

#### **IV. Travel Estimation Process**

The travel demand estimates that were used in this conformity analysis are the end result of a model chain that begins by forecasting and distributing population, households and employment for the SPC region. The model chain is iterative in nature. Estimates from the travel demand models are periodically cycled back as inputs to the socio-economic forecasting models.

SPC completed its ninth cycle of population, household and employment forecasts in the spring of 2011 (Cycle 9 forecast). The Cycle 9 forecast replaces the Cycle 8 forecast, which was adopted in 2007. The Cycle 9 forecast includes population, household, and employment estimates for the 10-county SPC region. Development of the 2040 Plan prompted SPC to re-examine the Cycle 8 forecasts of population and households. New and updated information from the Census Bureau and other data sources as well as current information about proposed development projects in the region was used to revise the employment, population, and household forecasts. The resulting Cycle 9 forecasts were then used to revise the highway and transit trip forecasts. With each cycle, models are revised to take advantage of the latest data and to incorporate evolving modeling techniques.

SPC uses an integrated economic-demographic forecasting model to develop regional estimates of future population and employment. That model, known as REMI (Regional Economic Models, Inc.), integrates an economic forecast with a demographic forecast for economic sub-regions of the United States. Based on historical analysis of the regional economy and a forecast of the U.S. economy, REMI forecasts regional employment, production, and other regional economic variables. REMI also utilizes historical data on population to forecast regional population growth or decline based on a traditional cohort-survival model. Then, based on the economic forecast, REMI determines the amount of migration in or out of the region for workers and their dependents to produce a complete population forecast. The model is recursive in nature. The population forecast is used to revise the employment estimate. The new employment estimate is then used to allow for further changes in economic migration. This cycle continues until the economic and demographic forecasts balance out. SPC first used the REMI model for forecasting in 1992, when the Cycle 4a forecasts were produced.

In 1992-93, SPC developed a model to allocate regional forecasts of population, households and employment to the traffic analysis zones in the region. The allocation model, known as MERLAM (Mature Economic Region Land Use Allocation Model) uses simple algorithms and an extensive database to allocate population and employment. The model's algorithms include a number of policy-sensitive variables. The database includes land use and attractiveness measures. The land use database provides essential baseline information on each traffic analysis zone.

## REGIONAL POPULATION

COUNTY	2010	2040	CHANGE 2010-2040	% CHANGE 2010-2040
Allegheny	1,223,337	1,435,855	+212,518	+17.4%
<i>Pittsburgh City</i>	313,925	355,035	+41,110	+13.1%
<i>non-Pittsburgh</i>	909,412	1,080,820	+171,408	+18.9%
Armstrong	68,694	77,247	+8,533	+12.4%
Beaver	169,571	198,016	+28,445	+16.8%
Butler	187,694	245,650	+57,956	+30.9%
Fayette	140,407	157,279	+16,872	+12.0%
Greene	39,712	43,658	+3,946	+9.9%
Indiana	88,129	100,261	+12,132	+13.8%
Lawrence	91,130	105,071	+13,941	+15.3%
Washington	207,621	270,246	+62,625	+30.2%
Westmoreland	358,664	423,432	+64,768	+18.1%
<b>TOTAL</b>	<b>2,574,959</b>	<b>3,056,715</b>	<b>+468,161</b>	<b>+18.2%</b>

TABLE 1

SPC June 2011

2010 and 2040 population estimates based on REMI forecast.  
Population allocation to counties based on SPC MERLAM process.

## REGIONAL HOUSEHOLDS

COUNTY	2010	2040	CHANGE 2010-2040	% CHANGE 2010-2040
Allegheny	529,111	648,840	+119,729	+22.6%
<i>Pittsburgh City</i>	139,672	168,987	+29,315	+21.0%
<i>non-Pittsburgh</i>	389,439	479,853	+90,414	+23.2%
Armstrong	29,447	34,788	+5,341	+18.1%
Beaver	70,936	85,961	+15,025	+21.2%
Butler	73,559	100,410	+26,851	+36.5%
Fayette	58,184	68,763	+10,579	+18.2%
Greene	14,551	16,295	+1,744	+12.0%
Indiana	35,212	41,725	+6,513	+18.5%
Lawrence	36,573	43,644	+7,071	+19.3%
Washington	84,320	113,064	+28,744	+34.1%
Westmoreland	151,819	188,279	+36,460	+24.0%
<b>TOTAL</b>	<b>1,083,712</b>	<b>1,341,769</b>	<b>+258,057</b>	<b>+23.8%</b>

TABLE 2

SPC June 2011

2010 and 2040 household estimates based on SPC MERLAM process.  
Household allocation to counties based on SPC MERLAM process.

## REGIONAL EMPLOYMENT

COUNTY	2010				
	RETAIL	MANU- FACTURING	SERVICES	OTHER	TOTAL
Allegheny	135,446	39,155	612,386	74,764	861,751
<i>Pittsburgh City</i>	<i>33,010</i>	<i>10,121</i>	<i>298,277</i>	<i>15,606</i>	<i>357,014</i>
<i>non-Pittsburgh</i>	<i>102,436</i>	<i>29,034</i>	<i>314,109</i>	<i>59,158</i>	<i>504,737</i>
Armstrong	4,615	1,721	16,332	5,280	27,948
Beaver	11,888	8,210	41,091	6,346	67,535
Butler	20,021	11,880	59,649	15,679	107,229
Fayette	11,731	3,532	36,531	7,497	59,291
Greene	2,658	708	13,341	5,749	22,456
Indiana	8,609	2,968	23,174	11,678	46,429
Lawrence	7,003	4,094	23,878	4,480	39,455
Washington	18,642	7,785	58,873	14,112	99,412
Westmoreland	34,861	19,270	103,968	22,477	180,576
<b>TOTAL</b>	<b>255,474</b>	<b>99,323</b>	<b>989,223</b>	<b>168,062</b>	<b>1,512,082</b>
COUNTY	2040				
	RETAIL	MANU- FACTURING	SERVICES	OTHER	TOTAL
Allegheny	149,133	36,278	850,416	100,945	1,136,772
<i>Pittsburgh City</i>	<i>31,694</i>	<i>9,180</i>	<i>364,946</i>	<i>22,207</i>	<i>428,027</i>
<i>non-Pittsburgh</i>	<i>117,439</i>	<i>27,098</i>	<i>485,470</i>	<i>78,737</i>	<i>708,745</i>
Armstrong	4,824	1,632	20,904	6,120	33,480
Beaver	12,773	6,553	55,211	9,898	84,435
Butler	23,512	10,157	87,692	20,212	141,573
Fayette	11,382	3,145	46,779	10,064	71,370
Greene	2,734	647	17,109	5,730	26,220
Indiana	9,075	2,644	31,041	11,743	54,503
Lawrence	7,596	3,897	33,581	6,165	51,239
Washington	22,678	6,834	91,198	18,892	139,602
Westmoreland	36,874	18,898	139,679	27,993	223,444
<b>TOTAL</b>	<b>280,581</b>	<b>90,685</b>	<b>1,373,610</b>	<b>217,762</b>	<b>1,962,638</b>
COUNTY	PERCENT CHANGE 2010-2040				
	RETAIL	MANU- FACTURING	SERVICES	OTHER	TOTAL
Allegheny	+10.1%	-7.3%	+38.9%	+35.0%	+31.9%
<i>Pittsburgh City</i>	<i>+4.0%</i>	<i>-9.3%</i>	<i>+22.4%</i>	<i>+42.3%</i>	<i>+19.9%</i>
<i>non-Pittsburgh</i>	<i>+14.6%</i>	<i>-6.7%</i>	<i>+54.6%</i>	<i>+33.1%</i>	<i>+40.4%</i>
Armstrong	+4.5%	-5.2%	+28.0%	+15.9%	+19.8%
Beaver	+7.4%	-20.2%	+34.4%	+56.0%	+25.0%
Butler	+17.4%	-14.5%	+47.0%	+28.9%	+32.0%
Fayette	-3.0%	-11.0%	+28.1%	+34.2%	+20.4%
Greene	+2.9%	-8.6%	+28.2%	-0.3%	+16.8%
Indiana	+5.4%	-10.9%	+33.9%	+0.6%	+17.4%
Lawrence	+8.5%	-4.8%	+40.6%	+37.6%	+29.9%
Washington	+21.7%	-12.2%	+54.9%	+33.9%	+40.4%
Westmoreland	5.8%	-1.9%	+34.3%	+24.5%	+23.7%
<b>TOTAL</b>	<b>+9.8%</b>	<b>-8.7%</b>	<b>+38.9%</b>	<b>+29.6%</b>	<b>+29.8%</b>

TABLE 3

SPC June 2011

2010 and 2040 total employment based on REMI forecast.  
Employment allocation to counties based on SPC MERLAM process.

## **Air Quality Conformity Determination**

*2040 Long Range Transportation Plan and 2011-2014 Transportation Improvement Program  
Southwestern Pennsylvania Commission – June 2011*

---

The attractiveness measures are used to determine each zone's relative attractiveness for different types of development. By varying the attractiveness measures and by altering the values of the model's policy variables, MERLAM is able to estimate the impact of various regional land use and development scenarios. SPC updated the databases and streamlined the MERLAM allocation process early in 2011. The Cycle 9 forecasts were allocated to traffic zones through the use of MERLAM.

SPC's Cycle 9 base year (2010) estimates, and 2040 forecasts, of population, employment, and households were used to estimate regional travel demand for this conformity assessment. SPC developed its travel estimation models to take full advantage of the capabilities of the TP+ software package. TP+ is a library of programs used for transportation planning.

Travel simulations for the ten-county SPC travel model region are produced with a standard four-step chain of transportation models developed by SPC for TP+ processing. The four steps include trip generation, trip distribution, modal split and travel assignment models. Travel was simulated for 2010 and 2040 based on socio-economic data from SPC's Cycle 9 forecasts. County-level socio-economic data is shown in Table 1 (population), Table 2 (households), and Table 3 (employment). Simulated 2010 travel was validated with 2008 and 2009 traffic counts, 2009 VMT, and 2010 transit ridership data.

SPC's trip generation model simulates person trip productions and attractions for three trip purposes (home-based work, home-based other, and non-home based) and truck trip productions and attractions for three truck classes (light, medium and heavy). Person trip productions are estimated by applying household trip rates to Cycle 9 household data in a cross-classification model stratified by household size and auto ownership. Person trip attractions are estimated by applying trip rates stratified by households and by three employment categories. In some instances, attraction trip rates are further stratified by area. Home-based work trip control totals are averaged production and attraction totals. Home-based other attractions were balanced to match productions. Non-home based person trips and truck trips are estimated by applying trip rates stratified by employment category. These rates are applied to Cycle 9 employment data.

Gravity models were calibrated to distribute person trips and truck trips by each trip generation category. Impedances are a weighted sum of highway travel time and distance to reflect out-of-pocket trip cost. Travel time includes running time, terminal time, and a penalty for major river crossings. Home-based work trips were distributed with peak-period impedances; all other trips were distributed with off-peak impedances.

A control total of air passenger-related travel to and from the Pittsburgh International Airport was derived from independent airport planning studies for existing and forecast years. A gravity model to distribute these trips was calibrated with air enplanement data reported for 2000. These trips were then added to home-based other trips.

## **Air Quality Conformity Determination**

*2040 Long Range Transportation Plan and 2011-2014 Transportation Improvement Program  
Southwestern Pennsylvania Commission – June 2011*

---

The home-based work component of the mode split model was initially developed by SPC in 1995 when calibration of a home-based work trip auto occupancy and mode split model was completed. In addition to estimating the number of person trips using transit, the home-based work mode split model also stratifies non-transit trips by four levels of auto occupancy (drive alone, two person carpools, three person carpools, and vehicles with four or more occupants). Based on those stratifications the model then converts home-based highway person trips into vehicle trips for use in highway assignment. The model is sensitive to the presence of high-occupancy vehicle (HOV) facilities in the highway network. The 2005-2009 Census American Community Survey Journey-to-Work (JTW) data reported that, regionwide, 10.8 percent of persons traveling to work were in HOVs (vehicles with two or more occupants). Table 4 compares actual JTW percentages with the model simulation by trip attraction districts. Actual numbers of trips, while shown in the table, should not be compared because JTW data only represents persons working at their primary job rather than all home-based work trips.

The auto occupancy component of the mode split model could not be used for non-work trips because the JTW survey data includes only work trips and there were no other available data sources for calibration. Non-work highway person trips were converted to vehicle trips by applying vehicle occupancy rates developed by SPC and stratified by trip purpose and attraction district.

Three travel impedances by auto and transit modes are included in the mode split model. These are run time (total in-vehicle time), "excess" time (total out-of-vehicle time), and cost (out-of-pocket cost). For home-based work trips the impedances are based on restrained highway travel times and peak period transit service. For home-based other and non-home based trips, impedances are based on free-flow highway times and mid-day transit service.

Table 5 compares observed and simulated transit route trips. Since the base year for the forecast is 2010, simulated network assignment summaries for 2010 and observed data for an average month (April) in 2010 were used for the comparisons. The route trip data and corridor definitions were obtained from Port Authority of Allegheny County and other transit providers in the region. Table 5 shows that, regionally, simulated route trips are within thirteen percent of observed data.

Overall, it was determined that transit mode split and transit assignment results were reasonably close to observed data.

**HOV MODEL VALIDATION**  
**Auto Person Trip Attractions**

District	2005-2009 Census ACS Journey to Work		2010 SPC Estimated		Percent HOV	
	<u>SOV</u>	<u>HOV</u>	<u>SOV</u>	<u>HOV</u>	<u>JTW</u>	<u>SPC</u>
PGH CBD	-	-	48,761	21,065	-	30.2%
PGH EAST	-	-	122,707	11,629	-	8.7%
PGH NORTH	-	-	33,221	3,121	-	8.6%
PGH SOUTH	-	-	39,537	3,339	-	7.8%
PGH TOTAL	179,837	32,340	244,226	39,154	15.2%	13.8%
ALLEG EAST	73,246	8,569	120,137	8,247	10.5%	6.4%
ALLEG SOUTH	142,364	15,990	237,010	18,796	10.1%	7.3%
ALLEG NORTH	93,500	10,465	155,048	12,060	10.1%	7.2%
ALLEG TOTAL	309,110	35,024	512,195	39,103	10.2%	7.1%
BUTLER	68,098	6,663	113,077	7,772	8.9%	6.4%
ARMSTR EAST	9,600	1,153	20,067	1,250	10.7%	5.9%
ARMSTR WEST	5,258	656	9,822	678	11.1%	6.5%
WESTMORELAND	116,289	11,246	193,882	12,373	8.8%	6.0%
WASHINGTON	62,834	6,389	103,542	7,512	9.2%	6.8%
BEAVER SOUTH	14,984	1,532	19,385	1,178	9.3%	5.7%
BEAVER NORTH	28,932	2,972	53,309	3,310	9.3%	5.8%
FAYETTE	35,202	3,373	65,840	3,438	8.7%	5.0%
GREENE	8,637	1,100	22,665	1,931	11.3%	7.9%
INDIANA	27,170	3,288	50,061	2,975	10.8%	5.6%
LAWRENCE	25,537	2,537	44,132	2,173	9.0%	4.7%
OUTSIDE ALLEG	402,541	40,909	695,782	44,590	9.2%	6.0%
GRAND TOTAL	891,488	108,273	1,452,203	122,847	10.8%	7.8%

TABLE 4

SPC June 2011

## TRANSIT ROUTE TRIP VALIDATION BY CORRIDOR

SUB-CORRIDOR NAME	ACTUAL OCT 2009	ASSIGNMENT 2010	ASSIGN / ACTUAL
ALLEGHENY VALLEY	3,658	2,000	0.55
NORTH HILLS	18,881	14,740	0.78
HOV LANE EXPRESS	3,734	6,996	1.87
OHIO VALLEY	10,529	12,693	1.21
<b>TOTAL NORTH HILLS</b>	<b>36,802</b>	<b>36,429</b>	<b>0.99</b>
WEST END - CARNEGIE	6,860	3,544	0.52
BANKSVILLE - GREENTREE	3,861	5,566	1.44
SOUTH HILLS LRV	25,475	18,240	0.72
AIRPORT SERVICE	2,231	4,121	1.85
WEST LIBERTY AVENUE	3,755	3,973	1.06
MT. WASHINGTON - HILLTOP	2,822	946	0.34
SAW MILL RUN - SOUTH BUSWAY	6,139	6,452	1.05
SOUTHSIDE	13,982	11,704	0.84
<b>TOTAL SOUTH HILLS - WEST END</b>	<b>65,125</b>	<b>54,546</b>	<b>0.84</b>
SECOND AVENUE	5,473	3,311	0.60
MON VALLEY EXPRESS	485	1,984	4.09
HOMESTEAD LOCAL AND EXPRESS	5,626	5,722	1.02
MCKEESPORT LOCAL	1,332	1,846	1.39
MONROEVILLE - EAST PITTSBURGH	589	968	1.64
<b>TOTAL SOUTHEAST</b>	<b>13,505</b>	<b>13,831</b>	<b>1.02</b>
FIFTH AVENUE	20,451	14,247	0.70
FORBES AVENUE - SQUIRREL HILL	22,643	21,325	0.94
EAST SUBURBAN - BLVD OF ALLIES	10,244	10,678	1.04
EAST BUSWAY	14,849	21,800	1.47
BIGELOW BLVD - PENN HILLS	7,139	3,333	0.47
HILL DISTRICT - CENTER AVENUE	10,153	3,087	0.30
BUTLER STREET - EAST LIBERTY	5,858	3,236	0.55
HOMEWOOD - PENN / LIBERTY	11,841	7,481	0.63
<b>TOTAL EAST END</b>	<b>103,178</b>	<b>85,187</b>	<b>0.83</b>
INCLINES	1,661	1,424	0.86
OTHER PORT AUTHORITY	14,541	10,606	0.73
<b>TOTAL PORT AUTHORITY SYSTEM</b>	<b>234,812</b>	<b>202,023</b>	<b>0.86</b>
NON-PORT AUTHORITY ROUTES	15,007	14,341	0.96
<b>TOTAL TRANSIT NETWORK</b>	<b>249,819</b>	<b>216,364</b>	<b>0.87</b>

TABLE 5

SPC June 2011

## **Air Quality Conformity Determination**

*2040 Long Range Transportation Plan and 2011-2014 Transportation Improvement Program  
Southwestern Pennsylvania Commission – June 2011*

---

A gravity model was calibrated for distributing internal/external vehicle trips (trips with one end inside and one end outside the region). To generate the internal/external trips to be distributed, relationships were initially developed between internal person trip ends by county and census 2000 journey to work data for work trips destined to the region from the external area. These trip patterns were factored to match PennDOT and SPC traffic count data by external cordon segment as shown on Map 4. Table 6 compares simulated external cordon segment volumes to PennDOT and SPC traffic count data from various years and factored to a 2010 value using factors supplied by PennDOT. The total simulated volume regionwide is about two percent higher than the observed volume.

An estimate of through trips (vehicle trips with both ends outside the region) is the final component of trips needed for the regional trip matrices. Results from SPC's 2006 External Cordon Survey provided traffic volume estimates for the major travel corridors crossing the region's boundary. The growth in through trips for forecast years is based on the increase in trips in the modeled area (all except Allegheny) for the appropriate time period.

SPC assigns vehicle trips to the TP+ -based highway networks with a multi-iteration equilibrium assignment process which includes capacity restraint after each iteration. The impedances used for capacity restraint are highway based costs which include weighted values of time and distance. Through trips and medium and heavy duty truck trips are pre-loaded on the network with a one pass assignment that attracts these vehicles to high-level facilities in the network and keeps them there through iterations of capacity restraint. Also, the highway assignment procedure permits only HOV trips to use HOV facilities. The accuracy of the travel estimation process was validated with 2008 and 2009 traffic counts at PennDOT permanent traffic count stations in the region and 2009 highway VMT data.

PennDOT maintains eleven permanent traffic count stations in the region as shown on Map 4. A comparison of current traffic counts at each location to assigned 2010 link volumes is made in Table 7. The total simulated volume for all eleven stations is about seven percent higher than the observed volume.

VMT, stratified by functional class and county, from a 2010 traffic assignment was compared to 2009 VMT estimates made by PennDOT. Regionwide, there was an eight percent difference between observed and simulated VMT. That comparison is shown in Table 8.

Overall, it was determined that highway assignment results were reasonably close to the observed data.

## TRAVEL MODEL VALIDATION External Cordon Volume Comparisons

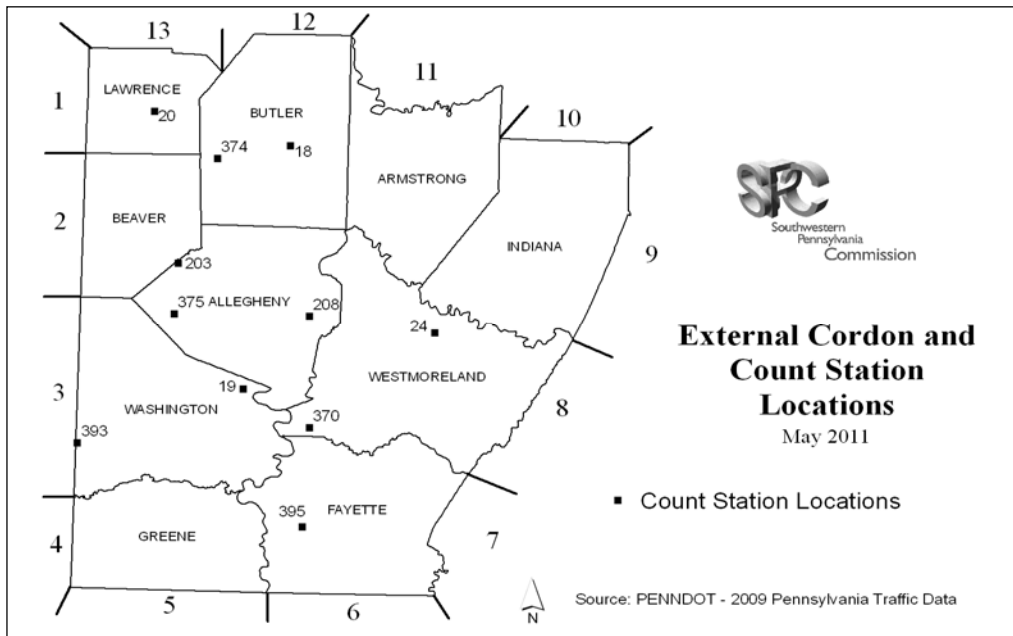
CORDON SEGMENT	COUNTY	OBSERVED VOLUME	SIMULATED VOLUME	SIMULATED / OBSERVED
1	Lawrence	36,921	33,332	0.90
2	Beaver	23,993	27,109	1.13
3	Washington	61,582	60,221	0.98
4	Greene	1,307	1,516	1.16
<b>Western Boundary Total</b>		<b>123,803</b>	<b>122,178</b>	<b>0.99</b>
5	Greene	32,843	33,397	1.02
6	Fayette	16,868	14,672	0.87
<b>Southern Boundary Total</b>		<b>49,711</b>	<b>48,069</b>	<b>0.97</b>
7	Fayette	8,500	15,969	1.88
8	Westmoreland	48,985	44,520	0.91
9	Indiana	28,242	25,872	0.92
<b>Eastern Boundary Total</b>		<b>85,727</b>	<b>86,361</b>	<b>1.01</b>
10	Indiana	11,569	12,707	1.10
11	Armstrong	14,794	18,066	1.22
12	Butler	21,294	24,504	1.15
13	Lawrence	52,184	53,099	1.02
<b>Northern Boundary Total</b>		<b>99,841</b>	<b>108,376</b>	<b>1.09</b>
<b>TOTAL</b>		<b>359,082</b>	<b>364,984</b>	<b>1.02</b>

Table 6

SPC June 2011

Observed volume is from SPC 2005 - 2006 external cordon counts, factored to 2010 values, and from factored PennDOT data.  
Simulated volume from SPC assigned 2010 trips.

## TRAVEL MODEL VALIDATION External Cordon and Count Station Locations



Map 4

SPC June 2011

**TRAVEL MODEL VALIDATION  
TRAFFIC VOLUME COMPARISONS**

<b>COUNT STATION</b>	<b>COUNTY</b>	<b>ROUTE</b>	<b>OBSERVED VOLUME</b>	<b>SIMULATED VOLUME</b>	<b>SIM/OBS</b>
18	Butler	PA 38	6,414	6,183	0.96
19	Washington	PA 88	5,712	10,162	1.78
20	Lawrence	PA 65	7,401	9,888	1.34
24	Westmoreland	US 22	17,992	31,386	1.74
203	Allegheny	PA 65	20,589	24,717	1.20
208	Allegheny	I-376	64,510	59,530	0.92
370	Westmoreland	I-70	31,319	25,714	0.82
374	Butler	I-79	32,253	34,969	1.08
375	Allegheny	US 22/30	23,249	25,227	1.09
393	Washington	I-70	29,812	32,944	1.11
395	Fayette	PA 21	10,736	7,586	0.71
<b>TOTAL</b>			<b>249,987</b>	<b>268,306</b>	<b>1.07</b>

Table 7

SPC June 2011

Observed volume is "Average Weekday Traffic" from 2008 and 2009 PennDOT data.  
Simulated volume from SPC assigned 2010 trips.

## TRAVEL MODEL VALIDATION - VMT COMPARISONS

COUNTY	Observed VMT (000)			
	INTERSTATE	ARTERIAL	COLLECTOR LOCAL	TOTAL
Allegheny	5,800	12,806	6,373	24,980
Armstrong	0	1,143	477	1,620
Beaver	688	1,747	1,280	3,715
Butler	960	2,408	1,447	4,815
Fayette	0	1,669	1,027	2,697
Greene	321	360	496	1,177
Indiana	0	1,392	744	2,136
Lawrence	241	979	777	1,997
Washington	1,749	2,081	1,412	5,241
Westmoreland	2,064	4,293	2,540	8,896
<b>TOTAL</b>	11,823	28,878	16,573	57,274
COUNTY	Simulated VMT (000)			
	INTERSTATE	ARTERIAL	COLLECTOR LOCAL	TOTAL
Allegheny	5,437	15,406	4,534	25,376
Armstrong	0	1,509	718	2,227
Beaver	315	2,514	1,008	3,837
Butler	1,102	2,745	1,829	5,676
Fayette	0	2,007	994	3,001
Greene	560	341	651	1,552
Indiana	0	1,618	950	2,568
Lawrence	255	1,172	628	2,055
Washington	2,359	2,402	1,738	6,499
Westmoreland	1,833	4,844	2,803	9,480
<b>TOTAL</b>	11,861	34,558	15,853	62,271
COUNTY	Simulated/Observed VMT			
	INTERSTATE	ARTERIAL	COLLECTOR LOCAL	TOTAL
Allegheny	0.94	1.20	0.71	1.02
Armstrong	---	1.32	1.50	1.37
Beaver	0.46	1.44	0.79	1.03
Butler	1.15	1.14	1.26	1.18
Fayette	---	1.20	0.97	1.11
Greene	1.74	0.95	1.31	1.32
Indiana	---	1.16	1.28	1.20
Lawrence	1.06	1.20	0.81	1.03
Washington	1.35	1.15	1.23	1.24
Westmoreland	0.89	1.13	1.10	1.07
<b>TOTAL</b>	1.00	1.20	0.96	1.09

TABLE 8

SPC June 2011

Observed VMT from 2009 PennDOT data.  
 Simulated VMT from SPC assigned 2010 link VMT.

## **Air Quality Conformity Determination**

*2040 Long Range Transportation Plan and 2011-2014 Transportation Improvement Program  
Southwestern Pennsylvania Commission – June 2011*

---

The above models were used to produce regional person trip matrices for 2010 from the Cycle 9 base year estimates. In addition, trip productions and attractions were generated for 2040 from the Cycle 9 2040 forecasts. Prior to trip distribution, productions and attractions for 2008, 2011, 2014, 2015, 2018, 2025, and 2035 were developed by interpolating between 2010 and 2040. Trip distribution for each scenario was based on the characteristics of the transportation network defined for the scenario.

Free-flow highway speeds and link capacities are selected from a look-up table that is stratified by roadway facility type and area type. SPC has developed a model to calculate area type based on population and employment densities. In general, free-flow speed and capacity decreases with increasing development density. The area type model provides an automated procedure for updating area type codes in the network based on changes in existing and future development densities. The area type model was applied for each scenario using population and employment densities estimated for the scenario year.

Modal split model runs were made for each scenario using appropriate combinations of trip tables and transportation networks. Detailed modal split results for the 2011 network are presented in Table 9. The 2040 network modal split results are shown in Table 10. Table 11 summarizes regional trips by purpose and mode for each of the seven scenarios defined for this conformity assessment of the 2040 Plan and the 2011-2014 TIP. Table 12 summarizes modeled HOV trips for each scenario.

## 2011 MODAL SPLIT SUMMARY

DISTRICT	2011 Person Trip Attractions				2011 Auto Trip Attractions				2011 Transit Trip Attractions				2011 Transit/2011 Total Person			
	HBW	HBO	NHB	TOT	HBW	HBO	NHB	TOT	HBW	HBO	NHB	TOT	HBW	HBO	NHB	TOT
CBD	161698	91594	36802	290094	74276	51966	28591	154833	59623	12863	3258	75744	36.87%	14.04%	8.85%	26.11%
PGH E	170695	290474	105778	566947	135049	174492	75894	385435	21786	15795	6264	43845	12.76%	5.44%	5.92%	7.73%
PGH S	41702	64305	22722	128729	36450	40062	16995	93507	1611	1273	316	3200	3.86%	1.98%	1.39%	2.49%
PGH N	49168	106953	44406	200527	43381	69944	34336	147661	1818	1668	686	4172	3.70%	1.56%	1.54%	2.08%
PGH TOT	261565	461732	172906	896203	214880	284498	127225	626603	25215	18736	7266	51217	9.64%	4.06%	4.20%	5.71%
ALG E	142151	437835	118419	698405	130284	284850	81599	496733	2206	2670	783	5659	1.55%	0.61%	0.66%	0.81%
ALG N	185955	555015	149960	890930	169449	358731	103015	631195	2236	2586	546	5368	1.20%	0.47%	0.36%	0.60%
ALG S	150595	474017	129222	753834	137265	305220	88777	531262	3059	3902	1223	8184	2.03%	0.82%	0.95%	1.09%
ALG W	135532	413161	101876	650569	121833	276330	72387	470550	1620	2599	500	4719	1.20%	0.63%	0.49%	0.73%
ALG TOT	614233	1880028	499477	2993738	558831	1225131	345778	2129740	9121	11757	3052	23930	1.48%	0.63%	0.61%	0.80%
OUTSIDE ALG	801337	2309890	615012	3726239	746435	1535470	438685	2720590	2833	3792	1378	8003	0.35%	0.16%	0.22%	0.21%
GRAND TOTAL	1838833	4743244	1324197	7906274	1594422	3097065	940279	5631766	96792	47148	14954	158894	5.26%	0.99%	1.13%	2.01%

TABLE 9

SPC June 2011

## 2040 MODAL SPLIT SUMMARY

DISTRICT	2040 Person Trip Attractions				2040 Auto Trip Attractions				2040 Transit Trip Attractions				2040 Transit/2040 Total Person			
	HBW	HBO	NHB	TOT	HBW	HBO	NHB	TOT	HBW	HBO	NHB	TOT	HBW	HBO	NHB	TOT
CBD	193587	107656	45084	346327	89137	61681	35141	185959	69918	14230	3827	87975	36.12%	13.22%	8.49%	25.40%
PGH E	197048	319683	116661	633392	156153	192172	83895	432220	24173	17259	6693	48125	12.27%	5.40%	5.74%	7.60%
PGH S	45768	69102	24617	139487	39755	43124	18435	101314	1783	1354	396	3533	3.90%	1.96%	1.61%	2.53%
PGH N	59042	121344	50456	230842	51873	79118	38959	169950	2207	1858	752	4817	3.74%	1.53%	1.49%	2.09%
PGH TOT	301858	510129	191734	1003721	247781	314414	141289	703484	28163	20471	7841	56475	9.33%	4.01%	4.09%	5.63%
ALG E	190434	552487	146177	889098	174481	359678	100784	634943	2905	3425	980	7310	1.53%	0.62%	0.67%	0.82%
ALG N	255644	727932	193684	1177260	233136	470522	133099	836757	2814	3287	696	6797	1.10%	0.45%	0.36%	0.58%
ALG S	205197	603874	161527	970598	186598	388791	110863	686252	4014	5121	1533	10668	1.96%	0.85%	0.95%	1.10%
ALG W	180696	528905	128863	838464	162869	356247	92270	611386	1817	3065	570	5452	1.01%	0.58%	0.44%	0.65%
ALG TOT	831971	2413198	630251	3875420	757084	1575238	437016	2769338	11550	14898	3779	30227	1.39%	0.62%	0.60%	0.78%
OUTSIDE ALG	989329	2815876	736891	4542096	923920	1878990	526846	3329756	3184	4095	1442	8721	0.32%	0.15%	0.20%	0.19%
GRAND TOTAL	2316745	5846859	1603960	9767564	2017922	3830323	1140292	6988537	112815	53694	16889	183398	4.87%	0.92%	1.05%	1.88%

TABLE 10

SPC June 2011

**TRAVEL MODEL RESULTS**  
**Trips By Purpose and Mode**

YEAR	SCENARIO	--- Total Person Trip Attractions ---			
		HBW	HBO	NHB	TOTAL
2011	2011 Existing Year	1,838,833	4,743,244	1,324,197	7,906,274
2014	2014 TIP Year	1,888,256	4,857,410	1,353,125	8,098,791
2015	2015 Johnstown Analysis Year	1,904,828	4,895,662	1,362,866	8,163,356
2018	2018 Ozone Budget Year	1,954,176	5,009,729	1,391,717	8,355,622
2025	2025 Interim Year #1	2,069,840	5,276,466	1,459,537	8,805,843
2035	2035 Interim Year #2	2,234,440	5,656,791	1,555,812	9,447,043
2040	2040 LRP Horizon Year	2,316,745	5,846,859	1,603,960	9,767,564
YEAR	SCENARIO	--- Auto Vehicle Trip Attractions ---			
		HBW	HBO	NHB	TOTAL
2011	2011 Existing Year	1,594,422	3,097,065	940,279	5,631,766
2014	2014 TIP Year	1,639,980	3,173,293	960,968	5,774,241
2015	2015 Johnstown Analysis Year	1,653,123	3,198,708	967,940	5,819,771
2018	2018 Ozone Budget Year	1,697,112	3,274,581	988,584	5,960,277
2025	2025 Interim Year #1	1,799,394	3,451,657	1,037,090	6,288,141
2035	2035 Interim Year #2	1,945,136	3,704,157	1,105,868	6,755,161
2040	2040 LRP Horizon Year	2,017,922	3,830,323	1,140,292	6,988,537
YEAR	SCENARIO	--- Transit Person Trip Attractions ---			
		HBW	HBO	NHB	TOTAL
2011	2011 Existing Year	96,792	47,148	14,954	158,894
2014	2014 TIP Year	96,810	47,271	15,146	159,227
2015	2015 Johnstown Analysis Year	98,772	47,523	15,230	161,525
2018	2018 Ozone Budget Year	100,050	48,037	15,396	163,483
2025	2025 Interim Year #1	104,162	49,805	15,863	169,830
2035	2035 Interim Year #2	109,959	52,422	16,555	178,936
2040	2040 LRP Horizon Year	112,815	53,694	16,889	183,398
YEAR	SCENARIO	--- Transit / Total Person Trips ---			
		HBW	HBO	NHB	TOTAL
2011	2011 Existing Year	5.26%	0.99%	1.13%	2.01%
2014	2014 TIP Year	5.13%	0.97%	1.12%	1.97%
2015	2015 Johnstown Analysis Year	5.19%	0.97%	1.12%	1.98%
2018	2018 Ozone Budget Year	5.12%	0.96%	1.11%	1.96%
2025	2025 Interim Year #1	5.03%	0.94%	1.09%	1.93%
2035	2035 Interim Year #2	4.92%	0.93%	1.06%	1.89%
2040	2040 LRP Horizon Year	4.87%	0.92%	1.05%	1.88%

TABLE 11

SPC June 2011

**HOV MODEL RESULTS**  
**Vehicle Trips By Auto Occupancy Level**  
**(Home-Based Work Trips Only)**

YEAR	SCENARIO	- - - - HBW Vehicle Trips by Occupancy - - - -					TOTAL
		1	2	3	4+		
2011	2011 Existing Year	1,468,915	109,051	11,801	5,120	1,594,887	
2014	2014 TIP Year	1,511,117	112,016	12,093	5,227	1,640,453	
2015	2015 Johnstown Analysis Year	1,523,119	112,878	12,238	5,338	1,653,573	
2018	2018 Ozone Budget Year	1,563,723	115,788	12,598	5,487	1,697,596	
2025	2025 Interim Year #1	1,658,168	122,485	13,359	5,858	1,799,870	
2035	2035 Interim Year #2	1,793,241	131,397	14,529	6,421	1,945,588	
2040	2040 LRP Horizon Year	1,860,463	136,186	15,100	6,660	2,018,409	

TABLE 12

SPC June 2011