CMAP Transit Modernization Model Project

Final Report

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CMAP Transit Modernization ABM

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1. Project Focus and Phasing

1.1. Essence of "Transit Modernization" of the CMAP ABM

The goals of the "Transit Modernization" project were to enhance the transit components of the CMAP Activity-Based Model (ABM) to be sensitive to a wider array of policy and service variables than traditional transit demand models. "Modernization" refers to the fact that traditional transit demand models usually account solely for a limited range of explanatory Level-of-Service (LOS) variables such as travel time, out-of-pocket cost, access time, egress time, and time spent waiting at boarding locations. More "modern" variables added to the traditional variables include reliability, safety, cleanliness, probability of having a seat (crowding level), opportunity to be productive during the ride (productivity), ease of boarding, etc. These modern service variables have components contributed by the stop or station and its surrounding environment, components contributed by the boarding or alighting experience, and components contributed by the transit vehicle itself (on-board experience).

The existing CMAP CT-RAMP ABM represents an advanced microsimulation platform integrated with CMAP socio-economic & land-use data and networks. It has been successfully applied for highway pricing studies. In the current project, the transit side of the CMAP ABM was substantially enhanced and tested. The project objectives included incorporation of the State-of-the-Art & Practice in transit procedures and mode choice with a primary focus on quantifiable measures of premium transit services described above as well as validation of the improved model system against available data on transit ridership. The ABM structure that is based on individual microsimulation represents a very good platform for incorporation of these additional attributes.

The CMAP transit model evolved over the course of the project's two phases to include a sophisticated means of calculating a host of impedance components that enter into transit path-building and transit choice. For example, boarding time in the model is in part a function of the number of persons boarding a vehicle at a given stop. Perceived in-vehicle time is a function of actual in-vehicle time, perceptions of crowding, ability to be productive, vehicle cleanliness, and other factors. The result is a unique model sensitive to a wide variety of public agency investment alternatives, service planning choices, and policy implementations.

1.2. Existing CMAP CT-RAMP ABM

The main CT-RAMP (Coordinated Travel & Regional Activity Modeling Platform) system structure first implemented as the CMAP Pricing ABM is shown in Figure 1 with the sub-models improved in the course transit modernization highlighted in green. Yellow highlights correspond to the components that were previously redeveloped for the Pricing ABM.

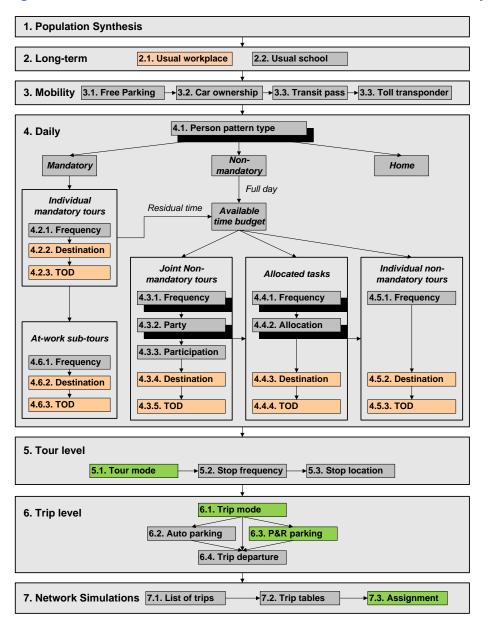


Figure 1: CMAP CT-RAMP ABM Structure and Sub-Models in the Focus of Current Project

Overall, the existing CT-RAMP structure remained the same for the transit modernization project since it provides an effective platform for implementation of the planned advanced modeling features. However, the transit modernization significantly affects mode choice models and transit assignment procedures including explicit choice of first boarding and final alighting stations for all transit access submodes including Walk to Transit (WT), Park-and Ride (PNR) and Kiss-and-Ride (KNR) trips. The entire

model system was restructured to work with an enhanced level of spatial resolution – 16,819 MAZs (Micro-Analysis Zones) nested within the 1,944 TAZs (Traffic Analysis Zones) applied for the Pricing ABM.

1.3. Main Model Improvements in Phase 1 and Phase 2

More specific translation of technical components listed in the previous section into the work plan adopted at the beginning of Phase 1 is presented in **Table 1**. The overall technical approach was to incorporate the major improvements in transit network procedures (and corresponding new transit service attributes) as soon as possible in Phase 1 to create the maximum useful platform for Phase 2. The most principal differences between Phases 1 and 2 are as follows. In Phase 1, the existing zonal system of 1,944 Traffic Analysis Zones (TAZs) is still used through the entire simulation process. In Phase 2, the entire model system was restructured to take advantage of a finer level of spatial resolution that is based on 16,819 Micro Analysis Zones (MAZs). In Phase 1, the mode choice model was implemented in a conventional "labeled" way. In Phase 2, a completely "non-labeled" approach was adopted where instead of mode labels like "conventional" and "premium", a wide set of multimodal transit path parameters and characteristics was used. These parameters were further interacted with individual attributes of transit users where a full advantage of the microsimulation framework was taken. The aggregate transit assignment and skimming procedure implemented in EMME was replaced with the core Transit Virtual Path Building (TVPD) procedure that finds the best Virtual Transit Path (VTP) for each individual from the origin MAZ to destination MAZ. VTP is defined in terms of three segments: 1) access from the origin MAZ to the first-boarding Transit Access Point (TAP), 2) ride from the first-boarding TAP to final-alighting TAP, 3) egress from the final-alighting TAP to destination MAZ.

Table 1: Main Model Improvements for Phases 1 and 2

Model component	Phase 1 (June 2012)	Phase 2 (June 2013)
Individual membership in latent class	Explicit segmentation by 18 travel-person categories: • 2 purposes (commuting vs. other) • 3 income groups (low, medium, high) • 3 age groups (children, younger adults, older adults) Single path type is assigned to each travel-person based on the category and VOT	Linking person characteristics with transit path characteristics: • Individual propensity to walk • Individual class membership with respect to path type preferences
Transit options for each TOD period	27 options (some eliminated): • 3 line haul modes (conventional, premium, mixed) • 3 access modes (walk, PNR, KNR) • 3 path types (streamlined, efficient, convenient)	Individualized choice preferences: Generic line haul transit mode 3 access modes (walk, PNR, KNR) 3 path types (streamlined, walk averse, premium transit preference)
Mode choice	9 modes: • 3 line haul modes (conventional,	3 "non-labeled" modes: • Generic line haul transit

	premium, mixed) • 3 access modes (walk, PNR, KNR)	mode • 3 access modes (walk, PNR, KNR)
Transit assignment and skimming procedures	 9 segments for each TOD: 3 line haul modes (conventional, premium, mixed) 3 path types (streamlined, efficient, convenient) 	3 station-to-station path types (streamlined, walk averse, premium transit preference) combined with individual access and egress preferences
Assigning and skimming PNR & KNR	EMME triple-index calculations with a deterministic station choice for each of 36 segments for each TOD: • 3 line haul modes (conventional, premium, mixed) • 2 access modes (PNR & KNR) and 2 egress modes (reversed PNR & KNR) • 3 path types (streamlined, efficient, convenient)	Replaced with virtual transit path building and station type choice: • 2 access modes (PNR & KNR) and 2 egress modes (reversed PNR & KNR) • 3 path types (streamlined, walk averse, premium transit preference
TOD periods for transit	 3 aggregate periods AM peak MD (off peak) (PM is transposed AM) 	8 detailed periods as for highway modeling: • AM early (6-7am) • AM peak (7-9am) • AM late (9-10am) • Midday (10am-4pm) • PM early (4-5 pm) • PM peak (5-7pm) • PM late (7-8pm) • Night (8pm-6am)
Spatial resolution	1,944 TAZs	16,819 MAZs with Virtual Transit Path (VTP) building

2. Key Technical Aspects Addressed in Phase 1

2.1. Redefining Transit Modes and Restructuring Mode Choice

The Pricing ABM model included 2 main transit modes (premium and bus) and 2 access sub-modes (walk and drive). The premium mode included the Metra commuter rail and CTA train services while the bus mode included all types of buses (local and express). These definitions correspond to a standard "mode labeling" practice while with the new approach, one of the primary intentions is to replace "labels" with objective and measurable service characteristics. In particular, in Phase 1, our intention was to create a mode choice structure that would be close to the final structure adopted for Phase 2.

With respect to access options, it was decided to extend the mode choice structure to include three access sub-modes (walk, PNR, KNR) that represent very different choice alternatives. It is also beneficial in practical terms, since these three sub-modes, essentially, represent different travel markets.

Changing the approach from using labeled line haul modes to using service (path) types requires some new definitions of path types. These path types are individualized that is a principal advantage of microsimulation. This required several path-preference-specific assignments (user classes) instead of predetermined mode combinations. For each possible trip (first-boarding TAP and final alighting TAP pair) we generate 3 possible paths each of them can include any transit multi-model combination. Each transit user chooses one path based on the probabilistic class-membership model. This choice is intertwined with the choice of access and egress options that are completely individualized (each person has an individual set of preferences based on his/her age, income, travel purpose and other characteristics). The general rules of relationship between (individual) segmentation and mode choices structure is summarized in **Table 2**.

Table 2: Relationship between Individual Segmentation and Mode Choice Structure

Model component	Traditional "mode labeling"	New "path type" approach
	approach	
Segments	Few segments by trip purpose, car ownership, income	Individual preferences organized into population and travel markets (latent classes; i.e. probabilistic individual membership)
Modes considered for each segment	Fixed set of modes with segment- specific utilities	1-2 generic modes per access type (walk, P&R, K&R) corresponding to path types (to keep premium separately)
Route considered for each mode and segment	One path for each mode (normally not segment-specific)	1-2 paths per each segment (class) that follows specific individual preferences

The following summary of main path-building parameters (each related to person classes) was adopted as the main guidance for Phases 1 and 2:

- Included in mode classification in Phase 1 (conventional vs. premium/express):
 - Schedule-based vs. frequent
 - Express vs. all-stop (stop spacing)
 - o Reliable vs. unreliable (mixed traffic, no priority)
 - Cost-insensitive (higher VOT) vs. cost-sensitive (lower VOT)
- Included in individual TVPB (MAZ-TAP-TAP-MAZ):
 - O Walk propensity (max and weight) as a function of person age, income, etc
 - Convenient waiting (station, plaza/other amenities at stations/information) vs. inconvenient wait (shelter, pole) / awareness & consideration
 - Formal parking lot vs. informal parking lot for PNR
 - Convenient access for KNR
 - Station amenities and commercial activity
 - Station/area safety and cleanliness
- Included in user-class-specific TAP-to-TAP transit path segment (streamlined, walk averse, premium transit preference):
 - Productive seating vs. non-productive seating (on-board amenities)
 - Direct service vs. transfers / age
 - o Single transit pass vs. multiple payments
 - Seated vs. standing and impacts on productivity
 - Cleanliness in the vehicles

Application of these main parameters for the specific Chicago Metropolitan Region in Phase 1 resulted in categorization of the transit services into 2 major categories – conventional and premium as summarized in **Table 3**. The original intention was to create the following 3 slots in the mode choice:

- Conventional service,
- Direct premium service with no conventional service involved as a feeder,
- Mixed service including premium and conventional services used for the same trip.

However, the statistical analysis implemented with the available data sources like the recent Household Travel Survey, 2007 in the Chicago Metropolitan Region has shown a negligible share of mixed services. This is an important specific of the Chicago Metropolitan Region that is quite different from such other metropolitan regions as New York and Los Angeles.

The implemented tour mode choice structure on the transit side includes 4 main modes that are defined in a new "non-labeled" way as recommended by FTA and in the related advanced transit research projects like TCRP H-37 "Transit Services that Affect Choice of Mode": 1) Conventional transit with walk access, 2) Premium transit with walk access, 3) Park-and-Ride, 4) Kiss-and-Ride. In Phase 2, where more advanced individualized path building procedures were applied, a single generic walk-to-transit mode was used in mode choice.

Table 3: Generic Transit Mode Definitions and Main Attributes

Attribute	Conventional	Premium
Service type:		
Frequency	Frequent (less than 15 min)	Schedule-based (15 min+)
Stop spacing	All-stop (less than 2 miles)	Express (2 miles+)
Reliability	Dependent on congestion (mixed traffic, no signal priority)	Reliable (right of way, full signal priority)
Vehicle type:		
Seating comfort & convenience	Low, "built to stand", for short trips	High, "built to seat", for long trips temperature control, cleanliness
On-board productivity	Non-productive seating	Productive seating (on-board amenities, Wi-Fi, power outlets, trays)
Station type:		
Size and waiting convenience	Shelter, pole, exposure to weather	Station, plaza (security, proximity to services, cleanliness, closed building)
Information	Limited route information	Real-time arrival/departure information, route information, announcements
Transfer convenience	May require crossing the street and finding the stop	General transfer convenience (the same building)
Cost:	Lower	Higher
Examples in Chicago Region:		
Clear	CTA Local Bus, Pace Local Bus	Metra Commuter Rail
Grey area, adopted for Phase 1	CTA Train	CTA Express Bus

Express services (Metra and CTA Express are identified as premium while local bus and CTA rail are identified as conventional. Pace Express is tentatively identified as premium.

Transit services and fares in the Chicago area represent a continuum of options rather than highly distinct modes or choices. This fact complicates the identification of premium and non-premium modes. The structure that is described in a working memorandum represents one way of distinguishing premium and non-premium services (i.e., premium means "express" with a station spacing greater than 2 miles). As we discussed in the telephone call, this means that CTA rail is somewhat awkward because trains (except the Purple Line) run local with stations that are more closely spaced than Metra (or express bus stops) but more widely spaced than local bus stops. An argument could be made that CTA rail is much more "express" than local bus and ought to be in the premium mode. If the definition of "express" were changed to 1 mile, then CTA rail would be considered "express" rather than local.

Another way we could have defined premium is based on fare. This is a very complex subject since the cost of transfers and the fare impact of multi-operator trips is dependent on the exact fare medium used. Given the fact that the basic CTA monthly pass is useable on all CTA and Pace local bus services and given the fact that Pace express services require payment of a surcharge and Metra is completely

separate (and generally more expensive), this suggests that a definition of premium based on fare can be defined that is different from the express-based definition. Under the fare based approach, the definition of transit modes would change slightly so that CTA Express Bus is part of the conventional mode while Pace Express service is part of the premium mode.

The bottom line is that there are at least 3 reasonable ways to distinguish local and premium services:

- Express vs. local with express defined as substantial runs with stop spacing greater than 2 miles. (Current approach). This would break service into local bus/local rail vs. express bus/commuter rail (Note that Metra Electric local trains have a stop spacing under 2 miles but should still be coded as express since express trains are widely available on this line).
- Express vs. local with express defined as substantial runs with a stop spacing generally equal to 1
 mile or more. This would break services into local bus vs. express bus/rail rapid
 transit/commuter rail
- Premium vs. non-premium with difference based on the presence of a premium fare for use of the service. This would break services into local bus/CTA express bus/CTA rail vs. Metra/Pace Express Bus

Advantages and disadvantages exist for all approaches. The current approach offers travelers on each zone-to-zone interchange the best chance of seeing multiple choices. For instance, trips from Evanston, O'Hare or 95th/Dan Ryan to the Loop will have a choice between Metra and CTA rail. Trips from Hyde Park or the North Shore to the Loop will have a choice between CTA rail and CTA Express bus. The downside is that in some places, travelers can choose between CTA rail and CTA bus in the real world and this choice is not preserved in the modeled representation. For the initial model this is probably acceptable and thus we should keep the current structure for now.

In Phase 2, we considered a more advanced concept of how we build paths. FTA is encouraging us to consider the possibility that there is really just one transit choice (for each access mode) but that different travelers weight these choices differently. To make this approach work, travelers need to be grouped according to how they select their paths. Example features of this approach adopted for Phase 2 include:

- Elderly travelers may prefer to walk a short distance even at the price of taking a slower bus with more transfers while young travelers may prefer the opposite.
- Wealthier travelers may prefer an express service at a premium fare while less wealthy travelers prefer the opposite.
- Travelers with higher education (correlated with higher income groups) may rank productivity,
 i.e. convenience to read or use laptops/tablets on board, as the most desired feature of transit
 service.

In Phase 1, we restructured the mode choice model to incorporate generic PNR and KNR modes while we still keep two groups of transit modes with walk access (conventional and premium) separately. A substantial transformation of the standard ABM structure (and Utility Expression Calculators, in

particular) was required to implement the modified structure as summarized in **Table 4**. Overall, the existing 4 mode "slots" were used but their content was changed significantly.

Table 4: Transformation of Transit Modes and Associated Modifications in CT-RAMP Structure.

Transit modes as	Transit modes as defined	Principal modifications / Phase 1
previously defined	in the new structure	
Walk to bus (CTA local	Walk to conventional	Change in the subset of modes and
bus, Pace local bus, CTA	transit (CTA local bus, Pace	corresponding network references,
express bus)	local bus, CTA train)	recalibration of mode specific constants for
		each segment (travel purpose)
Drive to bus (CTA local	KNR (CTA local bus, Pace	Change in the subset of modes and
bus, Pace local bus, CTA	local bus, CTA express bus,	corresponding network references, change in
express bus)	CTA train, Metra commuter	the mode availability settings (KNR is
	rail)	available to every person of the age of 8
		years or older, and is allowed at any
		station/stop), recalibration of mode specific
		constants for each segment (travel purpose)
Walk to premium transit	Walk to premium transit	Change in the subset of modes and
(CTA train, Metra	(CTA express bus, Metra	corresponding network references,
commuter rail)	commuter rail)	recalibration of mode specific constants for
		each segment (travel purpose)
Drive to premium transit	PNR (CTA local bus, Pace	Change in the subset of modes and
(CTA train, Metra	local bus, CTA express bus,	corresponding network references, change in
commuter rail)	CTA train, Metra commuter	the mode availability settings (PNR is
	rail)	available to adults with driver license,
		households with at least 1 car, and at
		stations/stops with designated parking
		capacity), recalibration of mode specific
		constants for each segment (travel purpose)

2.2. Premium Transit Attributes Affecting Mode Choice

If non-labeled formulation is adopted the difference between such categories as "Conventional transit" and "Premium transit" has to be explained by measurable attributes. Eventually, by using actual service attributes and assuming that this set captures the main transit characteristics perceived by the user, we could completely avoid predetermined mode choice slots and operate with a generic transit service. In order to operationalize this approach the following particular transit service characteristics were considered:

• Premium transit features and corresponding measures:

- On-board/vehicle characteristics such as seating availability, temperature, productivity, etc; these characteristics affect perception of in-vehicle time (findings of the TCRP Project H-37); significant interactions between vehicle type and transit in-vehicle time coefficients were found in the Portland study (LRT in-vehicle time equivalent to approximately 85% of Local Bus in-vehicle time).
- Stop/station design; perceptions of wait time (weight) due to stop characteristics. Stop/station type ("Full amenities", "Shelter\Seat", "Pole") is important for transferring as far as for first boarding, especially for "streamliners" or transfer-averse transit users as was found in the Portland Study. Wait time at "Full amenities" stop proved to be approximately 88% of wait at Pole. Wait time at "Shelter\Seat" proved to be approximately 93% of Pole.
- Service type (reliability, frequency, ease of payment, ease of boarding).
- Total equivalent of all additional premium attributes proved to be significant 25 min on the average (TCRP H-37).
- Span of the service is naturally accounted in tour-based framework. Less than 60% of commuters commute in AM/PM peak period combination. More than 40% of commuters experience low-frequency transit service at least on one of the commuting legs.
- Pedestrian environment factor based on number of census blocks per quarter-section (MAZ);
 it is used to calculate differential walk access/egress weight. It was applied in the Chicago 4-step model developed for the FTA New Start analysis in two ways:
 - Used to compute walk weight as function of pedestrian environment 1.5 in CBD to 3.0 in exurban areas (mode choice and transit assignment)
 - Used as element of mode choice disutility function. Later model versions applied a direct linear factor separately for the production and attraction zone
- Socio-demographic similarity index (or income incompatibility measure) at a mode or route level
 was needed to reflect on the fact that the individual decision is influenced by the mix of other
 passengers. Homogeneous (high-income) OD pairs have a better chance for transit than
 heterogeneous OD pairs where high-income riders may perceive the other population segments
 negatively:
 - Average transit mode shares by income group can be used as social feedbacks to individual choices
 - Income mix (presence of low-income riders) can be calculated by transit segments or as and OD skim to use in mode choice and transit assignment for medium and high incomes.
- Mode compatibility with respect to transit pass is important for allowing different modes/services to be used for the same trip, tour, and by the same person. Transit cost structure and free/discount transfer policy is an important factor that has to be taken into account when the transit cost is skimmed.
- Transit cost should be scaled based on the person type and transit pass holding. Transit pass holders as well as person types that have individual discounts (school children, college & university students, retirees) do not experience the entire single-trip cost.

2.3. Transit Network Preparation, Assignment, and Skimming Procedures

Completely new transit assignment procedures in Phase 1 were developed to replace static transit skims used in the Pricing ABM. Transit procedures in EMME fully support the adopted mode choice structure. These procedures incorporated a wide set of non-conventional transit service attributes beyond the standard time and cost components. The following main aspects were considered

- Address 8 TOD periods that are used by the CT-RAMP system; incorporate recent work on TOD transit networks based on Google Transit Feeds (GTFS).
- Apply Strategy Transit Assignment with Variants (5.32) that is a new option available with EMME 3.4 (tested in the Portland Study):
 - Cost attributes can be specified for boarding, in-vehicle, and auxiliary transit time components
 - o Perception factor of each time and cost component can be element-specific
 - Time and cost matrices can be saved separately
 - Consider the following additional attributes:
 - Station type and amenities:
 - Station, plaza, shelter, pole
 - Real-time info
 - Station/stop security
 - Proximity to services (coffee, shop)
 - Cleanliness
 - Park and Ride capacity and cost (formal vs. informal/street)
 - Vehicle type and amenities dummies:
 - On-board seating comfort
 - On-board temperature control
 - Cleanliness
 - Productivity features (Wi-Fi, power outlets, trays)
 - Seating availability modeled explicitly by crowding functions
- Consider several stations for PNR and KNR. The way it was implemented in the Chicago Area New Starts model is as follows:
 - Parking zone with non-zero off-street park-ride parking and the shortest highway time between the origin and that parking zone is identified and weighted at 1.0.
 - Travel time to all other potential parking zones is weighted at 1.0 times the time to nearest parking zone plus 2.5 times the additional travel time to the other parking zones.
- Some important details for combined transit services in the Chicago metropolitan area should be taken into account:
 - Private bus systems offering feeder connectivity in suburban areas; township-based dial/call-a-ride

Pace feeder bus service tied to Metra stations and timed to Commuter Rail arrivals (short transfer wait times)

2.4. Adopted Parameters for Transit Path Building

Initial set of parameters and weights adopted for Phase 1 is presented in **Table 5**. In general, initial weights were proposed based on the past experience. Final weights depend on which approaches calibrate best. The weights used to generate shortest paths are passed on to the choice models so that the choice models and the network/path finding models are consistently valuing each component of travel.

The project team also identified a need to update 8 transit vehicle types used in the existing transit network coding, that define (among other things) the unit (bus or train) capacity. Given the way that EMME computes capacity, rail modes should be coded with the train capacity rather than the car capacity. Train capacity should be coded based on the maximum feasible consist length (number of cars per train) rather than the actual consist lengths. In general, rail schedulers provide just enough cars to cover the demand (up to the maximum allowed by the infrastructure). Just because a train is operated with 4 cars today doesn't mean that it is the capacity limit since the train lengths could easily be extended if demand grew to require more cars. These improvements are essential for Phase 2 where capacity constraining and crowding functions are applied.

All transit assignment and network procedures were completely updated to incorporate a large number of additional attributes including vehicle, station, and service characteristics and tested. This procedure is based on the advance features incorporated in the latest version of EMME (3.4.3) that includes "Extended Transit Assignment with Variants". CMAP provided the first set of input variables (station and vehicle characteristics) and the PB/RSG team specified default values for all parameters except for the reliability components.

The skims for transit LOS attributes are fed to the CT-RAMP mode choice model. The skims are calculated based on the new advanced methods that take into account combinations of several transit lines in the optimal strategy as shown schematically below. Some transit LOS components are handled through the combined frequency technique while some other ones through the embedded logit route choice. Each line obtains a share in the optimal strategy that is used to weigh the LOS variables of different lines.

Table 5: Initial Setting of Transit Path Parameters

Path Component	Parameter	Weight
Wait time	Variable "spline function" computing wait time as a function of headway (1/2 of short headway and ¼ (or less) of headways more than 10 minutes. Same curve should be applied for all modes.	2.5 for "pole" stop type. Potential reductions can be tested for other stop types down to 1.5 for stations. This relationship should be tested to determine which weights generate the best assignments and require the smallest modespecific constants
Boarding time	Node based parameter that reflects both real time required to travel from street to platform (or platform to platform) plus perceived penalty associated with making a transfer. For most bus stops the former quantity is 0 while most stations can be coded with 1 minute. Large Metra terminal stations should be 2 minutes. The initial value for the perceived penalty (on top of the real times) should be 2 minutes. Thus total times are as follows: • Bus stops 2 minutes • Most rail stations or bus transfer facilities 3 minutes • Large terminal stations 4 minutes.	2.5
Boarding Cost	CMAP representation of the station-specific component of fare.	Consistent with initial estimate of value of time in CT-RAMP
In-vehicle time	Weighted representation of in-vehicle time to account for more productive use of time in some modes. Code premium time as 0.85 times actual running time. Conventional time is coded as equal to actual running time.	1.0 (if the new version of emme can weight different modes differently, then the weights can be moved from the parameter column to the weight column)
In-vehicle Cost	CMAP representation of in-vehicle portion of cost	Consistent with initial estimate of value of time in CT-RAMP
Auxiliary Time	Walking time weighted as follows: 1.5 for urban areas with a PEF greater than 50 and 3.0 for a PEF less than 30. The adjustment factor between 30 and 50 is linearly interpolated between 1.5 and 3.0.	1.0 (input time pre-weighted)
Auxiliary Cost		Consistent with initial estimate of value of time in CT-RAMP

An example of the parameters setting for Premium Transit with walk access is shown below. In the same way all details were finalized and coded for the other three transit modes: Conventional Transit with walk access, Park and Ride, and Kiss and Ride. Skimming for Park and Ride and Kiss and Ride modes included matrix convolution process with choice of the boarding transit station to address both auto access and main transit line haul legs of the trip. In the example below, in the left column we present the actual options chosen at each stages of the procedure while in the right column we present the explanation of the option with the other possible choices supported by the current assignment and

skimming algorithm. All user defined parameters are set in the control section of the script based on the previous discussions.

Table 6: Example of Transit Path Building for Premium Transit with Walk Access

EMME script command	Comment and other possible choices
5.32	Extended transit assignment
2	1=optimal strategies, 2=strategies with variants
~?q=2	Branching condition
1	1=save volumes as new assignment, 2=add volumes to
	existing assignment
mf278	Demand matrix
BCPLuvxybcrEQMmwztd	Transit and auxiliary modes used in path building
2	Handle connector-to-connector path: 1=allow
	(standard), 2=prohibit (assign to another path),
	3=prohibit (do not assign)
1	Prohibit connector-to-connector paths: 1=everywhere,
	2=based on node attribute
2	Distribute flow between connectors based on: 1=only
	the best (standard), 2=transit time (logit), 3-5=user-
	defined proportions
0.2	Scale parameter for logit split between walk access
	links to first boarding stops
0.05	Truncation/cutoff parameter to eliminate low-
	probability alternatives
2	Distribute flow between attractive lines at stops by:
	1=frequency (standard), 2=frequency and transit time
	to destination
1	Use frequency and transit time to destination:
	1=everywhere, 2=based on node attribute
3	Source for effective headways: 1=actual line heaway,
	2=user-defined line attribute, 3=user-defined segment
	attribute
@hdwef	Effective headway multiplied by the fraction to get
	wait time, calculated based on the service-specific
	(non-linear) wait time functions of headway
1	Headway fraction (already accounted in effective
	headway)
1	Spread factor (multiplied on perception factor)
@wconv	Wait time perception factor by 5 station types

EMME script command	Comment and other possible choices
2	Source for boarding times: 1=same value for entire
	network, 2=node-specific, 3=line-specific, 4=node and
	line specific
@timbo	Node attribute containing boarding time (by 5 station
	types) multiplied by perception factor
1.00	Node boarding time perception factor (included in
	weighted boarding time)
3	Source for boarding cost: 1=same value for entire
	network, 2=node-specific, 3=line-specific, 4=node and
	line specific
ut1	Line attribute containing boarding cost, cents
%r52%	User-defined line boarding cost perception factor
	(1/VOT, min/cent)
@ivtpf	User-defined In-vehicle time perception factor (mode-
	vehicle-specific convenience by line)
@zfare	Attribute containing in-vehicle cost (incremental zone
	fare by segment)
%r52%	In-vehicle cost perception factor (1/VOT, min/cent)
@pefli	Auxiliary transit time perception factor (PEF by link)
	scaled between 1 (best pedestrian conditions) and 3
	(worst pedestrian conditions)
ul1	Attribute containing auxiliary transit cost (transfer
	discount)
0	Auxiliary transit cost perception factor (transfer
	discount is not used in path building but can be
	skimmed)
2	Send reports to printer
6.27	Analysis for extended transit assignment
~/	Section separator for skims that include all
	conventional modes
1	1=matrix, 2=network, 3=other, 4=user-defined,
	5=strategy and transit path details, 6=summary stats,
	7=end
1	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
mf245	Matrix to hold total transit impedance for P&R
	convolution
~+ ~?q=1 y PrWtot Conv_Prem_Total_Per%2% y 999	Matrix naming details for total transit impedance
у	More matrix skims to process?

EMME script command	Comment and other possible choices
2	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
5	1=first wait, 2=total wait, 3=first boarding time,
	4=total boarding time, 5=in-vehicle time, 6=auxiliary
	time
mf250	Matrix to hold in-vehicle time (total)
~+ ~?q=1 y PrWivt Prem_Walk_IVT_Per%2% y 0	Matrix naming details for total in-vehicle time
У	More matrix skims to process?
2	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
2	1=first wait, 2=total wait, 3=first boarding time,
	4=total boarding time, 5=in-vehicle time, 6=auxiliary
	time
mf394	Matrix to hold total waiting time
~+ ~?q=1 y PrWwai Prem_Walk_Wait_Per%2% y 0	Matrix naming details for wait time
У	More matrix skims to process?
2	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
6	1=first wait, 2=total wait, 3=first boarding time,
	4=total boarding time, 5=in-vehicle time, 6=auxiliary
	time
mf395	Matrix to hold auxiliary time
~+ ~?q=1 y PrWwal Prem_Walk_Walk_Per%2% y 0	Matrix naming details for walk time
У	More matrix skims to process?
5	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
mf396	Matrix to hold number of boardings
~+ ~?q=1 y PrWboa Prem_Walk_Boar_Per%2% y 0	Matrix naming details for number of boardings
У	More matrix skims to process?
3	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
1	1=first boarding cost, 2=total boarding cost, 3=in-
	vehicle cost, 4=auxiliary transit cost
mf246	Matrix to hold initial boarding fares
~+ ~?q=1 y PrWifa Prem_Walk_InFa_Per%2% y 0	Matrix naming details for initial fares
У	More matrix skims to process?
3	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
3	1=first boarding cost, 2=total boarding cost, 3=in-
	vehicle cost, 4=auxiliary transit cost

EMME script command	Comment and other possible choices
mf247	Matrix to hold in-vehicle cost (incremental zone transit
	fares)
~+ ~?q=1 y PrWzfa Prem_Walk_ZoFa_Per%2% y 0	Matrix naming details for incremental zonal fares
у	More matrix skims to process?
3	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
4	1=first boarding cost, 2=total boarding cost, 3=in-
	vehicle cost, 4=auxiliary transit cost
mf248	Matrix to hold auxiliary cost (transfer link fare
	discounts)
~+ ~?q=1 y PrWdis Prem_Walk_Disc_Per%2% y 0	Matrix naming details for incremental zonal fares
N	More matrix skims to process?
1	What to skim: 1=actual components, 2=perceived
	components
*	Active modes to skim
2	Send results to printer
~/	Section separator for skims that include in-vehicle
	time and number of boarding for bus modes only
1	1=matrix, 2=network, 3=other, 4=user-defined,
	5=strategy and transit path details, 6=summary stats,
	7=end
2	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
5	1=first wait, 2=total wait, 3=first boarding time,
	4=total boarding time, 5=in-vehicle time, 6=auxiliary
	time
mf251	Matrix to hold in-vehicle time (bus)
~+ ~?q=1 y PrWivb Prem_Walk_IVTb_Per%2% y 0	Matrix naming details for bus in-vehicle time
У	More matrix skims to process?
5	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
mf249	Matrix to hold number of bus boardings
~+ ~?q=1 y PrWbob Prem_Walk_Boab_Per%2% y 0	Matrix naming details for bus boardings
N	More matrix skims to process?
1	What to skim: 1=actual components, 2=perceived
	components
BPLEQ	Active modes to skim
2	Send results to printer
~/	Section separator for skims that include in-vehicle
	time for Premium Transit (Express bus and Metra rail)

EMME script command	Comment and other possible choices
1	1=matrix, 2=network, 3=other, 4=user-defined,
	5=strategy and transit path details, 6=summary stats,
	7=end
2	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
5	1=first wait, 2=total wait, 3=first boarding time,
	4=total boarding time, 5=in-vehicle time, 6=auxiliary
	time
mf391	Matrix to hold in-vehicle time (Premium)
~+ ~?q=1 y PrWivp Prem_Walk_IVTp_Per%2% y 0	Matrix naming details for premium in-vehicle time
n	More matrix skims to process?
1	What to skim: 1=actual components, 2=perceived
	components
MEQ	Active modes to skim
2	Send results to printer
~/	Section separator for skims that include in-vehicle
	time for Local bus
1	1=matrix, 2=network, 3=other, 4=user-defined,
	5=strategy and transit path details, 6=summary stats,
	7=end
2	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings
5	1=first wait, 2=total wait, 3=first boarding time,
	4=total boarding time, 5=in-vehicle time, 6=auxiliary
	time
mf392	Matrix to hold in-vehicle time (Local Bus)
~+ ~?q=1 y PrWivb Prem_Walk_IVTb_Per%2% y 0	Matrix naming details for local bus in-vehicle time
n	More matrix skims to process?
1	What to skim: 1=actual components, 2=perceived
	components
BPL	Active modes to skim
2	Send results to printer
~/	Section separator for skims that include in-vehicle
	time for CTA train
1	1=matrix, 2=network, 3=other, 4=user-defined,
	5=strategy and transit path details, 6=summary stats,
	7=end
2	1=total transit impedance, 2=time component, 3=cost
	components, 4=distance, 5=number of boardings

EMME script command	Comment and other possible choices
5	1=first wait, 2=total wait, 3=first boarding time,
	4=total boarding time, 5=in-vehicle time, 6=auxiliary
	time
mf393	Matrix to hold in-vehicle time (CTA)
~+ ~?q=1 y PrWivc Prem_Walk_IVTc_Per%2% y 0	Matrix naming details for CTA in-vehicle time
n	More matrix skims to process?
1	What to skim: 1=actual components, 2=perceived
	components
С	Active modes to skim
2	Send results to printer
Q	Finish the operation

2.5. Specifics of Kiss-and-Ride (KNR) Mode

KNR represents a special transit option that is associated with specific mode choice effects and path choice effects that have to be properly incorporated and distinguished from PNR. That was the primary reason to consider PNR and KNR as separate modes rather than combine them together (that is a prevailing practice). Different from PNR, KNR transit itinerary is frequently asymmetrical because of the difficulty in coordinating return arrival times. Cell phones, however, have significantly improved the ability of coordinating return arrival times, even for children. KNR users will try to obviate a transfer is very appealing if the intra-household pattern supports it; either the drop-off point is along the driver's planned route, the vehicle is committed to another use during the day, or parking at the drop-off point is unavailable. This justifies a separate setting of transfer penalties for KNR compared to WT. This is also behaviorally appealing for PNR.

There are also several path choice effects (i.e. KNR station/stop choice) that have to be taken into account. It was recommended to correlate KNR station choice with stop type as follows:

- Large Rail Terminal and O'Hare: KNR is less likely since auto cannot get conveniently close to the boarding point.
- Rail Station and Bus Plaza: KNR is more likely since design often includes auto pullouts for this purpose; also schedules are typically more reliable at these locations.
- Shelter and Pole: KNR is unlikely since there are little drop-off design accommodation and less predictable schedule advantage.

Additionally, it was recommended to correlate PNR station/stop choice with area type grouped (by color) as shown in Table 7.

Table 7: Area Type Classification for KNR Convenience

1=inside Chicago CBD (2009 subzones 1-47)

2=inside remainder of Chicago central area (2009 subzones 48-80)

3=inside remainder of Chicago (2009 subzones 81-976)

4=inside inner suburbs where Chicago street grid is generally maintained

5=remainder of Illinois portion of the Chicago Urbanized Area

6=Indiana portion of the Chicago Urbanized Area

7=other Urbanized Areas and Urban Clusters within the CMAP Metropolitan Planning area plus other Urbanized Areas in northeastern Illinois

8=other Urbanized Areas and Urban Clusters in northwestern Indiana

9=remainder of CMAP Metropolitan Planning Area

10=remainder of Lake County Indiana (rural)

11=external area

99=points of entry

The PNR convenience and probability relates to the area type as follows:

- 1 = Less likely. Driving in the downtown area is difficult. Associate perceptional penalty is 10 min.
- 2-4 = Likely from the path choice perspective. Rich grid of transit service available. Free parking is scarce. Associate perceptional penalty is 0 min.
- 5-8 = Somewhat likely from the mode choice perspective. In combination with accommodations at stations or plazas. Associate perceptional penalty is 5 min.
- 9 = Less likely. Infrequent service and unsupportive transit amenities. Associate perceptional penalty is 8 min.

With respect to the regulation rules, KNR is not officially prohibited by any of the transit agencies. Local government may restrict drop-offs at specific locations for safety or traffic management, usually through signage and citation. This would require an additional network inventory.

2.6. Hardware and Software Setting for Model Validation & Calibration

The following aspects of hardware and software settings were addressed:

- All mode choice adjustments described above and related linkages to other sub-models were implemented in the core CT-RAMP software.
- All transit procedures (assignments and skimming) were implemented using the Macro script language. For Phase 2 EMME Modeler API were used for all newly developed components.
- The entire set-up including the CT-RAMP core model integrated with EMME transit and highway procedures was delivered to CMAP. Sampling strategy protocol for calibration runs was established (20% to save on run times).

3. Model Validation & Calibration in Phase 1

3.1. Validation & Calibration Targets

The following aspects of model validation and corresponding sources of information were considered:

- Three main levels of geography (CBD, CTA service area, remainder of region) are essential.
- Modes / lines summaries by Premium vs. Conventional services
- For Phase 1 the following main validation dimensions were adopted: Total Boardings by Premium vs. Conventional services (i.e. Rail vs. Bus); Sub-tabulated by interchanges between two services (i.e. transfers) and geography (i.e. cordon).
- 2002 Metra Origin-Destination Survey:
 - 65,000 Metra customers.
 - Used to create the Metra portion of the Year 2000 transit trip tables.
- 2000 Census Transportation Planning Package (CTPP):
 - Used to generate the HBW person trip table.
 - Transit flows are used to prepare non-Metra elements of Year 2000 HBW transit trip table for validation and calibration.
- 2007 Household Travel Survey (HTS):
 - All trip purposes in trip and tour format; rich set of person and household characteristics
 - Relatively small size.
- Future-year forecast for some meaningful scenarios is necessary to evaluate the model in Phase 2.

Transit calibration targets were developed from on-board surveys (CTA and Metra). Missing data on transit ridership were developed from the expanded HTS. Two sets of calibration targets were developed: Linked transit trips/tours for calibration of tour and trip-based mode choice models and unlinked trips for assessment of assignment results.

Linked trips included the same stratifications as used in the mode choice models (i.e., purpose and user segment class). Linked trip analysis converted data that is organized in the surveys as unlinked transit trips (i.e., boardings) into linked transit trips (origin to destination) and tours. Conversion to linked transit trips was done based on the transit trip record to infer the number of boardings incurred during the course of the trip (Metra and CTA surveys contain this information. The surveys did not contain information to exactly convert trip records to tour records but a reasonable approximation was applied dividing home-based linked trips by two and non-home based linked trips by three. This assumption was additionally tested and refined by examining the HTS dataset.

Survey derived linked trip and tour data were organized as a production zone-to-attraction zone trip (or tour) table. This allowed for an easy conversion to district-to-district tables for actual calibration and validation which can evolve over time as early calibration results are reviewed. A zone-to-zone linked trip table has the additional advantage that it can be assigned to the networks to help with QA/QC on the networks and to confirm path building parameters.

Two types of districts were used. A simple set of districts was defined for purposes of developing modespecific constants:

- CBD
- Urban
- Suburban
- Exurban

These areas were defined based on a quantitative measures (density and CMAP Pedestrian Environment Factor) and generated a 4x4 table, each potentially having its own (but related to its neighbors in a meaningful way) set of mode-specific constants. For validation, a more detailed district structure was used to confirm that the underlying model properly represents regional variations in transit travel. The structure used in the validation process most frequently included 16×16 table defined as follows:

- CBD
- Urban
 - o North
 - Northwest
 - West
 - Southwest
 - South
- Suburban
 - North
 - Northwest
 - West
 - Southwest
 - o South
- Exurban
 - North
 - Northwest
 - West
 - Southwest
 - South

This table was used to compare modeled trips to survey trips and to identify locations where the model results are significantly at variance from observed totals. Calibration was not performed at this level since 16×16 constants would over-specify the model. Instead, significant discrepancies were studied on a case-by-case basis to determine what, if any, corrective action is warranted. In Phase 1, essentially only the constants for the CBD destination were enabled.

Unlinked transit boardings were also organized to allow assignment results (boardings) to be compared to observed data. Assignment and survey boardings were separately reported for each model segment (purpose, socio-economic group, transit mode, and TOD). This stratification provided helpful

information regarding the elements of the model that are or are not working well and will confirm simulated transfer rates for each segment.

The comparison of modeled and observed transit boardings by stratum will be performed in Phase 2 for groups of 5-10 stations ("station groups") and bus routes serving a similar function ("bus route groups"). Transit assignments never accurately estimate route- or station level-ridership and the validation should concentrate on replicating observed ridership at a level of detail that can be realistically achieved.

3.2. Validation & Calibration Results

The new transit procedures were integrated into the CMAP CT-RAMP model system. This included transit assignment and skimming macros implemented in EMME macro scripting language for 4 transit modes (1=conventional transit with walk access, 2=premium transit with walk access, 3=park and ride, 4=kiss and ride) as well all required modifications to the CT-RAMP mode choice models (tour-level and trip-level) and Utility Expression Calculators. The modifications included new matrix references for the extended set of skims and new mode availability rules with respect to set of modes available for Premium and Conventional services as well as generic Park and Ride and Kiss and Ride. All transit assignment and network procedures were completely updated to incorporate a large number of additional attributes including vehicle, station, and service characteristics and tested. This procedure is based on the advance features incorporated in the latest version of EMME (3.4.3) that includes "Extended Transit Assignment with Variants".

The skims for transit LOS attributes are fed to the CT-RAMP mode choice model. The skims are calculated based on the new advanced methods that take into account combinations of several transit lines in the optimal strategy as shown schematically below. Some transit LOS components are handled through the combined frequency technique while some other ones through the embedded logit route choice. Each line obtains a share in the optimal strategy that is used to weigh the LOS variables of different lines. Transit procedures were currently implemented for two representative periods: 3 (AM peak) and 5 (Midday), for testing the new methodology and procedures. The corresponding skims are used to construct level-of-service variables for all periods. For example, the PM peak period is currently using transposed AM peak skims. The improvements to the transit procedures and mode choice model resulted in a much better match to the observed data. Below are examples of comparison of the model output at the tour level to the observed data (targets) by 2 main tour purposes (work and non-work), 4 transit modes (1=conventional transit with walk access, 2=premium transit with walk access, 3=park and ride, 4=kiss and ride), and 25×25 origin and destination districts. As an example in this report, we compare the model output to the expanded Household Travel Survey, 2007 - see Table 8-Table 15. Similar comparisons were made to all other available sources (CTPP journey-to-work table as well as Metra, CTA, and PACE on-board surveys)

Table 8: Comparison of Model Output to the Expanded Household Travel Survey, Work Tours, Conventional Transit with Walk Access (Phase 1)

	TARGETS		wc	DRK	WK C	ONV	HIS																			
rigin											De	stinatio	n Sector													
ctor	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Tota
1	63,172	1,950	-	-	280	2,216	280	709	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68
2N	95,466	35,325	1,907	1,598	955	-	1,064	2,668	2,012	-	637	-	-	-	-	-	-	-	-	-	-	-	-	-	-	141
NW	25,354	1,730	1,834	5,886	487	-	-	-	297	-	2,407	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
/NW	7,814	-	1,171	2,122	2,580	-	- 055	-	-	1,404	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
w /sw	19,301	1,010	1,314	1,119	1,082 3,368	839 5,313	856 1,831	56 -	-	-	-	-	-	194	-	-	-	-	-	-		-	-	-	-	24 19
SW	7,970 41,193	851	3,188	-	3,306	5,515	6,942	2,019	-	546	-	-	-	-	-	-	-	-	-	-		-	-	-		54
S S	37,561	1,694	745	-	2,322	943	4,232	25,014	-	451	140	175	-	505	745			-		-				-		7.
N	1,015	71	-	-	-	-	- 1,232	-	574	73	-	-	-	-		_	_	-	_	-		-	-	-	_	1
w	92	-	-	-	-	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
w	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N	285	-	-	-	-	-	-	-	-	-	-	-	2,474	-	-	-	-	-	-	-	-	-	-	-	-	
sw	142	-	-	-	4,488	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
w	946	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
s	-	-	-	-	-	-	852	513	-	-	-	-	-	-	1,025	-	-	-	-	-	-	-	-	-	-	
VI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N	186	- 70	-	-	-	-	-	207	-	-	-	-	-	301	-	-	-	1,674	- 10:	-	-	-	-	-	-	
N.	452	73	-	- 07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	124	-	-	-	-	-	-	
W	153	-	-	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,317	4,416	-	-	-	-	
w								-		-					_			-		3,317	4,410	1,141	_	-		
		-	_	_	-	_		-	-	_	_	_	_	_	-	_		-	_	-	_		-	_		
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	-	-	-																							
sw	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
vsw sw	300,648	42,703	10,159	10,813		9,384	16,057	31,185	2,882	2,473	3,184	175	2,474	1,000	1,770	-	-	1,674	124		4,416	1,141	-	-	-	46
IW VSW SW al		42,703			15,562		16,057	31,185	2,882	2,473	3,184	175	2,474	1,000	1,770	-		1,674	124		4,416	1,141			-	46
VSW SW	300,648	42,703	10,159 WC		-		16,057	31,185	2,882	2,473				1,000	1,770	-		1,674	124		4,416	1,141			-	46
sw w w	IODEL OUTPU	42,703 Г	wc	ORK	15,562 WK (ONV					De	estinatio	n Sector		İ		-			3,317			-	-		
w W gin tor	ODEL OUTPU	42,703 T	WC 2NW	ORK 2WNW	15,562 WK C	ONV	2SW	25	3N	3NW	De 3WNW	estinatio	n Sector 3WSW	3SW	1,770 3S	- - XWI		1,674 3IN	124 XIN		4N	1,141 4WNW			- - 4SW	То
w v gin cor	1 24,025	- 42,703 T	2NW 1,255	2WNW 445	15,562 WK (2WSW 1,090	2SW 1,285	2S 710	3N	3NW 40	De 3WNW 25	estinatio 3W 145	n Sector 3WSW	3SW	35	XWI	XIL	3IN		3,317 4NW	4N 5	4WNW	- 4W	-	4SW	To
w v gin or	1 24,025 57,070	- 42,703 T 2N 2,065 24,815	2NW 1,255 9,415	2WNW 445 1,180	15,562 WK (2W 1,010 1,265	2WSW 1,090 665	2SW 1,285 635	2S 710 935	3N 60 1,645	3NW 40 355	De 3WNW 25 360	28tinatio 3W 145 175	n Sector 3WSW 25 10	3SW 10 25	3S - 5	XWI -	XIL	3IN	XIN -	3,317 4NW 5	4N 5 205	4WNW	- 4W	4WSW	4SW	To
w v gin or	1 24,025	- 42,703 T	2NW 1,255	2WNW 445	15,562 WK (2WSW 1,090	2SW 1,285	2S 710	3N	3NW 40	De 3WNW 25	estinatio 3W 145	n Sector 3WSW	3SW	3S -	XWI -	XIL	3IN - -	XIN -	3,317 4NW	4N 5	4WNW	- 4W	4WSW	4SW	Тс
w v in or v w	1 24,025 57,070 19,030	2N 2,065 24,815 5,565	2NW 1,255 9,415 12,345	2WNW 445 1,180 2,150	15,562 WK C 2W 1,010 1,265 2,130	2WSW 1,090 665 685	2SW 1,285 635 275	2S 710 935 270	3N 60 1,645 665	3NW 40 355 780	25 360 560	28tinatio 3W 145 175 205	n Sector 3WSW 25 10 50	3SW 10 25 10	3S - 5	XWI -	- XIL	3IN - -	XIN -	3,317 4NW 5 115 180	4N 5 205 100	4WNW	- 4W	4WSW	4SW - -	To
w w in or	1 24,025 57,070 19,030 10,085	2N 2,065 24,815 5,565 1,665	2NW 1,255 9,415 12,345 4,090	2WNW 445 1,180 2,150 2,395	2W 1,010 1,265 2,130 2,870	2WSW 1,090 665 685 810	2SW 1,285 635 275 345	2S 710 935 270 165	3N 60 1,645 665 190	3NW 40 355 780 115	De 3WNW 25 360 560 175	28tinatio 3W 145 175 205 335	n Sector 3WSW 25 10 50 90	3SW 10 25 10 5	3S - 5 5	XWI	- XIL	3IN	XIN	3,317 4NW 5 115 180 35	4N 5 205 100 25	4WNW	- 4W	4WSW	4SW	Т
w v v v v v v v v v v v v v v v v v v v	1 24,025 57,070 19,030 10,085 14,230	2N 2,065 24,815 5,565 1,665 865	2NW 1,255 9,415 12,345 4,090 2,115	2WNW 445 1,180 2,150 2,395 1,565	2W 1,010 1,265 2,130 2,870 6,265	2WSW 1,090 665 685 810 2,185	2SW 1,285 635 275 345 680	2S 710 935 270 165 275	3N 60 1,645 665 190 75	3NW 40 355 780 115 45	25 360 560 175 160	28tinatio 3W 145 175 205 335 1,200	n Sector 3wsw 25 10 50 90 225	3SW 10 25 10 5	3S - 5 5	XWI	- XIL	3IN	XIN	3,317 4NW 5 115 180 35	4N 5 205 100 25	4WNW	- 4W	4WSW	4SW	Т
w w w w w v	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940	2N 2,065 24,815 5,565 1,665 865 440 550 1,360	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100	2WNW 445 1,180 2,150 2,395 1,565 570 320 185	15,562 WK C 2W 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940	2WSW 1,090 665 685 810 2,185 3,725	2SW 1,285 635 275 345 680 2,055 10,000 5,995	25 710 935 270 165 275 305	3N 60 1,645 665 190 75 5 35	3NW 40 355 780 115 45 25 10	25 360 560 175 160 120 55 20	145 175 205 335 1,200 795	n Sector 3WSW 25 10 50 90 225 255	3SW 10 25 10 5 35	3S - 5 5	XWI	- XIL	3IN	XIN	3,317 4NW 5 115 180 35 - 10 5	4N 5 205 100 25 35 - 5	4WNW	- 4W	4WSW	4SW	Т
w w iin or	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490	2N 2,065 24,815 5,565 865 440 550 1,360 635	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285	2WNW 445 1,180 2,150 2,395 1,565 570 320 185 10	15,562 WK C 2W 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 25	2WSW 1,090 665 885 810 2,185 3,725 2,370 1,260	2SW 1,285 635 275 345 680 2,055 10,000 5,995	25 710 935 270 165 275 305 3,450 21,490	3N 60 1,645 665 190 75 5 35 25	3NW 40 355 780 115 45 25 10 20 105	25 360 560 175 160 120 55 20	28stinatio 3W 145 175 205 335 1,200 795 240 200	n Sector 3wsw 25 10 50 90 225 255 70 85	3SW 10 25 10 5 35 60 925 960	3S - 5 5 - - - - 55 580	XWI	XIL	3IN 5 150	XIN	3,317 4NW 5 115 180 35 - 10 5 - 25	4N 5 205 100 25 35 - 5 110		- 4W	4WSW	4SW	To
w w in or	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135	2N 2,065 24,815 5,565 1,665 865 440 550 1,360 635 265	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990	2WNW	15,562 WK C 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 25 20	2WSW 1,090 665 8810 2,185 3,725 2,370 1,260	2SW 1,285 635 275 345 680 2,055 10,000 5,995	2S 710 935 270 165 275 305 3,450 21,490	3N 60 1,645 665 190 5 5 35 25 560 285	3NW 40 355 780 115 45 25 10 20 105 1,255	25 360 560 175 160 120 55 20 55	**************************************	n Sector 3WSW 25 10 50 90 9225 2255 770 85 - 10	3SW 10 25 10 5 35 60 925	3S - 5 5 5 5 5 5 5 5 6 5 6	XWI	- XIL	3IN 5 150	XIN	3,317 4NW 5 115 180 35 - 10 5	4N 5 205 100 25 35 - 5	4WNW	- 4W	4WSW	4SW	Т
w w in or	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135	2N 2,065 24,815 5,565 1,665 865 440 550 1,360 635 265 20	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 205	2WNW 445 1,180 2,150 2,395 1,565 570 320 120 40 40	2W 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 20	2WSW 1,090 665 685 810 2,185 3,725 2,370 1,260 - 5	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5	2S 710 935 270 165 275 305 3,450 21,490	3N 60 1,645 665 190 75 5 35 25 560 285	3NW 40 355 780 115 45 25 10 105 1,255 70	De 3WNW 25 360 560 175 160 120 55 500 330	28tinatio 3W 145 175 205 335 1,200 795 240 200 - 45 165	n Sector 3wsw 25 10 50 90 225 255 70 85 - 10 40	3SW 10 25 10 5 35 60 925 960	3S - 5 5 5 55 - 580	XWI	XIL	3IN	XIN	4NW 5 115 180 3,317 10 5 - 25 225 -	4N 5 205 100 25 35 - 5 - 110 75 -		- 4W	4WSW	4SW	Т
wwww	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135 50 435	2N 2,065 24,815 5,565 1,665 865 440 550 1,360 635 265	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 205 110	2WNW 445 1,180 2,150 2,395 1,565 570 320 185 10 40 40	15,562 WK C 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 25 20 20 375	2WSW 1,090 665 685 810 2,185 3,725 2,370 1,260 - 5 80	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 5	25 710 935 270 165 275 305 3,450 21,490	3N 60 1,645 665 190 5 5 35 25 560 285	3NW 40 355 780 115 45 25 10 20 105 1,255 70	De 3WNW 255 360 560 175 160 120 55 20 55 500 330 135	**************************************	n Sector 3wsw 25 10 50 90 225 255 70 85 - 10 40 715	3SW 10 25 10 5 5 35 60 925 960	3S - 5 5 5 5 5 5 5 5 6 5 6	XWI	- XIL	31N 5 150	XIN	3,317 4NW 5 115 180 35 - 10 5 - 25 225	4N 5 205 100 25 35 - 5 - 110 75		- 4W	4WSW	4SW	Т
w v v v v v v v v v v v v v v v v v v v	24,025 57,070 19,030 10,085 14,230 20,020 31,940 490 135 50 435 35	2N 2,065 24,815 5,565 1,665 865 440 1,360 635 265 20 5	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 205 110 10	2WNW 445 1,180 2,150 2,395 1,565 570 320 185 10 40 40 45 5	15,562 WK C 2W 1,010 1,265 2,130 2,870 6,265 3,235 1,235 940 25 20 20 3755 120	2WSW 1,090 665 685 810 2,185 3,725 2,370 1,260 5 80 50	25W 1,285 635 275 345 680 2,055 10,000 5,995 5 5	25 710 935 270 165 275 305 3,450 21,490 - - - 5	3N 60 1,645 665 190 75 5 35 25 560 285 100 5	3NW 40 355 780 115 45 25 10 20 105 1,255 70 - 10	Dec 3WNW 25 360 560 175 165 20 55 50 330 135 25	25 1,770 610	25 10 50 90 225 70 85 - 10 40 715 1,820	3SW 10 25 10 5 5 60 925 960 5 5	35 - 5 5 - - - - 55 55 580 - - -	XWI	- XIL	3IN 5 150	XIN	4NW 5 115 180 35 - 10 5 - 25 225	4N 5 205 100 25 35 - 5 - 110 75	4WNW	- 4W		4SW 5	To
wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135 50 435 50 435 1,215	2N 2,065 24,815 5,565 865 440 550 1,360 635 265 20 5	2NW 1,255 9,415 12,345 4,090 2,115 9550 1,100 285 990 205 110	2WNW 445 1,180 2,150 2,395 1,565 570 320 185 10 40 40	2W 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 25 20 20 375 120	2WSW 1,090 665 685 810 2,185 3,725 2,370 1,260 - 5 80	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 - 20 5 1,055	25 710 935 270 165 275 305 3,450 21,490 - - - - - - - - - -	3N 60 1,645 665 190 75 5 35 560 285 10 5 -	3NW 40 355 780 1115 45 25 10 20 105 1,255 70 -	25 360 560 175 160 120 55 20 55 500 330 135 25	28stinatio 3W 145 175 205 335 1,200 795 240 200 - 45 165 1,770 610 90	n Sector 3WSW 25 10 50 90 225 255 70 8 - 10 40 715 1,820	3SW 10 25 10 5 60 925 960 5 1,140	3S - 5 5 5 125	XWI	XIL	3IN 5 150 5 5	XIN	3,317 4NW 5 115 1180 35 - 10 5 - 25 225	4N 5 205 100 25 35 - 110 75	4WNW 5	4W	4WSW	4SW 5 5	To
w v v v v v v v v v v v v v v v v v v v	24,025 57,070 19,030 10,085 14,230 20,020 31,940 490 135 50 435 35	2N 2,065 24,815 5,565 1,665 865 440 550 1,360 635 265 20 5	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 205 110 10 -	2WNW 445 1,180 2,150 570 320 185 10 40 40 45 5 30	2W 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 25 20 20 375 120	2WSW 1,090 665 685 810 2,185 3,725 2,370 1,260 - - 5 80 50	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 5 5 - - 20 5 5 1,055	25 710 935 270 165 275 305 3,450 21,490 - - - 5 - 645 890	3N 60 1,645 665 1990 75 5 35 25 560 285 10 5	3NW 40 355 780 1115 45 25 10 105 1,255 70	De 3WNW 25 360 560 120 555 20 3330 135	**stinatio** 3W 145 175 205 335 1,200 795 240 200 - 45 165 1,770 610 90 5	25 10 50 90 225 70 85 - 10 40 715 1,820	3SW 10 25 10 5 35 60 925 960 - - - 5 1,140	3S - 5 5 5 125 1,080	XWI	- XIL	3IN 5 150 5 15	XIN	3,317 4NW 5 115 180 35 - 10 5 - 25 225	4N 5 205 100 25 5 - 5 - 110 75	4WNW	- 4W		4SW 5	To
w w w w w w w w w w w w w w w w w w w	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135 50 435 50 435 1,215	2N 2,065 24,815 5,565 1,665 440 550 1,360 635 265 20 5	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 205 110 10 - 5	2WNW	15,562 WK (1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 20 20 20 375 120 155 15	2WSW 1,090 665 810 2,185 3,725 2,370 1,260	2SW 1,285 635 275 345 680 2,055 5 5 5 - 20 5 5 1,055 75	25 710 935 270 165 275 305 21,490 - - - - 645 890	3N 60 1,645 6665 190 75 5 35 25 560 285 100 5	3NW 40 355 780 115 45 25 10 20 105 1,255 70 -	De 3WNW 25 360 175 160 120 555 55 55 55 50 135 20 135 25	205 335 1,200 795 240 200 - 45 1,770 610 90 5	n Sector 3WSW 25 10 50 90 225 255 70 8 - 10 40 715 1,820	3SW 10 25 10 5 35 60 925 960 - - - 5 1,140	3S - 5 5 125 1,080	XWI	- XIL	3IN 5 150 5 5	XIN	3,317 4NW 5 115 180 35 - 10 5 - 25 225	4N 5 205 100 25 35 - 110 75 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	4WNW 5	- 4W	4WSW	4SW 5	To
w w v v w v v w v v v v v v v v v v v v	1 24,025 57,070 19,030 10,085 14,230 20,020 31,940 4990 495 50 435 12,215 375	2N 2,065 24,815 5,565 1,665 865 440 550 1,360 633 265 20 5	2NW 1,255 9,415 12,345 4,090 2,115 965 500 1,100 285 990 205 110 10	2WNW 4445 1,180 2,150 2,395 1,565 570 320 185 10 40 40 45 5 30 -	15,562 WK C 1,010 1,265 2,130 6,265 3,235 940 25 20 20 375 120 155 15	2WSW 1,090 6695 6885 810 2,185 3,725 2,370 1,260 5 80 50 155	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 5 - 20 5 1,055 75 -	2S 710 935 270 165 275 305 3,450 21,490 - - - - 645 890	3N 60 1,645 665 190 75 5 35 5 25 560 285 10 5	3NW 40 40 355 780 115 45 25 10 20 105 1,255 70	De 3WNW 25 360 560 175 160 120 55 500 330 135 25	205 205 335 1,200 795 240 200 - 45 165 1,770 610 90 5	n Sector 3wsw 25 10 50 90 225 255 70 10 40 715 1,820 15 10 -	3SW 10 25 10 5 5 35 60 925 960 - - - 5 1,140 135	35 - 5 - - - - 55 580 - - - - - - - - - - - - - - - - - - -	XWI	- XIL	3IN 5 150 5 15	XIN	3,317 4NW 5 115 180 35 - 10 5 225	4N 5 205 100 25 35 - 110 75	4WNW 5	- 4W		4SW	To
w w w w w w w w w w w w w w w w w w w	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135 50 435 50 435 1,215	2N 2,065 24,815 5,565 1,665 865 440 635 200 550 1,360 635 265 20 35 2-5 -	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 205 110 10 - 5	2WNW	15,562 WK C 1,010 1,265 2,130 2,870 6,265 3,235 1,235 940 25 20 375 120 155 15	2WSW 1,090 665 810 2,185 3,725 2,370 1,260 5 80 500 155	2SW 1,285 635 275 345 680 2,055 5 5 5 - 20 5 5 1,055 75	2S 710 935 270 165 275 305 3,450 21,490 - - - 5 - 645 890 - -	3N 60 1,645 6665 190 75 5 35 25 560 285 100 5	3NW 40 355 780 115 45 25 10 20 105 1,255 70 -	De 3WNW 25 360 560 175 160 120 55 500 330 135 25	2stinatio 3w 145 205 335 1,200 795 240 200 - 165 1,770 610 90 5	n Sector 3WSW 25 10 50 90 225 255 70 8 - 10 40 715 1,820	3SW 10 25 10 5 35 60 925 960 5 1,140 135 15	3S	XWI	XIL	3IN	XIN	3,317 4NW 5 115 180 35 - 10 5	4N 5 205 100 25 35 - 110 75 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	4WNW 5	4W	4WSW	4SW	Т
w / / iin / w / / / / / / / / / / / / / / / / /	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135 50 435 35 1,215 37 -	2N 2,065 24,815 5,565 1,665 865 440 550 1,360 65 20 5 5 -	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 205 110 10	2WNW 4445 1,180 2,150 2,395 1,565 570 320 185 10 40 40 45 5 30 -	15,562 WK C 1,010 1,265 2,130 6,265 3,235 940 25 20 20 375 120 155 15	2WSW 1,090 6695 6885 810 2,185 3,725 2,370 1,260 5 80 50 155	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 5 - 20 5 1,055 75 -	2S 710 935 270 165 275 305 3,450 21,490 - - - - 645 890	3N 60 1,645 665 190 75 5 35 25 560 285 10 5	3NW 40 40 355 780 115 45 25 100 105 1,255 70	De 3WNW 25 5 60 120 55 50 00 330 135 25	205 205 335 1,200 795 240 200 - 45 165 1,770 610 90 5	n Sector 3wsw 25 10 50 90 225 255 70 10 40 715 1,820 15 10 -	3SW 10 25 10 5 5 35 60 925 960 - - - 5 1,140 135	35 - 5 - - - - 55 580 - - - - - - - - - - - - - - - - - - -	XWI	- XIL	3IN 5 150 5 15	XIN	3,317 4NW 5 115 180 35 - 10 5 - 25 225	4N 5 205 100 25 35 - 1110 75	4WNW 5	- 4W		4SW	Т
w / / iin / w / / w / / / / / / / / / / / / / /	1 24,025 57,070 19,030 10,085 14,230 20,020 31,940 490 135 50 435 1,215 375 	2N 2,065 24,815 5,565 865 1,665 865 440 550 1,360 635 205 5 - - - - - - 10	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 205 110	2WNW 445 1,180 2,150 2,395 1,565 570 320 185 10 40 40	15,562 WK C 1,010 1,265 2,130 2,870 6,265 3,235 940 25 20 20 375 120 155 15	2WSW 1,090 665 810 2,185 3,725 2,370 1,260 5 80 500 155	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 5 - 20 5 1,055 75 -	25 710 935 270 165 275 305 3,450 21,490 - - - - 645 890 - - -	3N 60 1,645 665 190 75 35 35 25 10 5 5 55 55	3NW 40 40 355 780 115 45 25 10 20 105 1,255 70 90	De 3WNW 25 360 560 175 160 120 55 500 330 135 25	28tinatio 3W 145 175 205 335 1,200 795 240 200 - 45 165 1,770 610 90 5	n Sector 3wsw 25 10 50 90 225 255 70 10 40 715 1,820 15 10 -	3SW 10 25 10 5 35 60 925 960 5 1,140 135	35 - 5 5 	XWI	XIL	3IN	XIN	3,317 4NW 5 115 180 35 - 10 5	4N 5 5 205 100 25 35 - 110 75 150	4WNW 5	4W		4SW	Т
w v v v v v v v v v v v v v v v v v v v	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135 50 435 35 1,215 37 -	2N 2,065 24,815 5,565 1,665 865 440 550 1,360 65 20 5 5 -	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 10 10	2WNW 445 1,180 2,150 2,395 1,565 570 320 185 10 40 40 45 5 30	15,562 WK C 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 25 20 20 375 120 155	2WSW 1,090 6655 685 810 2,185 3,725 2,370 1,260 5 80 50 155	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 5 - 20 20 5 1,055 75 5	25 710 935 270 165 275 305 3,450 21,490 - - - - 645 890 - - - - -	3N 60 1,645 665 190 75 5 55 560 285 100 5 - - - - - - - - - - - - -	3NW 40 355 780 115 45 25 10 105 1,255 70 90 15	De 3WNW 25 5 60 175 160 120 55 500 3330 135 25 5 5 - 5 5 5 5 5 5 5 5 5 5 5	**************************************	n Sector 3wsw 255 10 50 90 225 255 70 85 - 10 40 715 1,820	3SW 10 25 10 5 35 60 925 960 5 1,140 135 15	3S - 5 5	XWI	XIL	3IN	XIN	3,317 4NW 5 115 180 35 - 10 5 - 25 225	4N 5 205 100 25 35 - 1110 75	4WNW	4W	4WSW	4SW	To
w v v v v v v v v v v v v v v v v v v v	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135 50 435 35 1,215 375 	2N 2,065 24,815 5,565 865 1,665 865 440 550 1,360 635 205 5 - - - - - - 10	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 205 110	2WNW	15,562 WK C 1,010 1,265 2,130 2,870 6,265 3,235 940 25 20 20 375 120 155 15	2WSW 1,090 6655 685 810 2,185 3,725 2,370 1,260 5 80 50 155	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 5 - 20 20 5 1,055 75 5	25 710 935 270 165 275 305 3,450 21,490 - - - - 645 890 - - -	3N 60 1,645 665 190 75 35 35 25 10 5 5 55 55	3NW 40 40 355 780 115 45 25 100 105 1,255 70	De 3WNW 25 360 560 175 160 20 55 500 330 135 25 5 5 5 500 85 60 500 60 500 60 500 60 50 60 60 60 60 60 60 60 60 60 60 60 60 60	28tinatio 3W 145 175 205 335 1,200 795 240 200 - 45 165 1,770 610 90 5	n Sector 3wsw 25 10 90 225 225 70 85 - 10 40 40 715 1,820 15 5	3SW 10 25 10 5 35 60 925 960 5 1,140 135	3S - 5 5	XWI	XIL	3IN	XIN	3,317 4NW 5 115 180 35 - 10 5	4N 5 5 205 100 25 35 - 110 75 150	4WNW	4W		4SW	To
SW W	1 24,025 57,070 19,030 10,085 14,230 11,370 20,020 31,940 490 135 50 435 375 1,215 375 30 45 55 55	2N 2,065 24,815 5,565 1,665 865 440 550 1,360 65 20 5 5 - - - - - - - - - - - - - - - - -	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 205 110 10 45 30 55	2WNW 445 1,180 2,150 2,395 1,565 570 320 440 40 40 5 30 5	15,562 WK C 1,010 1,265 2,130 2,870 6,265 3,235 1,625 940 20 20 155 120 155 15 5	2WSW 1,090 665 685 810 2,185 3,725 2,370 1,260	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 20 5 1,055 75	25 710 935 270 165 275 305 3,450 21,490 - - - - 645 890 - - - - - - - - - - - - - - - - - - -	3N 60 1,645 665 190 75 5 35 25 560 285 10	3NW 40 355 780 115 45 25 10 105 1,255 70 90 15	De 3WNW 25 5 60 175 160 120 55 500 3330 135 25 5 5 - 5 5 5 5 5 5 5 5 5 5 5	**************************************	n Sector 3wsw 25 100 90 225 255 70 85 - 10 40 715 1,820 5 10	3SW 10 25 10 5 60 925 960 1,140 135	35 5 5 5 5 5 5 5 5 5 5 5 5 5	xwi	XIL	3IN	XIN	3,317 4NW 5 115 180 35 - 10 5 - 25 225	4N 5 205 100 25 35 - 110 75 150 1,595	4WNW	4W	4WSW	4SW	Tc
W W W W W W W W W W W W W W W W W W W	1 24,025 57,070 19,030 10,085 14,230 20,020 31,940 490 135 50 1,215 375 	2N 2,065 24,815 5,565 865 440 550 1,360 635 205 5 - - - - - 10 25 - -	2NW 1,255 9,415 12,345 4,090 2,115 965 550 1,100 285 990 205 1,10 10 45 30 55	2WNW 445 1,180 2,150 2,395 1,565 570 320 185 10 40 40 5 30	15,562 WK C 1,010 1,265 2,130 2,870 6,265 3,235 940 25 20 20 375 120 155 15 5	2WSW 1,090 665 685 810 2,185 3,725 2,370 1,260	2SW 1,285 635 275 345 680 2,055 10,000 5,995 5 20 5 1,055 75	25 710 935 270 165 275 305 3,450 21,490 - - - 5 - 645 890 - - - - - - - - - - - - - - - - - - -	3N 60 1,645 665 190 75 5 35 25 560 285 10 55 110 15	3NW 40 40 355 780 115 45 25 100 105 1,255 70	De 3WNW 25 3600 560 175 1600 555 500 330 135 5 5 - 5 5 5 5 5 5 5 5 5 5	**************************************	n Sector 3wsw 25 10 90 225 225 70 85 - 10 40 40 715 1,820 15 5	3SW 10 25 10 5 35 60 925 960	3S	xwi	XIL	3IN	XIN	3,317 4NW 5 115 180 35 - 10 5	4N 5 205 100 25 35 - 110 75 150 1,595	4WNW	4W		4SW	To

Table 9: Comparison of Model Output to the Expanded Household Travel Survey, Non-work tours, Conventional Transit with Walk Access (Phase 1)

	TARGETS		NON-	WORK	WK C	ONV	HIS	•																		
gin											De	estinatio	n Sector													
tor	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	xwı	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	То
	57,463	2,147	-	1,425	5,748	346	904	3,328	285	-	-	-	-	-	- 1	- 1	-	-	-	6,702	-	-	-	-	-	7
v -	27,841	44,996	3,799	652	1,630	-	-	582	582	-	-	81	-	-	-	-	-	-	-	-	-	-	-	-	-	
v l	11,223	4,516	9,826	14.343	-	-	1,527	239	-	-	-	-	-	-	-	-	-	-	-	1,527	-	-	-	-	-	
w	1,151	197	3,752	3,784	3,881	-	-,	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	
	13,720	481	298	3,016	14,404	988	522	1,916	-	_	-	662	_	-	-		-	_		662	-		-	-		
w	1,963	387	197	-	6,041	26,420	194		-	_	-	-	_	-	-		-	_		-	-	-		-		1
,	13,087	13,384		-	0,011	14,006	15,389	1,172		_	-	-		-			-	140		_	-		-	_		
	42,118	701	140	189	7,172	3,112	19,796	113,609	381	446	_			2,286	139			140		183				381		
	73	701	-	-			13,730	-	1,697	440	_	_		-	-		-	-		-	_		-	-		
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V	172,394	66,809	18,462	23,532	38,876	45,068	38,331	120,845	2,945	1,676	-	744	870	2,504	1,698 2,057	-	-	2,590	315	11,832	1,763	545	218	883	456 1,068	
V M							38,331	120,845	2,945	1,676		744	870			-		2,590	315	11,832	1,763	545	218	883		
м	172,394 ODEL OUTPUT		18,462 NON-\		38,876 WK C		38,331	120,845	2,945	1,676	-					-		2,590	315	11,832	1,763	545	218	883		
M(ODEL OUTPUT	г	NON-\	WORK	WK C	ONV					- De	estinatio	n Sector	2,504	2,057	-	-								1,068	
M(DDEL OUTPUT	ZN	NON-\	WORK 2WNW	WK C	ONV	2SW	25	3N	3NW	De 3WNW	estinatio 3W	n Sector 3WSW	2,504 3SW	2,057	- - XWI		2,590 3IN	315 XIN	11,832 4NW	1,763 4N	545 4WNW	218 4W	883 4WSW		
M(1 23,315	2N 8,310	NON-\ 2NW 3,320	2WNW 1,620	2W 2,685	2WSW 2,520	2SW 2,945	2S 4,255	3N	3NW 5	- De 3WNW	estinatio 3W	n Sector 3WSW	2,504 3SW 55	3S	-	XIL	3IN	XIN -	4NW	4N -	4WNW	4W	4WSW	1,068 4SW	
Mo n or	1 23,315 32,250	2N 8,310 45,055	2NW 3,320 10,155	2WNW 1,620 1,900	2W 2,685 915	2WSW 2,520 345	2SW 2,945 595	2S 4,255 1,430	3N 15 880	3NW 5 125	- De 3WNW 10 65	stinatio 3W 90 65	n Sector 3WSW 5	3SW 55 45	2,057	XWI	XIL -	3IN - -	XIN - -	4NW - 30	4N - 30		4W - -	4WSW	1,068	
MC n or	1 23,315 32,250 16,155	2N 8,310 45,055 12,330	2NW 3,320 10,155 18,955	2WNW 1,620 1,900 5,390	2W 2,685 915 2,285	2WSW 2,520 345 605	2SW 2,945 595 395	2S 4,255 1,430 765	3N 15 880 260	3NW 5 125 480	- De 3WNW 10 65 205	90 65 60	n Sector 3WSW 5 5 20	3SW 55 45 25	3S	-	XIL	3IN	XIN -	4NW	4N -	4WNW	4W	4WSW	1,068 4SW	
Mon or	1 23,315 32,250	2N 8,310 45,055	2NW 3,320 10,155	2WNW 1,620 1,900 5,390 6,575	2W 2,685 915 2,285 4,385	2WSW 2,520 345	2SW 2,945 595 395 495	2S 4,255 1,430 765 600	3N 15 880 260 25	3NW 5 125	- De 3WNW 10 65	stinatio 3W 90 65	n Sector 3WSW 5	3SW 55 45	3S	-	XIL -	3IN - -	XIN - -	4NW - 30	4N - 30	4WNW	4W - -	4WSW	1,068 4SW	
MC n or	1 23,315 32,250 16,155	2N 8,310 45,055 12,330	2NW 3,320 10,155 18,955	2WNW 1,620 1,900 5,390	2W 2,685 915 2,285	2WSW 2,520 345 605	2SW 2,945 595 395	2S 4,255 1,430 765	3N 15 880 260	3NW 5 125 480	- De 3WNW 10 65 205	90 65 60	n Sector 3WSW 5 5 20	3SW 55 45 25	3S	-	- XIL	3IN - -	XIN - -	4NW - 30	4N - 30 10	4WNW	4W - -	4WSW	1,068 4SW	
MC n or	1 23,315 32,250 16,155 11,950	2N 8,310 45,055 12,330 3,960	2NW 3,320 10,155 18,955 7,480	2WNW 1,620 1,900 5,390 6,575	2W 2,685 915 2,285 4,385	2WSW 2,520 345 605 860	2SW 2,945 595 395 495	2S 4,255 1,430 765 600	3N 15 880 260 25 25 20	3NW 5 125 480 30 20 5	- 3wnw 10 65 205	90 65 60 135 890 300	n Sector 3WSW 5 5 20 10	2,504 3SW 55 45 25 55 60 120	3S 5 5	-	- XIL	3IN - - - 5	XIN - -	4NW - 30 90	4N - 30 10	4WNW	4W - - -	4WSW	1,068 4SW	
Mon or or	1 23,315 32,250 16,155 11,950 17,515	2N 8,310 45,055 12,330 3,960 2,275	2NW 3,320 10,155 18,955 7,480 3,850	2WNW 1,620 1,900 5,390 6,575 4,825	2W 2,685 915 2,285 4,385 14,150	2WSW 2,520 345 605 860 4,125 9,735 3,300	25W 2,945 595 395 495 1,455	2S 4,255 1,430 765 600 925	3N 15 880 260 25 25 20 5	3NW 5 125 480 30 20 5	- De 3WNW 10 65 205 30 25 5 -	90 65 60 135 890 300 65	n Sector 3WSW 5 5 20 10 95 60 20	2,504 3SW 55 45 25 50 120 1,455	2,057 35 5 5 - 10 10 50	-	- XIL	3IN 5 5	XIN - -	4NW - 30 90 - 10	4N - 30 10 -	4WNW	4W - - - -	4WSW	1,068 4SW	7
Mon or or	1 23,315 32,250 16,155 11,950 17,515 13,085	2N 8,310 45,055 12,330 3,960 2,275 1,025	2NW 3,320 10,155 18,955 7,480 3,850 1,215	2WNW 1,620 1,900 5,390 6,575 4,825 1,165	2W 2,685 915 2,285 4,385 14,150 5,130	2WSW 2,520 345 605 860 4,125 9,735	25W 2,945 595 395 495 1,455 3,390	2S 4,255 1,430 765 600 925 1,185	3N 15 880 260 25 25 20 5	3NW 5 125 480 30 20 5	- De 3WNW 10 65 205 30 25 5	90 65 60 135 890 300	n Sector 3WSW 5 5 20 10 95 60	2,504 3SW 55 45 25 55 60 120	2,057 3S 5 5 - 10 10	-	- XIL	3IN 5	XIN - -	4NW - 30 90 - 10	4N - 30 10 - -	4WNW	4W	4WSW	1,068 4SW	7
Mon or or	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450	2W 2,685 915 2,285 4,385 14,150 5,130 1,510	2WSW 2,520 345 605 860 4,125 9,735 3,300	25W 2,945 595 395 495 1,455 3,390 21,280	2S 4,255 1,430 765 600 925 1,185 10,750	3N 15 880 260 25 25 20 5	3NW 5 125 480 30 20 5	- De 3WNW 10 65 205 30 25 5 -	90 65 60 135 890 300 65	n Sector 3WSW 5 5 20 10 95 60 20	2,504 3SW 55 45 25 50 120 1,455	2,057 35 5 5 - 10 10 50	-	- XIL	3IN 5 5	XIN - -	4NW - 30 90 - 10 -	4N - 30 10 - -	4WNW	4W	4WSW	1,068 4SW	1
Moin	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460	2W 2,685 915 2,285 4,385 14,150 5,130 1,510 975	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135	25W 2,945 595 395 495 1,455 3,390 21,280	2S 4,255 1,430 765 600 925 1,185 10,750 67,945	3N 15 880 260 25 25 20 5	3NW 5 125 480 30 20 5 5 5	De 3WNW 10 65 205 30 25 5 5 5 5 5	90 65 60 135 890 300 65 60	n Sector 3WSW 5 5 20 10 95 60 20	2,504 3SW 55 45 25 50 120 1,455	2,057 35 5 5 - 10 10 50	-	XIL	3IN - - 5 - - - 5 190	XIN	4NW - 30 90 - 10 -	4N - 30 10 - - - 5	4WNW	4W	4WSW	1,068 4SW	7
Months in Land	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200	8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10	2W 2,685 915 2,285 4,385 14,150 5,130 1,510 975 20	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5	2SW 2,945 595 395 495 1,455 3,390 21,280 13,415	2S 4,255 1,430 765 600 925 1,185 10,750 67,945	3N 15 880 260 25 25 20 5 25 20	3NW 5 125 480 30 20 5 5 155	De 3WNW 10 65 205 30 25 5 5 5 5	90 65 60 135 890 300 65 60	n Sector 3WSW 5 5 20 10 95 60 20	2,504 3SW 55 45 25 560 120 1,455 1,375	3S 5 5 10 10 10 50 970	- - - - - - - - -	XIL	3IN 5 5 190	XIN	4NW - 30 90 - 10 - 10 - 10	4N - 30 10 - - - 5 55	4WNW	4W	4WSW	4SW 5 5 5	7
Months in Land	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200 160	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25	2W 2,685 915 2,285 4,385 14,150 5,130 1,510 975 20	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5	2\$W 2,945 595 395 495 1,455 3,390 21,280 13,415	2S 4,255 1,430 765 600 925 1,185 10,750 67,945 15	3N 15 880 260 25 25 20 5 25 20 1,275 130	3NW 5 125 480 30 20 5 5 5 1,115	3WNW 10 65 205 30 25 - 5 - 5 255	90 65 60 135 890 300 65 60 10	n Sector 3wsw 5 5 20 10 995 60 20 20 -	2,504 3SW 55 45 25 55 60 120 1,455 1,375 - 5	2,057 35 5 5 - 10 10 50 970 -	- - - - - - - - - -	XIL	3IN 5 5 190	XIN	4NW - 30 90 - 10 10 125	4N - 30 10 5 5 55	4WNW 5 15	4W	4WSW	4SW 5 5	1
Mon or	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200 160 45	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25	2W 2,685 915 2,285 4,385 14,150 5,130 1,510 975 20 25	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5	25W 2,945 595 395 495 1,455 3,390 21,280 13,415	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10	3N 15 880 260 25 25 20 5 25 1,275 130	\$\begin{array}{cccccccccccccccccccccccccccccccccccc	De 3WNW 100 65 205 30 25 5 5 5 5 255 260	90 65 60 135 890 300 65 60 110	n Sector 3wsw 5 5 20 10 95 60 20 - - 35	2,504 3SW 55 45 25 55 60 120 1,455 1,375 -	2,057 35 5 5 - 10 10 50 970 -	- - - - - - - - - - - - - - - - - - -	XIL	3IN 5 5 190	XIN	4NW - 30 90 - 10 10 125	4N - 30 10 5 5 55	4WNW 5 15	4W	4WSW	4SW 5 5	7
Mon n por v	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200 160 45	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25 20 50	2W 2,685 915 2,285 4,385 14,150 5,130 1,510 975 25 25 330	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 5 85	25W 2,945 595 395 495 1,455 3,390 21,280 13,415	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10	3N 15 880 260 25 25 20 5 25 1,275 130 5	\$\begin{align*} \begin{align*} \begi	- De 3WNW 10 65 205 30 25 5 5 5 255 260 95	estinatio 3w 90 65 60 135 890 300 65 60 10 10 140 2,465	n Sector 3wsw 5 5 5 5 20 10 95 60 20 20 35 380 380	2,504 55 45 25 56 60 120 1,455 1,375 - 5	2,057 35 5 5 - 10 10 50 970 -	- - - - - - - - - - - - - - - - - - -	XIL	3IN 5 5 190	XIN	4NW - 30 90 - 10 10 2 10 125 -	4N - 30 10 - - - - - - - - - - - - -	4WNW	4W	4WSW	1,068 4SW	7
Moin	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200 160 45	8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 1,170 100 35	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25 20 50	2W 2,685 915 2,285 4,385 14,150 5,130 1,510 975 20 25 25 330 30	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 5 88	25W 2,945 595 395 495 1,455 3,390 21,280 13,415	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10 5	3N 15 880 260 25 25 20 5 25 25 1,275 130 5	\$\begin{array}{cccccccccccccccccccccccccccccccccccc	- De 3WNW 10 65 205 30 25 5 5 5 5 255 260 95	90 65 60 135 890 300 65 60 10 10 2,465	n Sector 3wsw 5 5 20 10 95 60 20 20 - - 35 380 2,150	2,504 55 45 25 55 60 120 1,455 1,375 - 5 5 5	2,057 3S 5 5 10 10 10 50		XIL	3IN 5	XIN	4NW - 30 90 - 10 - 10 12 10	4N - 30 10 5 5 55	4WNW	4W	4WSW	1,068 4SW	1
Mon n por v v v v v v v v v v v v v v v v v v v	23,315 32,250 16,155 11,950 17,515 14,650 30,700 200 45 195 40 290	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25 20 50 - 10	2W 2,685 915 2,285 14,150 5,130 1,510 975 20 25 25 330 30	20NV 2wsw 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 5 5 15 90	25W 2,945 595 395 495 1,455 3,390 21,280 13,415 - - 20 5 1,255	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10 5 10	3N 15 880 260 25 25 20 5 25 1,275 130 5	\$\begin{array}{cccccccccccccccccccccccccccccccccccc	- De 3WNW 10 65 205 5 5 5 5 255 260 95	90 65 60 135 890 300 65 60 10 10 140 2,465 330 25	n Sector 3wsw 5 5 20 10 95 60 20 20 - - - 35 380 2,150	2,504 3SW 55 45 25 55 60 120 1,455 1,375 - 5 - 5 1,825	2,057 3S 5 5 10 10 50 970 125		XIL	3IN 5	XIN	4NW - 30 90 - 10 10 125	4N - 30 10 5 55	4WNW	4W	4WSW	1,068 4SW	1
Mon n por v	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200 160 45 195 40 299	8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25 20 50 - 10	2W 2,685 915 2,285 14,150 5,130 1,510 975 20 25 25 330 30	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 85 15 90 5	25W 2,945 595 395 495 1,455 3,390 21,280 13,415 - - 20 5 1,255	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10 5 10	3N 15 880 260 25 25 25 20 5 1,275 130 5	\$\begin{array}{cccccccccccccccccccccccccccccccccccc	- De 3WNW 10 65 5 5 5 5 5 260 95	90 65 60 135 890 300 65 60 10 10 140 2,465 330 25	n Sector 3wsw 5 5 20 10 95 60 20 20 - - - 35 380 2,150	2,504 3SW 55 45 25 55 60 120 1,455 1,375 - 5 5 1,825 1,825	2,057 3S 5 5 10 10 50 970 125		- XIL	3IN 5	XIN	4NW 30 90 - 10	4N - 30 10	4WNW	4W	4WSW	1,068 4SW	1
Mon n por v	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 200 160 45 195 40 290 135	2N 8,310 45,055 12,330 2,275 1,025 1,140 770 215 25 65 35	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25 20 50 - 10	2W 2,685 915 2,285 4,385 14,150 5,130 975 20 25 25 330 30 45	20NV 2wsw 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 5 5 15 90	25W 2,945 595 395 495 1,455 3,390 21,280 13,415 - - 20 5 1,255 70	25 4,255 1,430 765 600 925 1,185 10,750 67,945 10 5 10 5 485 650	3N 15 880 260 25 25 20 5 25 1,275 130 5	3NW 5 125 480 30 20 5 5 5 155	- De 3WNW 10 65 205 30 25 5 5 5 255 260 95	90 65 60 135 890 300 65 60 10 10 140 2,465 330 25 5	n Sector 3wsw 5 5 20 10 95 60 20 20 35 380 2,150	2,504 3SW 55 45 25 55 60 120 1,455 1,375 - 5 5 1,825 125	2,057 35 5 5 10 10 50 970 125 1,955		- XIL	3IN	XIN	4NW - 30 90 - 10 10 125	4N 30 10	4WNW	4W	4WSW	1,068 4SW	1
Mon n por v	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 200 200 160 45 195 40 290 135	8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15 -	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25 20 50 - 10	2W 2,685 915 2,285 4,385 14,150 975 20 25 330 30 45 15	2WSW 2,520 2,520 860 860 4,125 3,300 1,135 5 5 90 5	25W 2,945 595 395 495 1,455 1,455 200 5 1,255 70 - 5	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10 5 10 5 600 10 5 600 10 750 600 600 600 600 600 600 600 600 600 6	3N 15 880 260 25 25 25 25 1,275 130 5	3NW 5 125 480 30 20 5 5 5 155	- De 3WNW 10 65 205 30 25 5 5 5 5 255 260 95	90 65 60 135 890 300 65 60 10 140 2,465 5	n Sector 3wsw 5 5 20 10 95 60 20	2,504 3SW 55 45 25 55 60 120 1,455 1,375 5 - 5 1,825 125	2,057 35 5 5 10 10 10 50 970 125 1,955 20		- XIL	3IN	XIN	4NW 30 90 10	4N	4WNW	4W	4WSW	1,068 4SW	7
Man n n n n n n n n n n n n n n n n n n	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200 160 45 195 40 299 195 	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 10 25 20 - 10	2W 2,685 915 2,285 4,385 14,150 5,130 975 20 25 25 330 30 45	2WSW 2,520 345 605 860 4,125 5 5 5 5 5 15 90 0 5	25W 2,945 595 395 495 1,455 3,390 21,280 13,415 - - 20 5 1,255 70	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10 5 485 650 -	3N 15 880 260 25 25 20 5 20 5 1,275 130 5	3NW 5 125 480 30 20 5 5 5 155 1,115 60	- De 3WNW 10 65 205 30 25 5 5 5 255 260 95	90 65 60 135 890 300 65 60 10 10 140 2,465 330 25 5	n Sector 3wsw 5 5 20 10 95 60 20 20 35 380 2,150	2,504 3SW 55 45 25 56 60 120 1,455 - 5 5 5 1,825	2,057 35 5 5 10 10 50 970 125 1,955		XIL	3IN	XIN	4NW 30 90 - 10 10 125	4N	4WNW	4W	4WSW	1,068 4SW	7
Man n n n n n n n n n n n n n n n n n n	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 200 160 45 195 40 290 135 	8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15 - 65 35 - - 5	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15 40	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 460 10 25 20 50 - 10	2W 2,685 915 2,285 4,385 14,150 975 20 25 25 25 30 30 45 15	2WSW 2,520 345 605 860 4,125 9,735 3,300 5 5 5	25W 2,945 595 395 495 1,455 3,390 21,280 13,415	25 4,255 1,430 765 600 925 1,185 10,750 5 10,00 5 10 5 485 650 	3N 15 880 260 25 25 20 5 5 5 5 5 - - -	3NW 5 125 480 30 20 5 5 5 155	- De 3WNW 100 65 205 5 5 5 5 5 260 995	90 65 60 135 890 300 65 60 10 10 2,465 5 5	n Sector 3wsw 5 5 20 10 95 60 20	2,504 3SW 55 45 25 55 60 120 1,455 5 5 5 1,875	2,057 3S 5 5 10 10 970 125 1,955 20		XIL	3IN	XIN	4NW 30 90 10	4N 30 10	4WNW	4W	4WSW	1,068 4SW	7
Moor or	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 200 200 160 45 195 40 290 135 	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15 - - - - - - - - - - - - -	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15 40 10	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 10 25 50 - 10	2W 2,685 915 2,285 4,385 14,150 5,130 1,510 20 25 25 330 30 455 15	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 85 15 90 5 5	2SW 2,945 595 395 495 1,455 3,390 21,280 13,415 1,255 70	25 4,255 1,430 765 600 925 1,185 10,750 5 10,00 5 10 5 485 650 	3N 15 880 260 25 25 20 5 20 5 1,275 130 5	3NW 5 125 480 30 20 5 5 155 1,115 60	- De 3WNW 100 65 205 30 5 5 5 5 5 5 5 5 5 5 5 6 6 7 5 7 5 7 5 7	90 65 60 135 890 300 65 60 10 10 140 2,465 330 5 5	n Sector 3wsw 5 5 20 10 95 60 20	2,504 3SW 55 45 25 55 60 120 1,455 1,375 5 - 5 1,825	2,057 35 5 5 10 10 10 50 970 125 1,955 20		XIL	3IN	XIN	4NW 30 90 - 10 10 125	4N	4WNW	4W	4WSW	1,068 4SW	7
Moin or	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200 160 45 49 40 290 290 135 	8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15 - 65 35 - - 5	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 400 10 25 20 10	2W 2,685 915 2,285 4,385 14,150 20 25 330 30 45 15	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	25W 2,945 595 395 495 1,455 3,390 21,280 13,415	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10 5 10 5 10 65 925 1,185 10,750 67,945 15 10 10 5 10 10 5 10 10 5 10 10 10 10 10 10 10 10 10 10 10 10 10	3N 15 880 260 25 25 20 5 1,275 130 5 10 50 -	3NW 5 125 480 30 20 5 5 5 155 1,115 60	- De 3WNW 100 65 205 30 25 5 5 5 5 255 260 95 5 5	90 90 65 60 135 890 300 65 60 10 10 140 2,465 330 25 5	n Sector 3WSW 5 5 20 10 20 20 35 380 2,150	2,504 3SW 55 45 25 60 120 1,455 1,375 5 - 5 1,825	2,057 3S 5 5 10 10 50 970 125 1,955 20		XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	1,068 4SW	1
Moor or www.	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 200 200 160 45 49 40 290 135 40 40 290 135 40 40 40 40 40 40 40 40 40 40 40 40 40	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15 - - - - 3 3 3 5 - - - - - - - - - - -	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15 40 10 5	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 4500 10 0 5 0 10	2W 2,685 915 2,285 4,385 14,150 5,130 1,510 975 20 25 330 30 45 15	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 85	25W 2,945 595 395 1,455 3,390 21,280 13,415	25 4,255 1,430 765 600 925 1,185 10,750 5 10 5 10 5 485 650 - - - - - - - - - - - - - - - - -	3N 15 880 260 25 25 20 5 5 5 - - - 10 50	3NW 5 125 480 30 20 5 5 155 155 1,115 60	- De 3WNW 100 65 205 5 5 5 5 5 5 5 60 95 5 5 - 5 5 5 5 5 5 5 5 5 6 5 6	25tinatio 3W 900 655 600 1355 8900 3000 655 600 100 1400 2,465 3300 255 5	n Sector 3wsw 5 20 100 95 600 20 20	2,504 3SW 55 45 25 55 60 120 1,455 5 5 5 1,875	2,057 3S 5 5 10 10 10 50 970 125 1,955 20		XIL	3IN	XIN	4NW	4N 30 10	4WNW	4W	4WSW	1,068 4SW	Т
	1 23,315 32,250 16,155 11,950 17,515 13,085 14,650 30,700 200 160 45 49 40 290 290 135 	2N 8,310 45,055 12,330 3,960 2,275 1,025 1,140 3,110 770 215 25 15 - - - - - - - - - - - - -	2NW 3,320 10,155 18,955 7,480 3,850 1,215 530 1,170 215 660 100 35 15	2WNW 1,620 1,900 5,390 6,575 4,825 1,165 450 400 10 25 20 10	2W 2,685 915 2,285 4,385 14,150 20 25 330 30 45 15	2WSW 2,520 345 605 860 4,125 9,735 3,300 1,135 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	2SW 2,945 595 395 495 1,455 3,390 21,280 13,415 1,255 70	25 4,255 1,430 765 600 925 1,185 10,750 67,945 15 10 5 10 5 10 65 925 1,185 10,750 67,945 15 10 10 5 10 10 5 10 10 5 10 10 10 10 10 10 10 10 10 10 10 10 10	3N 15 880 260 25 25 20 5 1,275 130 5 10 50 -	3NW 5 125 480 30 20 5 5 155 1,115 60	- De 3WNW 100 65 205 30 25 5 5 5 5 255 260 95 5 5	90 90 65 60 135 890 300 65 60 10 10 140 2,465 330 25 5	n Sector 3WSW 5 5 20 10 20 20 35 380 2,150	2,504 3SW 55 45 25 60 120 1,455 1,375 5 - 5 1,825	2,057 3S 5 5 10 10 50 970 125 1,955 20		XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	1,068 4SW	1

Table 10: Comparison of Model Output to the Expanded Household Travel Survey, Work tours, Premium Transit with Walk Access (Phase 1)

	TARGETS		wc	RK	WK	PRE	HIS	•																		
Origin											De	stinatio	n Sector													
Sector	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
1	4,683	-	742	-	-	-	-	-	-	-	1,306	-	1,255	-	-	-	-	103	-	-	176	-	-	-	-	8,264
2N 2NW	15,303	664	-	-	-	-	-	-	98	-	-	325	-	-	-	-	-	-	-	-	312	-	-	-	-	16,702
2WNW	3,970 1,046	761	-	3,603	-	-	-	308	-	325	378	308	224	-	-		-	-		183	-	-	-	-	-	5,618 5,490
2W	1,662	-	-	3,003	-	-	-	-	-		161	-	-	-	-		-	-		-	-	-		-	_	1,823
2WSW	7,562	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,660
2SW	2,221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,221
25	22,928	780	-	-	143	-	-	3,748	-	140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27,738
3N	6,467	381	-	-	-	-	-	2,354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,202
3NW	3,455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,455
3WNW	5,104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,104
3W 3WSW	8,442 17,249	2,992 456	-	-	-	-	-	-	-		282	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11,433 17,987
3SW	8,412	430	-	-	-	-	-	-	-		- 202		-	-	-		-	-		-	-	-		-	-	8,412
35	2,991		_	_	-	-	-	1,226	-		-		-	-		-	-	-		-	_			-	_	4,217
XWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-,217
XIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	
3IN	3,102	-	-	-	-	-	-	-	-	43	-	-	-	-	-	-	-	88	-	-	-	-	-	-	-	3,233
XIN	1,844	-	-	-	-	-	-	227	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	2,089
4NW	6,878	87	-	-	-	-	218	-	-	486	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,669
4N	5,912	-	-	-	-	-	-	-	-	-	740	-	-	-	-	-	-	-	-	-	3,137	-	-	-	-	9,789
4WNW	1,061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,061
4W 4WSW	1,129 4,654	-	-	-	-	-	-	- 83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,129 4,738
45W	7,757	_	-	-	-	-	-	- 03	-		-		-	-	-		-	-		-	-	-		-	-	7,757
Total	143,833	6,121	840	3,603	143	_	218	7,946	98	994	2,867	634	1,479	-	_	-	-	191	18		3,625	-	-	_	-	172,793
,	10DEL OUTPU		wc			PRE																				,
Origin	IODEL OUT O	•	***	7111	****						De	ctinatio	n Sector				l									
Sector	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	xwı	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
1	530	470	570	125	165	75	65	525	160	140	60	100	180	15	10			5	-	40	75	10	5	-	5	3,330
2N	20,685	355	300	35	90	40	5	95	145	105	60	20	30	5	-	-	-	-	-	30	190	5	-	-	-	22,195
2NW	10,940	125	370	90	65	20	35	45	75	125	50	10	45	-	-	-	-	-	-	25	65	10	-	-	-	12,095
2WNW	5,860	60	100	85	25	20	20	25	20	25	40	25	10	5	-	-	-	5	-	10	35	-	-	-	-	6,370
2W	4,515	60	100	20	60	25	-	25	30	15	25	20	80	5	-	-	-	-	-	-	25	5	-	-	-	5,010
2WSW	8,160	95	110	35	35	95	55	40	10	20	15	15	65	5	-	-	-	-	-	-	5	-	5	5	-	8,770
2SW	5,590	85	135	50	65	15	40	90	50	10	35	15	55	20	10	-	-	-	-	5	10	5	-	-	-	6,285
2S 3N	40,385 1,645	245 50	550	65	250	185	205	1,280 5	35	30	15	- 60	- 60	80	35	-	-	-	-	15	60 60	-	-	5	-	43,560
3NW	1,645	35	35 170	20	10 15	-	- 5	10	30 10	75	15 20	10	- 5	-	-		-	1 1		15 5	30	-	-	-	-	1,865 1,615
3WNW	980	30	45	20	30	- 5		-	5	5	40	5	-	-	-		-	-		-	10	- 5		-	-	1,180
3W	4,230	55	115	10	115	35	30	25	15	10	55	125	105	-	-	-	-	-	-	5	-	-	-	- 5	-	4,935
3WSW	9,205	20	95	20	130	110	55	45	5	15	35	70	400	5	-	-	-	-	-	-	-	-	10	5	5	10,230
3SW	5,200	40	25	15	50	50	60	100	5	5	10	25	35	105	15	-	_		-			-		-	-	5,740
				-	15	15	25	100	-	-	-	5	5	5	30	-	-	10	-	-	-	-	-	-	-	3,415
35	3,160	30	15	-													_	1		25					_	100
xwı		30 25	15 5	-	-	-	-	-	-	-	-	-	-	-	-	-	_			25	30	-	-	-		
XWI XIL	3,160 15	25 -	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XWI XIL 3IN	3,160 15 - 460	25 - 5	5	-	- - 5	-	-	- - 20	- - -	- - -	-	- - -	-	10	5	-	-	-	-	-		-	-	-	-	- 520
XWI XIL 3IN XIN	3,160 15 - 460 50	25 - 5	5 - 10 -	- - -	- - 5	- - 5		- - 20 -	-	-	-	-	-	10		-	- - -	-	-	- - -	- - -	-	-	-		- 520 55
XWI XIL 3IN XIN 4NW	3,160 15 - 460 50 875	25 - 5 - 80	5 - 10 - 310	- - - - 5	- - 5 - 10	- - 5 -	- - -	- 20 -	- - 165	- - 145	- - 70	- - 5	- - 5	10 - -	5 5 -	- - -	- - -		-	- - - 235	- - - 60	- - -	- - -	-	-	- 520 55 1,965
XWI XIL 3IN XIN 4NW 4N	3,160 15 - 460 50 875 1,310	25 - 5 - 80 165	5 - 10 - 310 50	- - - - 5	- - 5 - 10	- - 5	-	- - 20 -	- - 165 125	- - 145 35	- - 70 10	- - 5 5	- - 5	10	5	-	- - -	-	-	- - -	- - - 60 210	-	-		-	- 520 55 1,965 2,030
XWI XIL 3IN XIN 4NW	3,160 15 - 460 50 875 1,310 315	25 - 5 - 80	5 - 10 - 310 50 35	- - - - 5	5 - 10 -	- - 5 - -	- - - 5	- 20 - -	- - 165	- - 145	- - 70	- - 5 5 40	- - 5 5	10 - -	5 5 - -	- - - - - -	- - -		-	- - - 235	- - - 60	- - -	- - - -	-	-	- 520 55 1,965 2,030 520
XWI XIL 3IN XIN 4NW 4N 4N	3,160 15 - 460 50 875 1,310	25 - 5 - 80 165 20	5 - 10 - 310 50	- - - - 5	- - 5 - 10	- - 5 - - -	- - - 5	- 20 - - -	- - 165 125 5	- 145 35 15	- - 70 10 45	- - 5 5 40 35	- - 5	10 - - -	5 5 - -	- - - -	- - - -	- - - -	- - - -	- - 235 105	- - - 60 210	- - - 5	- - - -	- - - -	- - - -	- 520 55 1,965 2,030 520 395
XWI XIL 3IN XIN 4NW 4N 4WNW 4WNW	3,160 15 - 460 50 875 1,310 315 325	25 - 5 - 80 165 20	5 - 10 - 310 50 35 5	- - - - 5	5 - 10 - 10 10	5	- - - 5 -	- 20 - - - -	- 165 125 5	- 145 35 15	- 70 10 45	- - 5 5 40	- - 5 5 10	10 - - - - -	5 5 - - -	- - - -	-	- - - -	- - - -	- - 235 105 - -	- - 60 210 20	- - - 5 -	- - - - -	- - - -	- - - - -	520 55 1,965 2,030 520 395 930 1,145

Table 11: Comparison of Model Output to the Expanded Household Travel Survey, Non-work Tours, Premium Transit with Walk Access (Phase 1)

	TARGETS		NON-	WORK	WK	PRE	HIS																			
igin											De	estinatio	n Sector													
ctor	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Tot
1	1,115	-	-	-	-	-	-	-		-	-	-	-	-	280	-	-	-	-	285	-	-	-	-	-	. :
N	2,511	458	-	-	-	-	-	-	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	. 3
IW NW	378 161	-	-	-	-	-	-	-	-	-	-	239	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N	- 101		-	_	_	-	-	-	-			-	-	-		_	-	-		-		-		_		
sw	702	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
v	175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3,844	-	-	-	-	-	-	2,027	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1,645	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	524	-	-	-	-	-	
'	257	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N	374	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1,555	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N	1,939	-	-	-	-	-	1,363	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
'	5,390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	5,390		-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-				-	-	
	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		-		-	-	
	82	63	-	-	-	-	-	-	-	-	-	-	-	-		-	-	218	-	-		-		-	-	
H	35	-	-	-	-	-	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
,	3,357	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	556	-	-	-	-	-	
	1,006	232	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18,388	-	
	1,087	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
v		905	-	-	-	-	1,363	2,087	52	-	-	239	-	-	280	-	-	218	-	1,366	-	-	-	18,388	-	
M	1,087	905	-	WORK	- WK	-		2,087		-	-		-	-		-	-		-		-	-	-		-	
M	1,087 25,612	905	-	-	-	-		2,087		-	-		-	-		-	-		-		-	-	-		-	
M	1,087 25,612	905	-	-	-	-		2,087 25		- - 3NW	-	239	-	3SW		xwi	XIL		XIN		- - 4N		- - 4W		- - 4SW	
M	1,087 25,612 ODEL OUTPUT	905 2N 565	- NON-	WORK 2WNW 195	- WK 2W 250	PRE 2WSW 295	2SW 125	25 1,325	3N 30	3NW 25	- De 3WNW 35	239 estinatio 3W	n Sector 3WSW	- 3SW 20	280	XWI	-	3IN	-	1,366 4NW 45	4N 50	- 4WNW 25	-	18,388 4WSW 5	4SW 10	
M n or	1,087 25,612 ODEL OUTPUT 1 330 2,765	905 2N 565 405	NON- 2NW 590 130	- WORK 2WNW 195 25	- WK 2W 250 40	- PRE 2WSW 295 20	2SW 125 25	25 1,325 75	3N 30 85	3NW 25 30	- De 3WNW 35 15	239 estinatio 3W 65 15	- Sector 3WSW 115 35	3SW 20 10	280 3S 15	- xwi - 10	XIL -	218 3IN	XIN -	4NW 45 10	4N 50 45	4WNW 25 5	4W 20	18,388 4WSW 5	10	
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M n or	1,087 25,612 ODEL OUTPUT 1 330 2,765 2,895 1,670 1,395	905 2N 565 405 210 50 55	2NW 590 130 435 105 60	2WNW 195 25 70 150 55	- WK 2W 250 40 55 60 140	2WSW 295 20 20 5	2SW 125 25 35 20 20	2S 1,325 75 110 80 85	3N 30 85 15	3NW 25 30 25 10	- De 3WNW 35 15	239 estinatio 3W 65 15 15 30	n Sector 3WSW 115 35 20 30 55	3SW 20 10 10 25	280 3S 15 - 10 5 5	- XWI - 10 5	XIL -	3IN - 5	- XIN	4NW 45 10 5 10	- 4N 50 45 25 5	4WNW 25 5 - 5 15	- 4W 20 - 5 - 5	18,388 4WSW 5 5 -	10 - 10 -	
M n n or	1,087 25,612 ODEL OUTPUT 1 330 2,765 2,895 1,670 1,395 2,095	905 2N 565 405 210 50 55 55	2NW 590 130 435 105 60 45	- WORK 2WNW 195 25 70 150 55 45	2W 250 40 55 60 140 65	2WSW 295 20 20 5 90 225	2SW 125 25 35 20 20 45	25 1,325 75 110 80 85 105	3N 30 85 15 10 25	3NW 25 30 25 10 15 5	- De 3WNW 35 15 15 20	239 2stinatio 3W 65 15 15 20	n Sector 3wsw 115 35 20 30 55 60	3SW 20 10 10 25 15	280 3S 15 - 10 5 5 5	- XWI - 10 5	XIL	3IN - 5	- XIN	4NW 45 10 5 10 10	- 4N 50 45 25 5 10 10	4WNW 25 5 5 15 15 10	- 4W 20 - 5 - 5 - 5	18,388 4WSW 5 5 - - - 5	10 - 10 - -	
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M n pr	1,087 25,612 ODEL OUTPUT 1 330 2,765 2,895 1,670 1,395 2,095 825 11,950 2,885 420	905 2N 565 405 210 50 55 55 50 305 110 45	2NW 590 130 435 105 60 45 55 305 5 65	- WORK 2WNW 195 25 70 150 55 45 20 65	2W 250 40 55 60 140 65 30 125	2WSW 295 20 20 5 90 225 30 125 5 5 5	2SW 125 25 35 20 20 45 115 355 5 5	25 1,325 75 110 85 105 180 3,635 20	3N 30 85 15 10 25 - 15 40 40	3NW 25 30 25 10 15 5 15 35	- De 3WNW 35 15 15 20 10 15 5 10	239 estinatio 3W 65 15 15 30 20 10 80 5	n Sector 3wsw 115 35 20 30 55 60 25 90 5	3SW 20 10 10 25 15 15 50 185 -	3S 15 - 10 5 5 5 15 115 - 10 10 10 10 10 10 10 10 10 10 10 10 10	xwi - 10 5	XIL	3IN - 5 35	XIN	1,366 4NW 45 10 5 5 10 10 20	4N 50 45 25 5 10 10 40	4WNW 25 5 5 15 10 5	4W 20 - 5 - 5 - 10 -	18,388 4WSW 5 5 - - - 5 5 20	10 - 10 - - - - 5 25	
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Table 12: Comparison of Model Output to the Expanded Household Travel Survey, Work Tours, KNR (Phase 1)

	TARGETS		wo	RK	KI	NR.	HIS	•																		
Origin											De	stinatio	Sector													
Sector	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
1	1,491	-	-	-	-	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,603
2N	6,622	-	- 405	-	-	-	-	139	1,278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,039
2NW	3,856 4,306	-	186	-	-	-	-	416	-	-	320		- 224	-	-	-	-	-	-	-		-	-	-	-	4,778 4,530
2WNW 2W	2,482	-	-		-	-	-	-	-	-			224		-	-	-	-		-		708	-		-	3,190
2WSW	177	-	-		-	_	_	-	-	_	_	_	_	-	_	_	-	_	_	-		- 700	-		_	177
2SW	5,492	_	-		-	-	_	_	678	-			-		-	-	-	-	_	-		- 1	-	_	-	6,170
25	5,885	1,726	-	-	-	-	-	619	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,230
3N	560	-	-	-	-	-	-	397	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	957
3NW	4,000	-	-	-	-	-	-	-	-	-	-	89	116	-	-	-	-	-	-	73	-	-	-	-	-	4,278
3WNW	9,304	-	591	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,895
3W	2,676	-	-	-	369	-	-	-	-	-	-	285	1,196	-	-	-	-	-	-	-	-	-	-	-	-	4,527
3WSW	14,744	-	-	-	-	-	-	-	-	-	-	487	-	-	-	-	-	-	-	-	-	-	-	-	-	15,231
3SW	5,540	-	-	-	-	-	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,540
3S XWI	2,283	-	-		-	-	-	- 64	-	-	-		-	-	-	-	-	1 1	-	-		-	-	-	-	2,347
XIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	
3IN	4,096	-	-	-	-	-	55	87	-	43	_	-	96	-	-	-	-	88	-	-	-	- 1	-	-	-	4,465
XIN	1,456	-	-	-	-	-	-	-	-	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,504
4NW	8,655	765	73	-	-	-	-	-	185	-	-	-	153	-	-	-	-	-	-	218	-	-	-	-	-	10,049
4N	1,569	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,569
4WNW	509	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	509
4W	1,022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,022
4WSW	3,438	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,438
4SW Total	5,267 95,431	2,491	849	-	369	112	- 55	1,722	2,141	-	320	861	1,784	-	-	-	-	- 88	-	291	-	-	-	-	-	5,267 107,314
TOTAL	95,451	2,491	649	-	309	112	22	1,722	2,141	91	320	901	1,704	-	-		-	00	_	291	-	708	- 1	-	-	107,514
			14/0	DI	1/8	10																				
	ODEL OUTPU	т	wo	RK	KI	NR																				
Origin												estinatio														
Origin Sector	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
Origin Sector	1	2N 280	2NW 305	2WNW 80	2W 125	2WSW 240	170	140	10	10	3WNW 10	3W 20	3WSW 30	5	-	XWI -	XIL -	3IN -	XIN	5	5	4WNW	4W	4WSW	4SW	1,760
Origin Sector 1 2N	1 325 9,555	2N 280 1,030	2NW 305 430	2WNW 80 85	2W 125 75	2WSW 240 60	170 35	140 60	10 130	10 35	3WNW 10 30	3W 20 5	3WSW 30 5	- 5	-		-		-	5 25	5 30		-		4SW -	1,760 11,590
Origin Sector 1 2N 2NW	1 325 9,555 2,795	2N 280 1,030 235	2NW 305 430 615	2WNW 80 85 110	2W 125 75 125	2WSW 240 60 55	170 35 20	140 60 5	10 130 95	10 35 55	3WNW 10 30 105	3W 20 5 40	3WSW 30 5 15	- -	-					5 25 20	5 30 45				4SW	1,760 11,590 4,335
Origin Sector 1 2N 2NW 2NW	325 9,555 2,795 1,870	2N 280 1,030 235 140	2NW 305 430 615 280	2WNW 80 85 110 120	2W 125 75 125 155	2WSW 240 60 55 60	170 35 20 25	140 60 5 10	10 130 95 10	10 35 55 10	3WNW 10 30 105 35	3W 20 5 40 50	3WSW 30 5 15 40	- - 5	-		-		-	5 25 20 5	5 30 45 15		-		4SW	1,760 11,590 4,335 2,830
Origin Sector 1 2N 2NW	1 325 9,555 2,795	2N 280 1,030 235	2NW 305 430 615	2WNW 80 85 110	2W 125 75 125	2WSW 240 60 55 60 120	170 35 20	140 60 5 10	10 130 95 10	10 35 55	3WNW 10 30 105 35 40	3W 20 5 40 50 105	3WSW 30 5 15	5 - - 5 15	- - - -	- - -	- - -	- - -	- - - -	5 25 20	5 30 45	- - -	- - -	- - -	45W	1,760 11,590 4,335 2,830 3,575
Origin Sector 1 2N 2NW 2WNW 2W	325 9,555 2,795 1,870 2,570	2N 280 1,030 235 140 40	2NW 305 430 615 280 125	2WNW 80 85 110 120 45	2W 125 75 125 155 340	2WSW 240 60 55 60	170 35 20 25 65	140 60 5 10	10 130 95 10 15	10 35 55 10 20	3WNW 10 30 105 35	3W 20 5 40 50	3WSW 30 5 15 40 50	- - 5	- - - -	- - -	- - -	- - -	- - - -	5 25 20 5 10	5 30 45 15	- - -	- - -	- - -	4SW	1,760 11,590 4,335 2,830
Origin Sector 1 2N 2NW 2WNW 2W 2WSW 2SSW 2S	325 9,555 2,795 1,870 2,570 2,185 4,610 7,405	2N 280 1,030 235 140 40 40 25 60	2NW 305 430 615 280 125 100 40	2WNW 80 85 110 120 45 60 20	2W 125 75 125 155 340 260 170 55	2WSW 240 60 55 60 120 295	170 35 20 25 65 165	140 60 5 10 10 35	10 130 95 10 15 5	10 35 55 10 20 10	3WNW 10 30 105 35 40 35 15	20 5 40 50 105 185	3WSW 30 5 15 40 50 100 70 20	5 - - 5 15 30	- - - -	- - - -	- - - -	- - -	- - - - -	5 25 20 5 10 5	5 30 45 15 5	- - - -	- - - - -	- - - - -	- - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550
Origin Sector 1 2N 2NW 2WNW 2W 2WSW 2SSW 2S 3N	325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505	2N 280 1,030 235 140 40 40 25 60 115	2NW 305 430 615 280 125 100 40 65 135	2WNW 80 85 110 120 45 60 20 15	2W 125 75 125 155 340 260 170 55	2WSW 240 60 55 60 120 295 185 65	170 35 20 25 65 165 520 380	140 60 5 10 10 35 230 1,265	10 130 95 10 15 5 5	10 35 55 10 20 10 -	3WNW 10 30 105 35 40 35 15 -	20 5 40 50 105 185 45	3WSW 30 5 15 40 50 100 70 20 5	5 - - 5 15 30 55 115	- - - - - - - 15 75	- - - -	- - - - - - -	- - - - - - 15	- - - - -	5 25 20 5 10 5 -	5 30 45 15 5 - - - 65		- - - - - - - -	- - - - - - - -	- - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080
Origin Sector 1 2N 2NW 2WWW 2W 2WSW 2SSW 2S 3N 3NW	325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505	2N 280 1,030 235 140 40 40 25 60 115	2NW 305 430 615 280 125 100 40 65 135 440	2WNW 80 85 110 120 45 60 20 15	2W 125 75 125 155 340 260 170 55 10	2WSW 240 60 55 60 120 295 185 65 - 15	170 35 20 25 65 165 520 380	140 60 5 10 10 35 230 1,265	10 130 95 10 15 5 - 125 190	10 35 55 10 20 10 - - 70 610	3WNW 10 30 105 35 40 35 15 - 30 355	20 5 40 50 105 185 45 15 -	3WSW 30 5 15 40 50 100 70 20 5 90	5 - - 5 15 30 55 115	- - - - - 15 75	- - - - - - -	- - - - - - -	- - - - -	- - - - - - -	5 25 20 5 10 5 - - 20 165	5 30 45 15 5 - - - 65 140	- - - - - - - 10	- - - - - - - - 5	- - - - -	- - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580
Origin Sector 1 2N 2NW 2WNW 2W 2WSW 2SS 3N 3NW 3WNW	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825	2N 280 1,030 235 140 40 40 25 60 115	2NW 305 430 615 280 125 100 65 135 440 515	2WNW 80 85 110 120 45 60 20 15 -	2W 125 75 125 155 340 260 170 55 10 45 150	2WSW 240 60 55 60 120 295 185 - 15 45	170 35 20 25 65 165 520 380 - 5	140 60 5 10 10 35 230 1,265	10 130 95 10 15 5 - 125 190	10 35 55 10 20 10 - - 70 610 350	3WNW 10 30 105 35 40 35 15 - 30 355 805	20 5 40 50 105 185 45 15 - 40 260	3WSW 30 5 15 40 50 100 70 20 5 90 265	5 - - 5 15 30 55 115 - - 5	- - - - - 15 75 - -	- - - - - - - - -	- - - - - - - -	- - - - - - 15	- - - - - - - - -	5 25 20 5 10 5 - - 20 165 35	5 30 45 15 5 - - 65 140 25	- - - - - - - 10	- - - - - - - 5	- - - - - - - -	- - - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620
Origin Sector 1 2N 2NW 2WWW 2WW 2WSW 2SSW 2S 3N 3NW 3WNW 3WNW	1 325 9,555 2,795 1,870 2,185 4,610 7,405 505 315 825 1,445	2N 280 1,030 235 140 40 40 25 60 115 140 50	2NW 305 430 615 280 125 100 40 65 135 440 515 225	2WNW 80 85 110 120 45 60 20 15 - 15 40	2W 125 75 125 155 340 260 170 55 10 45 150 230	2WSW 240 60 55 60 120 295 185 65 - 15 45	170 35 20 25 65 165 520 380 - 5 10	140 60 5 10 10 35 230 1,265	10 130 95 10 15 5 - 125 190 115	10 35 55 10 20 10 - - 70 610 350	3WNW 10 30 105 35 40 35 30 30 355 805	20 5 40 50 105 185 45 15 - 40 260	3WSW 30 5 15 40 50 100 70 20 5 90 265 490	5 - - 5 15 30 55 115 - - 5	- - - - - - 15 75 - -	- - - - - - - - - -	- - - - - - - - - -	- - - - - - 15	- - - - - - -	5 25 20 5 10 5 - - 20 165 35	5 30 45 15 5 - - - 65 140 25	- - - - - - - 10 95	- - - - - - - - - 5 30 25	- - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620 3,870
Origin Sector 1 2N 2NW 2WWW 2W 2W 2SW 2S 3N 3NW 3WNW 3WSW	325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825 1,445 2,345	2N 280 1,030 235 140 40 40 25 60 115 140 50 25	2NW 305 430 615 280 125 100 40 65 135 440 515 225	2WNW 80 85 110 120 45 60 20 15 - 15 40 60 65	2W 125 75 125 155 340 260 170 55 10 45 150 230 300	2WSW 240 60 55 60 120 295 185 65 - 15 45 50 140	170 35 20 25 65 165 520 380 - 5 10 20	140 60 5 10 10 35 230 1,265 - - - - 45	10 130 95 10 15 5 - 125 190 115 55 25	10 35 55 10 20 10 - - 70 610 350 145	3WNW 10 30 105 35 40 35 15 - 30 355 805 290 320	20 5 40 50 105 185 45 15 - 40 260 735	3WSW 30 5 15 40 50 100 70 20 5 90 265 490 1,755	5 - - 5 15 30 55 115 - - 5 10	- - - - - - 15 75 - - - -	- - - - - - - - - - - - - - - - - - -		- - - - - - 15		5 25 20 5 10 5 - - 20 165 35	5 30 45 15 5 - - - 65 140 25	- - - - - - 10 95 50 40	- - - - - - - - - 5 30 25	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620 3,870 6,695
Origin Sector 1 2N 2NW 2WNW 2WSW 2SW 2S 3N 3NW 3WNW 3WS 3WSW 3SW	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825 1,445 2,345 2,2345 2,2345	2N 280 1,030 235 140 40 25 60 115 140 50 25 10	2NW 305 430 615 280 125 100 40 65 135 440 515 515 512 225 45	2WNW 80 85 110 120 45 60 20 15 - 15 40	2W 125 75 125 155 340 260 170 55 10 45 150 230 300 200	2WSW 240 60 55 60 120 229 185 65 - 15 45 50 140 195	170 35 20 25 65 165 520 380 - 5 10 20 250	140 60 5 10 10 35 230 1,265 - - - - 45	10 130 95 10 15 5 - 125 190 115	10 35 55 10 20 10 - - 70 610 350	3WNW 10 30 105 35 40 35 30 30 355 805	20 5 40 50 105 185 45 15 - 40 260 735 925	3WSW 30 5 15 40 50 100 70 20 5 90 265 490 1,755 265	5 - - 5 15 30 55 115 - - 5 10 95	- - - - - - 15 75 - - - - - - - - - - - - - - - - - -	- - - - - - - - - -	- - - - - - - - - -		- - - - - - - - -	5 25 20 5 10 5 - - 20 165 35	5 30 45 15 5 - - - 65 140 25	- - - - - - - 10 95	- - - - - - - - - 5 30 25	- - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620 3,620 6,695 4,985
Origin Sector 1 2N 2NW 2WNW 2WSW 2SW 2SW 2S 3N 3NW 3WNW 3WS 3SW 3SW	1 325 9,555 2,795 1,870 2,1850 4,610 7,405 505 3155 825 1,445 2,580 2,735	2N 280 1,030 235 140 40 25 60 115 140 50 25 10	2NW 305 430 615 280 125 100 40 515 225 440 515 5 5	2WNW 80 85 110 120 45 60 20 15 - 15 40 60 65	2W 125 75 125 155 340 260 170 55 10 45 150 230 300	2WSW 240 60 55 60 120 295 185 65 - 15 45 50 140	170 35 20 25 65 165 520 380 - 5 10 20	140 60 5 10 10 35 230 1,265 - - - - 45	10 130 95 10 15 5 5 - 125 190 115 5 5 -	10 35 55 10 20 10 - - - 70 610 350 145 90	3WNW 10 30 105 35 40 35 15 - 30 355 805 290 320 25	20 5 40 50 105 185 45 15 - 40 260 735	3WSW 30 5 15 40 50 100 70 20 5 90 265 490 1,755	5 - - 5 15 30 55 115 - - 5 10	- - - - - - 15 75 - - - -			- - - - - - 15		5 25 20 5 10 5 - - 20 165 35 10 -	5 30 45 15 5 - - - 65 140 25 -		- - - - - - - - 5 30 25	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620 3,870 6,695 4,985 4,405
Origin Sector 1 2N 2NW 2WNW 2WSW 2SW 2S 3N 3NW 3WNW 3WS 3WSW 3SW	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825 1,445 2,345 2,2345 2,2345	2N 280 1,030 235 140 40 25 60 115 140 50 25 10	2NW 305 430 615 280 125 100 40 65 135 440 515 515 512 225 45	2WNW 80 85 110 120 45 60 20 15 - 15 40 60 65	2W 125 75 125 125 340 260 170 55 10 45 150 230 200 200	2WSW 240 60 55 60 120 229 185 65 - 15 45 50 140 195	170 35 20 25 65 165 520 380 - 5 10 20 250	140 60 5 10 10 35 230 1,265 - - - - 45 315	10 130 95 10 15 5 - 125 190 115 55 25	10 35 55 10 20 10 - - 70 610 350 145	3WNW 10 30 105 35 40 35 15 - 30 355 805 290 320	3W 20 5 40 50 105 185 45 15 - 40 260 735 925 230	3WSW 30 5 15 40 50 100 70 20 5 90 265 490 1,755 265	55 15 30 55 1155 10 95 500 135	- - - - - - 15 75 - - - - - - - - - - - - - - - - - -					5 25 20 5 10 5 - - 20 165 35	5 30 45 15 5 - - - 65 140 25	- - - - - - - 10 95 50 40	- - - - - - - 5 30 25 10	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620 3,620 6,695 4,985
Origin Sector 1 2N 2NW 2WNW 2W 2WSW 2SS 3N 3NW 3WNW 3WS 3SSW 3S XWI	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825 1,445 2,345 2,580 2,735	2N 280 1,030 235 140 40 25 60 115 140 50 25 10 5	2NW 305 430 615 280 125 100 65 135 440 55 125 125 125 125 30	2WNW 80 85 110 120 45 60 20 15 - 15 40 60 65 30	2W 125 75 125 125 340 260 170 55 10 45 150 230 300 200 10	2WSW 240 60 60 120 295 185 65 - 15 55 55 188 65 - 1 15 45 50 140 195	170 35 20 25 65 165 520 380 - 5 10 20 25 375 110	140 60 5 10 10 35 230 1,265 - - - - 45 315 550	10 130 95 10 15 5 5 - - 125 190 115 55 25 10 -	10 35 55 10 20 10 - - - 70 610 350 145 90	3WNW 10 30 105 35 40 35 15 - 30 355 805 290 320 25 - 10	20 5 40 50 105 185 45 15 - 40 260 735 925 230	3WSW 30 5 15 15 40 40 70 20 5 90 265 490 1,755 265 15	5 - - 5 15 30 55 115 - - 5 10 95 500 135	- - - - - - 15 75 - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -				5 25 20 5 10 5 - - 20 165 35 10 - - - 455	5 30 45 15 5 - - - 65 140 25 -		- - - - - - - 5 30 25 10	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 1,080 2,580 3,620 3,620 6,695 4,985 4,405 1,025
Origin Sector 1 2N 2NW 2WNW 2WSW 2SSW 2S 3N 3NW 3WNW 3WSW 3SS 3S XWI XIL	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825 1,445 2,345 2,345 2,345 10 305 2,735 10	2N 280 1,030 235 5 10 5 5 10	2NW 305 430 615 280 125 100 40 65 133 440 515 225 125 45 5 30 10 -	2WNW 80 85 1100 120 45 60 20 15 15 40 60 65 30 5	2W 125 75 125 155 340 260 170 55 10 45 150 230 300 200 10 20 15	2WSW 240 60 60 55 60 120 295 185 65 - 15 45 50 140 195 10 - 20 -	170 35 20 25 65 520 380 - 5 10 20 250 375 110 -	140 60 5 10 10 35 230 1,265 - - - - 45 315 550 -	10 130 95 10 15 5 5 - - 125 190 115 55 25 10 -	10 35 55 10 20 10 - 7 70 610 350 145 90 10 	3WNW 10 30 105 35 40 35 15 - 30 355 805 290 320 25 - 10 115 -	20 5 40 50 105 185 45 15 - 40 260 735 925 230 15	3WSW 30 5 15 40 50 100 70 20 5 90 90 1,755 265 15 - 545 10	5 - - 5 15 30 55 115 - - 5 10 95 500 135 - 95	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -				5 25 20 5 10 5 - - - 20 165 35 10 - - - - - - - - - - - - - - - - - -	5 30 45 15 5 - - - 65 140 25 - - - - - - - - - - - - - - - - - -		- - - - - - - 5 30 25 10 - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620 3,870 4,985 4,405 1,025 3,440 5,145
Origin Sector 1 2N 2NW 2WNW 2WSW 2SW 2S 3N 3NW 3WNW 3WSW 3SW 3SW 3SW 3SW 3SW 3SW 3SW 3SW 3	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825 1,445 2,345 2,245 2,735 10 305 2,760 4,115 1440	2N 280 1,030 235 140 40 25 60 50 10 35 5 5 10 - 80	2NW 305 430 615 280 125 100 40 65 135 225 45 5 30 10 - 340	2WNW 80 85 85 110 120 45 60 20 15 15 40 60 65 30	2W 125 75 125 155 340 260 170 55 150 150 230 200 10 - 20 15 - 15	2WSW 240 60 65 60 120 295 185 65 - 15 45 50 140 195 10 - 20	170 35 20 25 65 165 520 380 - 5 10 20 25 110 - 60 160 -	140 60 5 10 10 35 230 1,265 45 315 550 - 205 1,275	10 130 95 10 10 15 5 5 125 190 115 55 25 10 10 	10 35 55 10 20 10 - - - 70 610 350 145 90 10 - - 25 60 - -	3WNW 10 30 105 35 40 35 15 - 30 30 355 290 320 25 - 10 115 360	20 5 40 50 105 185 45 15 - 40 260 735 925 230 15	3WSW 30 5 15 40 50 100 70 20 5 90 1,755 265 15 - 545 10 - 30	5 5 5 15 30 55 115		- - - - - - - - - - - - - - - - - - -				5 25 20 5 10 5 - - - 20 165 35 10 - - - - - - - - - - - - - - - - - -	5 30 45 15 5 - - - 65 140 25 - - - - - - - - - - - - - - - - - -		- - - - - - - - 5 30 25 10 - - -	- - - - - - - - - - - - - - - - - - -		1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620 4,985 4,405 1,025 3,440 5,145 1,090 4,685
Origin Sector 1 2N 2NW 2WNW 2W 2WSW 2SW 2S 3N 3NW 3WNW 3W 3WNW 3W 3WNW 3SW 3SW XWI XIL 3IN XIN 4NW 4N	1 325 9,555 2,795 1,870 2,579 2,185 4,610 7,405 505 315 825 1,445 2,345 2,735 10 305 2,760 415	2N 280 1,030 1,030 140 400 25 600 115 140 500 25 140 150 150 150 150 150 150 150 150 150 15	2NW 305 430 615 280 100 40 65 135 135 225 125 5 5 30 10 - 340 80	2WNW 80 85 110 120 45 60 20 15 - 15 40 60 65 30 - - - - - - - - - - - - -	2W 125 75 125 155 340 260 170 45 150 230 300 200 200 10 15 - 15	2WSW 240 60 60 55 60 120 295 185 65 15 45 50 140 20 20 5	170 35 20 25 65 165 520 380 - 5 10 20 250 375 110 - 60 160	140 60 5 10 10 35 230 1,265 - - - - 45 315 550 - - 205 1,275 265 - -	10 130 95 10 15 5 5 125 129 115 55 129 10 	10 35 55 10 20 10 - - - - 70 610 350 145 90 10 - -	3WNW 10 30 105 35 40 35 15 - 30 355 805 290 25 - 10 115 360 360 15	3W 20 5 40 105 105 185 45 15 - 260 735 925 230 15 - 125 10 - 45	3WSW 30 5 15 40 50 100 70 20 5 490 1,755 265 15 - 10 - 30 30 5	5					- - - - - - - - - - - - - - - - - - -	5 25 20 5 10 5 - - 20 20 165 35 10 - - - - - - - - - - - - - - - - - -	5 30 45 15 5 - - - 65 140 25 - - - - - - - - - - - - - - - - - -		- - - - - - - 5 30 25 10 - - - - - - - - - - - - - - - - - -			1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 2,580 3,620 3,620 4,985 4,405 1,025 3,440 5,145 1,090 4,685
Origin Sector 1 2N 2NW 2WNW 2WS 2W 2SW 2SW 3N 3NW 3WNW 3WNW 3WNW 3WSW 3SS XWI XIL 3IN XIN 4NW 4N	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315,825 1,445 2,345 2,345 2,735 10 305 2,760 415 140 2,650 415	2N 280 1,030 235 140 40 25 60 50 10 35 5 5 10 - 80	2NW 305 430 615 280 125 100 40 40 515 225 125 45 5 5 30 10 - 340 80 205	2WNW 80 85 85 110 120 45 60 20 15 - 15 40 60 65 30	2W 125 75 125 155 340 260 170 45 150 200 200 10 - 20 15 - 15	2WSW 240 60 60 60 120 295 185 65 - 15 90 140 195 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	170 35 20 25 65 165 520 380 - 5 10 20 25 110 - 60 160 -	140 60 5 10 10 10 35 230 1,265	10 130 95 10 15 5 5 - 125 190 115 55 25 190 - - - - - - - - - - - - - - - - - - -	10 35 55 10 20 10 - - - 70 610 350 145 90 10 - - - - - - - - - - - - - - - - - -	3WNW 10 30 105 35 40 35 15 - 30 355 805 290 320 - 10 115 360 155 255	20 5 40 50 105 185 - - 40 260 735 925 230 15 - - 125 10 - -	3WSW 30 5 5 15 40 60 70 20 20 265 490 1,755 265 15	5 5 5 15 30 55 115					- - - - - - - - - - - - - - - - - - -	5 25 20 5 10 5 - - 20 165 33 10 - - - - - - - 10 455 120 - - - - - - - - - - - - - - - - - - -	5 30 45 15 5 - - - 65 140 25 - - - - - - - - - - - - - - - - - -		- - - - - - - - - - - - - - - - - - -			1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 3,620 3,870 6,695 4,985 4,040 5,145 1,025 3,440 5,145 1,090 4,685 1,355
Origin Sector 1 2N 2NW 2WNW 2WSW 2SW 2S 3N 3NW 3WWW 3W 3WW 3W 3W 3WW 4N 4NW 4NW 4WN 4WN 5ECTOR 1 2N 3N	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825 1,445 2,345 2,580 2,735 10 305 2,760 4,110	2N 280 1,030 235 140 40 40 25 60 1115 140 50 25 10 35 10 - 80 50	2NW 305 430 615 280 125 100 40 65 513 52 125 45 5 5 30 10 - 340 80 205 30	2WNW 80 85 110 120 45 60 20 15 - 15 40 605 30	2W 125 75 125 155 340 260 170 55 10 45 150 230 300 200 10 - 20 15 - 15 15	2WSW 240 60 55 60 120 120 295 185 65 - 15 45 50 140 195 10 - 20 20 1 5 15 15	170 35 20 25 65 165 520 380 - 5 10 20 250 375 110 - 60 160 - -	140 60 5 10 10 35 2300 1,265 45 315 550 205 1,275 265	10 130 95 10 15 5 5 125 190 115 55 25 10 - - - - - - - - - - - - - - - - -	10 35 55 10 20 10 - - - 70 610 350 145 90 10 - - - - - - - - - - - - - - - - - -	3WNW 10 30 105 35 40 35 15 30 355 805 290 320 25 - 10 115 360 15 255 75	3W 20 5 5 40 105 105 125 15 - 40 260 735 230 15 - 125 10 - 70 140	3WSW 30 5 15 40 50 100 70 20 5 90 265 490 1,755 265 15 - 545 10 - 5 30 5 50 125	5						5 25 20 5 10 5 - - 20 165 35 10 - - - - - - - - 20 165 35 10 - - - - - - - - - - - - - - - - - -	5 30 45 15 5 - - - 65 140 25 - - - - - - - - - - - - - - - - - -		- - - - - - - - - - - - - - - - - - -			1,760 11,590 4,335 2,830 3,575 3,510 6,005 9,550 1,080 3,620 3,870 6,695 4,985 4,405 1,025 3,440 5,145 1,090 4,685 1,355 1,355
Origin Sector 1 2N 2NW 2WNW 2W 2WSW 2SW 2S 3N 3NW 3WW 3W 3WSW 3WSW 3SS XWI XII 3IN XIN 4NW 4N 4WNW 4WSW	1 325 9,555 2,795 1,870 2,185 4,610 7,405 505 315 825 1,445 2,345 2,345 2,735 10 305 2,760 415 140 45 45	2N 280 1,030 235 140 40 40 25 60 115 140 50 25 10 5 10 5 10	2NW 305 430 615 280 100 40 65 135 135 225 125 5 5 5 30 10 340 80 205	2WNW 80 85 85 110 120 20 20 15 15	2W 125 75 125 155 340 260 170 45 150 230 300 10 15 - 15 - 15 0 30 300 300 300 300 300 300 300 300 3	2WSW 240 60 60 60 120 295 185 65 - 15 45 50 140 120 20	170 35 20 25 65 520 380 - 5 10 20 25 5 10 10 10 10 10 10 10 10 10 10	140 60 5 10 10 10 35 230 1,265 45 315 550 - 1,275 265 5 5	10 130 95 10 15 5 5 - 125 190 115 55 10 - - - 85 5 - - - - - - - - - - - - - -	10 35 55 10 20 10 - - - - - - - - - - - - - - - - - -	3WNW 10 300 105 35 400 35 15 30 320 290 320 25 10 115	20 5 40 50 105 185 45 15 - 40 260 735 925 230 15 - - - - - - - - - - - - - - - - - -	3WSW 30 5 15 15 40 60 100 70 20 5 5 490 1,755 265 15 545 10 30 5 5 5 125 5 125 125 1215	5					- - - - - - - - - - - - - - - - - - -	5 25 20 5 10 5 - - 20 165 35 10 - - - - - - - - - - - - - - - - - -	5 30 45 15 5 - - - 65 140 25 - - - - - - - - - - - - - - - - - -					1,760 11,590 4,335 2,830 3,575 3,510 6,6005 9,550 1,080 2,580 4,985 4,985 4,405 1,025 3,440 5,145 1,090 4,685 1,355 1,355 1,355 1,355 1,255 2,575
Origin Sector 1 2N 2NW 2WNW 2WSW 2SW 2S 3N 3NW 3WWW 3W 3WS 3SW 3SW 4N 4NW 4NW 4WNW 4WW 4W	1 325 9,555 2,795 1,870 2,570 2,185 4,610 7,405 505 315 825 1,445 2,345 2,580 2,735 10 305 2,760 4,110	2N 280 1,030 235 140 40 40 25 60 1115 140 50 25 10 35 10 - 80 50	2NW 305 430 615 280 125 100 40 65 135 440 515 225 125 5 5 5 30 10 - 40 80 205 30 20 20	2WNW 80 85 110 120 45 60 20 15 - 15 40 605 30	2W 125 75 125 155 340 260 170 55 10 45 150 230 300 200 10 - 20 15 - 15 15	2WSW 240 60 60 60 120 295 185 65 - 15 90 140 195 - 20	170 35 20 25 65 165 520 380 - 5 10 20 250 375 110 - 60 160 - -	140 60 5 10 10 35 2300 1,265 45 315 550 205 1,275 265	10	10 35 55 10 20 10 - - - 70 610 350 145 90 10 - - - - - - - - - - - - - - - - - -	3WNW 10 30 105 35 40 35 15 30 355 805 290 320 25 - 10 115 360 15 255 75	3W 20 5 5 40 105 105 125 15 - 40 260 735 230 15 - 125 10 - 70 140	3WSW 30 5 15 40 50 100 70 20 5 90 265 490 1,755 265 15 - 545 10 - 5 30 5 50 125	5						5 25 20 5 10 5 - - 20 165 35 10 - - - - - - - - - - - - - - - - - -	5 30 45 15 5 - - - 65 140 25 - - - - - - - - - - - - - - - - - -		- - - - - - - - - - - - - - - - - - -			1,7 11,5 4,3 2,8 3,5 3,5 6,0 2,5; 3,6 6,6 4,9; 4,4 4,1,0 3,4 5,1 1,0 4,6 1,3

Table 13: Comparison of Model Output to the Expanded Household Travel Survey, Non-Work Tours, KNR (Phase 1)

	TARGETS		NON-	WORK	KI	NR	HIS	lacksquare																		
gin											De	estinatio	n Sector													
tor	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	То
	1,193	-	-	-	609	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3,114	548	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
′	197	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	876	-	-	-	-	-	-	-	
w	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	194	-	-	-	4 700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
V	-	-	-	-	1,788	-	200	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	
<u> </u>	415	-	-	-	-	-	286	1,638	-	-	-	-	-	-			-	-		-		-	-	-	-	
	415	-	-	-	-	-	-	- 1,036	- 55	-	-		-	-		-	-	-		-		-	-	-	-	
-	58		-			-	-	-	-	-	-		-				-					_	-			
v	414		_	_		_	-	-	_	_		_	_	_		_	-	_		_		_	_		_	
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	3,670	-	-	-	-	-	-	-	-	-	-	-	-	-	97	-	-	-	-	-	-	-	-	-	-	
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	70	-	-	-	-	-	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	129	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	-	
	7,182	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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	403	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	507	
<i>N</i>		548	-	-	2,554	-	537	1,694	55	-	-	-	-	-	97	-	-	998	24	-	-	71	-	-	507 507	
M	403		NON-V	-		-	537				-	-	-		97			998	24			71		-		
M	403 20,713		-	-	2,554	-	537				-	-	n Sector		97			998	24			71		-		
M	403 20,713		-	-	2,554	-	537 2SW				-	-	-		97			998 3IN	24 XIN			- 71 4WNW		- - - 4WSW		7
M	403 20,713 ODEL OUTPUT		NON-V	WORK	2,554 KI	- NR		1,694	55	-	- De	estinatio	n Sector	-		-	-			-	-		-	-	507	-
M	403 20,713 ODEL OUTPUT	2N	NON-V	WORK 2WNW	2,554 KN	- NR 2WSW	2SW	1,694 2S	55	-	- De	estinatio	n Sector	-		-	- XIL			-	-		-	-	507	
Min n or	403 20,713 ODEL OUTPUT 1 80	2N 215	- NON-\ 2NW	- WORK 2WNW 60	2,554 Kľ	- NR 2WSW 125	2SW 275	2S 300	3N	3NW -	De 3WNW	estinatio	n Sector 3WSW	3SW	3S -	XWI	XIL -	3IN -	XIN -	- 4NW -	- 4N	4WNW	- 4W	4WSW	507 4SW	
Min n or	403 20,713 DODEL OUTPUT 1 80 915 455 485	2N 215 755 225 105	- NON-N 2NW 100 185 410 120	- WORK 2WNW 60 55 140 250	2,554 Kr 2W 100 15 105	2WSW 125 15 20 30	2SW 275 35 35 30	2S 300 20 30 30	3N - 20 30	3NW 20	- De 3WNW 300	- estinatio 3w - 5 10	n Sector 3WSW	3SW	3\$	XWI	XIL	3IN - -	XIN -	- 4NW -	4N	4WNW	- 4W	4WSW	507 4SW	
Mon or	403 20,713 DDEL OUTPUT 1 80 915 455 485 740	2N 215 755 225 105 25	- NON-N 2NW 100 185 410 120 85	2WNW 60 55 140 250 135	2,554 Kr 2W 100 15 105 110 340	2WSW 125 15 20 30 110	25W 275 35 35 30 50	2S 300 20 30 30 35	3N - 20	3NW 20 - 5	- De 3WNW 30 - 5	- - - - - - - - - - - - -	n Sector 3WSW - - - - - 5	- 3SW 5	3S - -	XWI	XIL -	3IN - -	XIN	- 4NW - - - 5	4N	4WNW	- 4W	4WSW	507 4SW	
Mun lur	403 20,713 DDEL OUTPUT 1 80 915 455 485 740 560	2N 215 755 225 105 25 40	- NON-N 2NW 100 185 410 120 85 35	- WORK 2WNW 60 55 140 250 135 70	2,554 Kr 2W 100 15 105 110 340 125	2WSW 125 15 20 30 110 325	2SW 275 35 35 30 50 130	2S 300 20 30 30 35 40	3N - 20 30 - 5	- 3NW 20 - 5 5	- De 3WNW 30 - 5	- S 10 5 40 5	n Sector 3WSW	- 3SW 5 30	3S - - - - -	- XWI	- XIL	3IN	XIN 5	- 4NW - - 5 5	- 4N - 5 5	4WNW	- 4W	4WSW 5	4SW	
Mon pr	403 20,713 DDEL OUTPUT 1 80 915 455 485 740 560 730	2N 215 755 225 105 25 40	- NON-N 2NW 100 185 410 120 85 35 25	- WORK 2WNW 60 55 140 250 135 70 10	2,554 KP 2W 100 15 105 110 340 125 65	2WSW 125 15 20 30 110 325 95	2SW 275 35 35 30 50 130 610	2S 300 20 30 30 35 40 290	3N - 20 30 - 5	3NW 20 - 5 5	- De 3WNW 30 - 5		- Sector 3WSW 5 60	- 3SW 5 30 40	3S - - - - - - - 5	- XWI	XIL	3IN	XIN 5	4NW 5 5	- 4N - 5 5	4WNW	- 4W	4WSW 5	4SW	
Mon pr	403 20,713 ODEL OUTPUT 1 80 915 455 485 740 560 730 1,205	2N 215 755 225 105 25 40 10	- NON-N 2NW 100 185 410 120 85 35 25 35	- WORK 2WNW 60 55 140 250 135 70 10	2,554 KN 100 15 105 110 340 125 65 25	- VR 2WSW 125 15 20 30 110 325 95 20	2SW 275 35 35 30 50 130 610 340	25 300 20 30 30 35 40 290 1,885	3N - 20 30 - 5	3NW 20 5 5	- De 3WNW 30 5 5		n Sector 3WSW 5 60	3SW 5 30 40 35	3S - - - - - - 5 55	XWI	XIL	3IN 15	XIN 5	4NW 5	- 4N - 5 5 5	4WNW	4W	- 4WSW	4SW 5	
Min n	403 20,713 DODEL OUTPUT 1 80 915 455 485 740 560 730 1,205 75	2N 215 755 225 105 25 40 10 70 50	2NW 100 185 410 120 85 35 25 35 75	- WORK 2WNW 60 55 140 250 135 70 10 15 5	2,554 KN 100 15 105 110 340 125 65 25	2WSW 125 15 20 30 110 325 95 20 -	2SW 275 35 35 30 50 130 610 340	25 300 20 30 30 35 40 290 1,885	3N - 20 30 - 5 40	3NW 20 - 5 5 30	- De 3WNW 5 - 5	- S 10 5 400 5 10 5 10 10 10 10 10 10 10 10 10 10 10 10 10	n Sector 3wsw 5 60	3SW 5 30 40 35 -	3S - - - - - - - 5 55	XWI	XIL	3IN	XIN 5	4NW 5 5 10	4N - 5 5 30	4WNW	4W	4WSW	4SW 5	
Mor N	403 20,713 DODEL OUTPUT 1 80 915 455 485 740 560 730 1,205 75 15	2N 215 755 225 105 25 40 10 70 50 25	- NON-N 2NW 100 185 410 120 85 35 25 35 75	-WORK 2WNW 600 55 140 250 135 70 10 155 5	2,554 KN 100 100 15 105 110 340 125 65 25 10 25	- VNR 2WSW 125 15 20 30 110 325 95 20 - 15	25W 275 35 35 30 50 130 610 340 -	25 300 20 30 30 35 40 290 1,885	3N - 20 30 - 5 40 25	3NW 20 5 5 30 175	- De 3WNW 30 5 5 5 5 60	- S 10 5 400 5 5 10 10 10 10 10 10	n Sector 3wsw 5 60 10	3SW 5 30 40 35	3S 5 5 55	XWI	XIL	3IN	XIN 5	4NW 5 5 10 35	- 4N - 5 5 5	4WNW 15	- 4W	4WSW 5	4SW 5	
Min or	403 20,713 DDEL OUTPUT 1 80 915 455 485 740 560 730 1,205 75 15 30	2N 215 755 225 105 25 40 10 70 50	- NON-N 2NW 1000 1885 410 120 885 35 25 25 75 115	-WORK 2WNW 60 55 140 250 135 70 10 15 5 5 15	2,554 KN 100 105 105 110 340 125 65 25 100 25 45	- VNR 2WSW 125 15 20 30 110 325 95 - 15 15 15	25W 275 35 35 30 50 130 610 340 - 5	2S 300 20 30 30 35 40 290 1,885 -	3N - 20 30 - 5 40	3NW 20 - 5 5 30 175 100	- De 3WNW 30 5 5 5 60 155		n Sector 3WSW	- S S S S S S S S S S S S S S S S S S S	3S - - - - - - - 5 55	XWI	XIL	3IN	XIN 5	4NW 5 5 10 35 15	4N	4WNW	- 4W 5	4WSW	4SW 5	
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Min	403 20,713 DDEL OUTPUT 1 80 915 455 740 560 730 1,205 75 15 30 65 75 60	2N 215 755 225 105 25 40 0 50 25 15 5 5	2NW 100 185 410 120 85 35 25 35 75 115 70 30	- WORK 2WNW 60 55 140 250 135 70 10 15 5 5 15 30 5 5	2,554 KI 100 15 105 110 340 125 65 10 25 45 65 30 35	2WSW 125 15 20 30 110 325 95 20 - 15 15 5 65 66 60	25W 275 35 35 35 30 50 130 610 340 - 5 20 20 155	25 300 20 30 30 35 40 290 1,885 - - 5 10 35 200	55 3N - 20 30 - 5 - - - - - - - - - - - - -	3NW	- De 3wnw			3SW 5 30 40 35 5 30 30 325	3S 5 5 55 5 80	XWI	XIL	3IN	xin	4NW 5 5 5 10 35 15 5 15 15	4N - 5 5 5 30 15	4WNW 55 50 15 5	4W 5 10	4WSW 15 10 50	507 4SW	
Min	403 20,713 DDEL OUTPUT 1 80 915 455 455 455 740 560 730 1,205 75 15 30 65 75 60 60 140	2N 215 755 225 105 25 40 10 70 50 25 15 -	2NW 100 185 410 120 85 35 75 75 70 30 5 5	- WORK 2WNW 60 55 140 250 135 70 10 15 5 5 15 30 5	2,554 KN 100 105 105 110 340 125 65 25 10 25 45 65 30	2WSW 125 15 20 30 110 325 95 20 - 15 15 5 65	25W 275 35 35 30 50 40 20 20 20 45	25 300 20 30 30 35 40 1,885 - - - 5 10	3N - 20 30 - 5 5 40 25 10	3NW 5 5 30 175 100 10	- De 3WNW		- Sector 3wsw	3SW 5 30 40 35 5 35 35 30	3S 5 5 55 5 5 55	XWI	- XIL	3IN	XIN	4NW	- 4N - 5 5 5	4WNW	- 4W	4WSW 15 10	4SW 5 20	
Min	403 20,713 DDDEL OUTPUT 80 915 455 485 740 560 730 1,205 75 15 30 65 65 75 60 140	2N 215 755 225 105 25 40 10 70 50 25 15 	2NW 100 120 85 35 75 115 70 30 5 5 5 5 5	2WNW 60 55 140 250 135 70 10 15 5 5 5 5	2,554 KN 100 105 110 340 125 65 25 10 25 45 65 30 35	- VR 2WSW 125 125 20 30 110 325 20 - 15 5 65 66 60 15 15 15 15 15 15 15 15 15 15 15 15 15 15	2SW 275 35 35 30 50 130 50 120 20 20 20 155 45 5	1,694 2S 300 20 30 30 35 40 290 1,885 10 35 200 175 -	55 3N - 20 30 - 5 - - - - - - - - - - - - -	3NW 20 - 5 5 30 175 100 10 15 5	- De 3WNW		- Sector 3wsw	3SW 5 30 40 35 5 35 30 325 45	35 5 5 55 5 80 320	XWI	XIL	3IN	xin	4NW	- 4N - 5 5 5 30 15 30 30 30 30 30 30 30 30 30 30 30 30 30	4WNW	- 4W		507 4SW	
Mor n pr v v v v v v v v v v v v v v v v v v	403 20,713 20DEL OUTPUT 1 80 915 455 745 560 1,205 75 30 655 75 60 140 15 190	2N 215 755 225 105 25 40 10 50 25 15 - - 5 10 5 25	- NON-V 2NW - 100 - 185 - 410 - 120 - 85 - 35 - 25 - 35 - 75 - 70 - 30 - 5 - 5 - 30	- WORK 600 555 140 2500 135 700 10 15 5 5 15 30 5 5	2,554 KI 100 105 110 340 125 65 25 45 65 30 35 -	2WSW 125 15 20 30 110 325 95 20 - 15 15 5 65 66 60	25W 275 355 35 30 50 130 610 340 - 5 20 20 20 155 45 5 65	25 300 20 30 30 35 40 290 1,885 - - 5 10 35 200 175 - 165	55 3N - 20 30 - 5 - - - - - - - - - - - - -	3NW 5 5 30 175 100 10	- De 3wnw		- Sector 3wsw	3SW	35 - - - - - - 5 55 - - - - - - - - - -	xwi	XIL	3IN	XIN	4NW	- 4N - 5 5 5	4WNW 55 50 15 5	4W 5 10	4WSW 15 10 50	507 4SW	
Mor vvvvvvvvvvvvvvvvvvvvvvvvvvvvvvvvvvvv	403 20,713 DDEL OUTPUT 1 80 915 455 560 730 1,205 75 15 30 65 75 60 140 140 15 190 160 160 170 180 180 180 180 180 180 180 18	2N 215 755 225 105 25 40 10 70 0 50 25 15 - 5 5 10 25	2NW 100 120 85 35 75 115 70 30 5 5 5 5 5	2WNW 60 55 140 250 135 70 10 15 5 5 5 5	2,554 KN 100 105 110 340 125 65 25 10 25 45 65 30 35	- VR 2WSW 125 15 20 30 110 325 95 20 - 15 15 66 60 15 - 5	25W 275 35 35 35 30 50 130 610 340 - 5 20 20 20 45 45 5 65	25 300 20 30 30 35 40 290 1,885 - - - - - - - - - - - - -	55 3N - 20 30 - 5 - - - - - - - - - - - - -	3NW 20 - 5 5 30 175 100 10 15 5	- De 3WNW		- Sector 3wsw	3SW	3S	xwi	- XIL	3IN	XIN	4NW	- 4N - 5 5 5 30 15 30 30 30 30 30 30 30 30 30 30 30 30 30	4WNW	- 4W		507 4SW	
Min	403 20,713 20,713	2N 215 755 225 105 25 40 70 50 25 15 5 5 5 10	2NW 100 185 410 120 85 35 25 35 75 115 70 30 5 10 5 5 30 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	2WNW 600 555 140 250 100 100 155 5 5 5 5 5 5 5 5 5 5 5 5 5	2,554 KIN 100 15 105 110 340 125 65 25 10 25 30 35 - 5 15	2WSW 125 15 20 30 30 110 325 95 20 15 65 60 15 5 5	25W 275 35 35 30 50 130 610 340 - 5 20 20 20 155 45 5 665 70 0 15	25 300 20 30 30 35 40 290 1,885 - - 5 10 35 200 175 - 165	3N - 20 30 - 5 5 5	3NW	- De 3WNW		- Sector 3wsw	3SW	35 - - - - - - 5 55 - - - - - - - - - -	xwi	XIL	3IN	XIN	4NW 5 5 10 35 15 5	4N - 5 5 5 300 15 300 5 5	4WNW	4W		507 4SW	
Mor v v v v v v v v v v v v v v v v v v v	403 20,713 DDEL OUTPUT 1 80 915 455 560 730 1,205 75 15 30 65 75 60 140 140 15 190 160 160 170 180 180 180 180 180 180 180 18	2N 215 755 225 105 25 40 10 70 0 50 25 15 - 5 5 10 25	2NW 100 185 410 120 85 35 75 115 70 30 5 5 30 10	- WORK 600 555 140 2500 135 700 10 15 5 15 30 5 5 5 5	2,554 KI 100 15 105 110 340 125 65 55 10 25 45 65 30 35 5 15	- VR 2WSW 125 15 20 30 0 110 325 95 20 15 66 0 60 15 - 5 5	25W 275 35 35 35 30 50 130 610 340 - 5 20 20 20 45 45 5 65	25 300 20 30 30 30 29 40 290 1,885 - - 5 10 35 200 175 - - - - - - - - - - - - -	3N - 20 30 - 5 10 - 5 - 5	3NW	- De 3WNW		- N Sector 3WSW	3SW	3S	xwi	XIL	3IN	XIN	4NW 5 5 10 35 5 15	- 4N - 5 5 5	4WNW	4W	4WSW	\$07 4\$W 	
Mon n n n n n n n n n n n n n n n n n n	403 20,713 20DEL OUTPUT 1 80 915 485 740 60 60 60 60 60 60 60	2N 215 755 225 105 25 100 20 20 20 20 20 20 20 20 20 20 20 20 2	2NW 100 185 410 1200 85 35 75 115 70 30 5 10 5 30 10 40	2WNW 600 55 140 2500 135 70 100 15 5 5 15 30 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	2,554 KI 100 105 105 1100 340 125 65 25 10 25 45 65 30 35 - 15	- VR 2WSW 1255 15 20 30 0 110 325 95 5 65 60 15 - 5 5 5	25W 275 35 35 30 50 130 610 340 20 20 20 20 20 55 45 55 70 15	25 300 20 30 30 35 40 290 1,885 - - - - - - - - - - - - - - - - - -	55 3N - 20 30 - - - - - - - - - - - - -	3NW 20 - 5 5 5 300 100 15 5 15 5 60 60	- De 3WNW		- Nector 3WSW	3SW	35 	xwi	XIL	3iN	XIN	4NW 5 5 10 35 15 5 15	- 4N - 5 5 5	4WNW	4W	4WSW	\$507	
Mon or	403 20,713 20,713 80 915 455 455 740 560 730 1,205 75 15 30 65 75 60 140 140 15 190 190 190 190 190 190 190 190	2N 215 755 225 105 25 40 10 70 50 55 15 - 15 10 25 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	2NW 100 185 410 120 85 35 35 75 115 5 10 30 10 5 40 40	- WORK 2WNW 600 55 140 250 135 70 10 15 5 5 5 5 5	2,554 KI 100 15 105 110 340 125 65 25 10 25 45 65 30 35 10 10 10	- VR 2WSW 125 15 20 300 1100 325 95 20 15 5 660 15 5 5	25W 275 35 35 30 50 130 610 340 - 5 20 20 20 21 155 45 70 15 5 5	25 300 20 30 30 35 40 290 1,885 - - - 5 10 35 200 200 175 - - - - - - - - - - - - -	55 3N - 20 30 - - - - - - - - - - - - -	3NW	- De 3WNW	- Stination 3W - Standard Stan	- N Sector 3WSW	- S 30 40 35 - S 35 30 325 45 - S 30 20 5	3S	xwi	XIL	3IN	XIN	4NW	- 4N - 5 5 5	4WNW	4W		\$07	
'	403 20,713 20,713	2N 215 755 225 105 25 40 10 70 25 15 - 10 25 15 5 45 25 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	2NW 100 185 410 120 85 35 25 35 75 115 70 30 5 10 10 20 10	2WNW 600 555 140 250 100 100 155 5 5 5 5 5 5 5 5 5 5 5 5 5	2,554 KI 100 15 105 110 340 125 65 25 10 25 45 65 30 35 10 10 10	- VR 2WSW 15 125 20 30 110 325 95 20 15 5 65 60 15 5 5 20	25W 275 35 35 36 37 37 38 38 39 39 39 39 39 39	1,694 300 20 30 30 35 40 290 1,885	55 3N - 20 30 - - - - - - - - - - - - -	3NW	- De 3wNw	- estinatio 3W - 5 100 5 400 5 100 100 2500 1500 355 - 455 5 15 - 10	- N Sector 3WSW	3SW	35 	xwi	XIL	3IN	XIN	4NW	- 4N - 5 5 5	4WNW	4W		507 4SW	
Mor Nor No	403 20,713 20DEL OUTPUT 1 80 915 485 740 560 730 1,205 75 15 560 60 140 15 15 15 15 15 15 15 1	2N 215 755 225 105 25 40 10 70 25 15 - 10 25 15 5 45 25 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	2NW 100 185 410 120 85 35 75 115 70 30 5 10 5 40 10 10 10 10 10 10 10 10 10 10 10 10 10	- WORK 600 55 140 2500 135 70 100 15 5 5 5 5 5 5	2,554 KI 100 105 105 1100 340 125 65 25 10 25 45 65 30 35 10 5 20	- VR 2WSW 125	25W 275 35 35 30 30 310 340 340 340 340 340 340 340 35 35 35 35 35 35 35 3	25 300 20 30 30 35 40 290 1,885 - - - - 5 200 175 - 165 380 65 5	55 3N - 20 30 - - - - - - - - - - - - -	3NW	- De 3wNw		- Nector 3WSW	3SW	35 	xwi	XIL	3iN	XIN	- 4NW 5 5 5 10 35 5 15 5 5 15 65 40 775 60 45 5 5	- 4N - 5 5 5 5	4WNW	4W	4WSW	\$07	

Table 14: Comparison of Model Output to the Expanded Household Travel Survey, Work Tours, PNR (Phase 1)

	TARGETS		wo	ORK	PN	IR	HIS																			
rigin											De	estination	Sector													
ector	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
1	429	959	-	-	-	-	1,008	-	-	224	-	-	-	-	-	-	-	336	-	-	139	-	-	-	-	65 8,64
2N 2NW	6,207 11,765	959	305	-	-	-	1,008	-	-	-	-	-	-	-	-	-	-	336	-	-	139	-	-	-	-	12,07
WNW		-	-	-	-	-	-	-	-	1,404	-	-	-	-	-	-	-	-		-	-	-	-	-	-	1,40
2W	4,138	-	-	-	3,768	-	-	-	-	-	-	-	1,842	-	-	-	-	-	-	-	-	-	-	-	-	9,74
wsw	2,419	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,41
2SW	3,694	-	-	-	-	-	-	-	678	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,37
25	6,211	1,147	-	-	-	114	560	-	-	-	-	-	-	365	-	-	-	-	-	-	-	-	-	-	-	8,3
3N 3NW	277 145	-	-	-	-	-	-	-	-	413	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2 5
WNW	569	_	-	-	-	-	-	-	-	415	-	-	-		-	-		-	-	-	-	-	_	-	-	5
3W	4,517	-	-	-	-	-	-	-	-	-	-	674	-	-	-	-	-	-	-	-	-	-	-	-	-	5,1
wsw	13,317	-	-	-	-	-	-	109	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13,4
3SW	1,379	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,3
35	6,577	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,5
XWI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XIL	- 201	-	-	-	-	-	-	-	-	- 40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3IN XIN	281 60	-	-	-	-	-	-	-	-	48	-	-	96	-	-	-		-	-	-	-	-	-	-	-	4
4NW	1,437	-		_	-			-			-	_				_		_	_	_			-	_	_	1,4
4N	1,222	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	-	-	1,2
wnw	2,522	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,5
4W	5,940	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,9
wsw	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1SW	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87,2
tal	73,107	2,106	305	-	3,768	114	1,568	109	678	2,089	-	674	1,938	365			-	336	-	1	139	- 1	-	-	-	
				2014																						07,2
	ODEL OUTPU	Т	wo	ORK	PI																					07,2
rigin						NR .						estination														
rigin ector	1	2N	2NW	2WNW	2W		2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	xwı	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
rigin ector	1 555	2N 60	2NW	2WNW	2W	2WSW	-	25	3N 20	5	3WNW	3W -	3WSW 5	3SW	-	-	-	3IN	-	-	4N	-	-	-	-	Tota
rigin ector 1 2N	1 555 9,640	2N 60 135	2NW 30 105	2WNW - 10	2W - 20	2WSW - 5	-	25	3N 20 10	5 -	3WNW - 15	3W - 5	3WSW 5 5	3SW - 10	-		-	3IN - -	-	- 5	4N 10 50	4WNW - 5	-	- 5	4SW	Tota
rigin ector 1 2N	555 9,640 2,180	2N 60 135 30	2NW 30 105 80	2WNW - 10 10	2W	2WSW	- - 5	25	3N 20	5	3WNW	3W -	3WSW 5	3SW	-	-	-	3IN	-	-	4N	-	-	-	-	Tota
rigin ector 1 2N NW NNW	1 555 9,640	2N 60 135	2NW 30 105 80 15	2WNW - 10	2W - 20	2WSW - 5	-	2S 10 - 10	3N 20 10	5 -	3WNW - 15	3W - 5	3WSW 5 5	3SW - 10	- - -	-	- - -	3IN - -	-	- 5 -	4N 10 50	-	-	- 5	-	Tota 10,
rigin ector 1 2N NW NNW 2W	1 555 9,640 2,180 190	2N 60 135 30 10	2NW 30 105 80 15	2WNW - 10 10	2W - 20	2WSW - 5 5	- - 5	2S 10 - 10	3N 20 10 20	5 - 15 -	3WNW - 15 20	- 5 15	5 5 - -	3SW - 10 -	- - - -	- - -	- - -	3IN	- - - -	- 5 -	4N 10 50 40	- 5 -	- - -	- 5 - -	-	Tota 10, 2,
rigin 2N 2NW WNW 2W WSW 2SW	1 555 9,640 2,180 190 50 595 995	2N 60 135 30 10 20 10	2NW 30 105 80 15 15 10	2WNW - 10 10 10 5 - 5	2W - 20 5	2WSW - 5 5 - 5 35 20	- - 5 5 - - 20	2S 10 - 10 - 10 10 35	3N 20 10 20	5 - 15 - 5 -	3WNW - 15 20 - 10	3W - 5 15	3WSW 5 5 5 15 30 10	3SW - 10	- - - - - - 5	- - -	- - - - - - -	3IN	- - - -	- 5 - - - 5	4N 10 50 40 - - 10	- 5 - - - -	- - - - - -	- 5 - - - -	-	Tota 10,4 2,4
rigin 2ctor 1 2N NW VNW 2W WSW 2SW 2S	1 555 9,640 2,180 190 50 595 995 6,465	2N 60 135 30 10 20 10 25 80	2NW 30 105 80 15 15 10 15	2WNW - 10 10 10 - 5 - 5 15	2W - 20 5 35	2WSW - 5 5 5 - 5 20 30	5 5 - - 20 20	2S 10 - 10 - 10 10 35 205	3N 20 10 20 - 5 - 10	5 - 15 - 5	3WNW - 15 20 - 10 - 5	3W - 5 15 15	3WSW 5 5 15 30 10 5	3SW - 10 15	- - - - - - 5	- - -	- - - - - - -	3IN	- - - - - -	- 5 - - - 5	4N 10 50 40 - - 10 15	- 5 - - - - -	- - - - - -	- 5 - - - -	-	Tota 10, 2,
rigin 1 2N NW VNW 2W NSW 2SW 2S	1 555 9,640 2,180 190 50 595 995 6,465 485	2N 60 135 30 10 20 10 25 80 30	2NW 30 105 80 15 15 10 15 10 15 60	2WNW - 10 10 10 5 - 5 15	2W - 20 5 35 10	2WSW - 5 5 5 20 30 5	- - 5 5 - - 20 20	25 10 - 10 10 10 35 205	3N 20 10 20 - 5 - 10 -	5 - 15 - 5 - - 20	3WNW	3W - 5 15	3WSW 5 5 15 30 10 5 5	3SW - 10 15	- - - - - 5 5	- - -	- - - - - - - - - -	3IN	- - - -	- 5 - - 5 - -	4N 10 50 40 - - 10 15 35	- 5 - - - - -	- - - - - - - -	- 5 - - - -	- - - - - - -	10, 2,
ctor 1 2N NW VNW 2W VSW SW 2S 3N NW	1 555 9,640 2,180 190 50 595 995 6,465 485 1,140	2N 60 135 30 10 20 10 25 80 30	2NW 30 105 80 15 15 10 15 60 15	2WNW - 10 10 10 5 - 5 15 10	2W - 20 5 35 10 25	2WSW - 5 5 5 20 30 5 20	- - 5 5 - - 20 20 5 5	25 10 - 10 10 10 35 205 - 5	3N 20 10 20 - 5 - 10 - 5	5 - 15 - 5 - - 20 - 75	3WNW - 15 20 - 10 - 5 - 20	3W - 5 15 15 5	3WSW 5 5 15 30 10 5 5 10	3SW - 10 15	- - - - - 5 5	- - - - - - - -	- - - - - - - -	3IN	- - - - - - -	5 - - 5 - - - - 15	4N 10 50 40 10 15 35 45	- 5 - - - - - - - 5	- - - - - - - -	- 5 - - - - - -	- - - - - - -	10, 2, 1, 6,
igin ctor 1 2N NW VNW 2W VSW SSW 2S BN NW VNW	1 555 9,640 2,180 190 50 595 995 6,465 485 1,140 1,805	2N 60 135 30 10 20 10 25 80 30 105	2NW 30 105 80 15 15 16 60 15 345 215	2WNW - 10 10 10 5 - 5 15 5 10 55	2W - 20 5 35 10 25 60	2WSW - 5 5 5 - 5 35 20 30 5 20 15	- - 5 5 - - 20 20 5 5 5	2S 10 - 10 - 10 10 10 35 205 - 5	3N 20 10 20 - 5 - 10 - 5 5 - 15 35	5 - 15 - 5 - - 20 - 75	3WNW	3W - 5 15 15 5 15 5 15	3WSW 5 5 15 30 10 5 5 10 55	3SW - 10 15	- - - - - 5 5	- - -	- - - - - - - - - -	3IN	- - - - - -	- 5 - - 5 - -	4N 10 50 40	- 5 - - - - - - - 5 20	- - - - - - - - 10	- 5 - - - - - - - - - 5	- - - - - - -	10, 2, 1, 6, 1, 2,
rigin ctor 1 2N NW VNW 2W VSW 2SS 3N NW VNW 3W	1 555 9,640 2,180 190 50 595 995 6,465 485 1,140	2N 60 135 30 10 20 10 25 80 30	2NW 30 105 80 15 15 10 15 15 10 15 215 70	2WNW - 10 10 10 5 - 5 15 10	2W - 20 5 35 10 25	2WSW - 5 5 5 20 30 5 20	- - 5 5 - - 20 20 5 5	25 10 - 10 10 10 35 205 - 5	3N 20 10 20 - 5 - 10 - 5	5 - 15 - 5 - - 20 - 75	3WNW - 15 20 - 10 - 5 - 20	3W - 5 15 15 5	3WSW 5 5 15 30 10 5 5 10	3SW - 10 15	- - - - - 5 5	- - - - - - -	- - - - - - - -	3IN	- - - - - - -	5 - - 5 - - - - 15	4N 10 50 40 10 15 35 45	- 5 - - - - - - - 5	- - - - - - - -	- 5 - - - - - - - - 5 10	- - - - - - -	10, 2, 1, 6, 1, 2, 3, 3,
rigin ctor 1 2N NW VNW 2W NSW 2S 3N NW VNW 3W VNW	1 555 9,640 2,180 190 50 595 995 6,465 485 1,140 1,805 2,755	2N 60 135 30 10 20 10 25 80 30 105 75	2NW 30 105 80 15 15 10 15 15 10 15 215 70	2WNW 10 10 10 5 5 15 10 55 5 5 5 5 5 5 5 5 5 5 5 5 5 5	2W - 20 5 35 10 25 60 70	2WSW - 5 5 5 - 5 35 20 30 5 20 15 30	- - 5 5 - - 20 20 5 5 15	25 10 - 10 - 10 10 35 205 - 5 10	20 10 20 - 5 - 10 - 5 - 15 35	5 - 15 - 5 - - 20 - 75 10 20	3WNW - 15 20 - 10 5 - 20 20 45	3W - 5 15 15 5 - 15 5 - 25	3WSW 5 5 15 30 10 5 5 10 55 1115	3SW - 10 15	- - - - - - 5 5 - -	- - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	3IN	- - - - - - - - - - -	5 - - - 5 - - - 15 5	4N 10 50 40 - - 10 15 35 45 25	- 5 - - - - - - - 5 20 25	- - - - - - - - - - 10	- 5 - - - - - - - - 5 10	- - - - - - - - - -	10, 2, 1, 6, 1, 2, 3, 6, 6,
rigin ctor 1 2N NW vNW 2W NSW 2S 3N NW VNW SW VNW SW SSW SSW SSW SSW SSW SSW SSW	1 555 9,640 2,180 190 50 595 6,465 485 1,140 1,805 2,755 5,070 3,345 3,300	2N 60 135 30 100 20 10 25 80 30 105 75 45 50 25	2NW 30 105 80 155 15 15 10 15 60 155 345 215 70 55 355	2WNW - 10 10 10 10 5 - 5 15 5 20 20	2W - 20 5 35 10 25 60 70 140	2WSW - 5 5 35 20 30 5 20 30 125	- - 5 5 - - 20 20 5 5 5 15 25	25 10 - 10 - 10 10 35 205 - 5 10 10 40 125 195	3N 20 10 20 - 5 - 10 - 5 5 5 15 35 5 10 - 5 5 5 5 5 5 5 5 5 5 5 5 5	5 	3WNW - 15 20 - 10 5 - 20 45 95 10	3W - 5 15	\$\frac{5}{5}\$ \$\frac{5}{5}\$ \$\frac{1}{5}\$ \$\frac{15}{5}\$ \$\frac{10}{5}\$ \$\frac{5}{5}\$ \$\frac{10}{10}\$ \$\frac{55}{5}\$ \$\frac{115}{425}\$	3SW - 10 15 25	- - - - - 5 5 - - -			3IN		5 - - - 5 - - - - - - - - - - - - - - -	4N 10 50 40 10 10 15 35 45 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10	- 5 5 20 25 30	- - - - - - - - - - 10 5	- 5 - - - - - - - - 5 10 25	- - - - - - - - - - - - - - - - - - -	10, 2, 1, 6, 3, 3, 3, 3, 3,
rigin 2ctor 1 2N NWW NWW 2W WSW 2S 3N NW NWW 3W WSW 3S KWI	1 555 9,640 2,180 190 50 595 6,465 485 1,140 1,805 2,755 5,070 3,345 3,300 175	2N 60 135 30 20 20 10 25 80 30 105 75 45 50 25 35	2NW 30 105 80 15 15 10 15 10 15 20 15 345 215 70 55 50 95	2WNW - 10 10 10 5 - 5 15 5 10 20 11 10 15	2W - 20 5 35 10 25 60 70 140 100 20	2WSW - 5 5 5 - 5 35 20 30 5 20 125 45 45	- 5 5 5 - 20 20 5 5 5 15 25 35	25 10 - 10 10 10 10 35 205 - 5 10 40 40 125 195 -	3N 20 10 20 - 5 5 - 10 - 5 5 15 5 230	5 	3WNW	3W - 5 15 15 5 - 15 5 - 10 10 - 10 -	3WSW 5 5 15 30 10 5 5 10 425 40 5	3SW - 10	- - - - - 5 5 - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -		31N		5 - - - 5 - - - - - - - - - - - - - - -	4N 10 50 40	- 5 5 20 25 30 10	- - - - - - - - 10 5	- 5 5 10 25 5	- - - - - - - - - - - - - - - - - - -	Tota 10,4 2,4 1,1 6,5 1,1 2,4 3,3 6,3 3,1 1,1
rigin ector 1 2N 2NW WNW 2W WSW 2S 3N BNW WNW 3W WSW 3S WSW 3S XWI XIL	1 555 9,640 2,180 190 50 595 995 6,465 485 1,140 1,805 2,755 5,070 3,345 3,300 3,300	2N 60 135 30 100 20 10 25 80 30 105 75 45 50 25 35	2NW 30 105 80 115 15 10 10 15 60 15 345 215 70 55 35 50 955 85	2WNW - 10 10 10 5 5 15 5 10 20 15 10 30	2W - 20	2WSW	5 5 5 20 20 20 5 5 5 5 15 25 30 75 35 - 40	2S 10 10 10 10 10 10 10 10 10 10 10 10 10	3N 20 10 20 - 5 5 - 10 10 - 5 5 15 35 5 10 - 5 230 40	5 -15 -5 20 -75 10 20 20 20 20 -165 80	3WNW	3W - 5 15 15 5 - 15 5 - 10 10 430	\$\frac{5}{5}\$ \$\frac{5}{5}\$ \$\frac{1}{5}\$ \$\frac{15}{30}\$ \$\frac{10}{5}\$ \$\frac{5}{10}\$ \$\frac{10}{55}\$ \$\frac{115}{425}\$ \$\frac{40}{5}\$ \$\frac{5}{5}\$ \$\frac{1}{5}\$ \$\frac{390}{390}\$	3SW - 10	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -		3IN		- 5 5 	4N 10 50 40	- 5 5 20 25 30 10 70	- - - - - - - 10 5 5	- 5 5 10 25 5 65		Tota (10,0) (2,4) (1,2) (6,5) (6,1) (8,3) (9,3) (1,1)
rigin ector 1 2N 2NW WNW 2W WSW 2SSW 2S 3N BNW WNW 3W WSW 3S XWI XIL 3IN	1 555 9,640 2,180 190 500 595 995 6,465 485 1,140 2,755 5,070 3,3345 3,330 175 340 8,095	2N 60 135 30 10 20 10 25 80 30 105 75 45 50 25 35 90	2NW 30 105 80 105 15 15 15 10 115 60 115 345 215 70 55 35 50 95 85 85	2WNW 10 10 10 10 5 5 15 5 10 0 20 20 10 10 30 30 15	2W - 20	2WSW	5 5 5 20 20 5 5 15 25 30 75 35 40 95	25 10 - 10 - 10 35 205 - 5 10 10 40 40 40 125 195 - 110 370	3N 20 10 20 - 5 5 - 10 - 5 5 15 5 230	5 		3W - 5 15 15 5 - 15 5 - 10 10 - 10 -	3WSW 5 5 15 30 10 5 5 5 10 5 425 40 5 - 390 -	3SW - 10	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -		3IN		- 5 5 	4N 10 50 40	- 5 5 20 25 30 10	- - - - - - - 10 5 5	- 5 5 100 225 5 65		Total (10,0 (2,4,4) (1,1) (6,5) (6,1) (8,5) (9,1) (1,1) (9,1) (1,1) (9,1) (1,1) (9,1) (1,1) (9,1) (1,1) (9,1) (1,1) (9,1) (1,1) (9,
rigin 2N 2N 2NW WNW 2W WSW 2S 3N 3SNW WNW 3SW 3SW 3S XWI 3IN XIN	1 555 9,640 2,180 190 500 595 995 6,465 485 1,140 1,805 2,755 5,070 3,345 3,340 175 340 8,095 2,540	2N 60 135 30 10 20 10 25 80 30 105 75 45 50 25 335 90 10	2NW 30 105 800 15 15 15 10 15 60 15 345 215 70 55 50 95 85 65	2WNW 100 100 10 5 5 15 5 100 20 115 100 30 15 5 5	2W - 20 5 5 35 10 25 60 70 140 20 45 65	2WSW	- 5 5 5 - 20 20 20 5 5 15 25 30 75 35 - 4 95	2S 10 10 10 10 10 35 205 - 5 10 10 40 125 195 - 110 370 370 275	3N 20 10 20 - 5 - 10 - 5 15 35 5 10 - 5 230 40	5 	3WNW	3W - 5 15 15 5 - 15 5 10 - 15 430	3WSW 5 5 5 15 30 10 5 5 10 55 40 55 425 390	3SW	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -		3IN		5 	4N 10 50 40 10 10 10 10 10 10 10 10 10 10 10 10 10	- 5 	- - - - - - - - 10 5 5 - - -	- 5 5 10 25 5 65		Tota (10,6) 2,4 6,5 6,5 6,6 1,4,4 2,4,6 3,3,9 1,5 2,6 8,5,9 2,5 2,5
rigin 1 2N NNW NNW 2W NNW 2SW 2SSW 2SS 3N NNW NNW NNW NNW NNW NNW NN	1 555 9,640 2,180 190 50 595 995 6,465 485 1,140 1,805 2,755 3,300 175 340 8,095 2,540 1,605	2N 60 60 135 30 10 20 10 25 80 105 75 50 25 35 90 10 85 5 275	2NW 30 105 80 15 15 15 10 10 15 345 215 345 215 55 35 50 95 85	2WNW 100 100 100 5 5 115 5 100 200 115 10 30 30 115 5 80	2W	2WSW	5 5 5 20 20 5 5 15 25 30 75 35 40 95	25 10 - 10 10 10 10 35 205 - 5 10 40 40 40 40 125 195 110 370 275 5	3N 20 10 20 5 5 15 10 0 5 230 40 415	5 		3W - 5 15 15 5 - 15 5 - 10 10 430	3WSW 5 5 15 30 10 5 5 5 10 5 425 40 5 - 390 -	3SW - 10	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -		3IN		- 5 	4N 10 50 40 10 10 10 10 10 10 10 10 10 10 10 10 10	- 5 5 20 25 30 10 70	- - - - - - - 10 5 5	- 5 5 100 225 5 65		Tota 10,0,0 2,0 1,1,1 6,5,0 1,1,1 2,0,1 3,3,3 6,5,1 1,1,1 2,0 8,8 2,0 5,5,1
rigin 1 2N 2N 2NW 2NW 2W WSW 2SW 2SSW 3N	1 555 9,640 2,180 190 500 595 995 6,465 485 1,140 1,805 2,755 5,070 3,345 3,340 175 340 8,095 2,540	2N 60 135 30 10 20 10 25 80 30 105 75 45 50 25 335 90 10	2NW 30 105 800 15 15 15 10 15 60 15 345 215 70 55 50 95 85 65	2WNW 100 100 10 5 5 15 5 100 20 115 100 30 15 5 5	2W - 20 5 5 35 10 25 60 70 140 20 45 65	2WSW - 5 5 - 5 35 20 30 5 20 15 30 125 45 45 - 10 40 15 5		2S 10 10 10 10 10 35 205 - 5 10 10 40 125 195 - 110 370 370 275	3N 20 10 20 - 5 - 10 - 5 15 35 5 10 - 5 230 40	5 	3WNW	3W - 5 15 15 5 - 15 5 10 - 15 430	3WSW 5 5 5 15 30 10 5 5 115 425 40 5 390 10	3SW	- - - - - - - - - - - - - - - - - - -			3IN		5 	4N 10 50 40 10 10 10 10 10 10 10 10 10 10 10 10 10	- 5 		5 		Total 6 10,0,0 2,4 2 1,1 6,5,6 6,5,6 1,8 2,4 3,3 6,2 3,9,1 2,0 8,9,2 5,0 1,2 1,2
ector 1 2N 2NW WNW 2W WSW 2SW	1 555 9,640 2,180 190 500 595 995 6,465 485 1,140 1,2605 2,755 5,070 3,345 3,300 175 340 8,095 2,540 1,665	2N 60 60 135 30 20 10 25 80 30 105 75 45 50 25 35 90 10 85 5	2NW 30 105 80 15 15 15 100 15 15 15 15 15 15 15 15 15 15 15 15 15	2WNW	2W	2WSW - 5 5 - 5 35 20 30 5 20 15 30 125 45 45 - 10 40 15 5		25 10 - 10 10 10 35 205 5 10 40 40 125 195 - 10 370 275 5	3N 20 10 20 - 5 - 10 - 5 15 35 5 10 5 40 1 10 10 10 10 10 10 10 10 10 10 10 10 1	5 -15 -5 -20 -75 10 20 20 20 20 -165 80 	3WNW -1 -1 -20 -1 -1020 -5 -20 -55 -45 -95 -1065225225	3W	3WSW 5 5 5 15 30 10 5 5 10 55 115 40 5	3SW - 10				3IN		- 5 	4N 10 50 40 10 15 35 45 25 10 10 560 355 5 360 100	5 - - - - - - 5 20 25 30 - - - - - - - - - - - - - - - - - -	- - - - - - - - - - 5 5 5 - - - - - - -	5 		Total 6 10,0,0 2,4 2 1 6,9 6,9 6,2,4 3,3,3 6,2,2,9 2,0 8,9,9 2,9 5,0 1,2 1,2,2
Prigin 1 2N 2N 2N WWNW WWNW 2W WSW 2S 3N 3N 3N WWNW WSW XS 3W WSW XS 3S XS	1 555 9,640 2,180 190 500 595 995 6,465 485 1,140 1,805 2,755 5,070 3,345 3,300 175 340 8,095 2,540 1,605 715 1,605 1,6	2N 60 135 30 10 20 20 10 25 80 30 105 75 50 25 35 90 10 85 5 5 5 5 5 6 6 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8	2NW 30 105 80 15 15 15 100 15 15 15 70 15 70 55 50 95 95 855 65 65 15 40	2WNW	2W	2WSW	20 20 20 5 5 5 5 15 25 30 75 35 - 40 95 15 5	25 10 - 10 10 10 35 205 5 10 10 40 40 125 195 - 110 370 275 5 5	3N 20 10 20 - 5 - 10 - 5 15 35 5 10 5 110 15 5 110 15 5 110 15 5 5 5	5 -15 -5 	3WNW -15 20 -10 -10 -5 -20 55 -45 95 10 -65 6525 -11 -11 -11 -11 -11 -11 -11 -11 -11 -1	3W 5 - 15	3WSW 5 5 5 15 30 10 5 5 10 5 5 115 425 425	3SW	- - - - - - - - - - - - - - - - - - -			3IN		- 5 	4N 10 50 40 40	5 - - - - - - - 5 20 25 30 - - - - - - - - - - - - - - - - - -		- 5 		Total 6 10,0 2,4,4 2 1 6,9 6,9 1,8 2,4 3,3,3 6,2 3,9 2,0 9 5,0 1,2 1,1 2,3 4,6,6
Prigin 1 2N 2N 2N WNW WNW 2W 2W 2S 3N 3N 3W WNW 3W WNW 3W WNW 3W WNW 3W WNW 3SSW 3SS	1 555 9,640 2,180 190 50 595 995 6,465 485 1,140 1,805 2,755 5,070 3,345 3,300 1,75 340 8,095 2,540 1,605 715 4,605 715 4,605 6,655	2N 60 60 135 30 10 20 10 25 80 10 5 5 5 10 85 5 5 275 90 5 5 -	2NW 30 105 80 15 15 15 100 15 600 15 345 215 70 55 35 50 95 65	2WNW 10 10 10 10 15 5 15 5 10 20 15 10 30 30 15 5 80 30 30	2W	2WSW - 5 5 5 - 5 35 20 30 5 5 20 30 125 45 45 - 10 40 15 5 5 - 1 15	- 5 5 5 - 20 20 20 5 5 15 25 30 75 35 - 40 95 5 - 15 5	25 10 - 10 10 10 35 205 - 5 10 40 40 40 40 125 195 - 110 370 275 5 5 5 5	3N 20 10 20	5	3WNW	3W	\$\frac{5}{5}\$ \$\frac{5}{5}\$ \$\frac{1}{5}\$ \$\frac{1}{5}\$ \$\frac{1}{30}\$ \$\frac{1}{30}\$ \$\frac{1}{30}\$ \$\frac{1}{5}\$ \$\frac{1}{5}\$ \$\frac{1}{5}\$ \$\frac{1}{425}\$ \$\frac{4}{40}\$ \$\frac{5}{5}\$ \$\frac{1}{5}\$ \$\frac{1}{	3SW - 10	- - - - - - - - - - - - - - - - - - -			3IN		- 5 5 	4N 10 50 40 10 15 35 45 25 10 10 10 560 35 5 - 360 100 30 30 10	- 5 		- 5 		

Table 15: Comparison of Model Output to the Expanded Household Travel Survey, Non-Work Tours, PNR (Phase 1)

	TARGETS		NON-	NORK	PI	NR	HIS	V																		
gin											De	stinatio	Sector													
or	1	2N	2NW	2WNW	2W	2WSW	2SW	2 S	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	To
	1,807	-	-	-	-	680	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
_	1,946	3,342	-	-	-	-	-	-	-	-	-	117	354	-	-	-	-	-	-	-	-	-	-	-	-	
'	787	-	269	-	-	-	-	-	-	-	-	-	-	-	-	-	-	876	-	422	-	-	-	-	-	-
V	-	-	387	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
. -	7,069	885	2,833	-	596	3,974	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	_
V	302	-	-	-	1,788	631	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
H	-	-	-	-	-	-	2,646	451	-	-	-	-	-	-	-	-	-	140	-	-	-	-	-	-	-	-
L	280	-	-	-	-	-	1,764	3,437	-	-	-	-	-	-	278	-	-	-	-	-	-	-	-	-	-	
H	159	198	-	-	174	-	-	-	620	4 407	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
. –	2,704	-	-	-	-	-	-	-	-	1,137	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	142	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-		-
V	1,555	-	-	-	-	-	-	-	-	-	-	-	1,793	-	-	-	-	-	-	1,292	-	-	-	-	2,089	
H	2.400	-	-	-	-	-	- 505	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3,406	-	-	-	-	-	506	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
H	- 10												-				-	-								-
	18	-	-	-	-	-	-	327	-	-	-	-	-	-	-	-	-	121	-	-	-	-	-	-	-	-
	790	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	131	-	9,619		-	-	-	-	
-			-	-	-	-	-	-	-	-	-	-	-	-	-		-	-		9,619		-	-	-		-
	46	-	-	-	-	-	-	-			-	-	-	-	-		-	-		-		-	_	-		-
V		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-		-	-		-	-	-		-
	2.404	-	-	-		-	-		-			-	207		-			-				-	-	204		-
	3,401	-	-		-	-	-	-	-	-	-	-	207	-	-	-	-	-	-	-	-	-	-	294	-	
	-,																									ı
	-	4.425	3.489	-	2.557	5.284	4.916	4.214	620	1.137	-	117	2.354	-	278	-	-	1.147	-	11.334	-	-	-	294	2.089	
,	24,414	4,425	3,489	-	2,557	5,284	4,916	4,214	620	1,137	-	117	2,354		278			1,147	-	11,334	-	-	-	294	2,089	
MC	-		3,489 NON-\	-	2,557 PN		4,916		620	1,137	-				278			1,147	-		-	-		294	2,089	
MC n	24,414	-	NON-\	- WORK	PI	NR		4,214			- De	stinatio	n Sector	-		-	-			11,334	-		-			
MC	24,414 DDEL OUTPUT	2N	NON-\	-	PN 2W		4,916 2SW	4,214 25	620 3N	1,137 3NW	-	stinatio	n Sector 3WSW		278			1,147 3IN	- - XIN		- - 4N	4WNW		294 4WSW	2,089 4SW	
MC	24,414 DDEL OUTPUT	2N 75	NON-\ 2NW	VORK	2W 5	2WSW	2SW -	25	3N -	3NW	- De	stination 3W	Sector 3WSW	3SW	3S -	-	-			11,334 4NW	- 4N	4WNW 5	-	4WSW		
MC	24,414 DDEL OUTPUT	2N 75 440	NON-\	- WORK	PN 2W	NR		2S 145 20			De 3WNW	stinatio	n Sector 3WSW	3SW - 5		-	- XIL			11,334	- 4N - 25	4WNW	-			
MC n	24,414 DDEL OUTPUT 1 430 2,015 1,110	2N 75	NON-\ 2NW	VORK	2W 5	2WSW	2SW -	25	3N -	3NW	De 3WNW	stination 3W	Sector 3WSW	3SW	3S -	XWI	XIL -	3IN -	XIN -	11,334 4NW	- 4N	4WNW 5	- 4W	4WSW	4SW	
MC n or	24,414 DDEL OUTPUT 1 430 2,015 1,110 215	2N 75 440 5	2NW 10 350 170 165	- WORK 2WNW - 25 70 115	2W 5 45 20 30	2WSW - 25 15 15	2SW - 5 - 5	2S 145 20 55	3N - 50 10	3NW - 5 10	De 3WNW	5 5 5 25 15	5 15 10 15	3SW - 5	3S - 5	XWI	XIL	3IN - -	XIN -	11,334 4NW - 10 15 5	- 4N - 25	4WNW 5 10 15	- 4W	4WSW - 20	4SW	
MC n	24,414 DDEL OUTPUT 1 430 2,015 1,110 215 115	2N 75 440 5 35 15	2NW 10 350 170 165 25	- WORK - 2WNW - 25 - 70 - 115 - 40	2W 5 45 20	2WSW - 25 15 15 15 15	2SW - 5 - 5 - 5 5	2S 145 20 55 10	3N - 50 10 - 5	3NW - 5 10	- De 3wnw 30	5 5 5 25 15	1 Sector 3WSW 5 15 10 15 40	- 3SW - 5 15	3S -	XWI	XIL -	3IN - -	XIN	11,334 4NW - 10 15	- 4N - 25 25	4WNW 5 10	- 4W	4WSW - 20 - 5	4SW	
MC n or	24,414 DDEL OUTPUT 1 430 2,015 1,110 215 115 460	2N 75 440 5 35 15	2NW 10 350 170 165 25 35	- WORK - 2WNW - 25 - 70 - 115 - 40 - 5	2W 5 45 20 30 15 -	2WSW - 25 15 15 15 15 115	2SW - 5 - 5 - 5 - 5 - 5 - 5	2S 145 20 55 10 15	3N - 50 10 - 5	3NW - 5 10 - 5	- De 3WNW 30 5	5 5 5 25 15	5 15 10 15 40 45	- S 15	3S - 5 5 - -	XWI	- XIL	3IN	XIN	11,334 4NW - 10 15 5 -	- 4N - 25 25 5 -	4WNW 5 10 15 - 5	- 4W	4WSW - 20	4SW 5	
MC n or	24,414 DDEL OUTPUT 1 430 2,015 1,110 215 115 460 165	2N 75 440 5 35 15 10 40	2NW 10 350 170 165 25 35	- WORK 2WNW - 25 - 70 - 115 - 40 - 5 - 35	2W 5 45 20 30 15 - 10	2WSW - 25 15 15 15 15 90	2SW - 5 5 5 5 125	2S 145 20 55 10 15 15	3N - 50 10 - 5 10 5	3NW - 5 10 - 5 - 20	- De 3WNW 30 5	5 5 25 15 10	5 15 10 15 40 45 20	- 3SW - 5 15 - - - 45	3S - 5 5	XWI	XIL	3IN	XIN	11,334 4NW - 10 15 5 -	- 4N - 25 25 5 - -	4WNW 5 10 15	- 4W	4WSW - 20 - 5 10	4SW - 5 - 5 5	
MC n or	24,414 DDEL OUTPUT 1 430 2,015 1,110 215 115 460 165 4,530	2N 75 440 5 35 15 10 40 235	2NW 10 350 170 165 25 35 35 135	- WORK 2WNW - 25 70 115 40 5 35 20	2W 5 45 20 30 15 - 10 70	2WSW - 25 15 15 15 15 90 75	2SW - 5 - 5 - 5 - 5 - 125 - 145	25 145 20 55 10 15 15 15 1740	3N - 50 10 - 5 10 5	3NW - 5 10 - 5 - 20 50	- De 3WNW 30 5 35	5 5 5 25 15 10 15 -	5 15 10 15 40 45 20 30	3SW - 5 15 45 80	3S - 5 5 - - - 5 60	XWI	XIL	3IN 10	XIN	11,334 4NW - 10 15 5 - - 20	4N - 25 25 5 - 10 25	4WNW 5 10 15 - 5 - 25	- 4W 5	4WSW - 20 - 5 10 - 5	4SW - - 5 - - - 5	
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4. Key Technical Aspects of Phase 2

4.1. Summary of ABM Improvements in Phase 2

During the implementation work in Phase 1, many additional factors were revealed that were relevant and useful for Phase 2 beyond the previously reported summary from the workshop held at CMAP in February 2012. The list of main model improvements is summarized in **Table 16**.

Table 16: Summary of Main Model Improvements

Model Component	Phase 1	Phase 2
Advanced "non-labeled" mode choice	X	Х
Transit access / spatial resolution		Х
Station characteristics	X	Х
In-vehicle parameters	X	Х
Capacity constraints		X
Crowding effects		X
Service reliability		Х
Transit frequency / wait time	X	Х
Fare / cost structures	X	X
Individualized transit path choice		X

The corresponding detailed analysis of main model improvements is included in the subsequent subsections below.

4.2. Non-Labeled Transit Mode Definitions: Further Steps in Phase 2

Non-labeled mode definitions refer to actual transit service characteristics and are based on understanding of traveler perceptions. This approach allows for elimination of proliferation of modegeography-specific constants that plagued many mode choice models applied in practice. This approach is being promoted by FTA and also represents a conceptual essence of the TCRP Project H-37 "Transit Services that Affect Choice of Mode". In line with this approach, transit user sees generic transit service where different modes and lines can be used. Access modes (Walk, PNR, and KNR) still represent distinct options (modes). The main shift of modeling focus is from proliferation of transit modes (that will never be enough to describe the multitude of trip origins, destination, and user characteristics.) to capturing individual path-building rules (that include the necessary level of details associated with trip origins, destinations, as well as user characteristics). With the non-labeled mode choice approach we have fewer modes in the mode choice set. However, we have a much more elaborate description of the transit path choice that is sensitive to transit attributes and person characteristics. The corresponding transformation of transit mode definitions from the Pricing ABM to Transit Modernization ABM Phase 1 and, finally, to Transit Modernization ABM Phase 2 is summarized in **Table 17**.

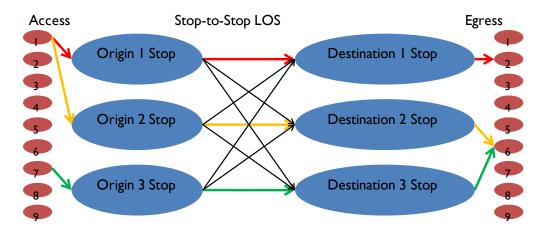
Table 17: Transformation of Transit Mode Definitions

Previous (labeled)	Phase 1	Phase 2
Walk to bus (CTA local bus, Pace	Walk to conventional transit (CTA	Walk to transit (CTA local bus,
local bus, CTA express bus)	local bus, Pace local bus, CTA train)	Pace local bus, CTA express bus,
Walk to premium transit (CTA	Walk to premium transit (CTA	CTA train, Metra commuter rail)
train, Metra commuter rail)	express bus, Metra commuter rail)	
Drive to premium transit (CTA	PNR (CTA local bus, Pace local bus,	PNR (CTA local bus, Pace local bus,
train, Metra commuter rail)	CTA express bus, CTA train, Metra	CTA express bus, CTA train, Metra
	commuter rail)	commuter rail)
Drive to bus (CTA local bus, Pace	KNR (CTA local bus, Pace local bus,	KNR (CTA local bus, Pace local bus,
local bus, CTA express bus)	CTA express bus, CTA train, Metra	CTA express bus, CTA train, Metra
	commuter rail)	commuter rail)

4.3. Taking Advantage of Micro Analysis Zones (MAZs)

The overall logic of TVPB is presented in **Figure 2**. Virtual path building represents a convolution of three essential transit pass components: 1) access time/cost pre-calculated for MAZ-to-station matrices using detailed street network, 2) station-to-station time/cost matrices skimmed using EMME transit assignment, and 3) egress time/cost pre-calculated for MAZ-to-station matrices using detailed street network. The entire MAZ-station-station-MAZ path calculated on the fly and cannot be stored in an MAZ-to-MAZ matrix format for two reasons. First, MAZ-to-MAZ matrix would contain roughly one third of a billion cells that is an object that is very inefficient to store and read. Secondly, with the multitude of individual parameters involve in path building (person age, income, trip purpose, etc) one would need to store hundreds of such matrices.

Figure 2: Transit Virtual Path Building (TVPB)



CMAP has established a system of 16,819 MAZs nested within 1,944 TAZs. The following aspects were considered and the following technical steps were made to take a full advantage of a finer level of spatial resolution.

- Use a detailed system of Transit Access Points (TAP). TAP represents a station or group of stops for
 the same transit mode with insignificant walk between them. TAPs replace TAZs for the purpose of
 transit assignment and skimming. The connectors between TAPs and stops (nodes) in the transit
 network are used to represent initial boarding transit fares and station-specific walk times. TAP-toTAP links used to represent transfer fare additions, walk times, and timed transfers (shorter transfer
 wait time that would have been calculated based on the headway).
- The MAZ system developed by CMAP (16,819 MAZs) is a significant step forward in terms of spatial resolution but it has its own limitations. In general, having more than one TAP per MAZ is excessive in terms of spatial resolution.
- MAZs can be added if necessary; some of the MAZs in the outer areas are still big. New Starts zone system provides some additional details in Indiana & Wisconsin.
- Chicago has 37,000 total Google transit stops:
 - o Pace 25,000 stops
 - o CTA 12,000 stops
 - Metra 240 stops
 - NICTD 20 stops
- Many stops are duplicative, overlapping, or very close to each other. It proved possible to collapse stops to reasonable number, without losing too much accuracy. Application of the TAP building method previously applied for San-Diego and Miami CT-RAMP ABMs resulted in 4,600 aggregate TAPs for Chicago. In the transit assignment and skimming procedures, TAPs are separated by mode (Local Bus, Express Bus, CTA train, Metra rail) for setting mode-specific path building attributes.
- Detailed street network provided by NAVTEQ was used to model transit walk access and egress travel times with actual sidewalk connectivity. MAZ-to-TAP connectors were built to calculate access/egress times by transit access modes (walk, PNR, KNR) with a higher level of accuracy.

4.4. Detailed Transit Network Coding Compatible with MAZ System

The transit network utilizes on-the-fly stop-to-stop path-building approach for transit Level-of-Service (LOS) calculations. This requires a 'dummy' zone system (referred to as Transit Access Points, or TAPs) created in a transit-specific EMME databank. Each TAP represents an explicit fixed-guideway transit stop, or one or more aggregated bus stops. Bus stops are only aggregated with other stops of the same mode-type (local with other local or express with other express). Each TAP is connected to the actual transit route stop in the highway network via an auxiliary transit link. Walk and drive connections from Micro Area Zones (MAZs) to TAPs are not coded directly in the network; instead, they are represented in a file or database table that is an output of another program developed as part of the Transit Modernization ABM setup.

Pseudo-code for creating the MAZ system, transit network, TAPs, and associated walk and drive access files are given below.

Pseudo-code:

- 1) Define MAZ system
 - a. Start with statistical areas
 - b. Should be much denser along existing or future planned fixed-guideway stations
 - c. 20k 40k MAZs acceptable
 - d. Code MAZ centroids
- 2) Import transit stops
 - a. Metra (~250 TAPS):
 - i. Create TAP at every station, with actual XY either from GTFS or existing emme network; one TAP per station
 - ii. Set Metra Rail = 1 in TAP attributes
 - iii. Code parking availability and other attributes
 - iv. Generate auxiliary transit link from TAP to highway network transit stop node
 - b. CTA Rail (~144 TAPS)
 - i. Create TAP at every station, with actual XY either from GTFS or existing emme network; one TAP per station
 - ii. Set CTA Rail = 1 in TAP attributes
 - iii. Code parking availability and other attributes
 - iv. Generate auxiliary transit link from TAP to highway network transit stop node
 - c. CTA Express bus (? TAPS)
 - i. From highest to lowest ridership, by route
 - 1. For each stop
 - a. Find closest link to stop
 - b. If no CTA express bus TAP within 1/8 mile on same link
 - i. Code TAP at actual XY
 - ii. If no node on link within 1/8 mile of stop
 - 1. Split link at stop location
 - Generate auxiliary transit link from TAP to highway network transit stop node
 - c. Else continue to next stop
 - d. PACE Express bus (? TAPS)
 - i. From highest to lowest ridership, by route
 - 1. For each stop
 - a. Find closest link to stop
 - b. If no CTA or PACE express bus TAP within 1/8 mile on same link
 - i. Code TAP at actual XY
 - ii. If no node on link within 1/8 mile of stop
 - 1. Split link at stop location
 - iii. Generate auxiliary transit link from TAP to highway network transit stop node
 - c. Else continue to next stop

- e. CTA Local bus (? TAPS)
 - i. From highest to lowest ridership, by route
 - 1. For each stop
 - a. Find closest link to stop
 - b. If no CTA local bus TAP within 1/8 mile on same link
 - i. Code TAP at actual XY
 - ii. If no node on link within 1/8 mile of stop
 - 1. Split link at stop location
 - iii. Generate auxiliary transit link from TAP to highway network node
 - c. Else continue to next stop
- f. PACE Local bus (? TAPS)
 - i. From highest to lowest ridership, by route
 - 1. For each stop
 - a. Find closest link to stop
 - b. If no CTA or PACE local bus TAP within 1/8 mile on same link
 - i. Code TAP at actual XY
 - ii. If no node on link within 1/8 mile of stop
 - 1. Split link at stop location
 - ii. Generate auxiliary transit link from TAP to highway network transit stop node
- 3) Evaluate the number of stops by mode. If too many, consider revising distance thresholds as described below and re-running procedure.
- 4) Code transit routes
 - a. Same logic\procedure as currently used; grade-separated fixed-guideway routes are coded over transit-only links while at-grade fixed-guideway and bus routes are coded over the highway network, with stops coded explicitly at nodes (see note 6)
 - b. Average headways should be coded for each time period to be modeled
 - c. Express bus routes should be coded in appropriate direction by time-of-day (for example, inbound in the AM period and outbound in the PM period).
- 5) Code transfer links.
 - a. Transfer links (auxiliary transit) can be coded between actual highway transit stop nodes within a given distance threshold. (see note 9)
- 6) Calculate TAP service file
 - a. For each TAP, create list of transit routes that stop at connecting highway node, across all time periods (can create one file for each time period or index by time period)
- 7) Create MAZ-TAP table
 - a. Determine walk distance threshold from on-board data (see note 10)
 - b. For each MAZ
 - For each TAP within walk distance threshold, sorted by distance in ascending order from MAZ to TAP
 - Check service file for TAP. If TAP provides service to a route that is not already connected to MAZ, create record in MAZ-TAP table

- 8) Create Formal TAZ TAP PNR table
 - a. Determine formal drive distance threshold from on-board data
 - b. For each TAZ
 - i. Sort TAPs by distance from TAZ in ascending order
 - ii. For each TAP
 - 1. If within maximum drive distance and Formal PNR Spaces>0, create record in Formal TAZ-TAP PNR table
- 9) Create Informal TAZ TAP PNR table
 - a. Determine informal drive distance threshold from on-board data, or informal catchment area to select specific TAPs
 - b. For each TAZ
 - i. Sort TAPs by distance from TAZ in ascending order
 - ii. For each TAP
 - Check service file. If within maximum drive distance and Informal PNR Spaces>0 and TAP provides new service, create record in Formal TAZ-TAP PNR table
- 10) Create TAZ TAP KNR table
 - a. Determine KNR drive distance threshold from on-board data
 - b. For each TAZ
 - i. Sort TAPs by distance from TAZ in ascending order
 - ii. For each TAP
 - Check service file. If within maximum drive distance and TAP provides new service, create record in Formal TAZ-TAP PNR table

Additional notes to be taken into account:

- 1) An emme 'transit' databank needs to be created, where each TAP is represented as a zone.
- 2) Fixed-guideway rail station TAPs are coded explicitly at actual XY location; routes are coded on transit-only links between stations with actual station-station travel times.
- 3) Bus TAPs can be aggregated, but only for the same type of service (express with express, local with local).
- 4) Threshold for combining bus TAPs on a link is 1/8 mile, based upon a maximum walk error of 2.5 minutes. This could be modified based upon the size of MAZs bordering each link. For example, if the average length of the face of each MAZ bordering a link is ½ mile, the TAP distance threshold could be increased to 1/4 mile, so that the variance in walk time between stops is consistent with the variance from any point within the MAZ to the stop.
- 5) The procedure assumes that stops will be coded on links if there is no stop already coded on that link for the same type of service. So for shorter, downtown links, the stop spacing will be closer than 1/8 mile (Chicago blocks are approximately 350 feet long or 1/16 mile).

- 6) If TAP is more than 1/8 mile from an existing highway node, a link split is recommended at the stop location in order to minimize error in walking time calculation this is particularly important if stop is in densely-coded MAZ area.
- 7) Once TAPs are coded, they can be offset by a small distance to make viewing networks easier.
- 8) Each TAP is connected to the transit stop highway node via an auxiliary transit link set to a minimal distance (1 foot).
- 9) Transfer links will be coded with a transfer time penalty and a mode-to-mode specific transfer cost penalty, if appropriate.
- 10) Walk distances can be set to vary by area type or district, in order to reflect longer relative walk distances in downtown. Walk distances can also be set to vary by mode; with longer walks allowed to stations and transit centers.

The TAP file has one record per TAP, with the following attributes created originally as shown in Table 18. Subsequently, many more attributes are added to the TAP file to represent transit station/stop type and characteristics as well as characteristics of the surrounding area. An example of a full TAP file with characteristics relevant for the TVPB procedure is shown in **Table 19**.

Table 18: TAP File Created Initially

Field Name	Description
TAP_ID	TAP ID
X_Coord	X coordinate or Longitude
Y_Coord	Y coordinate or Latitude
TAZ_ID	Number of TAZ that TAP is in
Metra_Rail	1 if stop is served by Metra Rail, else 0
CTA_Rail	1 if stop is served by CTA Rail, else 0
CTA_Express	1 if stop is served by CTA Express, else 0
Pace_Express	1 if stop is served by Pace Express, else 0
CTA_Local	1 if stop is served by CTA Local, else 0
Pace_Local	1 if stop is served by Pace Local, else 0
Stop_Type	Stop type (1=Pole, 2=Shelter, 3=Platform, 4=Station, 5=Transit center)
Formal_PNR_Spaces	Number of formal PNR spaces (0 if no formal PNR)
Informal_PNR_Spaces	Number of informal PNR spaces (0 if no informal PNR)
Daily_Park_Cost	Parking cost in cents
Elevator_Time	Average time from station location to platform
Lot_Time	Average time from center of PNR lot to station

Table 19: TAP File with a Full Set of Characteristics Used for TVPB

Parameters	Index	Skims generated
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Parameters	Index	Skims generated
Walk-transit-Walk path:		
Walk time weight & walk speed	MAZ-TAP/TAP-MAZ	Walk distance
Auto-transit-walk path:		
Travel time weight	MAZ(TAZ)-TAP(TAZ)	Travel time (total):
-	/TAP(TAZ)-MAZ(TAZ)	SOV-non-toll for PNR
		HOV2-non-toll for KNR
Shortest access/egress time PNR/KNR	MAZ(TAZ)-Closest	((2)
	TAP(TAZ)	
Shortest access/egress time PNR/KNR	Closest TAP(TAZ)-	
reversed	MAZ(TAZ)	
Extra travel time weight		Total – Shortest
Travel distance weight (cost per mile/VOT)	MAZ(TAZ)-TAP(TAZ)	Travel distance:
	/TAP(TAZ)-MAZ(TAZ	SOV-non-toll for PNR
		HOV2-non-toll for KNR
Boarding TAP:		
Station type attraction factor	TAP	Boarding TAP type (1-5)
Real-time information factor	TAP	1=yes, 0=no
Formal parking spaces weight (log)	TAP (PNR only)	# parking spaces
Informal parking spaces weight (log)	TAP (PNR only)	# parking spaces
Daily parking cost weight (1/VOT)	TAP (PNR only)	Daily parking cost
Parking lot time weight	TAP (PNR only)	Parking lot time
KNR convenience factor by category	TAP (KNR only)	KNR convenience category
Buffered area crime rate weight	TAP (MAZ) (WT only)	Buffered crime rate
Buffered retail density weight	TAP (MAZ) (WT only)	Buffered retail density
First boarding fare component weight	TAP	First boarding fare
(1/VOT)		
Alighting TAP:		
Station type attraction factor	TAP	Boarding TAP type (1-5)
Formal parking spaces weight (log)	TAP (reversed PNR only)	# parking spaces
Informal parking spaces weight (log)	TAP (reversed PNR only)	# parking spaces
Daily parking cost weight (1/VOT)	TAP (reversed PNR only)	Daily parking cost
Parking lot time weight	TAP (reversed PNR only)	Parking lot time
KNR convenience factor by category	TAP (reversed KNR only)	KNR convenience category
Buffered area crime rate weight	TAP (MAZ) (Not for reversed	Buffered crime rate
<u> </u>	PNR/KNR)	
Buffered retail density weight	TAP (MAZ) (Not for reversed	Buffered retail density
	PNR/KNR)	
First boarding fare component weight	TAP	First boarding fare
(1/VOT)		
EMME TAP-to-TAP:		
Total generalized time weight for user class	TAP-TAP	Total generalized time for virtual
(default is 1.0)		path building

There is one walk-access MAZ-TAP file that is created by the program that uses the detailed navigation network. It has one record per MAZ-TAP connection, with the following attributes as shown in **Table 20**. Only MAZ-TAP pairs within the maximum allowable walk distance per trip (3 miles) are listed which makes the storage of this table feasible.

Table 20: Walk Access/Egress Connections between MAZs and TAPs

Field Name	Description			
MAZ_ID	TAP ID			
TAP_ID	TAP Number			
Distance	Distance from MAZ centroid to TAP in feet			

There are three drive-access files\tables that are created programmatically: one for formal PNR, one for informal PNR, and one for KNR. For PNR and KNR, auto time is used for access rather than walk time. Auto time is currently available only at the TAZ-to-TAZ level since highway assignment is implemented using a standard deterministic user equilibrium algorithm in EMME. Each table has one record per TAZ-TAP connection.

4.5. Estimation of Individualized Transit Path Choice Parameters

One of the main focuses of the current project was to individualize parameters of transit path building by person type such as VOT, propensity to walk, sensitivity to comfort, convenience & productivity while on board or in the station, etc. Ideally, the entire transit path should be individualized that corresponds to the concept of Dynamic Transit Assignment parallel to Dynamic Traffic Assignment with individual microsimulation implementation. However, an efficient Dynamic Transit Assignment procedure is not yet available for a region of the size of Chicago. Thus, the adopted methodology for the current project was a hybrid. The TVPB procedure (finding the best OMAZ-OTAP-DTAP-DMAZ path) was implemented in a completely disaggregate micro-simulation fashion while the middle portion of the path (OTAP-to-DTAP) was aggregated by three user classes. Thus, a wide range of individualized parameters is applied to evaluate the access (OMAZ-to-OTAP) and egress (DTAP-to-DMAZ) parts of the path. The middle part (OTAZ-to-DTAP) is pre-calculated as a set of user-class-specific skims. However, when the class is specified for each user, a probabilistic choice model for class membership is applied that addresses a range of person and household characteristics.

4.6. Transit Path Experimentation

CMAP transit model encodes transit service supply using the seven mode labels listed in **Table 21**. While one overall project objective was to evolve beyond estimating choice models using "named modes" such as "Metra Rail" as major drivers of the model specification, the seven mode distinctions offered granularity useful in encoding fine-grained representations of impedance factors. The "Mode Type", "Bus Type", and "Hierarchy" columns in **Table 21** are relevant to distinctions in such encoding described later.

Code	Description	Mode Type	Bus Type	Hierarchy
Р	PACE Regional Bus	Local	Local	4
L	PACE Local Bus	Local	Local	4
В	CTA Bus	Local	Local	4
С	CTA Rail (the "El")	Local	n/a	3
E	CTA Express Bus	Premium	Express	2
Q	PACE Express Bus	Premium	Express	2
М	METRA Rail	Premium	n/a	1

The purpose of this task was to evaluate additional service elements for evaluation in the path-building process. We considered questions concerning how much weight travelers attach to IVT's various components and whether those weights varied by traveler characteristics, i.e. Is cleanliness more important than productivity? Do different types of travelers value productivity opportunities differently? One of the resources used to analyze such questions was the findings from--and techniques used to conduct--the Transit Cooperative Research Program H-37 research Characteristics of Premium Transit Services that Affect Choice of Mode.

The H-37 research used revealed and stated preference survey data to inform Max-Diff modeling of user preferences and logit modeling of user choices of transit. One of the surveys was conducted in Chicago, giving the team direct observations on Chicago transit riders' perceptions of assorted impedance factors. For the TCRP H-37 project, RSG also used the revealed preference data describing actual transit paths taken as a means of building transit path-building algorithms that could create small (no more than three choices) sets of path choices per trip with a high probability that one path in the choice set matched the observed path. For easy reference, this document labels the structured process of refining the model path-builder to produce path choices matching actual paths as "path experimentation."

Path Experiment Method

Path experimentation was conducted using observations in the CMAP Travel Tracker Household Travel Survey (HHTS). The model path-builder was modified to employ the five additional factors described below atop the detailed impedance calculations performed in the original transit model (**Table 22**). The boarding penalty factor (XferPen) was applied by adding it to the model's originally-calculated boarding penalty whereas the weight factors were applied as a multiplier to the appropriate impedance total produced by the original model code. For example, the premium in-vehicle-time weight (PmIVTwt) multiplied by the total perceived IVT time from the original model was used as the final IVT time in the path experiment model run.

Path Factor	Description	Range
XferPen	Additive boarding penalty (in minutes) applied to each transit boarding in	0-10
	the path	
PmIVTwt	Multiplicative weight applied only to "premium" mode types	0.5-1
NPbrdPenWt	Multiplicative weight applied to total calculated boarding time only for non-	0.5-2
	premium mode types	
WtTmWt	Multiplicative weight applied to each calculate wait time in the path	1-2
AuxTimWt	Multiplicative weight applied to each calculated access, egress, and transfer	1-3
	time (transfer time is the time spent getting to or between stations and does	
	not include wait time while at the station)	

Initially the CMAP Travel Tracker Household Travel Survey (HHTS) was filtered to those transit persontrip records with complete data on origin & destination location, demographics, trip purpose, and specific transit mode used per trip leg resulting in 2,499 "usable" trip records. Later, a data cleaning exercise was completed that used route identifiers to identify the fully detailed mode code (see **Table 21**) on an additional set of HHTS records resulting in a total of 2,631 usable trip records in the starting data set.

Path Matching to Observed Data

Systematic exercises were conducted matching model-produced paths to surveyed paths in the HHTS data in three general steps:

- Step 1: initial path matching
- Step 2: path matching refined by removing trip records found to be problematic
- Step 3: path matching using refined match criteria and additional path factor combinations
- Step 4: path matching using ordered mode matching applied to the results of groups of three selected path factor combinations

General results in terms of total match rates by access mode and overall appear in **Table 23**. Path factor combinations that produced the match results shown in **Table 23** appear in **Table 24** through **Table 26**.

Access Type	Step 1 Results	Step 2 Results	Step 3 Results	Step 4 Results
Walk	42%	43%	61%	53%
PNR	53%	54%	61%	60%
KNR	43%	43%	57%	52%
All Types	43%	44%	61%	54%
Paths Tested	32	32	57	57
Match Criteria	Ordered Mode	Ordered Mode	Highest Mode	Ordered Mode
Matches Reported	Best paths by access	Best paths by access	Best of chosen 3 paths	Combination of chosen 3 paths
HH Records Tested	2631	2570	2570	2570

The first experiment tested 32 systematically enumerated combinations of the five factors and used "Ordered Mode" matching criteria which considered the modeled path to match the observed path only if the mode for every trip leg matched in the observed order. For example, to match a HHTS trip record where the user walked to board a local CTA bus (B) then transferred to CTA rail (C) to finish their transit trip, the model path-builder would have to return a walk-access B-C path in that order, to produce a match. As shown in the "Step 1 Results" column of **Table 23** the most successful match rate of 53% was obtained for PNR-access trips with other access type match rates around 43%. Several sets of factors by access type produced similar results (see **Table 24**).

Table 24: Path Factor Combinations that Produced Step 1 Match Results

Path Success	XferPen	PmIVTwt	NPbrdPenWt	WtTmWt	AuxTimWt
Best Walk	10	1	0.5	1	2
Best Walk	10	1	0.5	2	2
Best PNR	0	1	0.5	1	1
Best PNR	0	1	1.5	1	1
Best PNR	0	1	0.5	2	1
Best PNR	0	1	1.5	2	1
Best KNR	10	1	0.5	1	1
Best KNR	10	1	1.5	1	1
Best KNR	10	1	0.5	2	1
Best KNR	10	1	1.5	2	1

Detailed examination of the Step 1 Results concluded that a small set of HHTS records should be discarded because their paths were such that the model would never successfully match them. After discarding those records the matches were recomputed to produce the "Step 2 Results" in **Table 23**. **Bold** text in **Table 25** indicates new path factor combinations not present in the Step 1 Results in **Table**

24. The new combinations resulting from discarding problematic records occur entirely for walk-access trips

Table 25: Path Factor Combinations that Produced Step 2 Match Results

Path	XferPen	PmIVTwt	NPbrdPenWt	WtTmWt	AuxTimWt
Success					
Best Walk	10	0.5	0.5	1	2
Best Walk	10	1	0.5	1	2
Best Walk	10	0.5	0.5	2	2
Best Walk	10	1	0.5	2	2
Best PNR	0	1	0.5	1	1
Best PNR	0	1	1.5	1	1
Best PNR	0	1	0.5	2	1
Best PNR	0	1	1.5	2	1
Best KNR	10	1	0.5	1	1
Best KNR	10	1	1.5	1	1
Best KNR	10	1	0.5	2	1
Best KNR	10	1	1.5	2	1

The entire project team discussed the findings from Steps 1 and 2 and concluded that the "Ordered Mode" matching criteria were too restrictive given the transit-rich Chicago environment and that "Highest Mode" criteria would be more appropriate. The latter criteria first categorize the bus modes by whether they are local or express service (column "Bus Type" in **Table 21**) then establish a mode hierarchy by consolidating local buses into one level, CTA Rail into its own level, express buses into another level, and Metra Rail as its own and highest level (column "Hierarchy" in **Table 21**). To constitute a match under "Highest Mode" the modeled transit path had only to have the same highest mode per the hierarchy as the HHTS transit path. For example, a modeled path where the user walked to CTA Bus (B) then transferred to CTA Rail (C) would match an HHTS record where the user walked directly to CTA Rail and that was the only transit mode used, the user walked to any local bus then transferred to CTA Rail, or where the user walked to CTA Rail then transferred to local bus.

While these discussions were taking place the model was run with additional path factor combinations it had deemed desirable but which had not yet been produced given model run-times. Applying the new "Highest Mode" matching criteria across the new set of 57 combinations of the five impedance adjustment factors produced a marked increase in the best success rates as shown in the "Step 3" column of **Table 23**. The best path combinations from Step 3 based on highest mode matching (plus the desire to have factor combinations that meaningfully differentiated potential traveler classes) were rematched as a group using ordered mode criteria; those match results appear in the "Step 4" column of **Table 23**. From the Step 4 matching experiment two path factor combinations were selected to carry into final estimation. The 1,395 HHTS records for which the two selected groups of factor combinations obtained matches were tested with multinomial logit choice models. The models were specified to

predict the likelihood of a traveler selecting a path built using the selected adjustment factors given trip and traveler characteristics (see next section). Due to the fairly low count of some access types by traveler characteristics in the usable HHTS record-set the access type distinction from path-building was moved to the choice model during the estimation process. The final set of impedance adjustment combinations deemed to have good explanatory power for traveler preferences in path choice appears in **Table 26**; the pathmatch rates by access type for this set appear in the "Step 4" column of **Table 23**.

Path Description	XferPen	PmIVTwt	NPbrdPenWt	WtTmWt	AuxTimWt
Premium Service	0	0.5	1.5	1	1
Non Transfer, Non-	10	1	0.5	2	2
Premium, Short Walk					
Short Walk	0	1	1	1	3

Table 26: Impedance Factor Combinations that Produced Steps 3 and 4 Match Results

4.7. Demographic Influence on Path Selection (Class Membership Model)

Multinomial logit choice model was used to quantify the significance and direction of effect of traveler, access type, and trip purpose characteristics for HHTS path choices matched by the most successful combinations of impedance factor-adjustments to the model path-builder. Age and income categorical variables used for this modeling were specified as follows. Age was categorized into two groups: 1) Up to and including 35 years, 2) 36 years an older. Income was categorized into four groups: 1) Less than or equal to \$35K, 2) \$35K-\$60K, 3) \$60K-\$100K, 4) higher than \$100K. Work purpose was used as a dummy variable to estimate commute trips effects on path selection.

The first model specifications included separate models by access type and trip purpose. Estimation attempts with those forms indicated that there were too few samples to have separate models. Instead of having separate models by access and trip purpose, we estimated a single model with access type and trip purpose as explanatory variables—Initially travelers were also separated into three age groups, two of which were subsequently combined due to low sample counts.

Subsequent estimation iterations used the impedance factor combinations for the 3 path choices: premium service preference, direct, conventional, short-access service preference, and short-access preference regardless of service. If a modeled path based on a particular factor combination matched the surveyed path, then that predicted path was identified as the observed choice. If more than one path factor combination predicted a match or no combination had a match, the record was dropped from the estimation dataset. Final model specification definitions and results appear below.

Coefficients Definitions for the Final Estimated Models:

- *age*2: tendency of people 35 years older towards choosing direct, conventional, short-access service preference
- hhinc2_2: preference of income group 2 (\$35K-\$60K) towards choosing direct, conventional, short-access service
- *hhinc*34_2: preference of income group 3 & 4 (>\$60K) towards choosing direct, conventional, short-access service
- acc2_2: preference of PNR mode towards choosing direct, conventional, short-access service
- acc3 2: preference of KNR mode towards choosing direct, conventional, short-access service
- Purp_2: preference of work tour towards choosing direct, conventional, short-access service
- age3: preference of people 35 years older towards choosing short-access regardless of service
- hhinc2_3: preference of income group 2 (\$35K-\$60K) towards choosing short-access regardless
 of service
- hhinc34_3: preference of income group 3 & 4 (>\$60K) towards choosing short-access regardless
 of service
- acc2_3: preference of PNR mode towards choosing short-access regardless of service
- acc3_3: preference of KNR mode towards choosing short-access regardless of service
- Purp_3: preference of work tour towards choosing short-access regardless of service

Variable Definitions for the Final Estimated Models:

- Age_Cat2&3_dummy: Dummy variable for people who are 35 years older, 1 if yes, 0 otherwise
- Inc_Cat2_dummy: Dummy variable for those whose household income is between \$35K and \$60K, 1 if yes, 0 otherwise
- *Inc_Cat*3&4_*dummy*: Dummy variable for those whose household income is higher than \$60K, 1 if yes, 0 otherwise
- acc2_dummy: Dummy variable for PNR access mode, 1 if chosen choice using PNR access mode, 0 otherwise
- acc3_dummy: Dummy variable for KNR access mode, 1 if chosen choice using KNR access mode, 0 otherwise
- work_tour_dummy: Dummy variable for work trip, 1 if it is a work trip, 0 otherwise

The models were estimated initially with all variables (**Table 27** and **Table 28**), then with no constants (**Table 29**), and finally with only significant variables (**Table 30**) that corresponds to the final specification implemented in the CMAP ABM.

Utility Expressions for the All-Variables Model:

```
U(Path\ factor\ 5-premium)=0
U(Path\ factor\ 20-direct, conventional, short-access\ service\ preference)
= ascnone1+age2*Age\_Cat3+hhinc2\_2*Inc\_Cat2\_dummy+hhinc34\_2
*Inc\_Cat3\&4\_dummy+acc2\_2*acc2\_dummy+acc3\_2*acc3\_dummy+Purp\_2
*work\_tour\_dummy
U(Path\ factor\ 53-short-access\ preference\ regardless\ of\ service)
= ascnone2+age3*Age\_Cat3+hhinc2\_3*Inc\_Cat2\_dummy+hhinc34\_3
*Inc\_Cat3\&4\_dummy+acc2\_3*acc2\_dummy+acc3\_3*acc3\_dummy+Purp\_3
*work\_tour\_dummy
```

Table 27: Final Estimation Results for Paths 5, 28, and 53, All Variables Model

Variable	Coeff.	SE	T-Stat	Note
ascnone1 (constant for direct, conventional, short-access service)	0.3384	0.4089	0.828	
ascnone2 (constant for shortest walk service)	1.1	0.353	3.12	On average, shortest walk service is preferred
age2 (tendency of age 35+ towards choosing direct, conventional, short-access service)	-0.2381	0.3701	-0.643	
age3 (tendency of age 35+ towards choosing short-access path regardless of service)	0.05292	0.3136	0.169	
hhinc2_2 (tendency of income group 2 (\$35K-\$60K) towards choosing non transfer, non-premium service)	0.1939	0.5515	0.352	
hhinc34_2 (tendency of income group 3 & 4 (>\$60K) towards choosing direct, conventional, short-access service)	-1.249	0.4449	-2.81	High income less likely choose direct, conventional, short-access path
hhinc2_3 (tendency of income group 2 towards choosing short-access path regardless of service)	0.1429	0.4728	0.302	

Table 28: Final Estimation Results for Paths 5, 28, and 53, All Variables Model

Variable	Coeff.	SE	T-Stat	Note
hhinc34_3 (tendency of income	-1.249	0.3619	-3.45	High income less likely choose
group 3 & 4 towards choosing short-access path regardless of				shortest access path
short-access path regardless of service				
acc2_2 (tendency of PNR mode	-0.08808	0.4785	-0.184	
towards choosing direct,	-0.00000	0.4763	-0.184	
conventional, short-access service)				
acc3_2 (tendency of KNR mode	0.3366	0.5992	0.562	
towards choosing direct,	0.5500	0.5552	0.502	
conventional, short-access service				
acc2 3 (tendency of PNR mode	-1.851	0.5655	-3.27	PNR less likely choose shortest
towards choosing short-access	1.031	0.5055	3.27	access path
path regardless of service)				decess patri
acc3 3 (tendency of KNR mode	-1.623	0.7935	-2.05	KNR less likely choose shortest
towards choosing short-access				access path
path regardless of service				
Purp_2 (tendency of work tour	-0.7099	0.3743	-1.9	
towards choosing direct,				
conventional, short-access service)				
Purp_3 (tendency of work tour	-0.6081	0.316	-1.92	Work purpose less likely choose
towards choosing short-access				shortest access path
path regardless of service)				
Initial LL:		•	•	-328.4
Final LL:				-269.4

Utility expressions for the three path impedance adjustment factor combinations for a No Constant model:

```
U(Path 5, premium service preference) = 0
```

 $U(Path\ 28, direct, conventional, short-access\ service\ preference)$

- $= age2 * Age_Cat2\&3_dummy + hhinc2_2 * Inc_Cat2_dummy + hhinc34_2$
- $*Inc_Cat3\&4_dummy + acc2_2 * acc2_dummy + acc3_2 * acc3_dummy + Purp_2$
- $*work_tour_dummy$

U(Path 53, short - access preference regardless of service)

- = age3 * Age_Cat2&3_dummy + hhinc2_3 * Inc_Cat2_dummy + hhinc34_3
- $*Inc_Cat3\&4_dummy + acc2_3*acc2_dummy + acc3_3*acc3_dummy + Purp_3$
- * work_tour_dummy

Table 29: Final Estimation Results for Paths 5, 28, and 53, No Constant Model

Variable	Coeff.	SE	T-Stat	Note
age2 (tendency of age 35+ towards choosing direct, conventional, short-access service)	-0.1486	0.308	-0.482	
age3 (tendency of age 35+ towards choosing short-access path regardless of service)	0.5936	0.2674	2.22	Over 35 persons more likely choose shortest access path
hhinc2_2 (tendency of income group 2 (\$35K-\$60K) towards choosing direct, conventional, short-access service)	0.4002	0.4678	0.855	
hhinc34_2 (tendency of income group 3 & 4 (>\$60K) towards choosing direct, conventional, shortaccess service)	-1.058	0.375	-2.82	High income less likely choose direct, conventional, short-access service
hhinc2_3 (tendency of income group 2 towards choosing short-access path regardless of service)	0.8474	0.4103	2.07	Medium income more likely choose shortest access path
hhinc34_3 (tendency of income group 3 & 4 towards choosing short-access path regardless of service	-0.7151	0.3176	-2.25	High income less likely choose shortest access path
acc2_2 (tendency of PNR mode towards choosing direct, conventional, short-access service)	-0.06006	0.4768	-0.126	
acc3_2 (tendency of KNR mode towards choosing direct, conventional, short-access service	0.3627	0.5994	0.605	
acc2_3 (tendency of PNR mode towards choosing short-access path regardless of service)	-1.847	0.5622	-3.29	PNR less likely choose shortest access path
acc3_3 (tendency of KNR mode towards choosing short-access path regardless of service	-1.733	0.8028	-2.16	KNR less likely choose shortest access path
Purp_2 (tendency of work tour towards choosing direct, conventional, short-access service)	-0.6271	0.3539	-1.77	
Purp_3 (tendency of work tour towards choosing short-access path regardless of service)	-0.3783	0.3085	-1.23	
Initial LL:				-328.4
Final LL:				-275.1

Utility expressions for the significant-variables-only model:

```
\begin{split} \textit{U(Path factor 5-premium)} &= 0 \\ \\ \textit{U(Path factor 28-direct, conventional, short-access service preference)} \\ &= \textit{hhinc} 34\_2 * \textit{Inc\_Cat} 3\&4\_\textit{Dummy} + \textit{Purp\_2} * \textit{work\_tour\_dummy} \\ \\ \textit{U(Path factor 53-short-access preference regardless of service)} &= \textit{hhinc} 2\_3 * \\ &\quad \textit{Inc\_Cat} 2 + \textit{hhinc} 34\_3 * \textit{Inc\_Cat} 3\&4\_\textit{Dummy} + \textit{acc} 2\_3 * \textit{acc} 2\_\textit{dummy} + \textit{acc} 3\_3 * \\ &\quad \textit{acc} 3\_\textit{dummy} + \textit{age} 3 * \textit{Aag\_Cat} 2\&3\_\textit{Dummy} + \textit{Purp\_3} * \textit{work\_tour\_dummy} \\ \end{split}
```

Table 30: Final Estimation Results for Paths 5, 28, and 53, Significant Variables Model

Variable	Coeff.	SE	T-Stat	Note
age3 (tendency of age 35+ towards	0.6501	0.2417	2.69	Over 35 persons more
choosing short-access path regardless of				likely choose shortest
service)				access path
hhinc34_2 (tendency of income group 3 &	-1.189	0.3179	-3.74	High income less likely
4 (>\$60K) towards choosing direct,				choose direct,
conventional, short-access service)				conventional, short-
				access path
hhinc2_3 (tendency of income group 2	0.6646	0.3393	1.96	Medium income more
towards choosing short-access path				likely choose shortest
regardless of service)				access path
hhinc34_3 (tendency of income group 3 &	-0.774	0.3097	-2.5	High income less likely
4 towards choosing short-access path				choose shortest access
regardless of service				path
acc2_3 (tendency of PNR mode towards	-1.838	0.5533	-3.32	PNR less likely choose
choosing short-access path regardless of				shortest access path
service)				
acc3_3 (tendency of KNR mode towards	-1.829	0.7812	-2.34	KNR less likely choose
choosing short-access path regardless of				shortest access path
service				
Purp_2	-0.5466	0.3038	-1.8	
Purp_3	-0.349	0.3003	-1.16	
Initial LL:				-328.4
Final LL:				-283.5

The estimation results in **Table 30** are intuitive across several dimensions:

- Older persons tend to choose the shortest access path; this is likely due to people who don't want to walk as far since walk access is the dominant access mode.
- Medium income households tend to choose the shortest access path and higher income
 households are more likely to choose premium service. This would lead to the assumption that
 low income households tend to choose direct, conventional service, probably because these
 services would tend to cost less.

- People who drive to transit (both park-and-ride and kiss-and-ride) are less concerned with short access paths, probably because driving a little further is not very onerous.
- Trip purpose does not have a significant effect on the path choice.

These results were incorporated into the mode choice model estimation work to identify a preferred path choice for each individual traveler.

4.8. Individual Propensity to Walk

In the TVPB procedure, we take a full advantage of individual microsimulation with respect to traveler's propensity to walk and associated path building attributes. This is significant step forward compared to the prevailing modeling practices that operate with crude across-the-board estimated like a 2.5 wait on walk time versus in-vehicle time or 3-mile maximum walk threshold. In the CMAP Transit Modernization ABM, this component is implemented in two steps. First, each person is assigned an individual propensity to walk scaled between zero and one. Zero means minimal propensity to walk while 1 means maximum possible propensity to walk. The model uses three curves: lower, median, and upper bound, for propensity to walk as a function of traveler's age as shown in **Figure 3**. The individual propensity to walk is randomly drawn for each individual using a "stretched" normal distribution scaled to have 0.5%, 50%, and 99.5% percentiles equal to the values defined by the curves.

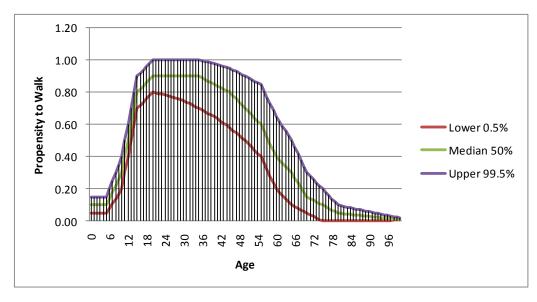


Figure 3: Propensity to Walk by Person Age

Secondly, individual propensity to walk is translated into three transit path building parameters: base walk time weight, walk speed, and maximum walk threshold (for a single trip) as summarized in **Table**31. For intermediate values of walk propensity the corresponding parameters are linearly interpolated

between the predefined minimum and maximum values for the extreme cases of propensity to walk equal to zero or one. This way, all three path building parameter are logically correlated. For example, a traveler with the maximum propensity to walk (1.0), who must be of age between 16 and 35, the base walk time weight (versus in-vehicle time) would be equal to 1.0, walk time speed would be 4.0 mph, and maximum walk threshold would be 3 miles.

Table 31: Individual Transit Pass Building Parameters as a Function of Walk Propensity

Walk	Base walk	Walk speed,	Maximum walk
propensity	time weight	mph	threshold, miles
0.0	3.50	1.00	0.50
0.1	3.25	1.30	0.75
0.2	3.00	1.60	1.00
0.3	2.75	1.90	1.25
0.4	2.50	2.20	1.50
0.5	2.25	2.50	1.75
0.6	2.00	2.80	2.00
0.7	1.75	3.10	2.25
0.8	1.50	3.40	2.50
0.9	1.25	3.70	2.75
1.0	1.00	4.00	3.00

4.9. Classification and Parameterization of Transit Stations & Stops

Transit stations/stops play an important role in transit path choices. They primarily affect wait time conditions but can also affect traveler's choice due to considerations of a bundle of station attributes including cleanliness, personal safety, provision of information, presence of amenities and commercial activities, parking conditions (for PNR), etc. The main categorization and initial setting of path building parameters is shown in **Table 32**. Wait convenience factor reflects relative weight of each minute of waiting vs. a minute of in-vehicle time. Real-time information factor is a multiplier that reduces wait time weight (makes waiting less onerous) if the information is available. Boarding/transfer time reflect an estimate of physical time required to traverse the station. It is further multiplied by an individual perceptional factor depending on user class membership discussed above.

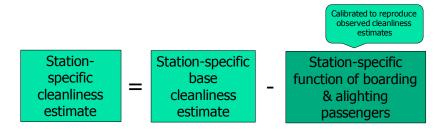
Table 32: Classification and Parameterization of Transit Stations & Stops

Station type	Visual association	Wait convenience	Real-time information	Boarding / transfer	Basic cleanliness
		factor	factor	time, min	estimate
1=Pole	Cata bus stop: 8 Halsted (a) North to Breadway Bary saving moreong Bary lake evening	2.50	0.9	0.5	80%
2=Shelter		2.25	0.9	0.5	80%
3=Plaza		2.00	0.9	1.0	85%
4=Station	was Chapp Los	1.75	0.9	1.5	90%
5=Major station		1.75	0.9	3.5	95%

Station cleanliness is an important characteristic of premium transit service that is normally ignored in travel models. In the CMAP Transit Modernization ABM, station cleanliness is incorporated as a

station/stop parameter that affects wait time and boarding time weight. This parameter is also subject to a special policy that improves cleanliness. Station cleanliness calculation involves station-type-specific base estimate shown in **Table 32** that is further multiplied by a station specific factor that depends on the number of boarding and alighting passengers – see **Figure 4**. The marginal impact of each passenger was calibrated to reproduce the available observed cleanliness data. It is currently set to -0.01 multiplied by the log of total (boarding plus alighting) passengers for station types 3, 4, and 5. It is set to zero for station types 1 and 2 since cleanliness of bus stop poles and shelters is indistinguishable from the environment.

Figure 4: Station Cleanliness Calculation



Quality and image of the boarding and alighting stations are important factors in choosing transit service and path by the user. A summary of the station characteristics used in the TVPB procedure is presented in **Table 33**. Station type and cleanliness affects boarding time weight and wait time wait that are used for building the TAP-to-TAP part in transit assignment procedure implemented in EMME.

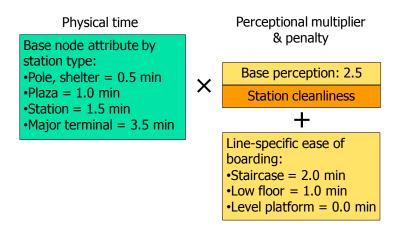
Table 33: Summary of Station Characteristics use in the Virtual Path Building

Characteristic	Origin TAP	TAP-to-TAP	Destination TAP
	(access)		(egress)
Station type	X	X	X
Real-time information	X (out)	X	X (inb)
Formal parking capacity	X (out)		X (inb)
Informal parking capacity	X (out)		X (inb)
Parking cost	X(out)		X (inb)
Parking lot walk time	X(out)		X (inb)
KNR convenience category	X(out)		X (inb)
Buffered area crime rate	X(out)		X (inb)
Buffered retail density	X		X
First boarding fare	X		
Boarding (traversal) time		X	
Ease of boarding		X	
Station cleanliness		X	

4.10. Perceived Boarding Time and Ease

Boarding time in the CMAP Transit Modernization ABM is calculated as a product of the physical time defined by station type and perceptional multiplier – see **Figure 5**. On top of this, line-specific ease of boarding & alighting is accounted as a perceived penalty ranging between 0 (for the most convenient level platform) and 2 min (for the least convenient staircase). The base perceived weight is specified currently as 2.5. Additional weight is associated with station cleanliness.

Figure 5: Perceived Boarding Time and Ease

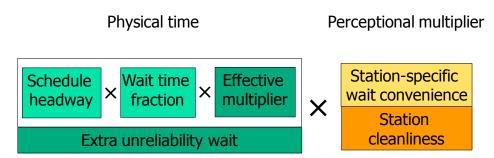


Station cleanliness impact on perception of boarding time is modeled as increased boarding time weight multiplied by the diminished cleanliness. The sensitivity coefficient is currently set to 1.5. This means that if the station cleanliness is, say, 80% (after accounting for the station activity) than the diminished cleanliness will be 1-0.8=0.2 and the additional wait time weight will be 0.2×1.5=0.30.

4.11. Perception and Parameterization of Wait Time

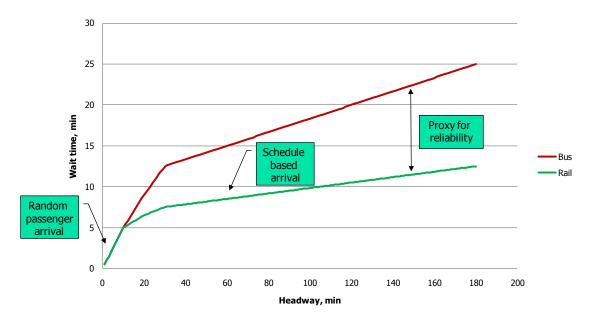
Wait time perceived by the transit users is modeled as a product of physical wait time (in green) and perceptional multiplier (in yellow) that reflects wait conditions that largely relate to the station type described above – see **Figure 6**. The base physical wait is calculated as a product of the line headway (combined for several overlapping lines in the optimal strategy assignment of EMME), fraction used to describe the profile of passenger arrival at the transit stop/station, and effective headway multiplier that is used to constrain line boarding capacity. Average extra wait associated with transit unreliability (currently applied for buses only) is added to the physical time. Perceptional multiplier includes station-specific wait convenience factor described in the section on transit station type and an additional factor that depends on the station cleanliness.

Figure 6: Wait Time Calculation in Transit Path Building



Wait time fraction used to calculate the base wait time as function of the schedule headway is presented in **Figure 7**. For a frequent transit service (headway up to 10 min), we assume that passengers arrive at transit stop randomly; hence the average wait time is calculated as half of the headway. When headway grows, passengers start arriving at stop according to the schedule that is expressed in a concave piece-wise linear function where wait time becomes progressively shorter than half of the headway. The observed pattern shows that with the same frequency, more reliable (rail) service is characterized by relatively shorter wait time (and more specific schedule based passenger arrival at the station) compared to buses.

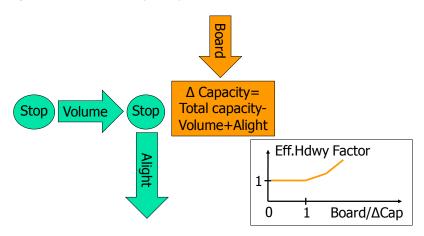
Figure 7: Wait Time Fraction of Transit Line Headway



Effective headway multiplier is calculated in the process of transit assignment equilibration. It reflects total transit capacity constraints at boarding points as shown in **Figure 8**. Number of barding passengers at each stop is compared to the residual capacity of the vehicle and if the boarding volume exceeds residual capacity, a wait time multiplier is applied. The corresponding function reflects the assumption

that if the boarding volume exceed capacity some of the passengers will have to wait for the next vehicle.

Figure 8: Effective Headway Multiplier



Average extra wait time due to unreliability is another physical wait time component that occurs because of the schedule non-adherence of the transit services (especially buses). This component represents another innovative feature of the Transit Modernization ABM. It is discussed in detail in the corresponding section on reliability.

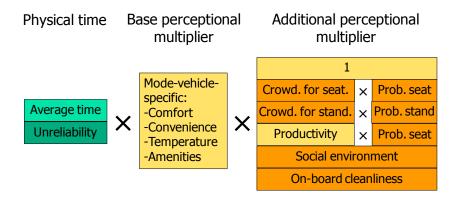
Station cleanliness impact on perception of wait time is modeled as increased wait time weight multiplied by the diminished cleanliness. The sensitivity coefficient is currently set to 1.2. This means that if the station cleanliness is, say, 80% (after accounting for the station activity) than the diminished cleanliness will be 1-0.8=0.2 and the additional wait time weight will be 0.2×1.2=0.24.

4.12. Perception and Parameterization of In-Vehicle Time

In the Transit Modernization ABM, in-vehicle time conditions are parameterized across a rich set of variables that include seating comfort, productivity (work, sleep, socialize), cleanliness, on-board amenities as well as socio-economic compatibility between riders. Traveler's perception of these characteristics is subject to person type. Since in-vehicle-time is currently handled by EMME aggregate assignment & skimming procedures, the possible multitude of person characteristics (age, income, etc) was encapsulated in three user class groups, where there is a correlation between the class and average income (growing from 1 through 3). The implemented concept of in-vehicle time calculation is presented in **Figure 9**. Physical in-vehicle time (that is shown in green as all physical components) is multiplied by a base (mode-vehicle-type specific) perceptional multiplier and subsequently by an additional multiplier that reflects specific conditions for a particular trip. Perceptional multipliers are distinguished from physical time components by the yellow color. Additional multiplier is a function of the number of passengers using this line segment; thus this component requires internal equilibration of

the transit assignment procedure. The darker yellow components specifically indicate on dependence on the number of passengers.

Figure 9: Calculation of In-Vehicle Time for Transit Path Building



Average in-vehicle time is calculated in the network assignment procedure implemented in EMME according to the network coding (Transit Time Function specified for each segment). The unreliability component is currently set to zero, but it can be added in future in a way similar to how extra wait time was added (discussed below in the section on unreliability).

The base in-vehicle time multiplier is currently specified by transit modes as shown in **Table 34**. The coefficient reflects a bundle of characteristics such as comfort, convenience, productivity, temperature, amenities, etc, associated with each mode. In further research it would be interesting to estimate the contribution of each characteristic and make the modeled in-vehicle time perception completely "unlabeled". The base coefficient is further differentiated according to the class-specific perception described above in the section on user class membership.

Table 34: Base In-Vehicle Time Perception Multiplier

Mode-vehicle type	In-vehicle time comfort/convenience factor
Local bus (BPL)	1.00
Express bus (EQ)	0.90
CTA train (C)	0.95
Metra rail (M)	0.85

Crowding effects and implemented crowding functions are discussed in detail in the corresponding section below. Productivity bonus is applied to decrease in-vehicle time perceptional weight for seated passengers (seated and standing passengers are separated explicitly in the transit assignment and skimming procedure). It is currently specified by transit mode-vehicle type and differentiated by user class as presented in **Table 35**. Specifically, user class 3 that is associated with higher income and

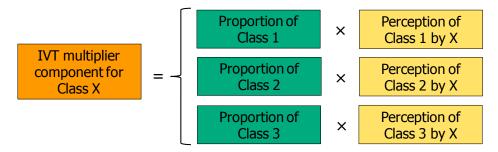
preference for commuter rail (explained in the section on user class membership) has the most substantial productivity bonus.

Table 35: Productivity Bonus for Seated Passengers

Mode -vehicle type	Fixed in-vehicle time productivity bonus as reduction of perceptional multiplier						
	User class 1 User class 2 User class 3						
Local bus (BPL)	0.00	0.00	0.00				
Express bus (EQ)	-0.05	-0.05	-0.10				
CTA train (C)	0.00	0.00	0.00				
Metra rail (M)	-0.05	-0.10	-0.25				

Social environment in the transit vehicle is usually not modeled explicitly. However, unpleasant social experience is constantly ranked amongst top 5 negative factors diverting travelers from public transit. The secret of commuter rail attractiveness is largely in its social environment, although productivity and reliability play an important role as well. In the Transit Modernization ABM, this effect is modeled explicitly by means of the proportion of different user classes encountered on each transit segment. Presence of other user classes differentially affects the perceived IVT multiplier a shown in **Figure 10**.

Figure 10: Social Environment Component of In-Vehicle Time Perception



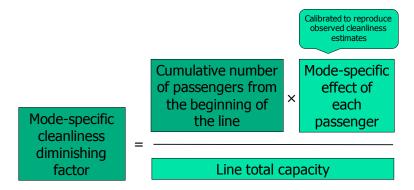
The proportion of each user class on each transit segment is skimmed as the result of equilibrium transit assignment. The cross-class perceptions are specified as a 3×3 matrix in the way shown in **Table 36**. Currently, only two "social frictions" are specified. There is a substantial class 1 aversion assumption made regarding class 3 and somewhat small class 1 aversion assumption for class 2. Since the classes are correlated with income this can be expressed as that higher income travelers (and especially commuter rail users) would try to avoid transit services that are used by low-income travelers.

Table 36: Matrix of Cross-Class Social Perceptions

Modeled passenger	Perception of other passengers as additional IVT weight			
	Class 1 Class 2 Class 3			
Class 1	0.00	0.00	0.00	
Class 2	0.10	0.00	0.00	
Class 3	0.50	0.00	0.00	

ON-board cleanliness is another important attribute that is normally ignored in travel models. In the Transit Modernization ABM, a mode-specific cleanliness diminishing factor is calculated for each line segment as shown schematically in **Figure 11**. The calculation is based on the ratio of the cumulative number of passengers from the beginning of the line divided by the line total capacity. This ratio that represents a relative intensity of the line use is multiplied by the marginal effect of one passenger to violate (originally clean) conditions. The one person contribution coefficient was calibrated to replicate the observed statistics on cleanliness percentage (in the range of 70%-95% depending on mode and line).

Figure 11: Calculation of On-Board Cleanliness Factor



The cleanliness diminishing factor represents an extra weight imposed on in-vehicle time to reflect the negative perception that transit users have of unclean vehicles. In the model application, this weight is additionally differentiated by user class. Currently classes 1, 2, and 3 are assigned sensitivity-to-cleanliness attributes of 0.5, 0.75 and 1.00 that are multiplied by the cleanliness diminishing factor.

4.13. Incorporation of Capacity Constraints and Crowding

Most applied travel models still utilize simplified unconstrained transit assignment procedures. This simplification results in two particular problems. First, ridership greater than total line capacity is allowed, that is obviously an unrealistic outcome. Secondly, inconvenience and discomfort in crowded transit vehicles (in particular, standing instead of sitting) is ignored despite that this factor strongly affects transit route choice, mode choice and other travel choices. The current research was intended to incorporate both factors in an operational travel model in a consistent non-duplicative way.

The first related aspect is to ensure feasibility of transit ridership forecast for each line and segment with respect to the *total capacity constraint*. This means that in a case where the transit volume exceeds total segment capacity a penalty should be applied until the feasible solution is reached. A feasible solution might not exist especially if a restricted transit assignment framework with a fixed transit table is employed (i.e. the riders of overcrowded lines can only switch to some other lines). It is normally a better chance to find a feasible solution if a mode choice framework is also employed (i.e. the riders of overcrowded lines can also switch to alternative modes). In terms of behavioral realism, the most appealing method to address infeasible volumes is to increase transit wait times at the corresponding boarding stations, i.e. use effective headways rather than schedule-based headways. This is based on the assumption that the riders will not always be able to board the first-arriving vehicle and will have to wait for the next vehicle. Effective headways is general is difficult to observe in reality. Thus, the form of the effective headway function is derived based on theoretical considerations and evaluated by the aggregate outcome of model application.

The second related aspect is to take into account *crowding in the vehicle* as a negative factor in the user perception of transit service quality. From this standpoint, not only exceeding of the total vehicle capacity but also exceeding the seated capacity (or even approaching it) should be penalized since standing is generally perceived by transit users as a very strong negative factor. Also, in a crowded vehicle, seated passengers experience inconvenience in finding a seat and getting off the vehicle. Crowding, however, should not be penalized in the same way as exceeding the total capacity since it is still a feasible observed situation. In terms of behavioral realism, the probability of having a seat should be reflected in the perceived in-vehicle time weight. This factor was incorporated in the transit assignment and mode choice model. Penalizing in-vehicle-time in crowding vehicles in transit assignment is algorithmically similar to applying volume-delay functions in highway assignment. This perceived weight should be estimated statistically which was one of the main purposes of the current research.

There were successful examples of applying both effective headways and in-vehicle time crowding weights in one model equilibrium framework. We also applied two functions (effective headway and crowding in-vehicle time weight) in parallel.

There is a significant body of literature reporting different forms of crowding functions estimated with either Revealed Preference (RP) or Stated Preference (SP) data or just calibrated based on the comparison of the model outcome to the aggregate ridership data. Some examples of the functions estimated for British Rail and London Underground are shown in **Figure 12**.

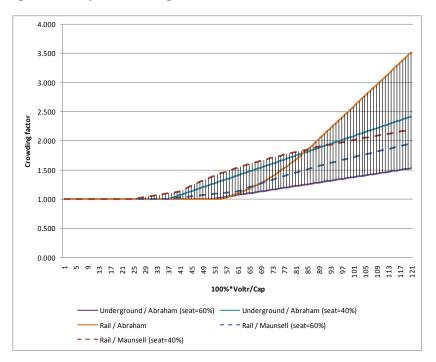


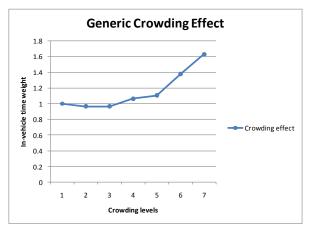
Figure 12: Examples of Crowding Functions

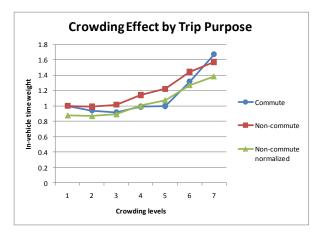
Despite significant differences in functional forms and parameters from study to study there is a clear common denominator that can be summarized in the following way:

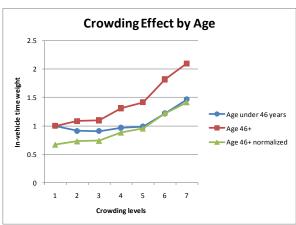
- Perceived (inconvenience) weight for in-vehicle time is a monotonically increasing (and most frequently convex) function of the number of passengers in the vehicle. It takes a value of 1.0 (maximum convenience) when the number of passengers is under the seated capacity. It starts increasing when the number of passengers approaches the seated capacity and grows the most when the number of passengers approaches the total capacity.
- It is a strong indication from the previous research that in-vehicle time for a crowded vehicle at maximum capacity should be weighted significantly (1.5 or more).
- Vehicle design and proportion between total and seated capacity affect the crowding function. Typical urban subway and (some) urban bus vehicles are "built to stand". They have a relatively low proportion of seats and consequently many standing passengers but standing itself is less onerous. For these vehicles, the crowding function starts increasing at a relatively low volume but remains relatively flat until the total capacity is reached. Typical commuter rail and express bus vehicles are "built to seat". They allow for only a few standing passengers but the standing itself is very inconvenient. For these vehicles, the crowding function starts increasing only at relatively high volumes but it grows rapidly when the total capacity is approached.
- Crowding function can be further segmented by person age, trip purpose, trip lengths and other person and/or trip characteristics that affect perception of crowding inconvenience, and standing in particular.

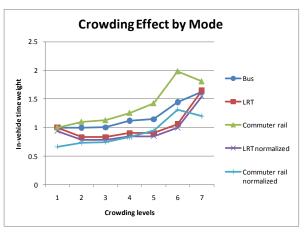
In the LACTMA study, 6 model specifications were explored that correspond to 6 crowding-related effects reported previously or hypothesized as possible ways to improve the model. Some of these hypotheses were confirmed by the estimation results while some other ones not. Below we discuss both positive and negative results. In order to facilitate the further analysis we present the crowding weights in a graphical form in Figure 13.

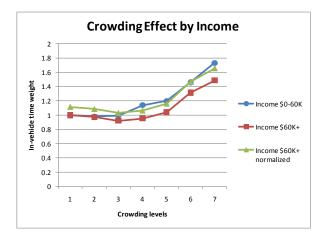
Figure 13: Main Crowding Effects

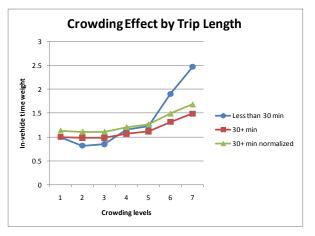












Non-normalized curved represent crowding weights relative to the minimum crowding level for the same segment (for example, commuting to work and non-work trip weights calculated separately). Normalized curves represent crowding weights relative to the minimum crowding level (for example, commuting to work and non-work trip weight calculated relative to the minimum crowding level for commuting trips).

The first specification used a generic formulation where crowding level used as the only segmentation dimension for in-vehicle time coefficient. Overall, the estimation results confirmed the main hypothesis that crowding is perceived by transit users as an extra weight on in-vehicle time that becomes quite significant (1.62) at the extreme crowding level. This number is somewhat lower than the numbers adopted for extreme crowding levels in some previous studies as discussed above (2.0 and higher). However, it is still very significant and affects transit assignment and mode choice results strongly.

The second specification included a segmentation by trip purpose – commuters to work and college where separated from trip for other (non-work) purposes. The original hypothesis was that crowding would be perceived as somewhat more onerous for commuters due to the frequency of the trip while for less frequent trips the users will be more tolerant to (occasional) crowding. This hypothesis was confirmed although the difference between travel purposes was not striking. The most significant difference corresponds to the highest crowding level that the users are more willing to tolerate on an occasional non-work trip but become very negative when it comes to a daily commuting trip.

The third specification included segmentation by person age. The original hypothesis was that younger users might be relatively tolerant to crowding while older users would be more sensitive and crowding-averse. In particular, having a seat should be essential for older users. The estimation results confirmed certain age-related effects. The most statistically significant results were obtained when the transit users were broken into two broad categories – younger users of age 45 or younger and older users of age 46 or older. There are two particular effects intertwined. One of them can be seen when the relative weights for in-vehicle time are normalized versus the in-vehicle time at the lowest crowding level for the same age group. In this case, older users proved to be more sensitive to higher crowding levels than younger users which is expressed in a greater weight (1.65 versus 1.51). The second interesting effect is that the base in-vehicle time coefficient for the lowest crowding level proved to be significantly lower for the older users. This means that while seated, the older users perceived travel time as a less onerous factor compared to younger users. When the ride becomes less convenient and probability of having a seat decreases the perception of time of older users is approaching the perception of younger users.

The fourth specification included segmentation by mode. The original hypothesis was that the vehicle design would have a significant impact on the crowding function. Bus curves were hypothesized as relatively flat but starting to "climb up" at relatively low crowding levels since these vehicles are built to make standing convenient. The commuter rail curve was hypothesized to have a longer initial flat part and then a spike at the end when crowding approaches the maximum level since commuter rail cannot

accommodate many standing passengers and standing in general is inconvenient. LRT curve was expected to be somewhere between bus and rail. While this initial hypothesis was somewhat confirmed the model estimation results gave some additional insights into the in-vehicle time perception by different transit modes. It proved that there is an overall difference between modes across all crowding levels where more convenient modes like LRT and Commuter Rail are characterized by lower in-vehicle time coefficients than bus. This is an interesting finding that suggests a differentiation of in-vehicle time coefficients by mode that is somewhat contrary to the prevailing practices. Overall, a discounting coefficient of 0.8 for most crowding levels except for very high crowding levels seems reasonable for rail modes compared to bus. When a relative crowding effect is added on top of this, it manifests itself stronger for rail modes although the curve proved to be not as steep as was expected.

The fifth specification included segmentation by household income groups. The original hypothesis was that transit users with higher income would exhibit more sensitivity to comfort and convenience, hence, a more crowding-averse behavior expressed in a steeper crowding function. This can be supported by the fact that higher-income travelers generally have more alternative options available because of the higher car ownership and higher willingness to pay while many low-income transit riders are captives because the auto for them is either not available or prohibitively expensive (for example, because of the parking cost). Multiple attempts were made with different income brackets to capture a systematic effect but neither of them brought a conclusive and statistically significant difference. The specification reported in this paper included two groups: 1=with a yearly income under \$60K, and 2=\$60K and more. As can be seen, no significant variation of in-vehicle time coefficient by income was found across the entire range of crowding levels. This finding might look counter-intuitive but it can be explained if the entire combination of behavioral parameters is compared across incomes. This is true, that value of time is strongly correlated with income. However, it does not automatically mean that the in-vehicle time coefficient should be lower for low-income users. It is more behaviorally appealing to assume that the lower value of time for low-income users would rather be a consequence of a higher cost coefficient (i.e. higher sensitivity to cost). In the same vein, there is no particular reason why while having an option to choose low-income users would be more tolerant to crowding and standing. When the willingness-to-pay factor is controlled, the user preferences with respect to convenience (traded against in-vehicle time) proved to be similar across all income groups. When the cost coefficient is taken into account, higher-income users are willing to pay more for convenience but this effect is proportional to their willingness to pay more for travel time savings. The expectation that high-income users would have a somewhat special sensitivity to crowding beyond their overall higher willingness to pay was not confirmed by the data.

The sixth specification included segmentation by trip length. The original hypothesis was that trip length would have a strong effect of the steepness of the crowding function. It is logical to expect that transit users would be tolerant to crowding (and standing) when the trip is short while for longer trips that would try to avoid crowded vehicles (and standing). Multiple statistical trials with different functional forms were implemented to capture this effect. However, the results proved to be either statistically insignificant or inconclusive. An example with trip segmentation by in-vehicle time into two categories: 1=under 20 min, and 2=20 min or longer, is shown in the table to illustrate the typical outcome. The

crowding weight proved to be roughly equal and independent of the trip length. While, this result looked originally counter-intuitive and disappointing, it can be explained by the underlying choice model structure. In the choice model context, even if the weight is constant, the resulted crowding effect does grow with trip length because the choice probability is defined by the difference in the utilities, and not by their ratio. Consider an in-vehicle time weight of 1.5 for a certain crowding level. With this weight, 10 min in a crowded vehicle would be equivalent to 5 extra min of travel time while 60 min in a crowed vehicle would be equivalent to 30 extra min of travel time. Thus, trip length would manifest itself in stronger crowding-averse behavior for longer trips even if the weight per min is constant.

The function currently adopted for the CMAP Transit Modernization ABM (**Figure 14**) is a modification of the generic function developed for the LACMTA study. In this function, seated and standing passengers are distinguished explicitly. This form is more advanced and better serves the current study since an explicit segmentation by standing and seated passengers is also important for calculation of productivity bonus that should only be applied to seated passengers.

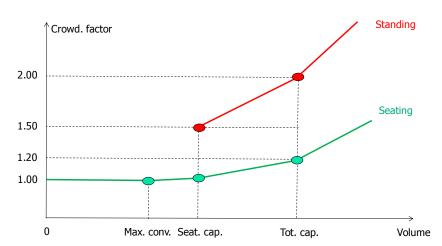


Figure 14: Adopted Crowding Function

4.14. Incorporation of Transit Service Reliability

Our intention is to incorporate transit service reliability in addition to mode-specific wait time curves in a way it was implemented in Los Angeles, CA. PB is currently undergoing an extensive research for the Los Angeles County Metropolitan Transit Authority (LACMTA) funded by FTA with respect to transit service reliability and its incorporation in the travel model. The outcomes of this research are applicable to the CMAP ABM. In general, transit reliability is defined as transit vehicles arriving/departing on schedule. Unreliable service may result in bus bunching, which is when buses deviate from their scheduled arrival intervals (i.e. headways). This deviation in service interval can subsequently increase stop wait time for riders. Currently, the LACTMA demand model (as practically all applied travel models) is insensitive to transit reliability as it assumes buses/trains arrive on schedule and maintain their desired headways. However, this is often not the case in selected areas where buses/trains often arrive

late (and sometimes early) due to a variety of reasons, including but not limited to, congestion, incidents, and additional dwell due to passenger demand, bicycles, and wheelchairs.

Without accounting for reliability, the utility (or attractiveness) of transit is overrepresented relative to the utility of other modes such as auto and walk as well as other transit routes that are not crowded. Therefore, the purpose of this work is to incorporate transit service reliability into the travel demand model in a manner that can be forecasted and can be modeled without significant additional data needs. The end result of this work is a simple transit reliability function that is a function of readily available highway and transit level-of-service measures. The resulting function is used within the transit assignment process to generate extra average wait time at stops. The extra average wait time due to reliability is skimmed and included in the utility of bus in the mode choice model.

There are multiple ways to define transit reliability. The simplest definition is that a transit service is unreliable at a stop if it arrives late or leaves early with respect to the schedule. Some more precise definitions of reliability include:

- En route Schedule Adherence (ESA) percent arrivals within (-1, +5) min scheduled window
- Headway Regularity (HR) percent actual headway within (150% to 50%) of scheduled headway
- Wait Assessment (WA) percent headways <= (scheduled headway + 3 minutes)
- Coefficient of Variation in Headways (C_{vh}) standard deviation of headway deviation / mean scheduled headway
- In-Service On-Time Performance (ISOTP) same as ESA and currently used by Metro
- Extra Average Wait Time (EAWT) (actual average wait time scheduled average wait time) assuming average wait time is half the headway, weighted by scheduled headway interval (see model estimation section for an example)

All of these reliability measures are also measures of on-time performance. Each requires a threshold at which service is deemed on-time. For example, the ESA and ISOTP measure define on-time as a six minute window (from one minute early to five minutes late) around the scheduled arrival time. At Metro, service is currently on-time 77 percent of the time according to ISOTOP. However, the ISOTP on-time window is greater than the headway of some lines such as the Rapid 720, so it isn't always the most useful measure of reliability. The Extra Average Wait Time (EAWT) measure simply calculates the average expected wait time from the schedule and subtracts it from the actual average wait time. A related measure is the ratio of actual average wait time to average expected wait time, which is insensitive to the magnitude of the expected wait time and is easier to compare across locations where the expected average wait times are very different. The EAWT measure is the key reliability measure used in this study since it is does not have any arbitrary bounds and since it a user-centric measure of reliability that can easily be coded into the demand model.

After developing the model estimation data set, some additional data post-processing was done before estimating the model. The main data post-processing step was to calculate stop level (by route and direction) EAWT. This was done as follows:

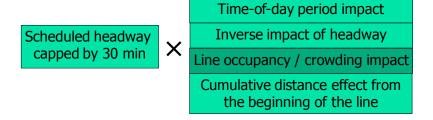
- Calculate the actual headway from the actual arrival times
- Calculate the actual wait time as half the actual headway
- Calculate the weighted actual wait time using the scheduled headway interval as the weight
- Do the same for the scheduled wait time to get the average weighted schedule wait time
- Subtract the weighted actual wait time from the weighted schedule wait time to get the extra average wait time (EAWT)

The following additional measures were created and used in the model estimation as well:

- Accumulated roadway saturation (ARS) = (accumulated miles of average previous road segment LOS) weighted by (road segment VMT)
- Accumulated transit stop activity saturation (ATS) = (accumulated boardings + alightings from the start of run) / (total vehicle capacity for run)

The model was then estimated based on the data provided by bus operators in the Chicago Metropolitan Region that defines EAWT as a function of such variables as accumulated roadway saturation (time-of-day specific parameters), cumulative transit line occupancy, cumulative route length, accumulated number of stops, and average weighted schedule wait time (**Figure 15**). EAWT is proportional to the schedule headway capped by 30 min where all other factors affect the second multiplier. This model was incorporated in the equilibrium transit assignment.

Figure 15: Extra Average Wait Time due to Unreliability of Bus Service



4.15. Incorporation of Fare Structures in Transit Mode & Path Choice

CMAP's Transit Modernization Model includes a representation of the Chicago region's transit fare payment policies that permits the modeler to interpret how out-of-pocket cost might affect a rider's choice of transit path. This includes, to the extent practicable, the cost incentives and discounts offered by the region's three public transit agencies to encourage multiple rides and facilitate transfers.

Discounts for monthly and multi-ride passes, seniors and person with disabilities are not included in this path-choice discussion, but can be incorporated in mode choice on the demand side.

This discussion is presented in three sequential sections to permit the development of algorithms for use in transit path skimming. The fare amounts, as of May 2012, are shown in cents as expected in the model code.

Operator Codes

The following codes are used in network coding to identify the transit operator providing the service on each line. They currently correspond to the fare policy associated with each code. These codes cannot be used to distinguish between types of vehicles or amenities.

- CTA Rail (Mode=C)
- CTA Regular Bus (Mode=**B**)
- CTA Express Bus (Mode=E)
- Pace Regular (Mode=P)
- Pace Local (Mode=L)
- Pace Express (Mode=Q)
- Metra (mode=M)

Single-Line Ride Fares

A single-line ride is the simplest transit path. It consists of a transit rider finding a direct connection between boarding zone and destination zone that can be accomplished without transferring between transit vehicles. Farecards are the preferred media for CTA and Pace. Cash fares are only allowed on buses and are not actively encouraged by the operators. The currently applied prevailing fares and payment types are summarized in **Table 37**.

Table 37: Single Ride Transit Fares in the Chicago Metropolitan Region

Operator code	Transit mode	Fare in cents	Prevailing payment method
С	CTA train	225	Farecard
В	Local bus	225	Cash
В	Local bus	200	Farecard
Е	Express bus	225	Cash
Е	Express bus	200	Farecard
P	Local bus	175	Farecard or Cash
L	Local bus	175	Farecard or Cash
Q	Express bus	400	Farecard or Cash
M	Metra rail	See table below	

Metra Zonal Fares

Metra fare districts A through M are based on distance from downtown Chicago. below shows the single line fare charged for a ride to or from district A (central Chicago). To find the fare for non-downtown interchanges, displace the first column of the matrix below by the number of rows needed to move the destination zone to the top of the list and reading the corresponding fare from the origin district row. (e.g. the fare from district F to E is found by moving E to the top along with the rest of the list; i.e. the fare is 300). Outbound fares are symmetrical.

Table 38: Metra Zonal Fares

Α	275
В	300
С	425
D	475
E	525
F	575
G	625
Н	675
1	725
J	775
K	825
М	925

Intra-Agency Transfers

Following the EMME convention, concatenating the operator codes indicates a trip that uses any (but not necessarily all) of the codes in the list.

CTA (**CBE**) and Pace (**PQL**) offer fare discounts for customers who transfer between lines during the course of their trip. Up to two additional boardings are permitted at a discounted fare within a two hour period.

CBE

CTA permits riders to alight and re-board the same line at different stops within the two hour period (i.e. it is not necessary to board a different line in order to earn the discount):

- 25 = 1st transfer
- $0 = 2^{nd}$ transfer

CC (select locations only)

There are several important stations on the CTA rail system (**C**) that allow free transfers between all lines serving the station. These are currently coded with a single node (cross platform) or a walk transfer (pedway or bridge between stations). The latter may involve a 1-2 minute walk and/or 1-2 story vertical change.

0 = unlimited transfer for all lines at the following locations:

- Merchandise Mart (32071): ctr002, ctr008
- Clark/Lake (32170, 32094, 32160): ctr002,ctr003, ctr004, ctr005, ctr008, ctr009, ctr010, ctr051
- State/Lake/Washington (32092, 32161, 32090): ctr002, ctr003, ctr004, ctr005, ctr008, ctr009, ctr010, ctr051
- Adams/Wabash (32164): ctr002, ctr003, ctr004, ctr008, ctr009, ctr010
- Washington/Wells (32073,32169): ctr002, ctr008, ctr009, ctr010
- Jackson/State/VanBuren (32030, 32077, 31650, 31651): ctr001, ctr002, ctr005, ctr008, ctr009, ctr10, ctr051
- Clinton (32096): ctr003, ctr004, ctr010
- Roosevelt (32032, 31750): ctr001, ctr003, ctr004, ctr009
- Howard (32009): ctr001, ctr002, ctr007
- Ashland (32116): ctr003, ctr004, ctr010

PL(Q)

Transfers discounts are only offered to other Pace routes. Transfers can be used for two trips following the initial ride. These trips must be taken within two (2) hours of the beginning of the initial ride. Reverse riding on a P route using a transfer is allowed within the two-hour time limit. Discount does not apply when transferring **to** Q **from** PQ or L:

- 25 = 1st transfer
- 0 = 2nd transfer

LL

Transfers between Local Pace routes are free, and are valid for one hour. Reverse riding is not allowed using free local transfers:

0 = 1st transfer

MM

Metra offers no discount for transferring between its own lines.

Inter-Agency Transfers

In general, the current fare policies do not discount transfers in a way that encourages inter-agency transfers.

(CBE)(PL)

No discount is currently offered to transfer between CTA and Pace. This is a temporary condition resulting from budget shortfalls and is expected to be re-introduced shortly. It will likely follow the intra-agency bus transfer policy.

M(CBE)(PL)

Metra Monthly Pass holders can purchase a premium pass for an additional \$45 (\$30 for Pace only) that permits unlimited free rides on CTA or Pace during peak travel times only. It is primarily oriented toward suburban commuters to downtown that do not work within walking distance of the Metra terminals. This is probably not a significant path choice determinant, but may be useful on the mode choice side.

The described rules in mode-to-mode transfer fare are summarized in **Table 39**. The rules from this table were applied in the transit assignment and skimming procedure implemented in EMME/4 using advance modules 5:32 (Extended Transit Assignment) and 6.27 (Analysis for Extended Transit Assignment).

Table 39: Mode-to-Mode Transfer Rules for Extra Fare Calculation

Mode from		Mode	to (transfer fa	re in cents by	number of tra	nsfers)	
	С	В	E	P	L	Q	M
C-CTA train	1=25 2=0 selected stations: 1=0	1=25 2=0	1=25 2=0	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	Full fare	Full fare for Metra Discounted fare 100 for CTA based on monthly pass extra of \$45
B-CTA LB	1=25 2=0	1=25 2=0	1=25 2=0	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	Full fare	Full fare Discounted fare 100 for CTA based on monthly pass extra of \$45
E-CTA EB	1=25 2=0	1=25 2=0	1=25 2=0	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	Full fare	Full fare
P-Pace reg.	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	1=25 2=0	1=25 2=0	Full fare	Full fare Discounted fare 75 for Pace based on monthly pass extra of \$45
L-Pace LB	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	1=25 2=0	1=0	Full fare	Full fare Discounted fare 75 for Pace based on monthly pass extra of \$45
Q-Pace EB	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	Expected: 1=25 2=0 Currently: Full fare	1=25 2=0	1=25 2=0	Full fare	Full fare
M-Metra	Discounted fare 100 based on monthly pass extra of \$45	Discounted fare 100 based on monthly pass extra of \$45	Discounted fare 100 based on monthly pass extra of \$45	Discounted fare 75 based on monthly pass extra of \$30	Discounted fare 75 based on monthly pass extra of \$30	Discounted fare 75 based on monthly pass extra of \$30	Full fare

4.16. Model System Integration

In summary, the following main improvements were incorporated in the CT-RAMP setup delivered to CMAP:

- All location choices were restructured to take advantage of the MAZ level of spatial resolution (16,819 MAZs).
- Transit Virtual Path Building procedure was implemented to find the best path OMAZ-OTAP-DTAP-DMAZ) with the first boarding station (OTAP) and last alighting station (DTAP) choice for all transit modes. As part of it a special procedure was be developed that calculates access/egress walk times MAZ-to-TAP using a detailed navigation network.
- Two "labeled" walk-to-transit modes ("conventional" and "premium") were replaced with a single generic walk-to-transit sub-mode. Taking into account that PNR and KNR sub-mode were made generic already in Phase 1, the entire model system became "non-labeled".
- Transit assignment, skimming, and TVPB procedures now applied for each of the 8 time-of-day periods as it is was previously implemented for the highway procedures. Mode choice and other models will take advantage of more specific time-of-day choice LOS (instead of transit peak and off-peak LOS applied in Phase 1).

A detailed description of the software components, installation, input and output files can be found in the companion User Guide delivered to CMAP.

5. Model System Validation in Phase 2

5.1. Validation & Calibration Targets

Validation targets for Phase 2 remained the same as for Phase 1

5.2. Validation & Calibration Results

The new transit procedures were integrated into the CMAP CT-RAMP model system. This included transit assignment and skimming macros implemented in EMME macro scripting language for transit with walk access by 3 user classes (1=walk averse 2=transfer averse ("streamlined"), 3=premium transit seekers) as well all required modifications to the CT-RAMP mode choice models (tour-level and trip-level) and Utility Expression Calculators. The modifications included new matrix references for the extended set of skims and new mode availability rules with respect to set of modes available for generic Walk to Transit, Park and Ride and Kiss and Ride. All transit assignment and network procedures were completely updated to incorporate a large number of additional attributes including vehicle, station, and service characteristics and tested. This procedure is based on the advance features incorporated in the latest version of EMME/4 that includes a new version of "Extended Transit Assignment with Variants".

The TAP-to-TAP skims for transit LOS attributes are fed to the TVPB procedure incorporated in the CT-RAMP mode choice model. Transit procedures were implemented for 8 periods: 1=Night, 2=AM early, 3=AM peak, 4=AM late, 5=Midday, 6=PM early, 7=PM peak, 8=PM late. The corresponding skims are used to construct LOS variables for all periods by adding access and egress components for each transit trip individually. The improvements to the transit procedures and mode choice model resulted in a much better match to the observed data. Below are examples of comparison of the model output at the tour level to the observed data (targets) by 2 main tour purposes (work and non-work), 4 transit modes (1=conventional transit with walk access, 2=premium transit with walk access, 3=park and ride, 4=kiss and ride), and 25×25 origin and destination districts. As an example in this report, we compare the model output to the expanded Household Travel Survey, 2007 – see **Table 40-Table 45**. Similar comparisons were made to all other available sources (CTPP journey-to-work table as well as Metra, CTA, and PACE on-board surveys)

Table 40: Comparison of Model Output to the Expanded Household Travel Survey, Work Tours, Transit with Walk Access (Phase 2)

	TARGETS		wo)RK	WK	PRE	HIS	-																		
igin											D	estinati	on Secto	r												
ctor	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Tot
1	32,382	1,702	742	-	280	2,216	280	709	-	-	653	-	1,255	-	-	-	-	103	-	-	176	-	-	-	-	40
!N	74,653	16,808	1,319	1,554	407	-	560	1,457	1,602	-	637	325	-	-	-	-	-	-	-	-	312	-	-	-	-	99
١W	17,709	1,676	1,145	3,570	438	-	-	-	148	325	671	-	-	-	-	-	-	-	-	183	-	-	-	-	-	25
NW	5,218	-	877	4,985	2,580	-	-	308	-	702	-	308	112	-	-	-	-	-	-	-	-	-	-	-	-	1
V	16,058	-	438	1,020	777	452	856	56	-	-	161	-	-	194	-	-	-	-	-	-	-	-	-	-	-	2
w	12,941	1,010	98	-	2,307	2,664	1,831	2.010	-	- 546	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12,773 44,715	569 1,394	3,188	-	1,275	- 042	5,818 3,893	2,019	-	546 521	70	- 88	-	- 265		-	-	-	-	-	-	-	-	-	-	
-	44,715	452	595	-	1,275	943	3,893	16,797 2,354	393	73	- 70	- 88	-	365	373	-	-	-		-	-	-	-	-	-	1
,	2,879	432				73	-	2,334	- 393	- 73	-			-	-			-								1
v	4,648	_		-	_		-	-		-	_	-		-	-		-	- 1		-	_	-	_	_	_	-
•	3,548	1,496		-	_	_	-	-		_	-	_	2,474	-	-		-	- 1		-	_	-	_	-	-	1
v	13,737	456	-	-	1,496	-	-	-	-	-	282	-		-	-	-	-	- 1	-	-	-	-	-	-	-	1
	7,342	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	2,284	-	-	-	-	-	852	768	-	-	-	-	-	-	513	-	-	- 1	-	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2,641	-	-	-	-	-	-	104	-	21	-	-	-	150	-	-	-	1,495	-	-	-	-	-	-	-	
	1,472	73	-	-	-	-	-	114	-	-	-	-	-	-	-	-	-	-	142	-	-	-	-	-	-	
	5,841	87	-	87	-	-	218	-	-	377	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
H	4,017	-	-	-	-	-	-	-	-	-	740	-	-	-	-	-	-	-	-	1,659	5,345	-	-	-	-	-
٧	1,061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	347	-	-	-	
F	914	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4,654	-	-	-	-	-	-	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	E 070																									
-	5,372	25 722	9 402	11 216	0 550	6 247	1/1 2/19	24 760	2 1/12	2 565	2 21/	721	2 9/12	700	- 005	-	-	1 500	1/12	1 0/11	- E 922	2/17	-	-	-	
v	281,638	25,722	8,402	11,216	9,559	6,347	14,308	24,769	2,143	2,565	3,214	721	3,842	709	885	-	-	1,598	142	1,841	5,833	347	-	-	-	
		25,722	8,402 WC		9,559 WK		14,308	24,769	2,143	2,565		721	3,842	709	885			1,598	142	1,841					-	
N	281,638	25,722 PUT	wc	ORK	WK	PRE					Desti	721 nation S	3,842 ector			-	-	1,598			5,833	347	-	-		
N n	281,638 IODEL OUT	25,722 PUT 2N	WC 2NW	2WNW	WK 2W	PRE 2WSW	2SW	25	3N	2,565 3NW	Desti 3WNW	721 nation S	3,842 ector 3WSW	709 3SW	35			1,598	XIN	4NW	5,833 4N				4SW	
N n	281,638 ODEL OUT	25,722 PUT 2N 680	2NW 400	2WNW 160	WK 2W 280	2WSW 340	2SW 560	2S 120	3N 20	3NW	Desti 3WNW	721 nation S 3W 40	3,842 ector 3WSW	3SW	3S -	XWI	XIL	3IN -	XIN	4NW 40	5,833 4N 60	347 4WNW	- 4W	4WSW	4SW	
N n	281,638 ODEL OUT 1 36,620 73,520	25,722 PUT 2N 680 14,680	2NW 400 2,840	2WNW 160 400	2W 280 300	2WSW 340 220	2SW 560 140	2S 120 260	3N 20 880	3NW - 120	Desti 3WNW 20 120	721 nation S 3W 40 60	3,842 ector 3wsw 20 20	3SW - -	3S - -	XWI -	XIL		XIN -	4NW 40 120	4N 60 500	347 4WNW	- 4W	4WSW	4SW	
N n or	281,638 IODEL OUT 1 36,620 73,520 29,180	25,722 PUT 2N 680 14,680 2,800	2NW 400 2,840 7,540	2WNW 160 400 780	2W 280 300 620	2WSW 340 220 240	2SW 560 140 160	2S 120 260 180	3N 20 880 80	3NW - 120 500	Desti 3WNW 20 120 520	721 nation So 3W 40 60 80	3,842 ector 3WSW 20 20 40	3SW	3S - - -	XWI -	XIL -	3IN -	XIN - -	4NW 40	4N 60 500 340	347 4WNW - -	- 4W	4WSW	4SW	
N n or	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860	25,722 PUT 2N 680 14,680 2,800 680	2NW 400 2,840 7,540 1,780	2WNW 160 400 780 1,760	2W 280 300 620 1,000	2WSW 340 220 240 260	2SW 560 140 160 120	25 120 260 180 40	3N 20 880 80 40	3NW - 120 500 20	Desti 3WNW 20 120 520 200	721 nation So 3W 40 60 80 80	3,842 ector 3wsw 20 20	3SW	35	- XWI	XIL	3IN -	XIN	4NW 40 120 40	4N 60 500 340 160	4WNW	- 4W	4WSW	4SW	
N n or	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860 20,360	25,722 PUT 2N 680 14,680 2,800 680 360	2NW 400 2,840 7,540 1,780 580	2WNW 160 400 780 1,760 600	2W 280 300 620 1,000 2,500	2WSW 340 220 240 260 640	2SW 560 140 160 120 160	25 120 260 180 40 80	3N 20 880 80 40 40	3NW - 120 500 20	Desti 3WNW 20 120 520 200 60	721 mation Sc 3W	3,842 ector 3WSW 20 20 40 40	3SW 20	3S - - - -	- XWI	- XIL	3IN -	XIN	4NW 40 120 40 -	5,833 4N 60 500 340 160 20	347 4WNW	- 4W	4WSW	4SW - - - -	
Nor	281,638 ODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440	25,722 PUT 2N 680 14,680 2,800 680 360 140	2NW 400 2,840 7,540 1,780 580 240	2WNW 160 400 780 1,760 600 320	2W 280 300 620 1,000 2,500 960	2WSW 340 220 240 260 640 2,640	2SW 560 140 160 120 160 680	25 120 260 180 40 80 80	3N 20 880 80 40 40	3NW - 120 500 20 20	Desti 3WNW 20 120 520 520 200 60 20	721 mation So 3W 40 60 80 80 480 380	3,842 ector 3WSW 20 20 40 40 - 380	3SW 20 60	35	- XWI	- XIL	3IN -	XIN	4NW 40 120 40 -	5,833 4N 60 500 340 160 20 20	347 4WNW	- 4W	4WSW	4SW	
Nor	281,638 DODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720	25,722 PUT 2N 680 14,680 2,800 680 360 140 300	2NW 400 2,840 7,540 1,780 580 240 280	2WNW 160 400 780 1,760 600 320 40	2W 280 300 620 1,000 2,500 960 380	2WSW 340 220 240 260 640 2,640 620	2SW 560 140 160 120 160 680 4,480	25 120 260 180 40 80 80 1,040	3N 20 880 80 40 40 -	3NW - 120 500 20	Desti 3WNW 20 120 520 200 60	721 nation S 3W 40 60 80 80 480 380 40	3,842 ector 3WSW 20 20 40 40 - 380 120	3SW - - - - 20 60 540	3S - - - - - - - 20	- XWI	- XIL	3IN	XIN	4NW 40 120 40 -	5,833 4N 60 500 340 160 20	347 4WNW	- 4W	4WSW	4SW	
Non None Non	281,638 DOEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560	2NW 400 2,840 7,540 1,780 580 240 280 440	2WNW 160 400 780 1,760 600 320	2W 280 300 620 1,000 2,500 960	2WSW 340 220 240 260 640 2,640 620 360	2SW 560 140 160 120 160 680	25 120 260 180 40 80 80	3N 20 880 80 40 40 - 40	3NW - 120 500 20 20	Desti 3WNW 20 120 520 200 60 20 20 -	721 nation So 3W 40 60 80 80 480 380 40 80	3,842 ector 3WSW 20 20 40 40 - 380	3SW 20 60	35	- XWI	- XIL	3IN -	XIN	4NW 40 120 40	5,833 4N 60 500 340 160 20 20 -	347 4WNW	- 4W	4WSW	4SW	
Nor	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960 4,920	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620	2NW 400 2,840 7,540 1,780 580 240 280 440 200	2WNW 160 400 780 1,760 600 320 40 80	2W 280 300 620 1,000 2,500 960 380 140	2WSW 340 220 240 260 640 2,640 620 360 20	2SW 560 140 160 120 160 680 4,480 1,760	25 120 260 180 40 80 80 1,040 7,080	3N 20 880 80 40 40 - 40 40 700	3NW - 120 500 20 20 40	Desti 3WNW 20 120 520 200 60 20 20 - 20	721 nation S 3W	3,842 ector 3WSW 20 20 40 380 120 20	3SW 20 60 540 440	3S - - - - - - 20 200	XWI	XIL	3IN 360	XIN	4NW 40 120 40 - - - - - - 80	5,833 4N 60 500 340 160 20 20 20 540	347 4WNW	- 4W	4WSW	4SW 20	
Non Der V	281,638 DOEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560	2NW 400 2,840 7,540 1,780 580 240 280 440	2WNW 160 400 780 1,760 600 320 40 80	2W 280 300 620 1,000 2,500 960 380 140	2WSW 340 220 240 260 640 2,640 620 360	2SW 560 140 160 120 160 680 4,480 1,760	25 120 260 180 40 80 80 1,040 7,080	3N 20 880 80 40 40 - 40	3NW - 120 500 20 20	Desti 3WNW 20 120 520 200 60 20 20 -	721 nation So 3W 40 60 80 80 480 380 40 80	3,842 ector 3WSW 20 20 40 380 120 20	3SW 20 60 540 440	3S - - - - - - 20 200	XWI	XIL	3IN 360	XIN	4NW 40 120 40	5,833 4N 60 500 340 160 20 20 -	4WNW	4W	4WSW	4SW 20	
N n or	281,638 IODEL OUT 36,620 73,520 13,860 20,360 17,440 23,720 4,920 1,720	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160	2NW 400 2,840 7,540 1,780 240 280 440 200 540	2WNW 160 400 780 1,760 600 320 40 80 -	2W 280 300 620 1,000 2,500 960 380 140 -	2WSW 340 220 240 260 640 2,640 620 360 20	2SW 560 140 160 120 160 680 4,480 1,760	25 120 260 180 40 80 80 1,040 7,080	3N 20 880 80 40 40 - 40 40 700	3NW - 120 500 20 20 40 1,520	Desti 3WNW 20 120 520 200 60 20 - 20 - 20 680	721 nation So 3W 40 60 80 80 480 380 40 20 20	3,842 ector 3wsw 20 20 40 40 - 380 120 20	3SW 20 60 540 440 -	35 - - - - - - - 20 200 -	**************************************	XIL	3IN 360	XIN	4NW 40 120 40 80 280	4N 60 500 340 160 20 20 - 540 180	347 4WNW 40	- 4W 20	4WSW	4SW 20	
Nor	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960 4,920 1,720 3,400	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 20	2NW 400 2,840 7,540 1,780 580 240 280 440 200 540	2WNW 160 400 780 1,760 600 320 40 80 60	2W 280 300 620 1,000 2,500 960 380 140 -	2WSW 340 220 240 260 640 2,640 620 3600 20 -	2SW 560 140 160 120 160 680 4,480 1,760 - 20	25 120 260 180 40 80 80 1,040 7,080	3N 20 880 80 40 40 - 40 700 80	3NW - 120 500 20 20 40 1,520	Desti 3WNW 20 120 520 200 60 20 20 - 20 680 1,900	721 nation So 3W 40 60 80 480 380 40 20 20 200	3,842 ector 3wsw 20 20 40 40 - 380 120 20 80	3SW	35 - - - - - - - 20 200 -	**************************************	XIL	3IN 360	XIN	4NW 40 120 40 80 280	4N 60 500 340 160 20 20 - 540 180	347 4WNW 40	- 4W 20	4WSW	4SW 20	
NOT	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860 17,440 23,720 4,920 1,720 1,720 3,400 5,460	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 40 40 60	2NW 400 2,840 7,540 1,780 580 240 280 440 200 540 60	2WNW 160 400 780 1,760 600 320 40 60 40	2W 280 300 620 1,000 2,500 960 380 140 - 40 60 380	2WSW 340 220 240 260 640 2,640 620 360 20 20 20	25W 560 140 160 120 160 680 4,480 1,760 - - 20 20	25 120 260 180 40 80 80 1,040 7,080 -	3N 20 880 80 40 40 - 40 700 80 -	3NW - 120 500 20 40 1,520 480	Desti 3WNW 20 120 520 200 60 20 20 - 20 688 1,900 60	721 nation S 3W 40 60 80 80 480 480 20 200 2,480	3,842 ector 3WSW 20 40 40 - 380 120 20 - 80 480	3SW 20 60 540 440 20 20	3S - - - - - - 20 200 - - - - - 1	xwi	XIL	3iN	XIN	4NW 40 120 40	4N 60 500 340 160 20 20 20 - 540 180 40	347 4WNW	- 4W 20 20	4WSW	4SW	
Nor	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960 4,920 1,720 3,400 5,460 7,300	25,722 PUT 2N 880 14,680 2,800 680 360 140 300 560 160 20 60 40	2NW 400 2,840 7,540 1,780 580 240 280 440 200 540 240 60 40	2WNW 160 400 780 1,760 600 40 80 600 40	2W 280 300 620 1,000 2,500 960 380 140 - 40 60 380 120	2WSW 340 220 240 260 660 2,640 620 20 20 20 - 20 120	2SW 560 140 160 120 160 680 4,480 1,760 - - 20 20	25 120 260 180 80 80 1,040 7,080 - - 20	3N 20 880 80 40 40 - 40 700 80 -	3NW - 120 500 20 20 40 1,520 480 40 40	Desti 3WNW 20 120 520 200 60 20 20 - 20 688 1,900 60	721 nation S 3W 40 60 80 80 480 480 200 200 2,480 400	3,842 ector 3WSW 20 40 40 - 380 120 20 - 80 480 3,860	3SW	35 - - - - - - 20 200 - - -	**************************************	- XIL	3iN	XIN	4NW 40 120 40	5,833 4N 60 500 340 160 20 20 20 - 540 180 40	347 4WNW	- 4W 20 20	4WSW	45W	
NOT	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960 4,920 1,720 3,400 5,460 7,300 8,700	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 40 40 60	2NW 400 2,840 1,780 580 240 280 440 200 540 240 60 40	2WNW 160 400 780 1,760 600 320 40 60 40	2W 280 300 620 1,000 2,500 960 380 140 - 40 380 120 40	2WSW 340 220 240 260 640 2,640 620 360 20 20 120 80	2SW 560 140 160 120 160 680 4,480 1,760 - - 20 20 -	2S 120 260 180 40 80 80 1,040 7,080 - - - - 20 20	3N 20 880 80 40 40 - 40 700 80 -	3NW - 120 500 20 20 40 1,520 480 - 40 20	Desti 3WNW 20 120 520 200 60 20 20 20 680 1,900 60 40 -	721 nation S 3W 40 60 80 480 480 20 200 2,480 400 20 20	3,842 20 20 40 - 380 120 - - - 80 480 3,860 40	3SW 20 60 440 20 60 220 60 2,220 180	3S - - - - - - 20 200 - - - - - 1	**************************************	XIL	3IN	XIN	4NW 40 120 40 80 280	5,833 4N 60 500 340 160 20 20 20 - 540 180 40 -	347 4WNW 40 680 - 20	- 4W 20 20 40	4WSW	4SW	
NOT	281,638 ODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960 4,920 1,720 3,400 5,460 7,300 8,700 6,240 40	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 40 40 60	2NW 400 2,840 1,780 580 240 200 540 200 540 410 200	2WNW 160 400 780 1,760 600 320 40 60 40	2W 280 300 620 1,000 2,500 960 380 140 - 40 60 380 120 40	2WSW 340 220 240 260 640 620 360 20 20 20 80 20	2SW 560 140 160 120 160 680 4,480 1,760 - - 20 20 -	25 120 260 180 40 80 80 1,040 - - - 20 20 20 700 - -	3N 20 880 80 40 40 - - 40 700 80 - - 20 - -	3NW	Desti 3WNW 20 120 520 200 60 20 20 20 680 1,900 60 40	721 mation So 3W 40 60 80 80 480 480 20 20 200 2,480 400 20 -	3,842 20 20 40 - 380 120 - - - 80 480 3,860 40	3SW	35 	xwi	- XIL	3IN	XIN	4NW 40 120 40	5,833 4N 60 500 340 160 20 20 540 40	347 4WNW	- 4W 20 20 40	4WSW	4SW	
NOT	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 4,920 1,720 3,400 5,460 7,300 8,700 6,240 40 -	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 20 60 40 60 40 -	2NW 400 2,840 1,780 580 240 200 540 400 60 40 140 200 -	2WNW 160 400 780 1,760 600 320 40	2W 280 300 620 1,000 2,500 960 380 140	2WSW 340 220 240 260 640 2,640 620 360 20 20 120 80 20	2SW 560 140 160 120 160 680 4,480 1,760 20 20 280 40	25 120 260 180 40 80 80 1,040 7,080 - - - - 20 20 540 700 - -	3N 20 880 80 40 40 40 700 80 20	3NW 120 500 20 20 40 1,520 480	Desti 3WNW 20 120 520 200 60 20 - 20 - 20 60 1,900 60 40	721 nation S 3W 40 60 80 80 88 40 20 20 2,480 400 20	3,842 ector 3WSW 20 20 40 40 - 380 120 20 80 480 3,860 40 -	3SW	3S 20 200 140 1,540	**************************************	XIL	3IN	XIN	4NW 40 120 40	5,833 4N 60 500 340 160 20 20 - 540 180 - - - - - - - - - - - - -	347 4WNW			4SW	
NOT	281,638 IDEL OUT 1 36,620 73,520 29,180 13,866 20,360 17,440 23,720 58,960 4,920 1,720 3,400 6,240 4,90 6,240 4,90 6,240 4,90 6,240 4,90 4,90 6,240 4,90 4,90 6,240 4,90 4,90 4,90 4,90 4,90 4,90 4,90 4,	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 40 60 40	2NW 400 2,840 7,540 1,780 580 240 280 440 200 540 40 140 20	2WNW 160 400 780 1,760 600 320 40 40	2W 280 300 620 1,000 2,500 960 380 140 40 40	2WSW 340 220 240 260 640 620 360 360 20 20	2SW 560 140 160 120 160 680 4,480 1,760 20 20 - 280 40	25 120 260 180 40 80 80 1,040 7,080 - - 20 20 540 700 - -	3N 20 880 80 40 40 40 700 80 - 20	3NW	Desti 3WNW	721 mation S 3W 40 60 80 80 480 20 20 20 2,480 400 20	3,842 200 400 40 380 120 80 480 3,860 40	3SW 20 60 540 440 20 60 220 180	35 	**************************************	XIL	3IN	XIN	4NW 40 120 40	5,833 4N 60 500 340 160 20 20 540 180 40	347 4WNW			4SW	
NOT	281,638 ODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960 4,920 1,720 3,400 5,460 7,300 8,700 6,240 40 40 1,860	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 20 60 40 140	2NW 400 2,840 7,540 1,780 580 280 440 200 540 240 60 40 140 20 220	2WNW 160 400 780 1,760 600 320 40 600	2W 280 3000 620 1,000 2,500 960 380 140 - 40 60 380 120 40	PRE 3490 240 240 260 640 2,640 620 20 20 20 20 - 20 120 80 20	25W 560 140 160 120 160 680 4,480 1,760 20 20	25 120 260 180 40 80 1,040 20 20	3N 20 880 80 40 40 40 700 80 - 20 - 20 - 20 - 20 - 20 - 20 - 20	3NW 120 500 20 20 40 1,520 480	Desti 3WNW	721 nation S 3W 40 60 80 80 480 380 20 20 200 2,480 400 20	3,842 ector 3wsw 20 40 40 380 120 20	3SW	3S	**************************************	XIL	3IN	XIN	4NW 40 120 40	5,833 4N 60 500 340 160 20 540 180 40 1,140	347 4WNW			4SW	
Non or	281,638 IODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 4,920 1,720 3,400 5,460 7,300 8,700 6,240 40 420 40 1,860 2,540 2,540	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 40 140 380	2NW 400 2,840 7,540 1,780 280 240 200 540 200 60 40 140 20 220 60	2WNW 160 400 780 1,760 600 320 40	2W 280 300 620 1,000 960 380 1400	PRE 340 220 240 260 640 2,640 620 360 20 20	2SW 560 140 160 120 160 680 4,480 1,760 20 20	25 120 260 180 40 80 1,040 7,080 - - - 20 20 540 700 - - - - - - - - - - - - - - - - -	3N 20 880 80 40 40 - 40 700 80 20	3NW	Desti 3WNW 20 20 200 520 200 20 20 20 20	721 nation S 3W 40 60 80 80 80 480 20 20 20 2,480 400 20	3,842 200 40 40 380 120	3SW	35 	xwi	XIL	3IN	XIN	4NW 40 40 120 40	5,833 4N 60 500 340 160 20 20 - 540 180 1,140 3,540	347 4WNW			45W	
Non I	281,638 I 36,620 73,520 29,180 13,866 20,360 17,440 23,720 58,960 4,920 1,720 3,400 5,460 7,300 8,700 6,240 40 1,860 2,540 492 40 40 40 40 40 40 40 40 40 40	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 20 60 40 140	2NW 400 2,840 7,540 1,780 280 240 200 540 200 40 40 140 20 200 60 80	2WNW 160 400 780 1,760 600 320 40 600	2W 280 3000 620 1,000 2,500 960 380 140 - 40 60 380 120 40	PRE 3490 240 240 260 640 2,640 620 20 20 20 20 - 20 120 80 20	25W 560 140 160 120 160 680 4,480 1,760 20 20	25 120 260 180 40 80 1,040 20 20	3N 20 880 80 40 40 40 700 80 - 20 - 20 - 20 - 20 - 20 - 20 - 20	3NW	Desti 3WNW	721 nation S 3W 40 60 80 80 480 380 40 20 20 200 2,480 400 20 80	3,842 ector 3WSW 20 20 40 40 - 380 120 20 80 480 20	3SW 20 60 540 440 20 60 220 180	35 	xwi	XIL	3IN	XIN	4NW 40 120 40	5,833 4N 60 500 340 160 20 540 180 40 1,140	347 4WNW			4SW	
w v v v v v v v v v v v v v v v v v v v	281,638 ODEL OUT 1 36,620 73,520 29,180 13,860 20,360 17,440 23,720 58,960 4,920 1,720 3,400 5,460 7,300 8,700 6,240 40 1,860 2,540 480 540	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 40 60 40 140 380 140	2NW 400 2,840 1,780 580 240 200 540 400 240 200 540 400 20 220 60 80 40	2WNW 160 400 780 1,760 600 320 40 40	2W 280 300 620 1,000 960 380 1400	PRE 2WSW 340 220 240 260 640 2,640 620 20 20 20 120 80 20	25W 560 140 150 120 160 680 4,480 20	25 120 260 180 40 180 80 80 1,040 10 10 10 10 10 10 10	3N 20 880 80 40 40 700 80 - 20 20	3NW - 120 500 20 20	Desti 3WNW	721 nation S 3W 40 60 80 80 480 20 20 200 2,480 400 - - - - - - - - - - -	3,842 20 20 40 40 380 120 20	3SW	35 	**************************************	- XIL	3IN	XIN	4NW 40 120 40 120	5,833 4N 60 500 340 160 20 540 1,140 3,540	347 4WNW			4SW	
,	281,638 I 36,620 73,520 29,180 13,866 20,360 17,440 23,720 58,960 4,920 1,720 3,400 5,460 7,300 8,700 6,240 40 1,860 2,540 492 40 40 40 40 40 40 40 40 40 40	25,722 PUT 2N 680 14,680 2,800 680 360 140 300 560 620 160 40 140 380	2NW 400 2,840 7,540 1,780 280 240 200 540 200 40 40 140 20 200 60 80	2WNW 160 400 780 1,760 600 320 40	2W 280 300 620 1,000 960 380 1400	PRE 340 220 240 260 640 2,640 620 360 20 20	2SW 560 140 160 120 160 680 4,480 1,760 20 20	25 120 260 180 40 80 1,040 7,080 - - - 20 20 540 700 - - - - - - - - - - - - - - - - -	3N 20 880 80 40 40 - 40 700 80 20	3NW	Desti 3WNW 20 20 200 520 200 20 20 20 20	721 nation S 3W 40 60 80 80 480 380 40 20 20 200 2,480 400 20 80	3,842 ector 3WSW 20 20 40 40 - 380 120 20 80 480 20	3SW	35 	xwi	XIL	3IN	XIN	4NW 40 40 120 40	5,833 4N 60 500 340 160 20 20 - 540 180 1,140 3,540	347 4WNW			4SW	

Table 41: Comparison of Model Output to the Expanded Household Travel Survey, Non-Work tours, Transit with Walk Access (Phase 2)

1 35,361 15,325	2N 1,425	NON V	2WNW	WK 2W						C)estinat	ion Secto	r												
35,361		2NW	2WNW	214/																					
35,361		21400			2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
	1.4/5	- 1	886	4,327	346	481	3,046	285	-	-	-	-	-	280	-	-	-	-	1,818	-	-		-	-	48,255
	23,586	2,963	326	1,630	-	-	291	343	-	-	81	-	-	-	-	-	-	-	-	-	-	-	-		44,546
4,794	2,680	4,108	2,789	-	-	1,527	239	-	-	-	239	-	-	-	-	-	-	-	1,527	-	-	-	-	-	17,903
1,312	197	2,000	1,881	2,821	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,211
6,923	481	298	2,084	7,653	392	409	1,105	-	-	-	662	-	-	-	-	-	-	-	662	-	-	-	-	-	20,670
2,491	250	197	-	948	6,838	194	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10,918
5,543	3,605	-	-	-	1,556	7,987	1,172	-	-	-	-	-	-	-	-	-	70	-	-	-	-	-	-	-	19,933
23,597	701	140	189	1,793	778	6,229	62,194	381	446	-	-	-	1,430	70	-	-	-	-	91	-	-	-	381	-	98,420
667	96	-	-	-	-	-	-	852	-	-	-	-	-	-	-	-	-	-	262	-	-	-	-	-	1,877
298	-	-	-	-	-	-	-	-	551	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	848
330	-	226	-	-	-	-	-	-	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	625
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	306	1,809
	-	-	-	-	-	227	-	-	-	-	-	870	218	-	-	-	-	-	-	-	-	-	-	-	1,854
	-	-	123	-	195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	458
	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	5,329
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				-						-															3,051 1,876
- 773	232																		2/0						327
				_	_												_		_			218	_		218
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544	-	-	-	-	-	-	-	_	-	-		-	-	849	-	-	_	-	-	-	_	-	-	456	1,848
	33.284	9.932	8.277	19.172	10.106	17.054	68.061	1.861	1.067	-	983	870	1.648		-	-	1.811	235	6.194	942	327	218	3.824		294,854
DEL OLITPI	IT	NON V	NORK	WK	DRF																				-
	7.		·							Docti	nation (actor													
		*****				****																	*******	****	Total
																			1			4W			27,760
																									43,480
																						-			23,680
-7									300	140									40	00		-	-		14,280
									20	20															18,700
				_														_				_	-		16,120
	340	40			740				-	-	-		440	-	-	-	-	-	-	-	-	-	-		19,840
_	840	260			280				-	20	20	-	380	600	-	-	80	-	-	60	-	-	-		48,620
580	580	240	40	40	-	-	40	2,320	340	-	20	-	-	-	-	-	-	-	20	180	-	-	-	-	4,400
420	120	500	60	60	20	60	20	80	2,300	400	-	20	-	-	-	-	-	-	60	-	-	-	-	-	4,120
400	80	200	40	100	40	40	20	20	440	2,460	240	20	-	-	-	-	-	-	-	-	480	-	-	-	4,580
440	40	60	40	140	60	20	60		-	60	3,620	480	-		-	-		-	20	-	-		20		5,060
720	20	60	-	60	260	40	60	-	-	-	320	5,640	40	-	-	-	-	-	20	-	-	-	20	100	7,360
440	40	- 1	20	80	100	800	220	-	-	-	-	100	3,160	260	-	-	-	-	-	-	-	-	-	40	5,260
600	20	-	-	20	-	40	400	-	20	-	-	-	120	3,240	-	-	40	-	-	-	-	-	-	-	4,500
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			20	20	20	-		-		40	-		20	-	-	-	-	-			-	-	-	-	5,860
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80								-	-	320			-				-			-			-	-	3,420
-	-	-	20	-	-	-	-	-	-	-	40	40	-	-	-	-	-	-	-	-	60	740		-	900 4,140
80 220	- 20	-	-	-	-	- 20	- 40	-	-	-	-	380 40	- 60	- 20	-	-	-	-	-	-	-	80	3,600	3,980	4,400
	23,597 667 298 330 1,503 330 1,503 331 41 5,219	23,597 701 667 96 298 - 330 - 1,503 - 539 - 141 - 5,219	23,597	23,597	23,597	23,597	23,597	23,597	23,597	23,597	23,597	23,597	23,597	23.597	23.597	33.97	33.59	23.537	23.597	23.597			13.597 701	1	

Table 42: Comparison of Model Output to the Expanded Household Travel Survey, Work Tours, KNR (Phase 2)

TARGETS		wc	DRK	KI	NR .	HIS	-																		
										-	Destinat	ion Secto	r												
1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	xwı	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
	-	-	-	-	56		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	553
	-				-																				4,088 2,865
	-	100	_		_	_	-			-				_		_			_	_	_		_		1,735
	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	-	-	-	-	-	177	-	-	-	1,306
89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	89
2,395	-	-	-	-	-	-	-	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,508
2,668	1,726	-	-	-	-	-	585	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,979
	-	-	-	-	-	-	397		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	854
	-	- 501	-	-	-	-	-		-	-			-	-	-	-	-	-		-	-	-	-	-	2,847 6,715
	-	291	-		-	-	-						-	_		-	-		-	_	_		-		2,594
	-	-	-	-	-	-	-		-			-	-	-		-	-	_	-	-	-	-	-	-	6,464
3,621	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,621
1,547	-	-	-	-	-	-	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,611
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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509	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	509
760	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	760
3,331	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,331
-/	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,564
			-			55	1,410	1,400	45	160	817	1,002	-	-	-	-	44	-	145	-	177	-	-	-	60,177
NODEL OUT	PUT	wc)RK	Kr	VR																				
						_		3N									-		4NW	ΔN	41A/NI1A/	414/	AVA/C/V/	4SW	
	160 820										-														Total
4,880	220					-		- 40	-									-	-	20	-	-	-	-	900
2,340		200	-	20	20	-	20	40	-	-	-	-	-	-	-	-	-	-	-	20 20	-	-	-	-	900 12,920
		440	- 40			-			20	-	-									20	-	-	-	- - -	900 12,920 5,720
3,280	40 20		-	20 60	20 20	-		40	-	-	-	-	-	-	-	-		-	-	20 20 40		-	- -		900 12,920 5,720 2,760
3,140	40 20 20	440 240	- 40 60	20 60 40 120 100	20 20 - 60 160	- 20 -	- - - -	40 - -	- 20 -	- - 20	-	- -	- - - - 40	- -	-	- -	- -	- - -	-	20 20 40	- - -	- - - -	- - -	-	900 12,920 5,720 2,760 3,520 3,560
3,140 5,020	40 20 20 60	240 - - -	- 40 60 20 20	20 60 40 120	20 20 - 60	- 20 - - 320	20 - - - - - 100	40 - - -	- 20 - -	- 20 - -	- 20 20	- - -	- - - 40 40	- - - - -	- - - - -	- - - - -	- - - - -	- - - -	- - -	20 20 40 -	- - - -	- - - -	- - - -	-	900 12,920 5,720 2,760 3,520 3,560 5,640
3,140 5,020 12,500	40 20 20 60 80	240 - - - - 40	- 40 60 20 20 -	20 60 40 120 100 20	20 20 - 60 160 80	- 20 - - 320 180	20 - - - - - 100 260	- - - - -	- 20 - - - -	- 20 - - -	- 20 20 -	- - - - 60	- - - 40 40 40	- - - - - - 40	- - - - -	- - - - -	- - - - - - 20	- - - - -	- - - - -	20 20 40 - - -	- - - - - -	- - - - - -	-	- - - - -	900 12,920 5,720 2,760 3,520 3,560 5,640 13,160
3,140 5,020 12,500 840	40 20 20 60 80 60	440 240 - - - 40	- 40 60 20 20 - -	20 60 40 120 100 20	20 20 - 60 160 80 -	20 - - 320 180	20 - - - - 100 260	40 - - - - - - 40	- 20 - - - - -	- 20 - - -	- 20 20 - -	- - - - 60 - -	- - - 40 40 40	- - - - - - 40	- - - - - -	- - - - - -	- - - - - 20	- - - - - -		20 20 40 - - - - - 40		- - - - - - -	-	- - - - -	900 12,920 5,720 2,760 3,520 3,560 5,640 13,160 980
3,140 5,020 12,500 840 640	40 20 20 60 80 60	440 240 - - - - 40 - 60	- 40 60 20 20 - -	20 60 40 120 100 20 -	20 20 - 60 160 80 - -	20 - - 320 180 - 20	20 - - - - - 100 260	40 - - - - - - - 40	- 20 - - - - - - - 180	- 20 - - - - - - -	- 20 20 -	- - - - 60	- - - 40 40 40	- - - - - - 40	- - - - - - -	- - - - -	- - - - - - 20	- - - - - - -	- - - - -	20 20 40 - - - - - - 40 60		- - - - - - -	-	- - - - -	900 12,920 5,720 2,760 3,520 3,560 5,640 13,160 980 1,100
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3,140 5,020 12,500 840 640 800 1,500 1,500 2,180	40 20 20 60 80 60 20 	440 240 - - - 40 - 60 - 20	- 40 60 20 20 - - - - 40	20 60 40 120 100 20 - - -	20 20 	- 20 - 320 180 - 20	20 - - - 100 260 - - - - - 40	40 - - - - - 40 -	- 20 - - - - - - 180 20	- 20 - - - - - - 60 160	- 20 20 - - - - - 260	- - - 60 - - - - - 20	- - - 40 40 40 - -	- - - - - - - - - - - - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - 20 - - -	- - - - - - - - -	- - - - - - - 80	20 20 40 - - - - - 40 60	- - - - - - - - 100	- - - - - - - - - -	- - - - - - - - - -	- - - - - -	900 12,920 5,720 2,760 3,520 3,560 5,640 13,160 980 1,100 1,140 1,800 1,900 2,520
3,140 5,020 12,500 840 640 800 1,500 1,500	40 20 20 60 80 60 -	440 240 - - - 40 - 60 - 20	- 40 60 20 20 	20 60 40 120 100 20 - - - -	20 20 60 160 80 - - - 20	- 20 - 320 180 - 20	20 - - - 100 260 - - -	40 - - - - - 40 - - -	- 20 - - - - - - 180 20	- - 20 - - - - - - - - - - - - - - - - -	- 20 20 - - - - - 260	- - - - 60 - - - - - - 20	- - 40 40 40 - -	- - - - - 40 - -	- - - - - - - - - - - -		- - - - 20 - -		- - - - - - - 80	20 20 40 - - - - - - - - - - - - - - - - - -	- - - - - - - - 100	- - - - - - - - - -	- - - - - - - - -	- - - - - -	900 12,920 5,720 2,760 3,520 3,560 5,640 13,160 980 1,100 1,140 1,800 1,900 2,520
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3,140 5,020 12,500 840 640 800 1,500 2,180 1,500 - - 420	40 20 20 60 80 60 - 20 - - 20	440 240 - - - 40 - 60 - 20 - -	-0 40 60 20 20 	20 60 40 120 100 20 - - - - -	20 20 	- 20 - 320 180 20 100	20 - - 100 260 - - - - - 40 60	40	- 20 	- 20 60 160 	- 20 20 - - - - 260 - -	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -			- - - - - 20 - - - - - - - - - - - - - -			20 20 40 - - - - - - - - - - - - - - - - - -	- - - - - - - 100			- - - - - - - - - -	900 12,920 5,720 3,520 3,560 980 1,100 1,144 1,800 1,900 2,520 1,844 40
3,140 5,020 12,500 840 640 800 1,500 2,180 1,500 - - 420	40 20 20 60 80 60 20 - 20 -	440 240 - - - - 40 - 60 - - - - - - - - - - - - - - - - -	- 40 60 20 20 	20 60 40 120 100 20 	20 20 	20 320 180 - 20 - 100	20 - - - 100 260 - - - - - - - - - - - - - - - - - - -	40	- 20 	- 20 	- 20 20 - - - - 260 - - -	- - - - - - - - - - 20 300 20 - -	- - - 40 40 40 - - - - 160 20	- - - - - - - - - - - - - - - - - - -			- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	- - - - - - - - 80 - - - - -	20 20 40 				- - - - - - - - - -	900 12,920 5,720 3,520 3,520 3,560 5,644 13,160 1,100 1,140 1,900 2,520 1,840 40
3,140 5,020 12,500 840 640 800 1,500 2,180 1,500 - - - 420 20 520	40 20 20 60 80 60 - - - - - - - - - - - - - - - - - -	440 240 - - - - - - - - 20 - - - - - - - - - -		20 60 40 120 100 20 - - - - - - - -	20 20	20 	20 - - - - - 100 260 - - - - - - - - - - - - - - - - - - -	40 	- 20 	- 20 	- 20 20 20 260 	- - - - - - - - - - 20 300 20 - - - - -		- - - - - - - - - - - - - - - - - - -			- - - - - - - - - - - - - - - - - - -			20 20 40 	- - - - - - - - - - - - - - - - - - -				900 12,920 5,720 2,760 3,520 3,560 5,640 13,160 980 1,100 1,140 1,800 1,900 1,900 1,800 60 60 980 780
3,140 5,020 12,500 840 640 800 1,500 2,180 1,500 - - - 420 20 480 480 420 20 520	40 20 20 60 80 60 - - - - - - - - - - - - - - - - - -	440 240 - - - - - - - - - - - - - - - - - - -		20 60 40 120 20 	20 20 60 160 80 	- 20 - 320 - 180 - 20 	20 - - - 100 260 - - - - - - - - - - - - - - - - - - -	40 	- 20 			- - - - - - - - 20 300 20 - - - - - - - - - - - - - - - - -		- - - - - - - - - - - - - - - - - - -			- - - - - - - - - - - - - - - - - - -			20 20 40 	- - - - - - - - 100		80		900 12,920 5,720 3,520 3,520 3,560 5,644 13,160 980 1,100 1,144 1,800 2,520 1,840 - 520 60 980 780 500
3,140 5,020 12,500 840 640 800 1,500 2,180 1,500 2,180 	40 20 20 60 80 60 20 - - - - - - - - -	440 240 - - - - 40 - - - 20 - - - - - - - - - - - - - - -	- 40 60 20 20 	20 60 40 120 100 20 	20 20 600 160 80 - - - 20 - - - - - - - - - - - -	- 20 - 320 180 - 20 - 100 	20 - - - - 100 260 - - - - - - - - - - - - - - - - - - -	40 	- 20 	- 20 	- 20 20 20 			- - - - - - - - - 20 220 - - -			- - - - - - - - - - - - - - - - - - -			20 20 40 	- - - - - - - 100 - - - - - - - - - - -				900 12,920 5,720 2,760 3,550 5,640 13,160 1,140 1,140 1,900 2,520 1,840 - - 520 980 780 500
	1 497 2,825 2,311 1,623 1,129 89 2,395 2,668 457 2,651 1,526 5,977 3,621 1,547 - - 2,630 698 4,010 780 509 760 3,331 3,354 51,723 MODEL OUT	497 2,825 2,311 1,623 1,129 89 - 2,395 - 2,668 1,726 457 2,651 - 6,125 - 1,526 - 5,977 3,621	1 2N 2NW 497 2,825 2,311 - 186 1,623 89 2,395 2,688 1,726 457 2,651 2,651 1,526 1,526 1,526 2,630 2,630 2,630 3,621 1,547 2,630 3,621 1,547 2,630 7,60 3,331 3,564 51,723 2,109 849 MODEL OUTPUT WCC	1 2N 2NW 2WNW 497	1 2N 2NW 2WNW 2W 497	1 2N 2NW 2WNW 2W 2WSW 497	1 2N 2NW 2WNW 2W 2WSW 2SW 2SW 497	1 2N 2NW 2WNW 2W 2WSW 2SW 2SW	1 2N 2NW 2WNW 2W 2WSW 2SW 2S 3N	1 2N 2NW 2WNW 2W 2WSW 2SW 2S 3N 3NW 497 -	1 2N 2NW 2WNW 2W 2WSW 2SW 2S 3N 3NW 3WNW 497	1	1	Note	Note	1	1	1	1	1	1	1	1	Second Color Sec	Table Tabl

Table 43: Comparison of Model Output to the Expanded Household Travel Survey, Non-Work Tours, KNR (Phase 2)

	TARGET	S	NON	WORK	KI	VR	HIS -	_																		
gin												Destinat	ion Secto	or												
tor	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	To
.	699	-	-	-	304	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	1,144	183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
v	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	219	-	-	-	-	-	-	-	
w	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
H	194	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>N</i>	-	-	-	-	199	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<u> </u>	243	-	-	-	-	-	143	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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w /	567 403	183	-	-	582	-	-																			
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M	567 403 8,498 10DEL OUT	183	-	-	582	-	-				-	-	-						24							1
M	567 403 8,498 10DEL OUT	- 183 TPUT	NON 1	WORK	582 KI		394 2SW	425 2S	55 3N	-	- Dest	ination S	- Sector	-	97 3S	- XWI	-	340	24	-	- 4N	71	-	-	254	1
M	567 403 8,498 10DEL OUT	183 FPUT 2N 500	- NON 1	WORK	582 KI 2W	- VR 2WSW 100	2SW 80	2S 200	3N	3NW	Desti	ination S	Sector 3WSW	3SW	97 3S	XWI -	XIL	340 3IN	XIN	- 4NW	4N	4WNW	- 4W	4WSW	254 4SW	1
M	567 403 8,498 1ODEL OUT 1 80 1,380	183 FPUT 2N 500			582 KI 2W	- NR 2wsw 100 -	2SW 80	2S 200	3N	3NW	Desti	ination S	Sector 3WSW	3SW	97 3S	XWI -	XIL	340 3IN	XIN	- 4NW	4N	4WNW	- 4W	4WSW	254 4SW	
M	567 403 8,498 10DEL OUT 1 80 1,380 520	- 183 TPUT 2N 500 260 -	- NON 1 2NW 80 40 60		582 KI 2W 80	- VR 2WSW 100 - 20	2SW 80	2S 200	3N	- 3NW - 20 -	Desti	ination S	Sector 3WSW	3SW	3S	XWI -	XIL -	3IN	XIN	4NW	4N -	4WNW	4W -	4WSW	254 4SW	
M n or	567 403 8,498 10DEL OUT 1 80 1,380 520 580	- 183 TPUT 2N 500 260 -	NON 1 2NW 80 40 60 20	- WORK 2WNW - 20 20 40	- 582 KI 2W 80 - -	- VR 2WSW 100 - 20	2SW 80	2S 200	3N	3NW - 20	Desti	ination S	Sector 3WSW	3SW	3S	XWI	- XIL	3IN	XIN	- 4NW	4N -	4WNW	4W -	- 4WSW	254 4SW	
M	567 403 8,498 10DEL OUT 1 80 1,380 520 580 760 720 460	183 TPUT 2N 500 260	NON 1 2NW 80 40 60 20 -	- WORK 2WNW - 20 20 40 20	- 582 KI 2W 80 - - - 80		2SW 80 - - - 20 40	2S 200 - - -	3N	- 3NW - 20	Desti 3WNW	ination S	Sector 3WSW	3SW	97 3S	- XWI	- XIL	31N	XIN	- 4NW	4N	4WNW	- 4W	- 4WSW	254 4SW	
M n or	567 403 8,498 10DEL OUT 1 80 1,380 520 580 760 720	- 183 TPUT 2N 500 20	- NON 1 80 40 60 20		- 582 KI 2W 80 80 20	NR 2wsw	2SW 80 20 40	2S 200 - - - -	3N	3NW - 20	Desti 3WNW	ination S	- 3wsw 20	3SW	3S	XWI	- XIL	31N	XIN	4NW	4N	4WNW	- 4W		254 4SW	
M m pr	567 403 8,498 10DEL OUT 1 80 1,380 520 580 760 720 460 2,200	- 183 TPUT 2N 500 260 20 20	- NON 1 80 40 60		- 582 KI 80 80 20		2SW 80	2S 200 - - - - - 80 340	3N 40	3NW - 20	Desti 3WNW	ination S		3SW	3S	XWI	XIL	31N	XIN	4NW	4N	4WNW	- 4W	4WSW	254 4SW	
M n por	\$677 403 8,498 10DEL OUT 1 80 1,380 520 580 760 720 460 2,200	- 183 TPUT 2N			- 582 KI - 2W - 80		2SW 80 20 40 40	2S 200 - - - - - 80 340	3N 40	3NW - 20 20 20		ination S		3SW	97 3S 	XWI	XIL	31N	XIN	4NW	4N	4WNW	- 4W	4WSW	254 4SW	1
Min Dor	567 403 8,498 10DEL OUT 1 80 1,380 520 520 760 720 460 2,200	- 183 TPUT 2N 500 260 20 20	- NON 1 80 40 60		- 582 KI 80 80 20		2SW 80	2S 200 - - - - - 80 340	3N	3NW - 20		ination S		3SW	3S	XWI	XIL	3IN	XIN	4NW	4N	4WNW	- 4W	4WSW	254 4SW	1
M n por	\$677 403 8,498 1ODEL OUT 1 80 1,380 520 580 760 720 460 2,200 80 60	- 183 FPUT 2N 500 260	2NW 80 40 60 20 		- 582 KI 80 		2SW 80 - - - - 20 40 40 - -	25 200 - - - - - 80 340 -	3N	3NW - 20 20 60	- Desti 3WNW			3SW	97 3S	xwi	- XIL	340 3in	XIN	4NW	4N	4WNW	- 4W	4WSW	254 45W	
M n pr	\$677 403 8,498 10DEL OUT 1 80 1,380 520 580 760 2,200 460 2,200 80 60 40	- 183 TPUT 2N - 500	- NON 1 2NW 80 60 20	2wnw 20 20 20 40 20	- S82 KI 80 	20	2SW 80	2S 200	3N 40	3NW - 20 20 60	- Desti 3WNW 20 40 40 20		- Sector 3wsw 20 120	3SW	97 3S 	XWI	XIL	340 3IN	XIN	4NW	4N	4WNW	- 4W	- 4WSW	254 4SW	
M n pr	\$677 403 8,498 10DEL OUT 1 80 1,380 520 580 760 2,200 460 2,200 80 60 60 40	- 183 TPUT 2N 500 260 20	- NON 1 2NW 80 40	2WNW - 20 20 40	- S82 KI	2WSW 100 - 20 80 20 20 - 20 - 20 - 20 - 20	2SW 80	25 200 - - - - - - - - - - - - - - - - - -	3N 40	3NW - 20 20 60			- 3wsw	3SW 80	97 3S 	XWI	XIL	340 3IN	XIN	4NW	4N	71 4WNW	- 4W	4WSW	254 4SW	
M n pr	\$677 403 8,498 10DEL OUT 1 80 1,380 520 580 760 2,200 460 2,200 80 60 40	- 183 FPUT 2N 500 260			- 582 KI 80		2SW 80	2S 200	3N	3NW	- Desti 3WNW	- 3W	- Sector 3wsw 20 120	3SW	97 3S 	XWI	- XIL	340 3IN	XIN	4NW	4N	71 4WNW	- 4W		254 4SW	
M n pr	\$677 403 8,498 10ODEL OUT 1 80 0 1,380 520 580 720 460 2,200 - 80 60 0 40 20 80	- 183 TPUT 2N - 500 260			- 582 KI 80	2wsw 100 20 80 20 20	2SW 80	25 200 - - - - - 80 340 - - - - - - - - - - - - - - - - - - -	3N	3NW - 20 20 60	- Desti 3WNW	- ination S 3W	- Sector 3wsw	3SW	97 3S 	xwi	- XIL	340 3IN	24 XIN	4NW	4N	71 4WNW			254 4SW	
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M n por	\$677 403 8,498 10DEL OUT 1 80 1,380 520 580 760 720 460 2,200 80 60 40 20 80 40	- 183 FPUT 2N 500 260	- NON 1 80 80 40 60 20		- 582 KI 80		2SW 80 20 40 40	25 200 	55 3N	3NW - 20 20 60	- Desti 3WNW	- ination \$ 3W	- Sector 3WSW	3SW	97	xwi	XIL	340 3IN	XIN		4N	71 4WNW	- 4W	4WSW	254	
M n or	\$677 403 8,498 10DEL OUT 1 80 1,380 580 760 720 460 2,200 80 60 40 20 80 40 40	- 183 TPUT 2N - 500 260	- NON NON NON NON NON NON NON NON NON NO		- 582 KI 80	NR 2wsw 100 20 20 - - - - - - - -	2SW 80	25 200 	3N	3NW - 20 20 60	Desti 3WNW	- ination \$ 3W	- Sector 3wsw	3SW	97 3S	XWI	XIL	340 3IN	XIN	4NW	4N	71 4WNW	4W		254 45W	
M	\$677 403 8,498 10DEL OUT 1 80 1,380 520 580 760 2,200 460 2,200 80 60 40 20 80	- 183 TPUT 2N - 500 - 60	- NON NON NON NON NON NON NON NON NON NO		- 582 KI 80		-394 80	25 200 	3N	3NW - 20	- Desti 3WNW	- ination \$ 3W	- 3wsw	3SW	97 3S 	XWI	- XIL	340 3IN	24 XIN		4N	71 4WNW	- 4W		254 4SW	
M M M M M M M M M M M M M M M M M M M	\$677 403 8,498 10DEL OUT 1 80 1,380 580 760 720 460 2,200 80 60 40 20 80 40 40	- 183 TPUT 2N - 500 260	- NON NON NON NON NON NON NON NON NON NO		- 582 KI 80	- NR 2wsw 100 - 20 - 20 - 80 20	2SW 80	25 200 	3N	3NW - 20 20 60	Desti 3WNW	- ination \$ 3W	- Sector 3wsw	3SW	97 3S	XWI	XIL	340 3IN	24 XIN	4NW	4N	71 4WNW	4W		254 45W	
M M M M M M M M M M M M M M M M M M M	\$677 403 8,498 10DEL OUT 1 80 1,380 580 760 720 460 2,200 80 60 40 20 80	- 183 IPUT 2N 500 260			- 582 KI 80	- NR 2wsw 100 -	2SW 80 20 40 40	25 200 	3N	3NW - 20		- ination \$ 3W	- Sector 3wsw	3SW	97 3S	XWI	- XIL	340 3IN	24 XIN			71 4WNW			254 4SW	
M M M M M M M M M M M M M M M M M M M	\$677 403 8,498 10DEL OUT 1 80 1,380 520 580 720 460 2,200 80 60 40 20 80	- 183 FPUT 2N 500 260	- NON 1 2NW 80 60 20		- S82 KI 80	NR 2wsw 100 - - - - -	25W 80	25 200 	3N	- 20 		- ination \$ 3W		3SW	97	XWI	XIL	340 3IN	24 XIN		4N	71 4WNW	- 4W		254 4SW	
w /	\$677 403 8,498 10DEL OUT 1 80 1,380 580 760 720 460 2,200 80 60 40 20 80	- 183 IPUT 2N 500 260			- 582 KI 80	- NR 2wsw 100 -	2SW 80 20 40 40	25 200 	3N	3NW - 20		- ination \$ 3W	- Sector 3wsw	3SW	97 3S	XWI	- XIL	340 3IN	24 XIN			71 4WNW			254 4SW	T

Table 44: Comparison of Model Output to the Expanded Household Travel Survey, Work Tours, PNR (Phase 2)

	TARGETS		wc	RK	PN	NR	HIS																			
rigin												Destinat	ion Secto	r												
ector	1	2N	2NW	2WNW	2W	2WSW	2SW	25	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	Total
1	262	- 242	-	-		-	- 504	-	-	112	-	-	-	-	-	-	-	- 100	-	-	-	-	-	-	-	37
2N 2NW	2,624 3,720	313	76	-		-	504	-		-	-	-	-	-	-	-	-	168	-	-	69	-		-		3,67 3,79
WNW	-	-	-	_	_	-	-	_	-	702	-	-	-	-	-	-	-	_	-	-	-	_	_	-	_	70
2W	1,698	-	-	-	942	-	-	-	-	-	-	-	921	-	-	-	-	-	-	-	-	-	-	-	-	3,56
wsw	584	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	58
2SW	462	-	-	-	-	-	-	-	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57
25	3,403	574	-	-	-	57	140	-	-	-	-	-	-	182	-	-	-	-	-	-	-	-	-	-	-	4,3
3N NW	139	-	-	-	-	-	-	-	-	- 207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
VNW	73 142	-		-		-	-	-		207	-		-	-	-	-	-	-	-	-	-	-		-		1
3W	1,862	-		-		-	-			-	-	337	-	-	-	-	-	-	-	-	-	-		-		2,:
NSW	5,034	_	-	-	-	-	-	109	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,1
3SW	690	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	É
35	1,383	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,3
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NW	263	-		-		-	-		-	-	-		-	-	-	_	-	-	-	-	-	-		-		:
4N	611	-	-	-		-	-			-	-		-	-	-	-	-	_	-	-	-	-		-		
VNW	1,304	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	1,
	1,485	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,
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wsw 4SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4W WSW 4SW	25,863	- - 887	- 76	-	942	- 57	644	109	113	1,044	-	337	945	182	-	-	-	168	-	-	69	-	-	-	-	31,4
wsw sw al	-	887	-	-	-		644	109	113	1,044	-		945	182				168		-			-		-	31,4
vsw sw al Vrigin	25,863	887	- 76	-	942		644	109	113	1,044				182				168		-			-		-	
vsw sw I N igin	25,863 10DEL OUTI	- 887 PUT 2N	- 76	-	942 PN	NR 2WSW	2SW	25	3N	3NW	Dest 3WNW	337 ination S		3SW	35	- XWI	- XIL	3IN	XIN	4NW	69 4N	- 4WNW	- 4W	- 4WSW	- - 4SW	Tota
wsw sw igin ctor	25,863 10DEL OUTI	- 887 PUT 2N 40	76 WC	PRK	942 PN	2WSW		25	3N -	3NW	Dest 3WNW	337 ination S 3W	Sector 3WSW	3SW	3S	XWI	XIL	3IN	XIN	4NW	4N	4WNW	- 4W	4WSW	4SW	Tota
vsw sw igin ctor	25,863 MODEL OUTI	2N 40 180	76 WC 2NW	- PRK 2WNW - 40	942 PN	2WSW	2SW 40	2S -	3N - 60	3NW -	Dest 3WNW	ination S	Sector 3WSW	3SW - -	3S	XWI	XIL -	3IN - -	XIN -	4NW	4N - 20	- 4WNW -	- 4W -	4WSW	4SW - -	Tota
vsw sw igin ctor 1	25,863 10DEL OUTI 1 140 3,600 2,380	- 887 PUT 2N 40 180 120	- 76 WC 2NW - 20 160	- - - - 2WNW - - 40	942 PN 2W	2WSW	2SW	2S - -	3N - 60	3NW	Dest 3WNW	337 ination S 3W	Sector 3WSW	3SW - - -	3S	XWI	XIL -	3IN	- XIN	4NW	4N	- 4WNW - -	- 4W	4WSW	4SW	Tota 3, 2,
vsw sw igin ctor 1 2N NW	25,863 10DEL OUTI 1 140 3,600 2,380 1,040	- 887 PUT 2N 40 180 120	- 76 WC 2NW - 20 160 100	- PRK 2WNW - 40 - 20	942 PN 2W - - 20 20	2WSW	2SW 40 - 20	2S	3N - 60 -	3NW 40	Dest 3WNW	337 ination S 3W	Sector 3WSW	3SW	3S -	XWI	XIL	3IN - -	- XIN	4NW	4N - 20	- 4WNW - - -	- 4W	4WSW	4SW	Tota 3, 2, 1,
vsw sw igin ctor 1 2N NW /NW	25,863 MODEL OUTI 1 140 3,600 2,380 1,040 1,300	- 887 PUT 2N 40 180 120	- 76 WC 2NW - 20 160	- - - - 2WNW - - 40	942 PN 2W	2WSW	2SW 40	2S - -	3N - 60	3NW -	Dest 3WNW	ination S	Sector 3WSW	3SW - - -	3S	XWI	XIL -	3IN - - -	- XIN	4NW	4N - 20	- 4WNW - -	- 4W -	4WSW	4SW - -	3, 2, 1,
NSW SW al Norigin ctor 1 2N NW VNW EW NSW	25,863 10DEL OUTI 1 140 3,600 2,380 1,040	- 887 PUT 2N 40 180 120	- 76 WC 2NW - 20 160 100 60	- 	942 PN 2W - - 20 20 20	2WSW	2SW 40 - 20	2S	3N - 60 -	3NW 40	Dest 3WNW	337 ination S 3W	Sector 3WSW	3SW	3S	- XWI	XIL	3IN - - -	- XIN	4NW	4N - 20	- 4WNW - - -	- 4W	4WSW	4SW	3, 2, 1, 1, 1,
NSW SW SW All Norigin Ctor 1 2N NW VNW EW VNSW SW	25,863 MODEL OUTI 1 140 3,600 2,380 1,040 1,300 1,120	- 887 PUT 2N 40 180 120 20	- 76 WC 2NW - 20 160 100 60		- 942 PN 20 20 20	2WSW 100	2SW 40 - 20 - 20 - 20 -	2S	3N - 60 - -	3NW 40	Dest 3WNW	337 ination S 3W - - - - - 20	3WSW 20	3SW	3S	xwi	XIL	3IN	- XIN	4NW	4N - 20	- 4WNW 20	- 4W	4WSW	4SW	3, 2, 1, 1, 1, 2,
VSW SW igin ctor 1 N N N N N N N N N N N N N N N N N N	1 140 3,600 2,380 1,040 1,300 1,120 2,180 4,940 600	- 887 PUT 2N	- 76 WC 2NW - 20 160 100 60	PRK 2WNW - 40 - 20	942 PN 2W - - 20 20 20	2WSW 100	2SW 40 - 20 - 20 - 20 -	2S - - - - - - - - 40	- 60 	3NW	Dest 3WNW	337 ination S 3W 20	3WSW 20	3SW	3S	- XWI	XIL	3IN - - - - -	- XIN	4NW	4N - 20	- 4WNW - - - - 20 -	- 4W	4WSW	4SW	3, 2, 1, 1, 2, 5,
vsw sw igin ctor 1 2N NW /NW vsw vsw ssw 22s BN NW	25,863 MODEL OUTI 1 140 3,600 2,380 1,040 1,300 1,120 2,180 4,940 600 580	- 887 PUT 2N	- 76 WC 2NW - 20 160 100 60 60		2W	2WSW 100 20 20	2SW 40 - 20 - 20 - 40	2S 40 200	3N - 60 40	3NW 60	Dest 3WNW	337 ination \$ 3W	3wsw	3SW	35	XWI	XIL	3IN 20	XIN	4NW 40	4N - 20 40	4WNW	- 4W	4WSW	4SW	3, 2, 1, 1, 2, 5,
vsw sw al V rigin ctor 1 1 2N NW VNW 2W vsw ssw 22s BN NW VNW	25,863 MODEL OUTI 1 140 3,600 2,380 1,040 1,300 1,120 2,180 4,940 600 580 920	- 887 PUT 2N 40 180 120 40	2NW - 200 160 100 60 60 60 60		942 PN 2W 20 20 20	2WSW 100 20	2SW 40 - 20 - 20 - 40	2S 40 200	3N - 60 40	3NW	Dest 3WNW	337 ination \$ 3W	Sector 3WSW 20 20 20	3SW		XWI	XIL	3IN - - - - -	XIN	4NW	4N - 20	- 4WNW 80	- 4W	4WSW	4SW	Tota 3, 2, 1, 1, 2, 5,
vsw sw s	25,863 MODEL OUTI 1 140 3,600 2,380 1,040 1,300 1,120 2,180 4,940 600 580 920 900	2N 40 180 120	- 76 WC 2NW - 20 160 100 60 60 60 60 20		- 942 PN	2WSW	25W 40 20 20 40	25 - - - - - - 40 200 - -	3N - 60 40	3NW	Dest 3WNW 20 140 20	337 ination S 3W	3wsw 20 20 40 40	3SW	3S	xwi	XIL	3IN 20	XIN	4NW	4N - 20 40	4WNW 80 20	- 4W	4WSW	4SW	Tota 3, 2, 1, 1, 2, 5,
VSW NO NO NO NO NO NO NO NO NO N	25,863 MODEL OUTI 1 140 3,600 2,380 1,040 1,300 1,120 2,180 4,940 600 580 920 900 1,620	2N 40 120	- 76 WC 2NW - 20 160 100 60 60 60 20		- 942 PN	2WSW 100 20 60	2SW 40 20 20 40 20	25 - - - - - - 40 200 - - -	3N - 60 40	3NW	Dest 3WNW	337 ination S 3W	3wsw	3SW		XWI	XIL	3IN 20	XIN	4NW	4N - 20 40		- 4W	4WSW	4SW	3, 2, 1, 1, 1, 2, 5, 1, 1, 2, 2, 2, 1, 1, 2, 2, 2, 1, 1, 2, 2, 2, 1, 1, 2, 2, 2, 1, 1, 2, 2, 2, 1, 1, 2, 2, 2, 1, 1, 2, 2, 2, 1, 1, 2, 2, 2, 2, 1, 1, 2, 2, 2, 2, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
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VSW	25,863 **AODEL OUTI 1 140 3,600 2,380 1,040 1,300 1,120 2,180 4,940 600 580 920 900 1,620 2,000	2N 40 180 120	- 76 WC 2NW 20 160 100 60 60 60 20		2W	2WSW	2SW 40 - 20 - 20 - 40	25 	3N - 60	3NW	Dest 3WNW	337 ination S 3W	3wsw	3SW		XWI	- XIL	3IN	XIN	4NW	4N - 20 40	- 4WNW	- 4W	4WSW	4SW 40	Tota 3, 2, 1, 1, 2, 5, 1, 2, 2, 2, 2, 2,
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NSW Normal State	25,863 **AODEL OUTI 1 140 3,600 2,380 1,040 1,300 1,120 600 900 1,620 2,000 1,620 2,000 1,620 540 120 660 280	2N 40 120	-76 WC 2NW -1 20 160 100 60		-942 PN	2WSW	2SW 40 20 - 40	25 	3N - 60	3NW	Dest 3WNW	337 ination 5 3W	Sector 3WSW	3SW	3S	XWI	- XIL	3IN	XIN	4NW	4N - 20		4W	4WSW	4SW	3, 2, 1, 1, 1, 2, 2, 5, 1, 1, 2, 2, 2, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
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Table 45: Comparison of Model Output to the Expanded Household Travel Survey, Non-Work Tours, PNR (Phase 2)

	TARGETS		NON	WORK	PN	IR	HIS																			
igin												Destinati	on Secto	or												
ctor	1	2N	2NW	2WNW	2W	2WSW	2SW	2\$	3N	3NW	3WNW	3W	3WSW	3SW	35	XWI	XIL	3IN	XIN	4NW	4N	4WNW	4W	4WSW	4SW	To
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N	933	1,401	-	-	-	-	-	-	-	-	-	59	354	-	-	-	-	-	-	-	-	-	-	-	-	
v	305	-	269	-	-	-	-	-	-	-	-	-	-	-	-	-	-	219	-	211	-	-	-	-	-	
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,		1,671		-	583								756					424						98	1,045	
M	7,287	1,671									-	59						424						98	1,045	
N n	ODEL OUTP	1,671 UT	NON	WORK	583 PN	IR	1,492	1,272	207	465	- Dest	59 tination S	ector	-	139	-	-		-	1,532	-	-	-			
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N n or	1 120 1,220	1,671 UT 2N 40 380	2NW 40 120	WORK 2WNW - 40	583 PN 2W - 40	IR	1,492 2SW	25 60 100	3N	3NW	Dest 3WNW	59 tination S	ector	-	139	XWI	-		XIN	1,532 4NW	4N	4WNW	-		4SW - -	
N n or	1 120 1,220 880	1,671 UT 2N 40 380 200	2NW 40 120 420	- WORK 2WNW - 40 80	583 PN 2W - 40 40	2WSW - 20	1,492 2SW	2S 60 100 40	3N - - 20	3NW 20	- Dest 3WNW 20	59 tination S 3W - 20	ector 3WSW	3SW -	3S	XWI -	XIL -	3IN	XIN -	1,532 4NW	- 4N 20	4WNW	4W	4WSW	4SW - - -	
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n or	1 120 1,220 880 380 340	1,671 UT 2N 40 380 200 80 40	2NW 40 120 420 40 80	2WNW - 40 80 140 80	583 PN 2W - 40 40 40 120	2WSW - 20 - 20 - 20	2SW 20 -	2S 60 100 40 40	207 3N - 20 - 20	3NW 20 -	Dest 3WNW - - 20 60 20	59 tination S 3W - 20 80	3WSW 40	3SW	3S	- XWI	XIL	3IN	XIN	1,532 4NW - - - -	- 4N 20	4WNW	- 4W	4WSW	4SW	
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N n or	120 1,220 880 380 380 500 720 1,680 80 180 180 1260 220 140	1,671 UT 2N 40 380 200 80 40 20 20 40 40 20 -	2NW 40 120 420 40 80 20 20	- WORK 2WNW - 40 80 140 80 - 40 - 40	2W	2WSW	1,492 25W 20 - 180 180	25 60 100 40 20 60 1,260 - - - 100 100	207 3N	3NW	Dest 3WNW	59 tination S 3W - 20	ector 3wsw	35W	139 35 - - - - - - - - - - - - -	xwi	XIL	3IN	- XIN	1,532 4NW	- 20 20 			4WSW	4SW 20 20	
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6. Conclusions

The developed CMAP Transit Modernization ABM represents a very advanced model system where the core CT-RAMP ABM functionality was greatly enriched on the transit side by incorporation of a large number of premium transit service attributes that are most frequently missing in travel models applied in practice. The project has shown that this extension of the applied modeling techniques is viable and resulted in a fully operational travel model that can be used for transit studies with a wide range of sensitivities to various transit attributed and policies. Amongst the main advanced features and technical improvements incorporated of the developed ABM we can mention:

- Individual transit path choice implemented with a fine level of spatial resolution that tremendously improved the accuracy with which transit access and egress are modeled.
- Advanced "non-labeled" mode choice implementation where the actual parameters that characterize transit path were used instead of multiple mode-specific constants.
- Equilibrium transit assignments with capacity constraints modeled through effective headways and crowding effects modeled through an explicit segmentation by seated and standing passengers.
- Incorporation of impacts of a wide range of station/stop characteristics including station type & size, cleanliness, real-time information, ease of boarding, commercial activity, safety, KNR convenience, etc., in addition to such traditional characteristics as parking capacity.
- Incorporation of impacts of a wide range of in-vehicle parameters including crowding (probability of having a seat), productivity, comfort & convenience, cleanliness, social environment.

The developed model was validated against origin-destination targets developed by expansion of the Chicago Household Travel Survey and ridership data from the On-Board surveys and transit operators. Overall, the new Transit Modernization ABM showed very good validation statistics.

A large number of technical ideas were generated by the project team throughout the course of the project. Some of them were not possible to implement in the current version of the model but they represent very interesting directions for future improvements. In this regard, the following future improvements can be considered:

- Several additional sub-models could be useful. One possibility is to extend the household car
 ownership model to include transit pass ownership and reserved parking. Person transit pass
 ownership model as a relevant mobility attribute was already estimated based on the Chicago
 Household Travel Survey (integrated with household car ownership as joint choice).
- Individual mobility attributes can be driven by modal preferences that could be predicted by a special sub-model. This sub-model could be placed after population synthesis in the model chain. Individual VOT can be correlated with modal preferences although it is also a function of the particular activities and time pressure on the given day.

- Chicago SP survey that was implemented complementary to the Household Travel Survey can be used to estimate VOT distribution using mixed logit (instead of distributions borrowed from the San Francisco ABM).
- Parking capacity restraints at PNR lots are essential. It is necessary to address capacity constraints on key rail sections of Metra and CTA. Parking capacity constraint for PNR lots can be incorporated by using shadow pricing. This should be applied to the total PNR volume of parked cars by station over several relevant time-of-day periods (2-4).
- Currently some coefficients were set to reflect a bundle of characteristics such as comfort, convenience, productivity, temperature, amenities, etc, associated with each mode. In further research it would be interesting to estimate the contribution of each characteristic and make the modeled in-vehicle time and wait perception completely un-labeled.
- Awareness and consideration with regard to transit services can be incorporated as was
 described in detail in the Phase 1 Interim Report. This sub-model can be integrated with the
 sub-model for individual modality and mobility attributes.
- More advanced mode choice structure like cross-nested logit model can be applied to describe a
 differential similarity of auto modes (SOV, HOV) and transit modes (PNR, KNR). In particular,
 certain similarities between HOV passenger mode and KNR could be taken into account. This
 was described in detail in the Phase 1 Interim Report.
- In the model validation process, it became clear that non-motorized modes (walk and bicycle) should be modeled with the level of details comparable to transit since they compete for short trips. Many of the details incorporated on the transit side would equally affect non-motorized travel preferences, for example, detailed modeling of walk distances using a navigation network or applying an individual propensity to walk as function of the person age.