8. RIDERSHIP

This chapter presents the ridership forecasting methodology, assumptions and results for the DTOGS project. Ridership forecasts were developed for the No-Build, TSM, BRT and LRT alternatives analyzed. The Model, known as the SEMCOG Hybrid Model, was developed following the general forecasting procedures for the Metropolitan Planning Organization (MPO) model from SEMCOG (E4 Model) with transit forecasting related model components adapted from the Ann Arbor to Downtown Detroit Transit Alternative Analysis (AA-DD) Model. This section of the LPA Report discusses the model choice model development, trip generation, trip distribution, and highway assignments along with additional summaries for the mode choice component.

Since the SEMCOG E4 Model was recently validated for other planning purposes including air quality analysis, the calibration and validation effort employed in the DTOGS project focused on comparing the Hybrid Model results with the SEMCOG E4 model.

The last section of this chapter presents the results of the year 2030 ridership forecasting exercise for each of the twelve alternatives modeled for the DTOGS project.

8.1 Mode Choice Model Development

This section describes the development of the mode choice modeling methodology used to forecast transit demand for the DTOGS project. As part of the methodology discussion, a limited description of the Hybrid/DTOGS model developed to forecast overall travel demand is provide as well. Following this description is a more comprehensive discussion of the adopted mode choice model, which includes a summary of the coefficients for the level of service variables and the mode-specific constants. This section also provides a review of these parameters with respect to general reasonableness and FTA guidance, along with a summary of the mode choice model calibration and existing transit estimates within the project corridors.

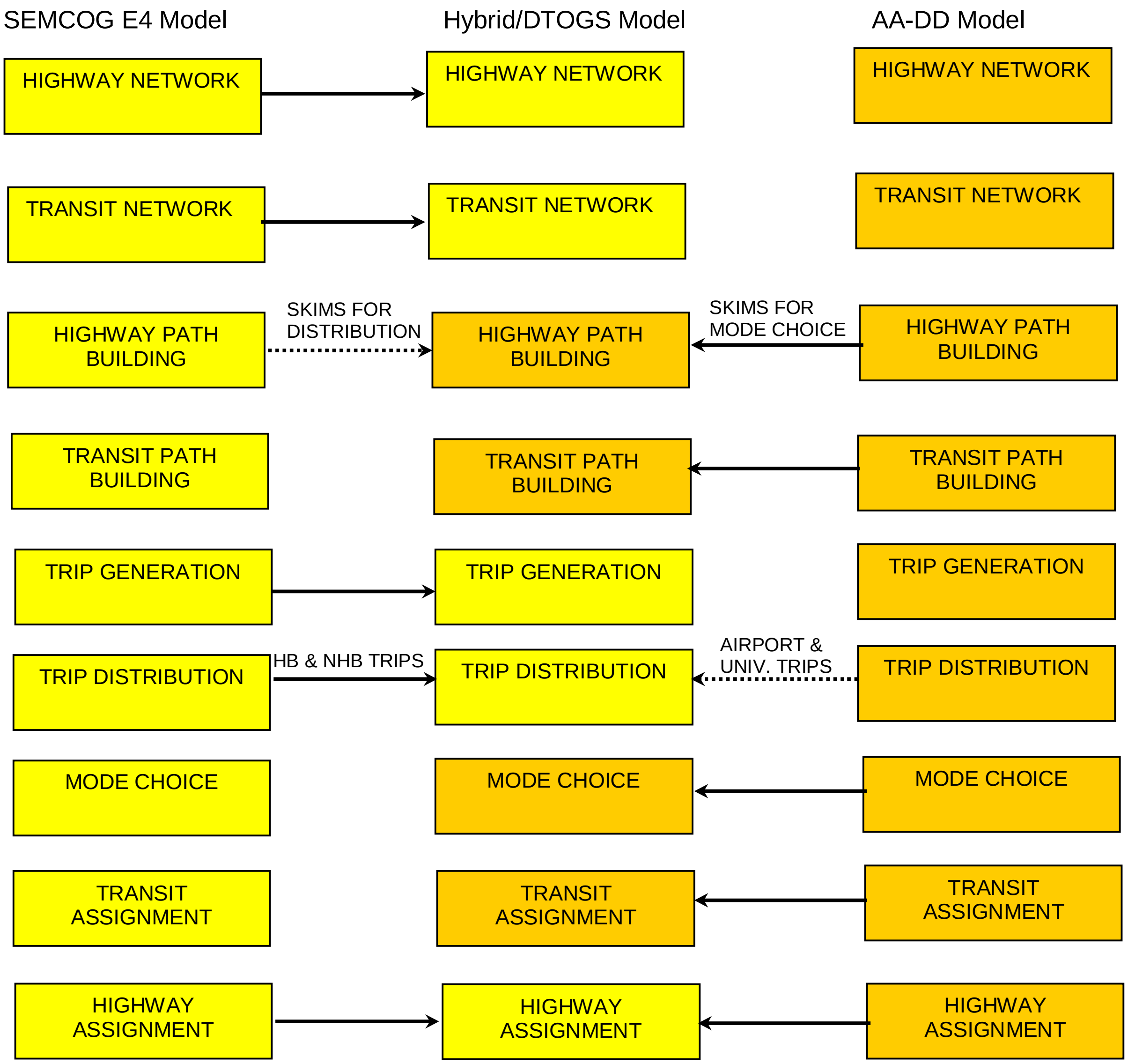
The forecasting methodology developed for the DTOGS project was specifically designed to utilize the best available planning tools available for the Detroit area. During initial conversations with SEMCOG staff, two regional models were identified for potential use in the project. One of these models was the existing MPO model from SEMCOG, which had been recently calibrated to the year 2005 conditions. This model serves as the officially approved regional travel forecasting process used for all federally mandated planning analysis conducted by SEMCOG. While this model utilizes updated socioeconomic data forecasts and proves the best available replication of current travel patterns in the region, the SEMCOG model's mode choice component is limited in its ability to forecast transit usage. As a result of this limitation, it was deemed inadequate for the specific needs of the DTOGS project. The second model available was developed specifically for transit forecasting as part of the AA-DD Alternatives Analysis project performed in 2006. This model was based on a previous version of the SEMCOG regional model and included the development of a more robust transit forecasting process. However, this model had been calibrated with previous networks and socioeconomic data estimates that have since been replaced by the current SEMCOG model.

After reviewing these two models and conducting several discussions with SEMCOG staff, a decision was made to develop a Hybrid/DTOGS model that would be based on the general forecasting procedures of the MPO, but would adopt the more robust mode choice process from the AA-DD Alternatives Analysis (AA-DD Model). Under this approach, the Hybrid/DTOGS model would be consistent with the latest travel demand forecast prepared by SEMCOG that are used for current regional planning efforts, and would offer enhanced capabilities regarding forecasting transit service. **Figure 8-1** presents a schematic description of the Hybrid/DTOGS model.

As of this writing, St. Clair County, MI , is using the Hybrid/DTOGS model to develop its Long Range Transportation Plan. SEMCOG has also started to incorporate the assumptions of the Hybrid/DTOGS model into its regional travel demand model.

Figure 8-1

Hybrid/DTOGS Model Development



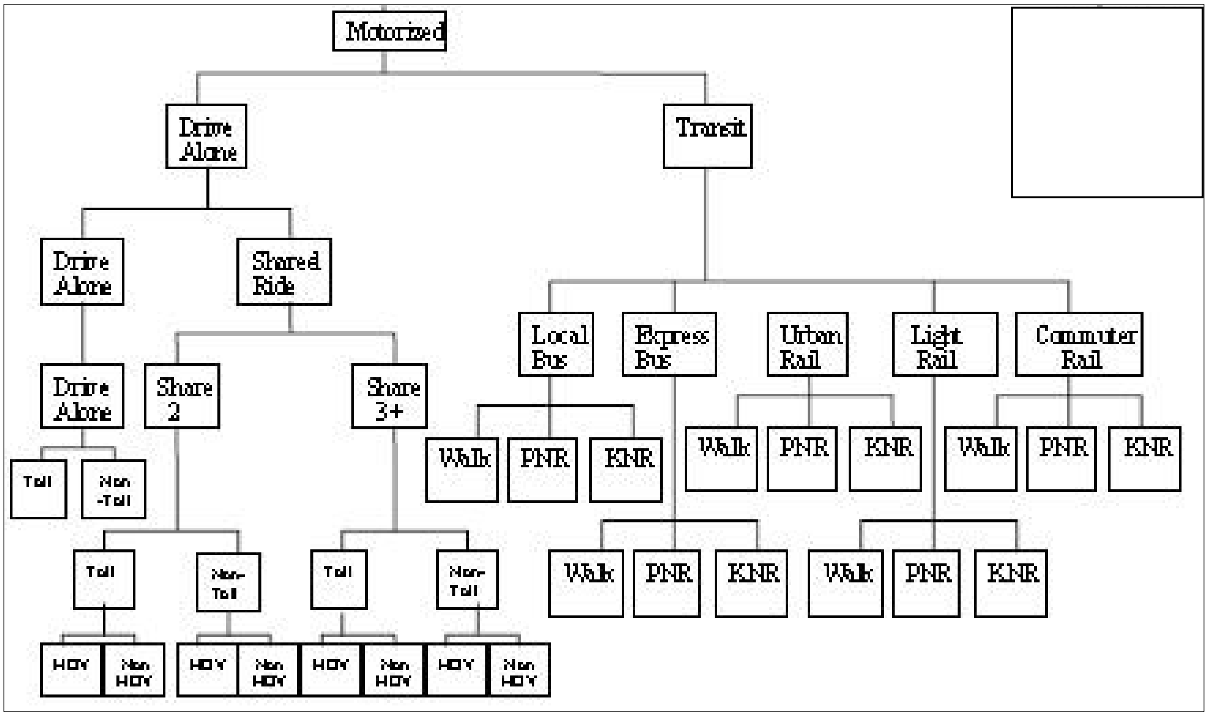
The adopted mode choice model was developed as part of a previous study used to forecast transit in Southeastern Michigan. As part of that effort, an extensive model estimation and calibration effort was performed using existing data and several surveys conducted specifically for that project. Using a household survey conducted in 1994 and an onboard transit survey conducted in 2002, a model estimation dataset was created for the model development effort. The transit onboard survey included observations from all of the transit operators in the region: DDOT, Suburban Mobility Authority for Regional Transportation

(SMART) Ann Arbor Transit Authority (AATA), Blue Water Area Transit (BWAT), and Lake Erie Transit (LET). This project also included revisions to the bus travel speed estimation procedures within the SEMCOG model in order to better reflect the actual run times of bus service in the region. Since this previous study also focused on the introduction of new modes and services in the region, a series of additional surveys were performed. Stated preference data was gathered in 2003 in order to assess potential patron's evaluation of new modes. The stated preference data was also utilized to develop new models for the "airport" and "special events" trip purposes. The mode choice model development effort was summarized in several draft technical memorandums that were provided to URS by SEMCOG in preparation for the DTOGS Project. These documents include:

- Mode Choice Estimation Report For Southeastern Michigan Region (Draft - January 2005)
- Mode Choice Estimation Report - Ann Arbor To Detroit Transit Alternatives Analysis (Draft September 2005)
- Ann Arbor To Detroit Travel Demand Model Revisions - Documenting Model Revisions in Support Of An Alternatives Analysis – (February 15, 2007)

The model estimation process resulted in the development of new nested-logit mode choice models for the existing SEMCOG trip purposes along with the University trip purpose and the Airport trip purpose. The nested logit model is applied only to motorized travel and its basic structure is displayed in **Figure 8-1**.

Figure 8-2
Nested Logit Mode Choice Model



As shown in **Figure 8-1**, the nested logit model estimates mode choice via individual multinomial logit models employed in three different tiers or "nests". The primary benefit of employing a nested logit model is that the structure permits the elasticity of choice between "primary" modes that are independent of the choice competition of the sub modes in the lower nests. For example, improvements to the service characteristics of one of the five "line-haul" transit modes will more directly impact mode choice between these modes than the auto modes. This is intuitively logical in that existing transit riders would be more likely to divert among transit modes in response to service improvements than travelers who currently utilize auto modes. Note, however, that improvements to the transit modes do have the ability to influence the primary choice between the "auto" and "transit" modes since the higher nests include "logsum" terms that reflect the cumulative benefits offered by the choices in the lower nests.

With respect to transit service, the lowest nest level partitions transit trips within each line-haul mode (say "local bus") into three separate access categories (walk, park/ride, and kiss/ride). The nest above this level partitions transit trips into the individual line-haul modes defined as "local bus", "express bus", "bus rapid transit" (BRT), "light rail", and "commuter rail". The topmost or highest nest performs the primary choice between the auto modes and transit modes.

8.1.1 Level of Service Coefficients and Relationships

The variables and their respective coefficients were adopted directly from the AA-DD model without modification, as shown in Table 1. The variables included in the model are typical of standard mode choice models. The coefficients are "mode-generic", indicating that identical coefficient values are applied to standard variables such as cost and time for each mode. The only exception is for the in-vehicle time coefficient for commuter rail time. Note, however, that the commuter rail mode is not included as an alternative in the DTOGS project.

Table 8-1
Mode Choice Level of Service Variables and Coefficients

Level of Service Coefficients	HBW	HBSH	HBSC	HBO	NHBW	NHBO	UNIV
CIVT - minutes	-0.02500	-0.00670	-0.01950	-0.00800	-0.02000	-0.02000	-0.02500
CRIVT (Comm. Rail)- minutes (peak period only)	-0.01875	-0.00503	-0.01875	-0.00600	-0.01500	-0.01500	-0.01875
CWAIT1S (IWAIT<5.0 min) - minutes	-0.06600	-0.01840	-0.04190	-0.02150	-0.05500	-0.05500	-0.06600
CWAIT1L (IWAIT>5.0 min) - minutes	-0.02500	-0.00670	-0.01950	-0.00800	-0.02000	-0.02000	-0.02500
CWAIT2 (XWAIT) - minutes	-0.06880	-0.01840	-0.04190	-0.02150	-0.05000	-0.05000	-0.06880
CTWALK (ACC/EGR/XFER WALK & XFER PEN) - minutes	-0.06250	-0.01670	-0.04870	-0.01990	-0.05000	-0.05000	-0.06250
CDRIVE (Drive Access Time) - minutes	-0.06250	-0.01670	-0.04870	-0.01990	-0.05000	-0.05000	-0.06250
COCOST - (operating costs) - cents	-0.00300	-0.00160	-0.00580	-0.00190	-0.00350	-0.00350	-0.00300
CPCOST - (parking costs) - cents	-0.00300	-0.00160	-0.00580	-0.00190	-0.00350	-0.00350	-0.00300

Relationships	HBW	HBSH	HBSC	HBO	NHBW	NHBO	UNIV
short wait time / In-vehicle time	2.64	2.75	2.15	2.69	2.75	2.75	2.64
long wait time / In-vehicle time	1.00	1.00	1.00	1.00	1.00	1.00	1.00
transfer wait time / In-vehicle time	2.75	2.75	2.15	2.69	2.50	2.50	2.75
walk time / In-vehicle time	2.50	2.49	2.50	2.49	2.50	2.50	2.50
drive access time / In-vehicle time	2.50	2.49	2.50	2.49	2.50	2.50	2.50
Value of Time wrt oper. Cost	$5.00	$2.51	$2.02	$2.53	$3.43	$3.43	$5.00
Value of Time wrt park Cost	$5.00	$2.51	$2.02	$2.53	$3.43	$3.43	$5.00

The upper portion of **Table 8-1** displays the level of service variables and coefficients. As noted in the technical memorandum listed above, the time and/or cost coefficients for each purpose were specified or "asserted" during the original model estimation in order to provide acceptable in-vehicle time coefficients and reasonable values of times. Coefficients for the remaining out-of-vehicle time components were derived from the estimation process, or were asserted during the estimation and/or implemented as part of subsequent adjustments. For example, the initial wait time was stratified into a "short wait" (five minutes or fewer) and "long wait" and separate coefficients for the long wait variable were adopted.

URS reviewed the coefficient values with respect to recent FTA guidance regarding acceptable coefficients for new starts projects. The in-vehicle time coefficients for all purposes, other than home-base shop (HBSH) and home-based other (HBO) are generally within the acceptable range of -0.02 to -0.03. For the HBSH and HBO purposes, the in-vehicle coefficients are below the lower limit of 0.02, but within the range expected for these purposes, which should demonstrate a lower sensitivity to time. The expected in-vehicle time coefficient range for these purposes is generally between -0.006 and -0.010.

The lower portion of **Table 8-1** summarizes key relationships established by the various level service coefficients. URS also reviewed these relationships to ensure the general reasonableness and acceptance with FTA guidance. Again many of these values were asserted doing original model estimation to ensure logical relationships. The general values of time appear reasonable and logical when compared across purposes. The values of time are highest for home-based work and university purposes, which tend to exhibit a greater sensitivity to time. The ratios of out-of-vehicle time to in-vehicle time are generally 2.5, which is consistent with expectations and FTA guidance.

In order to insure consistency between the mode choice model and the transit path-building process, URS also reviewed the weights and penalties utilized in the estimation of transit paths and skims. The transit paths for each mode were developed based on a generalized cost method heavily weighted to minimum travel time. The minimum time paths are weighted to minimize the use of the various out-of-vehicle time components. Both initial and transfer wait times were weighted by a factor of 2.5 which is generally consistent with the relationship of the coefficients in the mode choice model. Walk access and egress time were weighted by a factor of 2.0 and drive access time was factored by 3.0. The relationships for the mode choice model were slightly different with both walk time and drive access time weighed at values of 2.5. From this analysis it was deemed that the transit path building was generally consistent with the underlying assumptions in the mode choice model coefficients.

8.1.2 Mode-Specific Constants

Mode-specific constants are utilized to reflect the unmeasured attributes of each transit mode that contributes to the selection of a particular mode. These unmeasured attributes are commonly assumed to be features such as safety, reliability, and general comfort of the various transit vehicles used by each mode. For the DTOGS analysis, URS adopted the mode specific constants established from the AA–DD Model as an initial set of values. A limited set of modifications were implemented where deemed necessary for general logic and recalibration of the model to observed shares of transit and auto access.

During the original model estimation process the mode-specific constants were established that reflected the joint attributes of the line haul mode and the access mode. For example, the estimation process established a separate constant for the bus mode and the drive access mode for each market segment of auto availability. The final mode specific constant for a particular mode and access mode combination was created by the summation of the individual bias constants. A more comprehensive discussion of this process is provided in the previously referenced technical memorandums. Since the only available transit mode in the estimation dataset was “local bus”, the mode-specific constants derived for each trip purpose were limited to this single mode and can be considered as a generalized “transit bias” that exists prior to the introduction of any new modes. It should be further noted that the specific elements of the mode specific constants was implemented within each of the various nests related to transit modes.

These mode-specific constants were utilized in the uppermost nest of the mode choice model to reflect the general bias of “transit” with respect to the generic auto choice. The implementation of these mode-specific constants was provided as part of a distance-based lookup procedure using highway distance at five-mile intervals as the index variable. The distance for each origin-destination zonal pair was categorized into the appropriate distance interval and the mode-specific constants for each trip purpose and auto availability subcategory were applied at the topmost nest. **Table 8-2** provides a listing of the mode-specific constants by distance interval for each purpose and auto availability category.

Table 8-2
Transit Access Mode – Specific Constants by Purpose and Distance Interval

Purpose	Distance Interval (miles)	Time Period											
		AM Peak			Midday			PM Peak			Off Peak		
		0 auto	1 auto	2+ autos	0 auto	1 auto	2+ autos	0 auto	1 auto	2+ autos	0 auto	1 auto	2+ autos
HBW	0-5	3.57514	-0.18680	-1.83039	2.60259	2.19761	-0.72960	3.59455	0.76800	-1.20957	1.84771	-0.75085	-2.68892
	5-10	3.82885	-0.07876	-1.58672	3.55035	2.40949	-0.40722	4.46058	1.11980	-0.72231	2.69963	-0.02538	-1.69022
	10-15	3.73570	0.34784	-1.38917	6.36068	2.57083	-0.41931	3.34128	1.32379	-0.63568	3.88280	0.21658	-1.28721
	15-20	3.69055	0.38046	-1.50302	6.36068	2.57083	-0.41931	2.67098	1.42596	-0.41437	3.74490	0.90717	-0.92979
	20+	2.95846	0.02185	-1.49728	6.36068	2.57083	-0.41931	2.93396	1.22642	-0.12292	3.82933	1.31923	-0.00945
HBSH	0-5	-0.46167	-3.30153	-5.18481	-1.69401	-4.16043	-4.53248	-2.14792	-3.33004	-4.58718	-2.80509	-4.71682	-5.48120
	5-10	0.01277	-2.83405	-5.13098	-1.21575	-2.96846	-4.19994	-1.40014	-2.77688	-4.42336	-2.37756	-3.87940	-5.35949
	10-15	0.01277	-2.83405	-5.13098	-1.21575	-2.96846	-4.19994	-1.11841	-2.09929	-3.40094	-1.80901	-3.40789	-5.08395
	15-20	0.01277	-2.83405	-5.13098	-1.21575	-2.96846	-4.19994	-1.11841	-2.09929	-3.40094	-1.80901	-3.40789	-5.08395
	20+	0.01277	-2.83405	-5.13098	-1.21575	-2.96846	-4.19994	-1.11841	-2.09929	-3.40094	-1.80901	-3.40789	-5.08395
HBSC	0-5	-0.80757	-0.14812	0.44324	0.11165	0.75935	1.82981	0.10101	1.12126	2.11435	-0.98210	0.51324	2.86073
	5-10	0.44324	0.44324	0.44324	1.82981	1.82981	1.82981	2.11435	2.11435	2.11435	2.86073	2.86073	2.86073
	10-15	0.44324	0.44324	0.44324	1.82981	1.82981	1.82981	2.11435	2.11435	2.11435	2.86073	2.86073	2.86073
	15-20	0.44324	0.44324	0.44324	1.82981	1.82981	1.82981	2.11435	2.11435	2.11435	2.86073	2.86073	2.86073
	20+	0.44324	0.44324	0.44324	1.82981	1.82981	1.82981	2.11435	2.11435	2.11435	2.86073	2.86073	2.86073
HBO	0-5	-1.49099	-3.78221	-4.92322	-1.41842	-2.95996	-3.67785	-2.11423	-3.50590	-4.80634	-3.33459	-4.35941	-5.68781
	5-10	1.02290	-2.96985	-4.23912	-0.56722	-2.22629	-2.92996	-1.34142	-3.02857	-4.10842	-2.54032	-4.19201	-5.56058
	10-15	1.02290	-2.96985	-4.23912	0.44303	-2.04611	-2.92841	-0.97615	-2.53523	-3.60729	-1.86628	-3.64231	-5.15335
	15-20	1.02290	-2.96985	-4.23912	0.44303	-2.04611	-2.92841	-0.97615	-2.53523	-3.60729	-1.86628	-3.64231	-5.15335
	20+	1.02290	-2.96985	-4.23912	0.44303	-2.04611	-2.92841	-0.97615	-2.53523	-3.60729	-1.86628	-3.64231	-5.15335
NHBW	0-5	-2.33200	-1.59454	-1.59454	-1.87246	-1.20752	-0.06520	-2.63162	-1.85539	-1.08708	-1.66119	-0.72376	-0.25810
	5-10	-1.59454	-1.59454	-1.59454	-0.06520	-0.06520	-0.06520	-1.08708	-1.08708	-1.08708	0.80039	0.80039	0.80039
	10-15	-1.59454	-1.59454	-1.59454	-0.06520	-0.06520	-0.06520	-1.08708	-1.08708	-1.08708	0.80039	0.80039	0.80039
	15-20	-1.59454	-1.59454	-1.59454	-0.06520	-0.06520	-0.06520	-1.08708	-1.08708	-1.08708	0.80039	0.80039	0.80039
	20+	-1.59454	-1.59454	-1.59454	-0.06520	-0.06520	-0.06520	-1.08708	-1.08708	-1.08708	0.80039	0.80039	0.80039
NHBO	0-5	-2.44298	-1.44408	-1.44408	-3.67185	-2.28010	-1.51380	-3.02513	-1.80950	-1.80950	-3.85514	-2.75412	-1.67525
	5-10	-1.44408	-1.44408	-1.44408	-1.51380	-1.51380	-1.51380	-1.80950	-1.80950	-1.80950	-1.67525	-1.67525	-1.67525
	10-15	-1.44408	-1.44408	-1.44408	-1.51380	-1.51380	-1.51380	-1.80950	-1.80950	-1.80950	-1.67525	-1.67525	-1.67525
	15-20	-1.44408	-1.44408	-1.44408	-1.51380	-1.51380	-1.51380	-1.80950	-1.80950	-1.80950	-1.67525	-1.67525	-1.67525
	20+	-1.44408	-1.44408	-1.44408	-1.51380	-1.51380	-1.51380	-1.80950	-1.80950	-1.80950	-1.67525	-1.67525	-1.67525
UNV	0-5	1.06143	1.06143	1.06143	-0.43668	-0.43668	-0.43668	0.72419	0.72419	0.72419	-1.07344	-1.07344	-1.07344
	5-10	1.06143	1.06143	1.06143	-0.43668	-0.43668	-0.43668	0.72419	0.72419	0.72419	-1.07344	-1.07344	-1.07344
	10-15	1.06143	1.06143	1.06143	-0.43668	-0.43668	-0.43668	0.72419	0.72419	0.72419	-1.07344	-1.07344	-1.07344
	15-20	1.06143	1.06143	1.06143	-0.43668	-0.43668	-0.43668	0.72419	0.72419	0.72419	-1.07344	-1.07344	-1.07344
	20+	1.06143	1.06143	1.06143	-0.43668	-0.43668	-0.43668	0.72419	0.72419	0.72419	-1.07344	-1.07344	-1.07344

As shown in the **Table 8-2**, the generalized transit mode-specific constants vary by time of day and are increasingly negative as auto availability increases. The constants for the HBW purpose exhibit the variation across the largest range of distance, which is logical given the number of longer-distance trips for this purpose. In contrast, the remaining purposes have variation in the constant terms only for short distance trips, those being less than 5 miles. Note that for the HBSC and both NHB purposes, the trips are not stratified by auto availability, so the constants are effectively the same for all trips. For several purposes, such as HBW, the peak period constant terms are more positive than the off peak periods, which is generally logical in that, all other aspects being equal, it may be more desirable to use transit during the peak periods when auto modes face increased congestion.

At the lowest transit nest level that partitions each line haul mode by access submode, a set of mode-specific constants that reflect the unmeasured attributes of access choice are applied. **Table 8-3** provides a listing of these constants applied to the drive access submodes. As shown in the table, a general drive access mode-specific constant is applied to each of the auto access categories for all modes. Since the existing estimation dataset contained only local bus observations, it was assumed that there would be an additional willingness on the part of travelers to use auto access sub-modes if premium modes line-haul modes such as commuter rail, were introduced into the region. As a result, additional mode-specific constants for new modes were implemented into the AA-DD Model for each of the drive access submodes (P&R and K&R). Currently, these additional constant terms are equal for both drive access modes. The AA-DD Model documentation, provided by SEMCOG, indicates that these constants were calculated using assumed auto access shares from recent survey data in Los Angeles and Salt Lake City.

Table 8-3
Drive Access Mode – Specific Constants by Purpose and Time Period

Purpose	Line-Haul Mode	Access Mode Constant	Time Period											
			AM Peak			Midday			PM Peak			Off Peak		
			0 auto	1 auto	2+ autos	0 auto	1 auto	2+ autos	0 auto	1 auto	2+ autos	0 auto	1 auto	2+ autos
HBW	All	Drive Acc.	-2.32012	-1.47547	-1.60373	-3.55577	-2.49682	-1.97589	-2.58512	-1.52156	-1.04508	-2.79797	-1.61512	-1.58680
	LRT	PR & KR	-4.62901	0.30969	0.77008	-6.22713	0.88984	1.05351	-4.36403	1.02018	1.24555	-4.14867	0.05246	0.26617
	BRT	PR & KR	0.28691	0.37531	0.53880	0.08297	0.29062	0.25167	0.71449	1.12855	1.13438	0.24462	-0.02806	-0.29154
	Comm. Rail	PR & KR	0.92027	0.65547	0.90019	0.90269	0.88156	0.57377	1.27549	1.84275	1.78589	0.67760	-0.13041	-0.09451
HBSH	All	Drive Acc.	-1.23223	-1.51341	-1.29852	-1.90725	-2.58647	-1.61575	-1.39303	-1.58349	-0.85855	-1.55300	-0.92309	-0.64890
	LRT	PR & KR	-8.22273	-0.57677	-0.56502	-8.64751	-0.52871	-0.56201	-6.32853	-0.37427	-0.30754	-8.69305	-0.67716	0.64592
	BRT	PR & KR	-0.93504	-0.51760	-0.62044	-1.78153	-1.05973	-2.14952	-1.02916	-0.52426	-0.47505	-1.77353	-1.05796	-2.10681
	Comm. Rail	PR & KR	-0.59298	-0.42821	-0.61481	-0.99532	-0.69965	-0.91095	-0.81718	-0.39268	-0.28799	-1.02011	-0.74607	-0.93503
HBSC	All	Drive Acc.	-1.57547	-1.57547	-1.57547	-2.50536	-2.50536	-2.50536	-1.64547	-1.64547	-1.64547	-2.51635	-2.51635	-2.51635
	LRT	PR & KR	0.10170	0.10170	0.10170	-1.29892	-1.29892	-1.29892	-1.09402	-1.09402	-1.09402	0.75601	0.75601	0.75601
	BRT	PR & KR	-0.28821	-0.28821	-0.28821	-3.52304	-3.52304	-3.52304	-1.67151	-1.67151	-1.67151	-0.26420	-0.26420	-0.26420
	Comm. Rail	PR & KR	0.06535	0.06535	0.06535	-2.29955	-2.29955	-2.29955	-1.27943	-1.27943	-1.27943	0.21509	0.21509	0.21509
HBO	All	Drive Acc.	-1.02923	-1.26409	-1.08460	-1.49543	-2.02798	-1.26687	-1.14541	-1.30201	-0.70594	-1.47644	-0.87759	-0.61691
	LRT	PR & KR	-8.58929	-0.57886	-0.66270	-6.41001	1.75785	0.68818	-7.95887	-0.40380	-0.33010	-4.46182	0.16061	-0.24487
	BRT	PR & KR	-1.08587	-0.61230	-0.77109	-0.24519	0.34570	-0.94565	-0.96994	-0.44575	-0.41981	-0.30034	-0.50550	-1.59378
	Comm. Rail	PR & KR	-0.74154	-0.55051	-0.72748	0.51667	1.68283	0.57424	-0.72860	-0.34832	-0.23552	0.26419	-0.02429	-0.37880
NHBW	All	Drive Acc.	-1.64675	-1.64675	-1.64675	-1.95590	-1.95590	-1.95590	-1.48472	-1.48472	-1.48472	-1.88613	-1.88613	-1.88613
	LRT	PR & KR	-0.11228	-0.11228	-0.11228	0.02633	0.02633	0.02633	-0.37932	-0.37932	-0.37932	-0.06555	-0.06555	-0.06555
	BRT	PR & KR	0.35246	0.35246	0.35246	-1.99420	-1.99420	-1.99420	0.08597	0.08597	0.08597	-2.08397	-2.08397	-2.08397
	Comm. Rail	PR & KR	0.95309	0.95309	0.95309	0.87812	0.87812	0.87812	0.50859	0.50859	0.50859	0.71245	0.71245	0.71245
NHBO	All	Drive Acc.	-0.85941	-0.85941	-0.85941	-1.52773	-1.52773	-1.52773	-1.04401	-1.04401	-1.04401	-1.70759	-1.70759	-1.70759
	LRT	PR & KR	-0.94754	-0.94754	-0.94754	-0.74105	-0.74105	-0.74105	-0.62599	-0.62599	-0.62599	-0.64839	-0.64839	-0.64839
	BRT	PR & KR	-0.43605	-0.43605	-0.43605	-0.68836	-0.68836	-0.68836	-0.26900	-0.26900	-0.26900	-0.59816	-0.59816	-0.59816
	Comm. Rail	PR & KR	-0.49336	-0.49336	-0.49336	-0.23377	-0.23377	-0.23377	-0.12266	-0.12266	-0.12266	-0.31959	-0.31959	-0.31959
UNV	All	Drive Acc.	-0.61560	-0.61560	-0.61560	-0.24522	-0.24522	-0.24522	-0.29690	-0.29690	-0.29690	-0.28583	-0.28583	-0.28583
	LRT	PR & KR	-0.53109	-0.53109	-0.53109	-1.66785	-1.66785	-1.66785	-0.32306	-0.32306	-0.32306	-0.92175	-0.92175	-0.92175
	BRT	PR & KR	-0.88005	-0.88005	-0.88005	-2.21750	-2.21750	-2.21750	-0.65154	-0.65154	-0.65154	-1.48240	-1.48240	-1.48240
	Comm. Rail	PR & KR	-0.55271	-0.55271	-0.55271	-1.77290	-1.77290	-1.77290	-0.42277	-0.42277	-0.42277	-1.50270	-1.50270	-1.50270

The final set of mode specific constants was implemented in the nest that partitions transit trips among the primary line-haul modes. As noted in the previous technical memorandums listed above, these mode-specific constants were derived from assumed "equivalent minutes of benefit" attributable to the anticipated characteristics of the premium transit modes being considered as alternatives in that study. These values were adopted from experience related to studies performed in Los Angeles and Cleveland. **Table 8-4** lists these assumed values and **Table 8-5** provides the resulting mode-specific constants for each of the new modes. Note that the large negative values in **Table 8-4** for the off-peak are from an assumption that the new alternatives would provide a significantly reduced level of service during the off-peak period. These "negative" minutes of benefits significantly reduce the shares for the new modes in the off-peak periods and are somewhat counterintuitive given the assumption that the unmeasurable attributes such as safety and comfort would be present during the off-peak periods as well.

Table 8-4
Equivalent Minutes of Benefit for Alternative Modes – AA-DD Model

Mode	Time Period	Purpose						
		HBW	HBSH	HBSC	HBO	NHBW	NHBO	UNV
BRT	AM	6.00	6.00	6.00	6.00	5.45	5.45	6.00
	MD	-60.00	-60.00	-60.00	-60.00	-55.00	-55.00	-60.00
	PM	6.00	6.00	6.00	6.00	5.45	5.45	6.00
	OP	-60.00	-60.00	-60.00	-60.00	-55.00	-55.00	-60.00
LRT	AM	12.00	12.00	12.00	12.00	10.90	10.90	12.00
	MD	-60.00	-60.00	-60.00	-60.00	-55.00	-55.00	-60.00
	PM	12.00	12.00	12.00	12.00	10.90	10.90	12.00
	OP	-60.00	-60.00	-60.00	-60.00	-55.00	-55.00	-60.00
COMM. RAIL	AM	17.67	12.00	12.00	12.00	10.90	10.90	12.00
	MD	-60.00	-60.00	-60.00	-60.00	-55.00	-55.00	-60.00
	PM	17.67	12.00	12.00	12.00	10.90	10.90	12.00
	OP	-60.00	-60.00	-60.00	-60.00	-55.00	-55.00	-60.00

Table 8-5
Mode Specific Constants for New Modes – AA-DD Model

Mode	Time Period	Purpose						
		HBW	HBSH	HBSC	HBO	NHBW	NHBO	UNV
BRT	AM	0.15000	0.04020	0.11700	0.04800	0.10900	0.10900	0.15000
	MD	-1.50000	-0.40200	-1.17000	-0.48000	-1.10000	-1.10000	-1.50000
	PM	0.15000	0.04020	0.11700	0.04800	0.10900	0.10900	0.15000
	OP	-1.50000	-0.40200	-1.17000	-0.48000	-1.10000	-1.10000	-1.50000
LRT	AM	0.30000	0.08040	0.23400	0.09600	0.21800	0.21800	0.30000
	MD	-1.50000	-0.40200	-1.17000	-0.48000	-1.10000	-1.10000	-1.50000
	PM	0.30000	0.08040	0.23400	0.09600	0.21800	0.21800	0.30000
	OP	-1.50000	-0.40200	-1.17000	-0.48000	-1.10000	-1.10000	-1.50000
COMM. RAIL	AM	0.44175	0.08040	0.23400	0.09600	0.21800	0.21800	0.30000
	MD	-1.50000	-0.40200	-1.17000	-0.48000	-1.10000	-1.10000	-1.50000
	PM	0.44175	0.08040	0.23400	0.09600	0.21800	0.21800	0.30000
	OP	-1.50000	-0.40200	-1.17000	-0.48000	-1.10000	-1.10000	-1.50000

Given the relatively frequent service anticipated for the BRT and LRT modes in the DTOGS alternatives analysis, it was deemed necessary to replace the large negative bias terms used for the off-peak periods in the AA-DD Model with values that reflect the anticipated service plans for the DTOGS alternatives. Therefore, URS modified the off-peak mode-specific constants in the hybrid model to provide a limited recognition of the new alternatives' attributes in the off-peak periods. URS assumed an equivalent minutes of benefit for the off-peak period as being approximately one third of the assumed peak period benefit for the average of commuter rail and LRT modes. The revised equivalent minutes of benefit for the new modes are listed in **Table 8-6** and the resulting mode specific constants are listed in **Table 8-7**.

Table 8-6
Equivalent Minutes of Benefit for Alternative Modes – Hybrid Model

Mode	Time Period	Purpose						
		HBW	HBSH	HBSC	HBO	NHBW	NHBO	UNV
BRT	AM	6.00	6.00	6.00	6.00	5.45	5.45	6.00
	MD	2.00	2.00	4.00	4.00	3.63	3.63	4.00
	PM	6.00	6.00	6.00	6.00	5.45	5.45	6.00
	OP	2.00	2.00	4.00	4.00	3.63	3.63	4.00
LRT	AM	12.00	12.00	12.00	12.00	10.90	10.90	12.00
	MD	4.00	4.00	4.00	4.00	3.63	3.63	4.00
	PM	12.00	12.00	12.00	12.00	10.90	10.90	12.00
	OP	4.00	4.00	4.00	4.00	3.63	3.63	4.00
COMM. RAIL	AM	17.67	12.00	12.00	12.00	10.90	10.90	12.00
	MD	5.89	4.00	4.00	4.00	3.63	3.63	4.00
	PM	17.67	12.00	12.00	12.00	10.90	10.90	12.00
	OP	5.89	4.00	4.00	4.00	3.63	3.63	4.00

Table 8-7
Mode Specific Constants for New Modes – Hybrid Model

Mode	Time Period	Purpose						
		HBW	HBSH	HBSC	HBO	NHBW	NHBO	UNV
BRT	AM	0.15000	0.04020	0.11700	0.04800	0.10900	0.10900	0.15000
	MD	0.05000	0.01340	0.07800	0.03200	0.07267	0.07267	0.10000
	PM	0.15000	0.04020	0.11700	0.04800	0.10900	0.10900	0.15000
	OP	0.05000	0.01340	0.07800	0.03200	0.07267	0.07267	0.10000
LRT	AM	0.30000	0.08040	0.23400	0.09600	0.21800	0.21800	0.30000
	MD	0.10000	0.02680	0.07800	0.03200	0.07267	0.07267	0.10000
	PM	0.30000	0.08040	0.23400	0.09600	0.21800	0.21800	0.30000
	OP	0.10000	0.02680	0.07800	0.03200	0.07267	0.07267	0.10000
COMM. RAIL	AM	0.44175	0.08040	0.23400	0.09600	0.21800	0.21800	0.30000
	MD	0.14725	0.02680	0.07800	0.03200	0.07267	0.07267	0.10000
	PM	0.44175	0.08040	0.23400	0.09600	0.21800	0.21800	0.30000
	OP	0.14725	0.02680	0.07800	0.03200	0.07267	0.07267	0.10000

8.2 Model Calibration

The model calibration was focused on three distinct elements. These elements include the adjustments to the transit network and transit speed estimation process, revisions to the trip distribution process to minimize the differences between the HBW trips and the Journey-to-Work data from the CTPP, and a limited recalibration of the mode choice model to replicate the observed mode shares by time of day established for the AA-DD Study.

As part of the region-wide review of the transit network, URS initially compared the current transit system provided by each of the transit operators against the routes coded in the SEMCOG regional model network. Based on this review, URS altered selected routes and added new services in order to represent the transit system, as it currently exists. URS also compiled the service frequency and scheduled run times for all existing bus routes to establish a dataset for calibration and adjustment of the transit run times. Following that effort, URS then focused on adjustments specifically within the three study area corridors serving Woodward Avenue, Michigan Avenue, and Gratiot Avenue. Each of the routes in these corridors were then adjusted to ensure the proper route alignment and to minimize differences between the observed and estimated run times. These adjustments were successful in minimizing the run time differences on the DDOT routes that are to be eliminated with the introduction of the LRT and BRT alternatives in each corridor. In most cases the adjusted route run times are within approximately five minutes of the scheduled runtime. For the SMART routes that also traverse these corridors, the estimated run times are somewhat longer than the observed schedules, although these routes provide express-type service from the outlying counties and can only discharge passengers within Detroit. As such, these routes are not direct competitors with the proposed new alternatives.

URS also compared the estimated home-based work trips from the hybrid model to the trip patterns from the Journey- to-Work data. Given the orientation of the DTOGS corridors, the comparisons were focused on travel to the downtown Detroit region. Included in this analysis was a separate estimate of home-based work trips with selected district-level adjustments to the HBW productions and attractions. This adjustment process was originally developed as part of the AA-DD Study to correct some significant deficiencies in an earlier version of the SEMCOG Regional Model. While both the original estimates from the hybrid model and the adjusted estimates were close to the journey-to-work travel patterns, the adjustment procedure from the AA-DD Study provided a slightly better replication of the observed patterns and therefore, the adjustments were retained for the DTOGS analysis.

With the network adjustments and trip distribution refinements completed, URS recalibrated mode choice model in order to replicate observed mode shares by trip purpose and time of day. As an initial step, daily observed target values by purpose and mode were created using control values adopted from the AA-DD Study. These values were developed from the previously mentioned household survey and onboard survey data. In addition observe target values by time of day were established using the existing estimated shares by time of day from the AA-DD Model. These estimated shares were used as targets since the observed data set had not been summarized by time of day in the draft documentation for the AA-DD Study.

Table 8-8 provides a summary of survey data provided by SEMCOG regarding trips by purpose mode and time of day. **Table 8-9** lists the model estimates from the final calibration run. As values in **Table 8-9** show, the model provides a good replication of the aggregate shares by purpose and mode.

Table 8-8
Observed Trips by Mode and Time of Day[1]

Daily

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	2,328,088	1,009,513	305,957	2,346,396	1,051,061	1,868,260	8,909,275
HOV2	220,610	603,602	332,533	2,030,206	199,260	1,532,667	4,918,878
HOV3	54,356	314,016	504,864	1,514,172	72,327	994,586	3,454,322
Tot Hwy	2,603,054	1,927,132	1,143,354	5,890,775	1,322,648	4,395,513	17,282,475
WB	55,193	9,389	22,663	27,237	9,378	7,226	131,086
DB	4,688	368	1,418	1,957	802	809	10,041
Tot Transit	59,881	9,756	24,081	29,194	10,180	8,035	141,128
TOTAL	2,662,934	1,936,888	1,167,435	5,919,969	1,332,828	4,403,548	17,423,603
% Hwy	97.8%	99.5%	97.9%	99.5%	99.2%	99.8%	99.2%
% Transit	2.2%	0.5%	2.1%	0.5%	0.8%	0.2%	0.8%

AM

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	505,389	26,802	57,970	211,939	162,099	67,612	1,031,810
HOV2	44,651	9,275	133,805	181,453	15,232	51,974	436,390
HOV3	14,168	4,289	209,185	146,215	11,118	24,979	409,954
Tot Hwy	564,208	40,366	400,959	539,607	188,449	144,564	1,878,154
WB	9,643	478	4,778	4,592	1,082	607	21,180
DB	955	19	411	384	84	114	1,966
Tot Transit	10,599	496	5,189	4,975	1,166	720	23,146
TOTAL	574,807	40,863	406,148	544,583	189,615	145,285	1,901,300
% Hwy	98.2%	98.8%	98.7%	99.1%	99.4%	99.5%	98.8%
% Transit	1.8%	1.2%	1.3%	0.9%	0.6%	0.5%	1.2%

MD

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	319,163	361,885	100,546	735,301	332,768	1,147,268	2,996,931
HOV2	31,647	227,514	94,519	534,482	84,262	815,268	1,787,692
HOV3	9,835	91,669	108,838	290,367	33,933	419,351	953,992
Tot Hwy	360,646	681,067	303,902	1,560,151	450,962	2,381,887	5,738,615
WB	16,655	4,947	7,883	15,366	4,216	3,875	52,943
DB	1,050	111	279	909	294	392	3,036
Tot Transit	17,705	5,058	8,163	16,275	4,510	4,268	55,978
TOTAL	378,350	686,126	312,065	1,576,426	455,472	2,386,155	5,794,594
% Hwy	95.3%	99.3%	97.4%	99.0%	99.0%	99.8%	99.0%
% Transit	4.7%	0.7%	2.6%	1.0%	1.0%	0.2%	1.0%

PM

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	527,393	238,865	54,747	454,904	416,959	349,570	2,042,438
HOV2	64,985	132,399	63,488	407,447	66,741	284,030	1,019,091
HOV3	14,772	69,657	146,020	345,676	18,898	258,333	853,357
Tot Hwy	607,151	440,921	264,255	1,208,027	502,598	891,933	3,914,886
WB	19,069	2,771	6,833	4,780	2,459	2,065	37,977
DB	1,492	106	436	324	258	237	2,852
Tot Transit	20,560	2,877	7,268	5,104	2,717	2,303	40,829
TOTAL	627,711	443,798	271,524	1,213,132	505,315	894,235	3,955,715
% Hwy	96.7%	99.4%	97.3%	99.6%	99.5%	99.7%	99.0%
% Transit	3.3%	0.6%	2.7%	0.4%	0.5%	0.3%	1.0%

OP

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	976,142	381,961	92,695	944,252	139,235	303,810	2,838,095
HOV2	79,327	234,414	40,721	906,824	33,025	381,395	1,675,706
HOV3	15,580	148,402	40,822	731,914	8,379	291,924	1,237,020
Tot Hwy	1,071,049	764,777	174,237	2,582,990	180,639	977,129	5,750,820
WB	9,826	1,193	3,169	2,499	1,621	679	18,986
DB	1,191	132	292	340	167	66	2,188
Tot Transit	11,017	1,325	3,461	2,839	1,787	745	21,175
TOTAL	1,082,066	766,102	177,698	2,585,829	182,426	977,874	5,771,995
% Hwy	99.0%	99.8%	98.1%	99.9%	99.0%	99.9%	99.6%
% Transit	1.0%	0.2%	1.9%	0.1%	1.0%	0.1%	0.4%

[1] Source: SEMCOG

Table 8-9
Estimated Trips by Mode and Time of Day

Daily

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	2,311,020	994,578	326,945	2,330,901	1,047,396	1,869,743	8,880,583
HOV2	233,049	610,288	327,689	2,033,241	203,702	1,535,399	4,943,369
HOV3	63,459	322,450	489,294	1,526,823	71,319	990,524	3,463,867
Tot Hwy	2,607,528	1,927,316	1,143,928	5,890,964	1,322,418	4,395,665	17,287,818
WB	51,295	9,212	22,159	27,289	9,684	7,052	126,691
DB	4,112	360	1,348	1,716	727	830	9,093
Tot Transit	55,407	9,573	23,507	29,005	10,411	7,883	135,785
TOTAL	2,662,934	1,936,888	1,167,435	5,919,969	1,332,828	4,403,548	17,423,603
% Hwy	97.9%	99.5%	98.0%	99.5%	99.2%	99.8%	99.2%
% Transit	2.1%	0.5%	2.0%	0.5%	0.8%	0.2%	0.8%

AM

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	501,684	26,406	61,946	210,539	161,534	67,665	1,029,774
HOV2	47,168	9,378	131,856	181,724	15,572	52,067	437,765
HOV3	16,541	4,404	202,733	147,437	10,963	24,877	406,955
Tot Hwy	565,394	40,188	396,536	539,700	188,069	144,609	1,874,494
WB	8,962	469	4,672	4,600	1,117	592	20,413
DB	838	18	390	337	76	117	1,776
Tot Transit	9,800	487	5,062	4,937	1,193	709	22,189
TOTAL	575,194	40,675	401,598	544,637	189,262	145,317	1,896,682
% Hwy	98.3%	98.8%	98.7%	99.1%	99.4%	99.5%	98.8%
% Transit	1.7%	1.2%	1.3%	0.9%	0.6%	0.5%	1.2%

MD

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	316,824	356,531	107,443	730,446	331,607	1,148,179	2,991,029
HOV2	33,432	230,034	93,142	535,281	86,141	816,721	1,794,750
HOV3	11,482	94,131	105,481	292,793	33,459	417,638	954,984
Tot Hwy	361,737	680,695	306,066	1,558,520	451,207	2,382,538	5,740,764
WB	15,478	4,854	7,708	15,396	4,354	3,782	51,572
DB	921	109	266	797	266	403	2,762
Tot Transit	16,399	4,963	7,974	16,192	4,620	4,185	54,333
TOTAL	378,137	685,658	314,040	1,574,712	455,827	2,386,723	5,795,097
% Hwy	95.7%	99.3%	97.5%	99.0%	99.0%	99.8%	99.1%
% Transit	4.3%	0.7%	2.5%	1.0%	1.0%	0.2%	0.9%

PM

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	523,527	235,331	58,502	451,900	415,506	349,847	2,034,613
HOV2	68,649	133,865	62,564	408,056	68,229	284,536	1,025,900
HOV3	17,246	71,528	141,517	348,564	18,634	257,278	854,767
Tot Hwy	609,422	440,725	262,583	1,208,520	502,369	891,661	3,915,280
WB	17,722	2,719	6,681	4,789	2,539	2,016	36,466
DB	1,308	104	414	284	233	244	2,587
Tot Transit	19,030	2,823	7,095	5,073	2,773	2,259	39,053
TOTAL	628,453	443,547	269,678	1,213,594	505,142	893,920	3,954,333
% Hwy	97.0%	99.4%	97.4%	99.6%	99.5%	99.7%	99.0%
% Transit	3.0%	0.6%	2.6%	0.4%	0.5%	0.3%	1.0%

OP

	HBW	HBSH	HBSC	HBO	NHW	NHO	Total
SOV	968,985	376,310	99,053	938,016	138,750	304,051	2,825,166
HOV2	83,800	237,011	40,128	908,179	33,761	382,075	1,684,954
HOV3	18,189	152,387	39,563	738,029	8,262	290,731	1,247,161
Tot Hwy	1,070,975	765,708	178,744	2,584,224	180,773	976,858	5,757,280
WB	9,132	1,170	3,098	2,504	1,674	663	18,241
DB	1,045	130	278	299	151	67	1,969
Tot Transit	10,177	1,300	3,376	2,802	1,825	730	20,210
TOTAL	1,081,151	767,008	182,120	2,587,026	182,597	977,588	5,777,490
% Hwy	99.1%	99.8%	98.1%	99.9%	99.0%	99.9%	99.7%
% Transit	0.9%	0.2%	1.9%	0.1%	1.0%	0.1%	0.3%

As expected the overall transit share for the region is less than 1 percent and this value is consistent with the estimated transit share from the current SEMCOG Regional Model. The estimated transit shares by access mode also replicate the observed values derived from the expanded survey data, although the estimated drive access share of total transit is 6.7 percent, which is slightly lower than the 7.1 percent drive access share implied from the observed shares. Note that SEMCOG regional model has a slightly lower drive access transit share of approximately 4.0 percent.

Transit Ridership Calibration

A comparison of the observed and estimated transit ridership within the DTOGS corridors is provided in **Table 8-10**. The table includes all DDOT and SMART routes operating within the corridors and the latest available ridership data. The observed SMART ridership values are from 2006 data, while the DDOT ridership values are from 2007 data. For both the Michigan and Gratiot Corridors, the estimated transit ridership for both the corridor totals and the individual routes provide a good replication of the observed ridership data. Note that the ridership estimates for the DDOT routes (DD34, DD76, DD37) in these two corridors are close to the observed values, which is important since ridership from these routes would be subject to diversion when the routes are terminated in the BRT and LRT alternatives. For the Woodward Corridor, the overall ridership estimates are close to the observed corridor total, but there is significant variation between the DDOT routes and the SMART routes. The DDOT Route 53 is under-assigned by approximately 4,000 riders while the SMART routes are over-assigned by a similar amount. As part of the BRT and LRT alternatives, existing DDOT 53 will be restructured

Table 8-10
DTOGS Corridor Ridership Summary

Section	Route Name	Existing Ridership	2005 Base Ridership
Gratiot	DDOT 34	6,893	7,680
	DDOT 76	563	152
	SMART 510	2,856	3,891
	SMART 530	208	106
	SMART 560	5,714	4,890
	SMART 580	123	350
	Corridor Total	**16,357**	**17,070**
Michigan	DDOT 37	1,370	1,598
	SMART 200	2,717	3,068
	Corridor Total	**4,087**	**4,666**
Woodward	DDOT 53	13,512	9,105
	SMART 445	270	191
	SMART 450	4,757	3,701
	SMART 460	Combined with Route 450	3,850
	SMART 465	303	329
	SMART 475	Combined with Route 445	192
	SMART 495	2,327	2,889
	Corridor Total	21,169	20,256
Combined Three Corridors		**41,613**	**41,992**

8.3 Future Year Ridership Forecasts

This section documents the ridership forecasts for the various scenarios analyzed for each corridor using the Hybrid Model developed for this study. A total of 14 model runs listed below were performed:

1. 2005 Base with current transit services from DDOT & SMART
2. 2030 Base with the SEMCOG 2030 Model with current transit service
3. 2030 Gratiot No-Build (includes minor system optimization in the corridor)
4. 2030 Gratiot TSM (skip-stop service in corridor)
5. 2030 Gratiot BRT
6. 2030 Gratiot LRT
7. 2030 Michigan No-Build (includes minor system optimization in the corridor)
8. 2030 Michigan TSM (skip-stop service in corridor)
9. 2030 Michigan BRT
10. 2030 Michigan LRT
11. 2030 Woodward No-Build (includes minor system optimization in the corridor)
12. 2030 Woodward TSM (skip-stop service in corridor)
13. 2030 Woodward BRT
14. 2030 Woodward LRT

URS analyzed the model results to identify the impacts of each scenario on the system and corridor level ridership. The major observations from our analysis are listed below.

8.3.1 System Ridership

The SEMCOG Model transit network includes five transit systems in the greater Detroit region: Detroit Department of Transportation (DDOT), Suburban Mobility Authority for Regional Transportation (SMART), Ann Arbor Transportation Authority (AATA), Blue Water, and Lake Erie Transit (LET). URS also added Detroit People Mover (DPM) to the SEMCOG Model. The overall ridership of all systems in the region is included in the Table 8-11. The model estimated daily ridership for the 2030 Base Scenario is 205,700 riders, which is lower than the estimated 223,700 ridership for the base year 2005. This reduction was anticipated due to expected decrease in population in the Detroit City and employment in CBD served by transit, that are assumed in the model. In contrast, the 2007 Social Compact Report indicates growth in population and employment along the Woodward corridor; specifically, Detroit's population in 2007 was estimated to be 933,000 or 62,000 persons higher than estimated by the Census Bureau in 2006[2]. Moreover, of the five proposed stations on Woodward Avenue, between downtown Detroit and Grand Boulevard, four of them have experienced more than five percent growth in population within one-half mile of the station from 2000 to 2007, while one station location had stable population[3].

The 2030 No-Build scenario changes included in the network increase the system daily ridership by 2,600, 400 and 2,800 riders for the Gratiot, Michigan and Woodward Corridors, respectively, from the 2030 Base Scenario. The TSM improvements impacts are relatively the same for each corridor: increase of 1,300 for Gratiot, 1,000 for Michigan and 1,500 for Woodward, compared to the 2030 Base Scenario.

The introduction of the BRT system in the Gratiot Corridor increases the overall system Ridership by 6,700 riders. The Michigan Corridor BRT will increase the system ridership by 4,400 while Woodward Corridor BRT will increase ridership by 5,700 riders. The implementation of a LRT system in each corridor will increase the system ridership by 8,300, 5,700, and 7,500 riders on Gratiot, Michigan and Woodward Corridors, respectively.

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[2] Led by the Detroit Economic Development Corporation

[3] Stable population is defined as a population in 2007 that is within +- 5 percent of the population in 2000.

8.3.2 Corridor Ridership

Table 8-12 lists the corridor-level ridership for Gratiot, Michigan and Woodward Corridors and also includes ridership on both the DDOT and SMART buses operating in each corridor. The ridership listed for each routes in the table include the total ridership for the entire route not just within Detroit. This table also provides ridership for new services implemented under TSM, BRT, and LRT Scenarios. For the Gratiot and Michigan Corridors, TSM, BRT and LRT routes include an extension on Woodward Avenue from Downtown to Grand Blvd.

<u>2030 Base vs. 2005 Base</u>

The model estimated ridership for the three corridors for 2030 Base is 39,800 compared to 42,000 riders in 2005 model. This reduction is largely due to expected decrease in Detroit City's population and employment. The Michigan Corridor ridership shows some gain, most likely due to the fact that both SMART Route 200 and DD 37 serve area outside of the city. Note that the SMART ridership is approximately two-thirds of the corridor ridership in this corridor.

<u>Impact of No-Build & TSM Operating Plan</u>

Under the No-Build operating plans defined in Chapter 7 of this report, ridership in each corridor is increased by approximately 300 to 400 riders.

With the introduction of "skip-stop" services under the TSM alternatives, impacts on the ridership for each corridor are different. The Gratiot Corridor ridership on the local Route 34 is similar to the 2030 Base scenario and the "skip-stop" service (new Route 34T) does not attract much ridership (only 100 riders a day). For the Michigan Corridor, with the introduction of "skip-stop" at higher frequency than current local buses, the overall corridor ridership is increased by approximately 500 riders from the 2030 Base. The "skip-stop" service attracts 1,800 riders a day. The Woodward Corridor ridership in the TSM scenario is increased by 300 riders, although majority of this gain is in the local Route 53 ridership due to improvements in feeder system. The "skip-stop" service in this corridor attracts only 100 riders a day to due to less frequent service than the local Route 53.

The new "skip-stop" services do not gain any significant amount of riders on the Gratiot or Woodward Corridors where their frequencies are lower than the local services. The speed gains obtained by limiting stops are counterbalanced by higher wait time for these two corridors. (Also see **Appendix H** for detailed station-to-station travel times for each alternative.) On the other hand on the Michigan Corridor, the new bus route (37T) gains significant riders due to its frequency being higher than the competing local routes.

Impact of BRT and LRT

As noted previously, the BRT and LRT systems on the Gratiot and Michigan Corridors include the three-mile extension on the Woodward Avenue. For the Woodward Corridor, the new BRT and LRT system largely follow the same route as existing DDOT Route 53. Hence, the reader should keep this mind when comparing the system and corridor-level ridership among different corridors.

In the Gratiot Corridor, the BRT attracts 8,200 daily riders, compared to 6,600 riders in 2030 Base Scenario on the existing routes being discontinued (DDOT 34 and DDOT 76). Overall, the Gratiot Corridor ridership is increased by 2,400 in the BRT Alternative. The LRT on Gratiot draws 9,900 daily riders, while the overall corridor ridership increased by 4,100.

For the Michigan Corridor, BRT attracts 5,200 daily riders compared to 1,800 riders on the DD 37 Route being eliminated and the corridor ridership increased by 3,500. With the introduction of LRT in the Michigan Corridor, it draws 6,400 daily riders and the corridor ridership is increased by 4,600 riders.

In the Woodward Corridor, the BRT draws 9,200 daily riders compared to 7,700 riders on DD 53 in the 2030 Base. The corridor ridership increased by 1,900 riders in the BRT Alternative. The LRT in this corridor is expected to draw 11,100 riders compared to 7,700 on the DD 53, an increase of 3,400 riders on daily basis. The corridor ridership under the LRT Alternative is increased by 3,800 riders. Please note that, as mentioned earlier, we will continue to improve the calibration of the Hybrid Model in this corridor and expects the BRT and LRT ridership numbers to go up as the model estimated value for the 2005 base will be increased to match the observed ridership.

Table 8-11
System Ridership Summary

System	2005 Base	2030 Base	2030 Gratiot				2030 Michigan				2030 Woodward			
			No-Build	TSM	BRT	LRT	No-Build	TSM	BRT	LRT	No-Build	TSM	BRT	LRT
SEMCOG Region[4]	223,700	205,700	208,300	207,000	212,400	214,000	206,100	206,700	210,100	211,400	208,500	207,200	211,400	213,200
Difference vs. 2030 Base	N/A	0	2,600	1,300	6,700	8,300	400	1,000	4,400	5,700	2,800	1,500	5,700	7,500

Table 8-12
Corridor Ridership Summary

Corridor	Route Name	Existing Ridership	2005 Base	2030 Base	2030 Gratiot				2030 Michigan				2030 Woodward			
					No-Build	TSM	BRT	LRT	No-Build	TSM	BRT	LRT	No-Build	TSM	BRT	LRT
GRATIOT	DD34	6,900	7,700	6,500	6,700	6,300	NA	NA								
	DD76	600	200	100	NA	NA	NA	NA								
	SM510	2,900	3,900	4,000	4,000	4,000	4,000	3,900								
	SM530	200	100	100	100	100	100	100								
	SM560	5,700	4,900	4,800	4,900	4,900	5,500	5,600								
	SM580	100	400	200	200	200	200	200								
	DD34T	0	0	0	0	**100**	0	0								
	BRT Gratiot	0	0	0	0	0	**8,200**	0								
	LRT Gratiot	0	0	0	0	0	0	**9,900**								
	Corridor Total	**16,400**	**17,100**	**15,700**	**16,000**	**15,600**	**18,100**	**19,800**								
MICHIGAN	DD37	1,400	1,600	1,800					2,400	700	N/A	N/A				
	SM200	2,700	3,100	3,300					3,200	3,200	3,300	3,300				
	DD37T	0	0	0					0	**1,800**	0	0				
	BRT Michigan	0	0	0					0	0	**5,200**	0				
	LRT Michigan	0	0	0					0	0	0	**6,400**				
	Corridor Total	**4,100**	**4,700**	**5,100**					**5,700**	**5,600**	**8,600**	**9,700**				
WOODWARD	DD53	13,500	9,100	7,700									8,300	8,500	N/A	N/A
	SM445	300	200	200									200	200	200	200
	SM450	4,800	3,700	3,800									3,800	3,900	3,900	3,900
	SM460	0	3,900	4,000									4,000	4,000	4,100	4,100
	SM465	300	300	300									300	300	200	200
	SM475	0	200	200									200	200	200	200
	SM495	2,300	2,900	2,900									2,900	2,900	3,100	3,200
	DD53T	0	0	0									0	**100**	0	0
	BRT Woodward	0	0	0									0	0	**9,200**	0
	LRT Woodward	0	0	0									0	0	0	**11,100**
	Corridor Total	**21,200**	**20,300**	**19,000**									**19,600**	**20,000**	**20,900**	**22,800**
Total of Three Corridors		**41,600**	**42,000**	**39,800**	**40,100**	**39,500**	**41,300**	**43,000**	**40,400**	**40,200**	**43,200**	**44,500**	**40,400**	**40,700**	**41,800**	**43,600**

4 Includes ridership for all transit systems in the original regional model (i.e. DDOT, SMART, AATA, Blue Water, LET, and Detroit People Mover), and BRT or LRT where applicable.

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