent benefit arising out of improvements to overall level of service of all modes.

The following paragraphs describe in detail, the structure and estimation methodology of the induced demand models.

i. The mode choice models described in section C3 were applied on the entire OD-level datasets[3]. Modal utilities were computed for every OD pair.

ii. The composite utility of travel on any OD pair was calculated as follows:

$$U_{travel(i,j)} = U_{air(i,j)} + \theta * \log(e^{U_{auto(i,j)}} + e^{U_{Greyhound(i,j)}} + e^{U_{\mathrm{Re}\,dArrow(i,j)}})$$

where (i,j) represents an OD pair with i as origin zone and j as destination zone

θ is the nesting coefficient

$$\log sum(U_{travel(i,j)}) = \log(e^{U_{air(i,j)}} + e^{\theta * \log(e^{U_{auto(i,j)}} + e^{U_{Greyhound(i,j)}} + e^{U_{\mathrm{Re}\,dArrow(i,j)}})})$$

iii. The socioeconomic variables are combined as follows:

Business:

$$SE_{i,j} = Employment_i * Employment_j * (Income_i + Income_j)/2$$

Non-business:

[3] The OD pairs that had been removed from model estimation due to non availability of more than one mode were added back in for the induced demand model.

[a]Composite in-vehicle travel time for auto and air is the sum total of in-vehicle travel time, in-vehicle travel cost (converted into time), access/egress time, and access/egress cost (converted into time). Composite in-vehicle travel time for Greyhound and Red Arrow includes in-vehicle travel time, and in-vehicle travel cost

[b]Composite access/egress travel time for Greyhound and Red Arrow includes access/egress time, access/egress cost and wait time.

$$SE_{i,j} = Population_i * Population_j * (Income_i + Income_j)/2$$

where $Population_i$ = population of origin zone
$Employment_i$ = employment of origin zone
$Income_i$ = average household income of origin zone
$Population_j$ = population of destination zone
$Employment_j$ = employment of destination zone
$Income_j$ = average household income of destination zone

iv. Regional indicator variables were also included as regressors in the regression to account for greater induced demand for trips ending in Calgary and Edmonton.

v. A linear regression model was estimated with the number of trips as the dependent variable and the composite utility, socioeconomic variables and regional indicators as explanatory variables. The regression model was developed as follows:

$$\log(Trips_{ij}) = \alpha + \beta_1 * SE_{i,j} + \beta_2 * \delta_{30} + \beta_3 * \delta_{60} + \beta_4 * \log sum(U_{travel(i,j)})$$

where δ_{30} = indicator for Calgary
δ_{60} = indicator for Edmonton

vi. Separate induced demand models have been estimated for business and non-business trip purposes. Exhibits F.12 and F.13 present the model results.

Exhibit F.11: Nested Model Structure

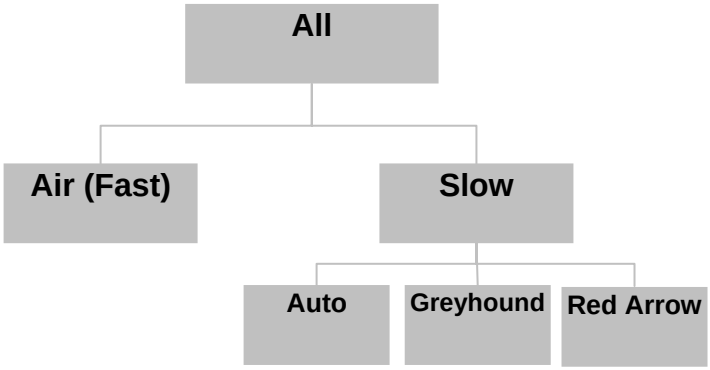


Exhibit F.12: Induced Demand Model for Intercity Business Travel

Variable	Parameter Estimate
Intercept	-11.45
Socioeconomic variable	0.299
Calgary regional indicator	0.239
Edmonton regional indicator	0.149
Logsum of composite MC utility	2.408

Exhibit F.13: Induced Demand Model for Intercity Non-business Travel

Variable	Parameter Estimate
Intercept	-10.41
Socioeconomic variable	0.383
Calgary regional indicator	0.385
Edmonton regional indicator	0.364
Logsum of composite MC utility	2.915

F.5 Model Validation

A detailed literature review was conducted to provide for a sound basis for comparison and validation. Several relevant pieces of information were collected from other HSR studies in the past, and a summary is provided in the Appendix G. Information gathered is summarized by category:

1) Value of time and frequency
2) Ratio of OVTT to IVTT
3) Mode choice model coefficients
4) Mode shares from mode choice models
5) HSR forecast – diverted and induced ridership
6) HSR ridership and revenue forecast
7) HSR mode constant and where HSR fits in
8) HSR sensitivity analysis

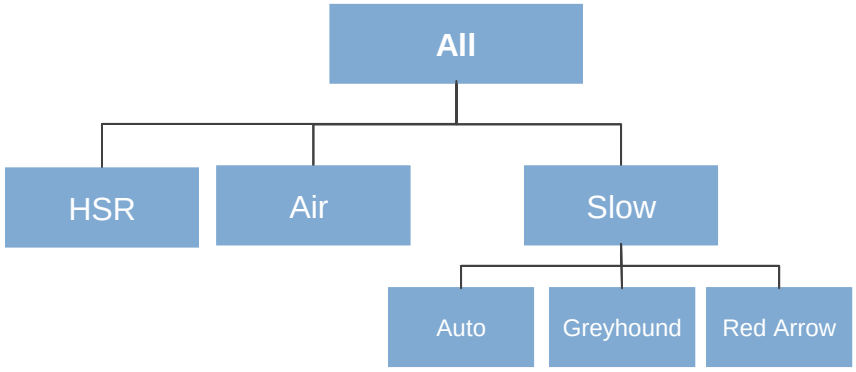
F.6 Modeling HSR Options

Different mode choice decision hierarchies were considered for the four alternative HSR options, with a structure that puts HSR parallel to Air chosen for implementation. Based on a comparison of in-vehicle travel time and travel costs between Calgary and Edmonton for existing modes and HSR modes, HSR was modeled to be behaviourally similar to and, therefore, parallel to Air. Our hypothesis and past research shows that HSR travellers have a much higher value of time than those using auto or slower public modes of transport.

Mode utility of Air, closest service type to HSR was used as the starting point for HSR. Given the differential frequencies of the four HSR options being considered, it was important to have frequency represented in the HSR utility equation. The frequency coefficient from Red Arrow was transferred to HSR in both Business and Non-Business models, with necessary adjustments made to the parameter estimate to account for the fact that Red Arrow was within a "Slow mode" nest.

The figure in Exhibit F.14 below illustrates the model structure chosen for implementation.

Exhibit F.14: Model structure for implementation of HSR (Redo this in Gray)



For the derivation of composite time for HSR modes, based on the assumed speed of service, Maglev travellers were assumed to have similar VOT as Air. For the other HSR modes, VOTs between that of Auto and Air were used, in consideration of varying speeds. The exhibit below shows the VOTs assumed for each HSR mode for Business and Non-Business trips, and for trips within and outside the Calgary-Edmonton corridor.

Exhibit F.15: HSR Assumed VOT ($/hour) for Composite Time Calculations

HSR Mode / Trip purpose	Business (within corridor)	Business (outside corridor)	Non-Business (within corridor)	Non-Business (outside corridor)
Talgo	68.3	52.4	42.3	36.1
Acela / Jet	73.7	56.5	45.5	38.8
TGV	79.8	61.2	49.0	41.8
Maglev	86.7	66.5	53.0	45.2

G

Review of Past HSR Studies by Oliver Wyman

G.1 Value of Time and Frequency

Summary across all studies reviewed: in 2006 CAD $/hr (assuming an average June 2006 exchange rate of 1.11 CAD for 1 USD)

Trip Purpose	Auto	Air	Bus	Rail
Business	$27-72	$82-121	$18-39	$21-66
Non- Business	$21-45	$33-67	$12-49	$17-43

The VOTs obtained from Stated Preference surveys by mode are

Trip Purpose	Auto	Air	Bus	Rail
Business	$40	$86	$19-20	NA
Non- Business	$16	$66	$15-18	NA

These values are on the lower end of the ranges observed from past studies. Since most of these studies are based in the US, where income levels are slightly higher than in Canada, this is an acceptable result.

Value of Time ($/hour) by Study

Trip Purpose	Auto	Air	Bus	Rail	Study
Business	$23	$67		$30	Corridor 3C (Cleveland-Columbus-Cincinnati) – TEMS (2001)
Business	$28	$67		$16	California High-Speed Rail – CRA (1995)
Business	$37-$47	$65-$67	$25	$39-$48	Tri-state – TEMS (1990)
Business	$26	$51		$26	New York - RPI/Cole Sherman (1990)

Business	$25	$58	$17	$25	Ontario-Quebec – Cole Sherman (1990)
Business	$23	$54		$28	Illinois- British Rail (1990)
Business	$26	$79	$16	$33	Ohio and Lake Erie regional Rail – TEMS (2002)
Business	$21	$70	$20	$20	Wisconsin State Rail Plan (2020 corridor feasibility study) – TEMS (2001)
Business	$24	$59	$16	$27	Midwest Regional Rail Initiative Business Plan – TEMS (1997)
Business	$36	$66	$20	$30	Illinois Rail Market Analysis – TEMS (1996)
Business	$33	$85	$24	$24	MBTA North Station-South Station Rail Link project – TEMS (1996)
Business	$31	$70	$20	$31	Restoration of Portland-Boston Passenger Rail service – TEMS (1994)
Non-Business	$17	$44	$12	$19	Corridor 3C (Cleveland-Columbus-Cincinnati) – TEMS (2001)
Non-Business	$15	$34		$15	California High-Speed Rail – CRA (1995)
Non-Business	$16-$37	$34-$42	$15-$34	$20-$37	Tri-state – TEMS (1990)
Non-Business	$26	$32	$32	$21	New York - RPI/Cole Sherman (1990)
Non-Business	$18	$32	$12	$19	Ontario-Quebec – Cole Sherman (1990)
Non-Business	$13	$19		$13	Illinois- British Rail (1990)
Non-Business	$19	$31	$11	$16	Ohio and Lake Erie regional Rail – TEMS (2002)
Non-Business	$17	$45	$13	$15	Wisconsin State Rail Plan (2020 corridor feasibility study) – TEMS (2001)
Non-Business	$18	$30	$11	$20	Midwest Regional Rail Initiative Business Plan – TEMS (1997)
Non-Business	$21	$42	$11	$21	Illinois Rail Market Analysis – TEMS (1996)
Non-Business	$23	$47	$18	$18	MBTA North Station-South Station Rail Link project – TEMS (1996)
Non-Business	$18	$27	$17	$17	Restoration of Portland-Boston Passenger Rail service – TEMS (1994)

Value of Frequency

Trip Purpose	Air	Bus	Rail	Study
Business	$34/hr		$9/hr	Corridor 3C (Cleveland-Columbus-Cincinnati) - TEMS
Business	$40/hr	$13/hr	$22/hr	Ohio and Lake Erie regional Rail – TEMS (2002)
Business	$44/hr	$11/hr	$14/hr	Wisconsin State Rail Plan (2020 corridor feasibility study) – TEMS (2001)

Business	$30/hr	$13/hr	$14/hr	Midwest Regional Rail Initiative Business Plan – TEMS (1997)
Business	$44/hr	$13/hr	$14/hr	Illinois Rail Market Analysis – TEMS (1996)
Business	$45/hr	$24/hr	$37/hr	MBTA North Station-South Station Rail Link project – TEMS (1996)
Business	$48/hr	$15/hr	$19/hr	Restoration of Portland-Boston Passenger Rail service – TEMS (1994)
Non-Business	$23/hr	$4/hr	$7/hr	Corridor 3C (Cleveland-Columbus-Cincinnati) – TEMS
Non-Business	$28/hr	$11/hr	$13/hr	Ohio and Lake Erie regional Rail – TEMS (2002)
Non-Business	$32/hr	$9/hr	$10/hr	Wisconsin State Rail Plan (2020 corridor feasibility study) – TEMS (2001)
Non-Business	$20/hr	$11/hr	$10/hr	Midwest Regional Rail Initiative Business Plan – TEMS (1997)
Non-Business	$31/hr	$9/hr	$10/hr	Illinois Rail Market Analysis – TEMS (1996)
Non-Business	$36/hr	$22/hr	$37/hr	MBTA North Station-South Station Rail Link project – TEMS (1996)
Non-Business	$17/hr	$12/hr	$13/hr	Restoration of Portland-Boston Passenger Rail service – TEMS (1994)

G.2 Ratio of OVTT to IVTT

For urban studies, a multiple of two to three times the value of "out of vehicle time" to "in vehicle time" is found or used. This, however, does not seem to hold well for intercity travel. This is because access dominates line-haul in urban travel choice of (transit) mode, while for longer distance intercity travel, the importance of access relative to line-haul decreases (Source: Florida High-Speed Rail, AECOM,)

For air travellers, the values of access/egress time reflect a roughly 10-percent premium relative to line-haul time due both to the higher uncertainty (or variance) associated with airport access times within a metropolitan area, and to the higher penalty or delay risk associated with access delay (you miss your flight). For auto travellers, the access/egress value of time premium over line-haul time is higher by roughly 50 percent (when considering diversion to an HSR station) reflecting both the delay risk and the segmentation of the value of access time distribution by mode choices that do and don't involve access/egress times (i.e., common carrier vs. private auto) (Source: California High-Speed Rail, Charles River Associates, 1995)

The Florida HSR study done by AECOM constrained the ratio of OVTT to IVTT to be 2.0.

G.3 Mode Choice Model Coefficients

Explanatory Variable	Business Model	Non-Business Model	Study
Auto travel time[1]	-0.003	-0.004	Florida HSR (Orlando-Tampa) - AECOM
Auto travel cost/group size/distance	-0.010	-0.022	Florida HSR (Orlando-Tampa) - AECOM
Travel cost/group size/distance (auto and rail)	-0.010	-0.022	Florida HSR (Orlando-Tampa) - AECOM
Rail in-vehicle travel time/distance	-0.005	-0.005	Florida HSR (Orlando-Tampa) - AECOM
Rail out-of-vehicle travel time/distance	-0.009	-0.009	Florida HSR (Orlando-Tampa) - AECOM
Rail constant	-0.105	-0.216	Florida HSR (Orlando-Tampa) - AECOM
Travel time (auto and rail)	-0.01	-0.008	Florida HSR – WSA
Travel cost time (auto and rail)	-0.001	-0.029	Florida HSR – WSA
Access/egress time/distance time (auto and rail)	-2.29	-1.888	Florida HSR – WSA
Damped frequency (rail) $(1-e^{-0.15*freq})$	1.51	2.66	Florida HSR – WSA
Rail constant	-1.961	-2.90	Florida HSR – WSA
GC_{rail}/GC_{bus}	-0.005/ 0.004	-0.003/0.002	3C corridor (Cleveland-Columbus-Cincinnati) - TEMS
$U_{surface}/GC_{air}$	1.258/0.009	1.051/0.005	3C corridor (Cleveland-Columbus-Cincinnati) - TEMS
U_{public}/GC_{auto}	0.679/0.005	0.685/0.005	3C corridor (Cleveland-Columbus-Cincinnati) - TEMS

[1]Value of auto time constrained to $20/hr for business and $10/hr for non-business

G.4 Mode Shares from MC Models

In Europe, HSR shares range from 32% to 95% when only rail and air are considered as competing modes. In the case of Acela Express actual 2001 rail shares was 45% as only rail and air are considered competing modes.

Auto	Air	Bus	Rail	Assumptions	Study
	55%		45%	Only air and rail	Acela Express Actual 2001 market shares (Source: Amtrak)
	45%		55%	Only air and rail	Stockholm-Gothenurg Actual 1995 market shares (Source: Mercer VIA Rail study)
61%	5%	4%	31%	1995 actual	Hanover-Frankfurt (335km) Source: Deutsche Bahn, Mercer analysis
96.3%	1%	0.71%	1.98%	2010 forecast; HSR frequency of 8 trains/day	3C corridor (Cleveland-Columbus-Cincinnati) – TEMS
46.5%	18.4%		35.1% (induced = 0.5%)	2020 forecast; funding scenario	CA HSR – CRA (1999)
	5%		95%	1998 actual; only rail and air included in market	Paris-Brussels (Source: Rail International September/October 1998)
	10%		90%	1998 actual; only rail and air included in market	Paris-Lyon (Source: Rail International September/October 1998)
	15%		85%	1998 actual; only rail and air included in market	Tokyo-Osaka (Source: Rail International September/October 1998)
	55%		45%	1998 actual; only rail and air included in market	Tokyo-Hiroshima; Paris-Amsterdam (Source: Rail International September/October 1998)
	68%		32%	1998 actual; only rail and air included in market	Rome-Milan (Source: Rail International September/October 1998)
	75%		25%	1998 actual; only rail and air included	Toronto-Montreal (Source: Rail International September/October 1998)

				in market	
	26%		74%	1998 actual; only rail and air included in market	Rome-Bologne (Source: Rail International September/October 1998)
	40%		60%	1998 actual; only rail and air included in market	Paris-London; Stockholm-Gothenburg (Source: Rail International September/October 1998)
	47%		53%	1998 actual; only rail and air included in market	Frankfurt-Munich (Source: Rail International September/October 1998)
43%	2%	5%	50%	2000 after Thalys	Paris-Brussels: UIC, CER & UNIFE, *High Speed Trains in Europe* (October 2002) at 5, available online at http://www.cer.be/files/Br_01_10_2002_ENb-112515A.pdf.
97.52%	1.12%	0.31%	1.05%	2025 forecast	Ohio Hub system - TEMS

G.5 HSR Ridership Forecast: Diverted versus Induced Trips

Forty-two percent to ninety-two percent of rail trips and 1% to 46% of air trips have been forecasted to be trips diverted from auto across several studies in the US. Induced demand varies from 0.5% to 16%.

Diverted auto	Diverted air	Diverted bus/rail	Induced	Assumptions	Study
85.5%	1%	6.9% is from bus	6.5%	2010 forecast; 8 daily frequencies	3C corridor (Cleveland-Columbus-Cincinnati) - TEMS
7% of auto trips	61% of air trips	71% of rail trips		2020 forecast = steady state, starts operation in 2016	CA HSR – CRA (2000)
41.9%	45.8%	6% (rail)	6.3%	2020, VHS Option B	CA HSR – CRA (2000)
8% of auto trips	62% of air trips				Sweden HSR
52%	34%		16%	2010 forecast	FOX Miami-Orlando-Tampa (1997)
75%	19%	6%		2025 forecast	Cleveland-Detroit corridor
87%	8%	5%		2025 forecast	Cleveland-Buffalo/Toronto
93%	4%	3%		2025 forecast	Cleveland-Pittsburgh
85%	3%	12%		2025 forecast	Cleveland-Columbus/Cincinnati
			3.8%	Low speed	Boston-Montreal HSR - CS

			2.6%	Mid speed	Boston-Montreal HSR - CS
			2.8%	Mid speed high fare	Boston-Montreal HSR - CS
			0.36%	Mid speed low frequency	Boston-Montreal HSR - CS
			3.1%	Mid speed all stations	Boston-Montreal HSR - CS
			2.4%	Mid speed low fare	Boston-Montreal HSR - CS
			2.6%	High speed	Boston-Montreal HSR - CS
			5.2%	2025; Beeline alignment	FOX Tampa-Lakeland-Orlando - AECOM
			2.9%	2025; Beeline alignment	FOX Tampa-Lakeland-Orlando - WSA

Generally speaking, rail market shares are far higher in Europe than in North America. For instance, three years after inception of the TGV service between Paris and Lyon in 1981 (430 km, 2h travel time), rail market share for the route had increased from 28 percent to 52 percent, while air market share had decreased from 31 percent to 7 percent.[1]

G.6 HSR Ridership and Revenue Forecasts

The tables below provide a sampling of the ridership and revenue forecasts from various HSR studies. As much information as available is shown for each study.

Forecast Year	Annual Ridership (share)	Annual Revenue	Assumptions	Study/HSR Corridor
2005	1,080,006	$35.47 million	8 daily runs	3C corridor – TEMS
2005	1,160,905	$38.21 million	10 daily runs	3C corridor – TEMS
2010	1,183,533 (1.98%)	$39.03 million	8 daily runs	3C corridor – TEMS
2010	1,271,281	$42.01 million	10 daily runs	3C corridor – TEMS
2020	1,385,681	$46.09 million	8 daily runs	3C corridor – TEMS
2020	1,485,386	$49.46 million	10 daily runs	3C corridor – TEMS
2035	1,681,884	$55.98 million	8 daily runs	3C corridor – TEMS
2035	1,802,686	$60.07 million	10 daily runs	3C corridor – TEMS
2020	32,002,103 (14.7%)	$888,177,557	VHS	CA HSR – CRA (2000)
2020	39,814,665	$1,136,530,877	Maglev	CA HSR – CRA (2000)
2025	213,276	$4,784,504	Low speed (60	Boston-Montreal corridor – PB/CS

[1] Rail International Engineering 1991 Number 3 "Ten Years TGV Sud-Est – A Resounding Success."

			mph)/$0.16/mile/4 daily/12 stn	
2025	446,710	$27,893,059	110 mph restricted/$0.26/mile/6 daily/ 8 stn	Boston-Montreal corridor – PB/CS
2025	330,097	$22,559,907	110 mph restricted/$0.30/mile/6 daily, 8 stn	Boston-Montreal corridor – PB/CS
2025	86,962	$5,724,020	110 mph restricted/$0.26/mile/2 daily/8 stn	Boston-Montreal corridor – PB/CS
2025	588,630	$32,291,348	110 mph restricted/$0.26/mile/6 daily/12 stn	Boston-Montreal corridor – PB/CS
2025	683,667	$34,614,601	110 mph restricted/$0.20/mile/6 daily/8 stn	Boston-Montreal corridor – PB/CS
2025	644,232	$59,062,561	110 mph unrestricted/$0.36/mile/ 8 daily/6 stn	Boston-Montreal corridor – PB/CS
2010	8,256,000			FOX Tampa-Orlando-Miami – KPMG and SYSTRA
2010	1,195,000	$23.29 million	Beeline alignment	FOX Tampa-Lakeland-Orlando - AECOM
2010	1,051,000	$19.86 million	Greeneway alignment	FOX Tampa-Lakeland-Orlando - AECOM
2010	1,065,000	$19.81 million	Beeline alignment	FOX Tampa-Lakeland-Orlando - WSA
2010	935,000	$16.92 million	Greeneway alignment	FOX Tampa-Lakeland-Orlando - AECOM
2025	1,817,000	$35.6 million	Beeline alignment	FOX Tampa-Lakeland-Orlando - AECOM
2025	1,646,000	$30.8 million	Beeline alignment	FOX Tampa-Lakeland-Orlando - WSA
2025	1,595,000	$30.3 million	Greeneway alignment	FOX Tampa-Lakeland-Orlando - AECOM
2025	1,433,000	$26.2 million	Greeneway alignment	FOX Tampa-Lakeland-Orlando - WSA
2025	980,000	$17.385 million	Detroit Metro Airport – with Youngstown Alternative/79 mph/ 8 daily	Cleveland-Detroit HSR - TEMS
2025	851,000	$15.955 million	Wyandotte – with Alliance Alternative/ 79 mph/8 trains	Cleveland-Detroit HSR - TEMS

2025	868,000	$15.568 million	Wyandotte – with Youngstown Alternative/79 mph/8 trains	Cleveland-Detroit HSR - TEMS
2025	950,000	$16.784 million	Detroit Metro Airport – with Alliance Alternative/79 mph/8 trains	Cleveland-Detroit HSR - TEMS
2025	1,251,000	$23.37 million	Detroit Metro Airport – with Youngstown Alternative/110 mph/ 8 daily	Cleveland-Detroit HSR - TEMS
2025	1,184,000	$22.085 million	Wyandotte – with Alliance Alternative/ 110 mph/8 trains	Cleveland-Detroit HSR - TEMS
2025	1,109,000	$21.037 million	Wyandotte – with Youngstown Alternative/110 mph/8 trains	Cleveland-Detroit HSR - TEMS
2025	1,209,000	$22.534 million	Detroit Metro Airport – with Alliance Alternative/110 mph/8 trains	Cleveland-Detroit HSR - TEMS

Market	Avg annual trips per person
Egypt	20.11
France	14.26
Germany	20.63
Hungary	11.88
India	4.45
Italy	8.22
Japan	69.38
Netherlands	19.06
Poland	7.56
Portugal	14.71
Romania	5.25
Russia	5.20
South Africa	11.13
South Korea	17.03
Spain	10.95
Switzerland	72.60

Taiwan	8.55
UK	16.12
Ukraine	11.35

Source: UIC Railway Statistics, 2000 (Mercer VIA Rail study)
Average annual trips per person in Canada is only 0.12

G.7 HSR Mode Constant

In general, information available is very limited, as documentation available does not provide the model specifications for most studies.

CRA (1995) claim in their CA HSR study that air and HSR are much more similar in the effect of the unobserved attributes of each mode on ridership than are private vehicle and HSR. The HSR constants in the private vehicle mode choice models mean that certain attributes of private vehicle (privacy, flexibility, etc.) are valued very highly relative to HSR (and to other common carrier modes).

Values of modal constants from HSR mode choice models with QOS adjustments ($1999)

Current Mode	Business	Non-business
Air local	$6.79	$5.23
Air connect	$9.09	$4.15
Private vehicle (long)	-$33.84	-$20.64
Rail	$8.25	$6.69

Values are equal to the fare advantage of HSR over the existing mode keeping all times and costs equal for all competing modes. (Source: CA HSR Study by CRA, 1995)

In another study for Florida HSR, AECOM claims that "Because rail does not currently exist in the Tampa-Orlando corridor, it is not possible to quantify the magnitude of the alternative specific constant/adjustment based on data collected in the corridor. Although high-speed rail also does not exist elsewhere in Florida, an attempt was made to derive an adjustment based on the observed air mode choices in these markets. Unfortunately, this did not yield any significant satisfactory results." Instead, AECOM estimated the magnitude of the adjusted rail alternative specific constants based on prior experience and relating it to the magnitude of the estimated costs parameters in the new models. The revised adjusted alternative specific constants are as follows:

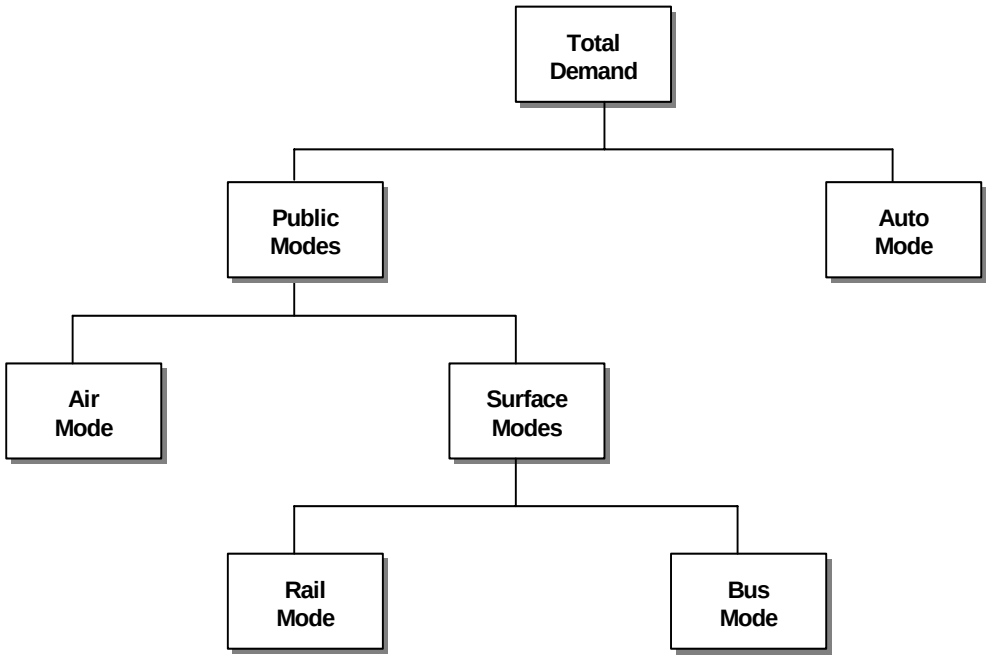
- Business Model: -0.1047 (vs. unadjusted of -0.08909)
- Non-Business Model: -0.2161 (vs. unadjusted of +0.8411)

Where does HSR fit in?

Based on the review of existing studies, information available is very limited, as documentation available does not provide the model specifications for most studies or hasn't dealt with the issue in a research context to be able to deduce where HSR really fits in the hierarchical decision tree.

One such available nesting structure is shown in the figure below.

Hierarchical structure of the Modal Split mode for 3C corridor HSR. (Source: TEMS)



G.8 HSR Sensitivity Analysis

Scenario	HSR Ridership Impact	HSR Revenue Impact	Assumption	Study
Annual air/auto growth at 3.5/2%	+25.5%	+26.9%	Base ridership = 32,002,103; Base revenue= $888,177,557	CA HSR – CRA (2000)
Air travel time +15 min	+2.8%	+3.5%	Base ridership = 32,002,103; Base revenue= $888,177,557	CA HSR – CRA (2000)
Auto travel time +30 min LA, Bay area	+9.6%	+9.2%	Base ridership = 32,002,103; Base revenue= $888,177,557	CA HSR – CRA (2000)
Air fares +50%	+17.7%	+22.4%	Base ridership = 32,002,103; Base revenue= $888,177,557	CA HSR – CRA (2000)
Air fares +100%	+28.7%	+36.2%	Base ridership = 32,002,103; Base revenue= $888,177,557	CA HSR – CRA (2000)

Air fares +150%	+33.3%	+42.0%	Base ridership = 32,002,103; Base revenue= $888,177,557	CA HSR – CRA (2000)
LA-SF HSR fare=50% of LA-SF air fare	Base ridership = 32,002,103	Base revenue= $888,177,557		CA HSR – CRA (2000)
LA-SF HSR fare=60% of LA-SF air fare	29,349,000	939,429,000		CA HSR – CRA (2000)
LA-SF HSR fare=70% of LA-SF air fare	26,804,000	965,937,000		CA HSR – CRA (2000)
LA-SF HSR fare=80% of LA-SF air fare	24,389,000	970,917,000		CA HSR – CRA (2000)
LA-SF HSR fare=90% of LA-SF air fare	22,125,000	958,111,000		CA HSR – CRA (2000)
LA-SF HSR fare=100% of LA-SF air fare	20,029,000	931,517,000		CA HSR – CRA (2000)
LA-SF HSR fare=110% of LA-SF air fare	18,111,000	895,070,000		CA HSR – CRA (2000)
Fare=$0.20/mile	1,377,126	$29.49 million	2010; 8 daily frequencies	3C corridor - TEMS
Fare=$0.25/mile	1,308,417	$33.36 million	2010; 8 daily frequencies	3C corridor - TEMS
Fare=$0.30/mile	1,244,150	$36.51 million	2010; 8 daily frequencies	3C corridor - TEMS
Fare=$0.35/mile	1,183,534	$39.03 million	2010; 8 daily frequencies	3C corridor - TEMS

H

Sensitivity Analysis - Summary

H.1 Ridership Tables

Exhibit H.1: Table of Ridership for all Sensitivities for 125 mph (in millions)

	Worst Case	Central Case	Best Case	Low Gasoline	High Gasoline	Low Congestion	High Congestion	Low Demographic	High Demographic
2011	1,051	1,143	1,483	1,101	1,466	1,142	1,213	1,091	1,217
2016	1,166	1,353	1,841	1,304	1,735	1,351	1,436	1,210	1,508
2021	1,255	1,555	2,208	1,498	1,992	1,553	1,650	1,302	1,809
2026	1,323	1,756	2,601	1,692	2,247	1,753	1,862	1,373	2,131
2031	1,456	1,956	2,952	1,884	2,502	1,953	2,075	1,511	2,418
2036	1,559	2,176	3,373	2,097	2,781	2,173	2,309	1,618	2,762
2041	1,652	2,372	3,745	2,286	3,031	2,368	2,516	1,714	3,066
2046	1,766	2,606	4,193	2,512	3,330	2,602	2,765	1,832	3,431
2051	1,861	2,821	4,619	2,720	3,605	2,817	2,993	1,931	3,778

Exhibit H.2: Table of Ridership for all Sensitivities for 150 mph (in millions)

	Worst Case	Central Case	Best Case	Low Gasoline	High Gasoline	Low Congestion	High Congestion	Low Demographic	High Demographic
2011	1,764	1,917	2,492	1,848	2,298	1,915	2,025	1,830	2,042
2016	1,920	2,226	3,025	2,146	2,701	2,222	2,383	1,994	2,482
2021	2,035	2,518	3,583	2,428	3,090	2,513	2,726	2,109	2,934
2026	2,119	2,811	4,119	2,709	3,481	2,804	3,070	2,261	3,378

2031	2,314	3,108	4,701	2,997	3,882	3,100	3,422	2,399	3,851
2036	2,458	3,431	5,306	3,308	4,320	3,422	3,809	2,563	4,349
2041	2,577	3,696	5,853	3,563	4,687	3,685	4,136	2,669	4,789
2046	2,718	4,011	6,469	3,868	5,127	3,998	4,529	2,820	5,291
2051	2,840	4,301	7,059	4,147	5,535	4,287	4,891	2,941	5,774

Exhibit H.3: Table of Ridership for all Sensitivities for 200 mph (in millions)

	Worst Case	Central Case	Best Case	Low Gasoline	High Gasoline	Low Congestion	High Congestion	Low Demographic	High Demographic
2011	2,780	2,995	3,730	2,912	3,466	2,992	3,118	2,859	3,191
2016	3,111	3,582	4,672	3,479	4,145	3,578	3,740	3,203	3,997
2021	3,360	4,136	5,616	4,015	4,786	4,131	4,325	3,461	4,819
2026	3,548	4,685	6,630	4,546	5,421	4,680	4,907	3,657	5,699
2031	3,918	5,236	7,556	5,079	6,056	5,230	5,489	4,039	6,488
2036	4,212	5,851	8,646	5,674	6,764	5,844	6,140	4,342	7,447
2041	4,467	6,385	9,626	6,191	7,383	6,377	6,704	4,607	8,274
2046	4,800	7,058	10,809	6,840	8,162	7,049	7,422	4,952	9,314
2051	5,069	7,657	11,947	7,418	8,856	7,647	8,057	5,231	10,279

Exhibit H.4: Table of Ridership for all Sensitivities for 300 mph (in millions)

	Worst Case	Central Case	Best Case	Low Gasoline	High Gasoline	Low Congestion	High Congestion	Low Demographic	High Demographic
2011	3,943	4,212	5,253	4,130	4,703	4,208	4,382	4,021	4,486
2016	4,412	5,037	6,580	4,933	5,633	5,032	5,236	4,505	5,617
2021	4,767	5,816	7,897	5,693	6,511	5,811	6,044	4,871	6,771
2026	5,034	6,586	9,319	6,443	7,377	6,579	6,841	5,146	8,002
2031	5,556	7,358	10,615	7,196	8,245	7,351	7,641	5,681	9,107
2036	5,966	8,212	12,135	8,030	9,203	8,204	8,525	6,102	10,439
2041	6,328	8,960	13,505	8,759	10,044	8,951	9,299	6,473	11,597
2046	6,798	9,903	15,160	9,678	11,110	9,894	10,275	6,957	13,053
2051	7,180	10,745	16,751	10,497	12,060	10,740	11,147	7,350	14,405

H.2 Revenue Tables

Exhibit H.5: Table of Revenues for all Sensitivities for 125 mph (in million of 2006$)

	Worst Case	Central Case	Best Case	Low Gasoline	High Gasoline	Low Congestion	High Congestion	Low Demographic	High Demographic
2011	50.634	55.127	79.900	53.053	72.850	55.051	58.797	52.613	58.683
2016	56.333	65.459	99.404	63.006	86.425	65.369	69.813	58.525	72.976
2021	60.637	75.244	119.202	72.436	99.276	75.144	80.245	62.987	87.557
2026	63.925	84.940	140.246	81.777	111.989	84.825	90.584	66.394	103.109
2031	70.288	94.580	159.396	91.049	124.629	94.451	100.888	73.011	116.982
2036	75.266	105.242	182.296	101.308	138.526	105.091	112.276	78.185	133.685
2041	79.896	114.905	202.654	110.626	151.209	114.742	122.565	82.982	148.617
2046	85.530	126.510	227.065	121.810	166.463	126.331	134.950	88.826	166.623
2051	90.228	137.074	250.585	131.990	180.347	136.865	146.217	93.698	183.642

Exhibit H.6: Table of Revenues for all Sensitivities for 150 mph (in million of 2006$)

	Worst Case	Central Case	Best Case	Low Gasoline	High Gasoline	Low Congestion	High Congestion	Low Demographic	High Demographic
2011	109.184	118.872	154.529	114.403	152.993	118.723	139.866	113.428	126.615
2016	119.122	138.420	187.813	133.242	180.509	138.190	164.649	123.410	154.062
2021	126.292	156.715	223.041	150.873	206.694	156.405	189.431	131.113	182.632
2026	131.651	174.931	256.218	168.427	232.888	174.530	213.322	140.376	210.134
2031	143.717	193.387	292.613	186.171	259.663	192.916	237.212	149.096	239.681
2036	152.720	213.544	330.189	205.569	289.041	212.972	262.151	159.149	270.616
2041	160.228	230.437	365.055	221.865	314.240	229.763	287.090	166.199	298.743
2046	169.445	250.631	404.292	241.328	344.675	249.830	314.204	175.813	330.663
2051	177.080	269.019	441.739	259.042	372.560	268.110	341.318	183.682	361.305

Exhibit H.7: Table of Revenues for all Sensitivities for 200 mph (in million of 2006$)

	Worst Case	Central Case	Best Case	Low Gasoline	High Gasoline	Low Congestion	High Congestion	Low Demographic	High Demographic
2011	219.154	236.879	321.482	229.610	276.426	236.651	247.736	226.093	252.404
2016	245.878	284.024	402.775	275.039	331.368	283.716	297.940	253.909	316.997
2021	265.708	328.203	485.251	317.614	382.855	327.833	344.807	274.563	382.457
2026	280.500	371.730	572.664	359.571	433.547	371.304	391.191	289.976	452.216
2031	309.816	415.526	652.343	401.837	484.344	415.038	437.708	320.364	514.984
2036	333.191	464.508	747.619	449.120	541.009	463.940	489.856	344.598	591.373
2041	353.830	507.512	832.467	490.551	591.226	506.886	535.440	366.049	657.888
2046	380.695	561.834	935.944	542.825	654.497	561.113	593.606	394.006	741.687
2051	402.318	609.986	1,035.741	589.176	710.637	609.199	644.895	416.501	819.137

Exhibit H.8: Table of Revenues for all Sensitivities for 300 mph (in million of 2006$)

	Worst Case	Central Case	Best Case	Low Gasoline	High Gasoline	Low Congestion	High Congestion	Low Demographic	High Demographic
2011	409.980	438.833	547.354	429.490	494.631	438.404	455.439	418.904	467.387
2016	459.941	526.069	687.373	514.325	593.815	525.563	545.603	470.453	586.769
2021	497.259	608.046	825.648	594.032	687.034	607.462	630.379	509.007	707.947
2026	524.993	688.427	974.149	672.212	778.272	687.761	713.569	537.692	836.451
2031	579.550	769.284	1,109.992	750.960	869.944	768.553	797.236	593.726	952.298
2036	622.648	858.959	1,269.505	838.384	971.277	858.157	889.826	637.966	1,092.151
2041	661.201	938.419	1,414.711	915.702	1,061.464	937.534	971.999	677.641	1,214.850
2046	711.290	1,038.695	1,590.388	1,013.105	1,175.623	1,037.716	1,075.606	729.291	1,369.297
2051	751.802	1,127.890	1,758.774	1,099.774	1,277.121	1,127.378	1,167.838	771.052	1,512.447

I

Air and Bus Schedules

I.1 Air Schedule

Exhibit I.1: Weekday Air Canada Schedule between Calgary and Edmonton

Calgary (YYC) to Edmonton (YEG)			Edmonton (YEG) to Calgary (YYC)		
Flight	Depart	Arrive	Flight	Depart	Arrive
AC8130	6:00	6:53	AC283	6:00	6:50
AC8132	7:30	8:23	AC8133	7:00	7:53
AC8134	8:30	9:23	AC8129	7:40	8:33
AC8136	9:30	10:23	AC8135	8:00	8:53
AC8138	10:30	11:23	AC8137	9:00	9:53
AC8140	11:30	12:23	AC8139	10:00	10:53
AC8142	12:30	13:23	AC8163	10:30	11:22
AC8144	13:30	14:23	AC8141	11:00	11:53
AC8146	14:30	15:23	AC8143	12:00	12:53
AC8148	15:30	16:23	AC8145	13:00	13:53
AC8166	16:00	16:48	AC8147	14:00	14:53
AC8164	17:40	18:28	AC8149	15:00	15:53
AC8170	18:00	18:53	AC8151	16:00	16:52
AC8154	18:30	19:23	AC8153	17:00	17:53
AC8156	20:00	20:53	AC8155	18:00	18:53
AC8160	21:30	22:23	AC8157	19:05	19:58
AC8162	22:45	23:38	AC8159	20:00	20:53
			AC8165	22:30	23:23

Exhibit I.2: Weekday WestJet Schedule between Calgary and Edmonton

Calgary (YYC) to Edmonton (YEG)			Edmonton (YEG) to Calgary (YYC)		
Flight	**Depart**	**Arrive**	**Flight**	**Depart**	**Arrive**
WS 137	7:15	8:02	WS 30	6:45	7:33
WS 38	9:15	10:02	WS 28	7:40	8:28
WS 73	12:10	12:57	WS 152	8:30	9:18
WS 450	16:15	17:02	WS 80	10:10	10:58
WS 514	17:00	17:47	WS 74	16:40	17:28
WS 153	19:50	20:37	WS 346	18:20	19:08
WS 36	22:30	23:17	WS 144	20:45	21:33

I.2 Bus Schedule

Exhibit I.3: Weekday Greyhound Schedule between Calgary, Edmonton and Red Deer. The routes with duration less than 3h,30m do not stop in Red Deer

Calgary to Edmonton			Edmonton to Calgary		
Depart	Arrive	Duration	Depart	Arrive	Duration
12:30am	05:35am	5h, 5m	12:15am	06:05am	5h, 50m
06:30am	10:15am	3h, 45m	06:30am	10:35am	4h, 5m
06:30am	12:05pm	5h, 35m	06:45am	12:35pm	5h, 50m
08:30am	12:15pm	3h, 45m	08:30am	12:20pm	3h, 50m
12:00pm	03:15pm	3h, 15m	12:00pm	03:20pm	3h, 20m
12:45pm	06:25pm	5h, 40m	01:00pm	04:40pm	3h, 40m
01:00pm	05:00pm	4h, 0m	01:45pm	07:50pm	6h, 5m
03:00pm	07:00pm	4h, 0m	03:00pm	06:55pm	3h, 55m
06:00pm	09:50pm	3h, 50m	06:00pm	10:00pm	4h, 0m
07:00pm	10:55pm	3h, 55m	07:00pm	10:50pm	3h, 50m
08:00pm	11:40pm	3h, 40m	08:00pm	11:45pm	3h, 45m

Exhibit I.4: Weekday Red Arrow Schedule between Calgary, Edmonton and Red Deer. The routes with duration 3h do not stop in Red Deer

Calgary to Edmonton			Edmonton to Calgary		
Depart	**Arrive**	**Duration**	**Depart**	**Arrive**	**Duration**
6:30	9:30	3h	6:30	9:30	3h
8:30	12:00	3h,30m	8:30	12:00	3h,30m
12:00	15:30	3h,30m	12:00	15:30	3h,30m
14:00	17:30	3h,30m	14:00	17:30	3h,30m
16:00	19:00	3h	16:00	19:00	3h
18:00	21:30	3h,30m	18:00	21:30	3h,30m