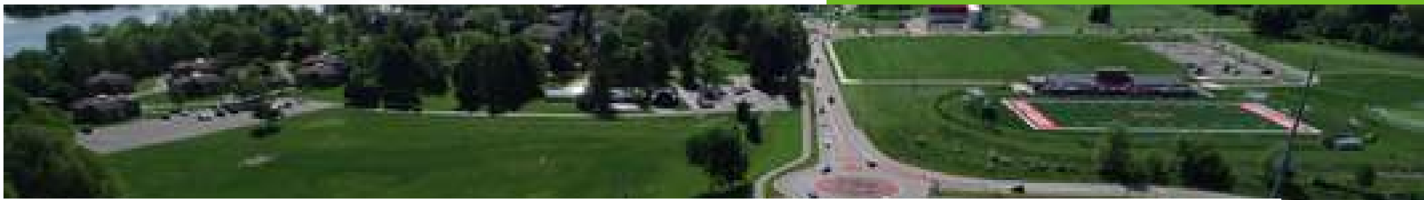
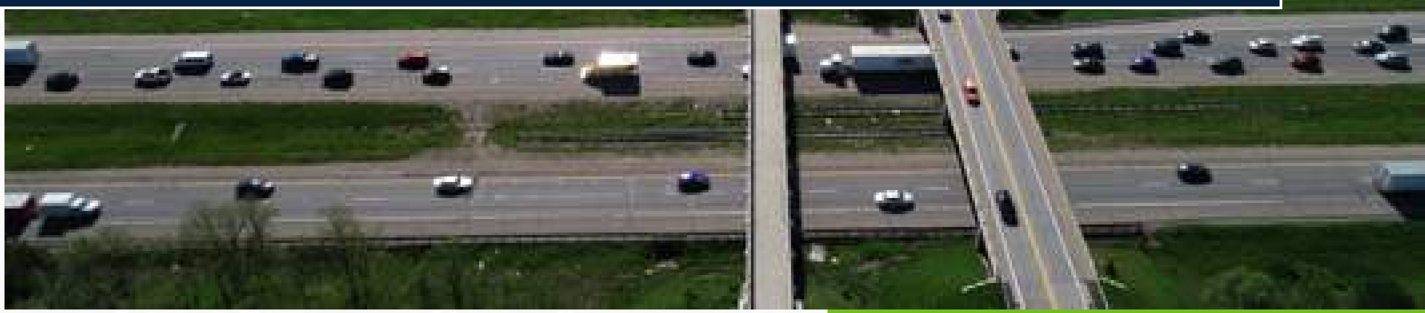
March 2019



2045 Regional Transportation Plan for Southeast Michigan: Appendix



SEMCOG | SOUTHEAST MICHIGAN COUNCIL OF GOVERNMENTS

SEMCOG . . . *Developing Regional Solutions*

Mission

SEMCOG, the Southeast Michigan Council of Governments, is the only organization in Southeast Michigan that brings together all governments to develop regional solutions for both now and in the future. SEMCOG:

- Promotes informed decision making to improve Southeast Michigan and its local governments by providing insightful data analysis and direct assistance to member governments;
- Promotes the efficient use of tax dollars for infrastructure investment and governmental effectiveness;
- Develops regional solutions that go beyond the boundaries of individual local governments; and
- Advocates on behalf of Southeast Michigan in Lansing and Washington

2045 Regional Transportation Plan for Southeast Michigan: Appendix

Abstract

This appendix to the *2045 Regional Transportation Plan for Southeast Michigan* contains the following supplemental information – Air Quality Conformity, Consultation Agency List, Environmental Justice Technical Analysis, Illustrative Projects, Public Comment, and Travel Demand Forecasting Process. This information was used in developing the *2045 Plan*.

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Appendix A: Air Quality Conformity

Introduction

The federal Clean Air Act requires that federally-funded highway and transit projects contained in regional long-range transportation plans (RTP) and Transportation Improvement Programs (TIP) be consistent with the air quality goals established in state air quality implementation plans (SIP). The process for demonstrating this consistency is called Air Quality Conformity. The purpose of Conformity is to ensure that projects in the plan will not cause new air quality violations, worsen any existing violations, or delay timely attainment of National Ambient Air Quality Standards (NAAQS).

The U.S. Environmental Protection Agency (EPA) has established NAAQS for six criteria pollutants: ozone, nitrogen dioxide, carbon monoxide (CO), lead, sulfur dioxide, and particulate matter. EPA designates an area as either "attainment" or "nonattainment" for each of these pollutants based on whether local air monitoring data shows it is meeting or not meeting these standards. Areas that were initially designated as "nonattainment" for a particular standard but later attain that standard are termed "maintenance" areas.

Pollutants Analyzed for Conformity in Southeast Michigan

Air quality conformity analysis is required for all areas currently designated as "nonattainment" or "maintenance" for CO, particulate matter, or ozone. Below is a summary of southeast Michigan's current air quality status for each of these pollutants.

- Carbon Monoxide: In Southeast Michigan, an area containing portions of three counties (Wayne, Oakland, and Macomb) was originally designated nonattainment back in the early 1990s. However, this area has been attaining the standard since 1995 and was re-designated as a "maintenance" area for this pollutant in 1999.
- Fine Particulate Matter (PM2.5): The entire seven-county region was originally designated nonattainment for both the 1997 annual (15 μg/m3) and 2006 24-hour (35 μg/m3) PM2.5 standards. However, since the implementation of Michigan's State Implementation Plan (SIP) for this pollutant, levels have declined significantly and all air monitors have been measuring levels well below the standards since 2009. Consequently, the U.S. EPA re-designated the region as a "maintenance area" for these two standards in 2013. In 2015, southeast Michigan was designated as "attainment" for the tougher 2012 annual standard (12 μg/m3) and the 1997 annual standard was revoked by the EPA in 2016. Thus, conformity analysis for this pollutant is only required for the 24-hour standard for the region.
- Ozone: The entire region was originally designated nonattainment for the 1997 ozone NAAQS of 0.08 ppm. Following successful implementation of Michigan's SIP for this pollutant, the region was re-designated as "maintenance" in 2009. In 2012, Southeast Michigan was designated as "attainment" for the 2008 ozone NAAQS of 0.075 ppm and the 1997 ozone NAAQS was revoked in April of 2015. Due to the federal appeals court ruling in February of 2018 regarding EPA's 1997 ozone NAAQS revocation, areas including SEMCOG are required to demonstrate that transportation projects continue to conform with the 1997 ozone standard. In addition, the entire seven-county region was designated nonattainment for the new stricter 2015 ozone NAAQS of 0.070 ppm by the EPA effective in August 3, 2018. Thus, the results of 8-hour ozone conformity analysis are included in this report.

Overview of Conformity Analysis Process

To analyze conformity, emissions generated by all vehicles on Southeast Michigan's roadway system are estimated using a complex set of computer models. The models estimate the expected change in these emissions due to the combination of:

- Anticipated growth in the region, and
- The implementation of regionally-significant transportation projects that either increase or decrease roadway capacity (e.g., building of new roads, adding or reducing the number of traffic lanes on existing roads). The impact of major transit projects is also included.

This report provides the results of SEMCOG's air quality conformity analysis for SEMCOG's 2045 regional transportation plan (RTP), as well as detailed documentation on the modeling process used to conduct this analysis.

Results of Transportation Conformity Analysis

Carbon Monoxide (CO)

Table 1 shows the results of the carbon monoxide (CO) conformity analysis for the Southeast Michigan "maintenance" area. This area includes the tri-county region of Macomb, Oakland, and Wayne. Conformity for this pollutant is demonstrated when forecasted emissions for specific future years do not exceed the EPA-approved mobile source emission budgets set forth in Michigan's SIP for CO. The data in Table 1 show that forecasted CO emissions for all analysis years are well below the SIP budget for this pollutant. Thus, conformity is demonstrated.

Table 1
Results of CO Conformity Analysis - Budget Emissions Test

Scenario	CO Emissions (tons/day)	Tri-County Winter Weekday VMT (in millions)
Conformity Budget	3,843	NA
2020	557.8	88.9
2025	414.1	89.5
2035	249.8	91.3
2045	222.5	94.0

24-Hour Fine Particulate Matter (PM2.5)

Table 2 shows the results of the 24-hour fine particulate matter (PM2.5) conformity analysis for the Southeast Michigan attainment/maintenance area. This area includes the entire seven-county SEMCOG region. In accordance with EPA conformity guidance on the 24-hour PM2.5 standard, the analysis uses daily emissions inventories for the season in which most 24-hour PM2.5 violations occur. Research by the Michigan Department of Environmental Quality and SEMCOG's Air Quality Study (SEMAQS) group found that PM2.5 concentrations in Southeast Michigan tend to be highest during the winter season. Thus, vehicle emissions for an average winter day are used for this conformity analysis.

Mobile source emission budgets for the 24-hour standard were approved by the EPA in 2013, when the region was redesignated as an attainment/maintenance area. Conformity is demonstrated if forecasted 24-hour PM2.5 and nitrogen oxide (NOx) emissions for specific future years do not exceed these budgets. The data in Table 2 show that forecasted emissions of both PM2.5 and NOx are well below the established budgets for all analysis years. Thus, conformity is demonstrated.

Table 2

Results of Daily PM2.5 Conformity Analysis-Budget Emissions Test

Analysis Year	Emissions (tons/day)		Regional Winter Weekday VMT (in millions)
	Primary PM2.5	NOx	
Conformity Budget	(in millions)	365	NA
2020	4.9	94.0	115.1
2025	3.3	58.7	116.4
2035	2.1	31.4	119.2
2045	2.1	29.1	123.0

Ozone

Table 3 shows the results of the ozone conformity analysis for SEMCOG's 1997 ozone "maintenance" area and 2015 ozone "nonattainment" area. This area includes the entire seven-county SEMCOG region. Conformity is demonstrated if forecasted emissions for specific future years do not exceed the EPA-approved mobile source emission budgets set forth in Michigan's State Implementation Plan (SIP) for ozone.

The data in Table 3 shows that forecasted emissions in the SEMCOG region for the two pollutants causing ozone formation - volatile organic compounds (VOC) and nitrogen oxides (NOx) are well below the 1997 established mobile source emissions budgets for all analysis years. Thus, conformity is demonstrated.

Table 3

Results of 8-Hour Ozone Conformity Analysis-Budget Emissions Test

Analysis Year	Emissions (tons/day)		Regional Summer Weekday VMT (in millions)
	VOC	NOx	
Conformity Budget	106	274	NA
2020	57.1	92.6	137.8
2025	41.7	56.3	139.3
2035	23.9	27.8	142.7
2045	21.4	25.2	147.2

Projects Included in the Conformity Analysis

This analysis included all capacity-related projects proposed for SEMCOG's 2045 RTP, plus those already in SEMCOG's 2040 RTP with the fiscal year between 2017 and 2019. A complete list of the projects included in this analysis can be found in this appendix.

Description of Public Participation Process

Public Involvement

A public comment period for SEMCOG's 2045 RTP was initiated on February 12, 2019 and concluded on March 14, 2019 when SEMCOG's General Assembly formally adopts the 2045 RTP. Public notices were emailed to a broad cross section that included interested citizens, advocacy groups, community organizations, and municipal clerks. The notice was also sent to the media, public libraries, published in SEMCOG's biweekly electronic newsletter, and posted on its website and social media pages.

Formal MPO Action Supporting the Conformity Determination

SEMCOG committee action on the 2045 RTP:

- Transportation Coordinating Council (TCC), January 2019
- Executive Committee, February 2019
- General Assembly, March 2019

Key Modeling Inputs and Assumptions for SEMCOG Area

MOVES Model Run Specifications

EPA's MOVES version of MOVES2014b was used to perform transportation conformity analysis for SEMCOG's 2045 Regional Transportation Plan (RTP). For each MOVES model year run, two separate run specifications were developed: one for ozone and fine Particular Matter (PM2.5), and another for Carbon Monoxide (CO).

For ozone and PM2.5, MOVES' County level run was utilized, and Wayne County was chosen to represent the fuel characteristics used in all seven SEMCOG counties. These seven counties comprise Southeast Michigan's ozone maintenance area for the 1997 National Air Ambient Quality Standard (NAAQS) and ozone nonattainment area for the 2015 NAAQS. As ozone conformity analysis involves generating emissions for a high-ozone summer weekday, only weekday emissions were specified in MOVES. The simulated ozone meteorological data was used for the month of July to represent the typical summer day. These seven counties also reflect the maintenance/attainment area for the 2006 24-hour PM2.5 NAAQS. MOVES runs for this pollutant specify the weekdays of the three winter months: December, January and February since previous monitoring data has shown PM2.5 emissions are highest during these months. Although Wayne County was chosen to represent the whole region geographically in MOVES runs, all local inputs were developed to represent the transportation activities in all seven SEMCOG counties.

Similarly, for CO, since the "maintenance" area for this pollutant only includes Macomb, Oakland, and Wayne counties, MOVES' county level run was utilized, and Wayne County was chosen to represent the fuel characteristics used in these three SEMCOG counties. The critical local inputs, including vehicle miles of travel (VMT), vehicle hours of travel (VHT), speed distribution, ramp fractions, and vehicle population were developed from data in just these three counties. CO emissions are highest during the winter months, therefore only December, January and February are included to produce average weekday emissions in CO conformity analysis.

More information on the development of these local inputs is provided in the following sections.

Description of Local Travel Data Inputs

Demographic Data

Travel forecasts used to calculate on-road mobile source emissions for the conformity analysis are based on demographic data from SEMCOG's 2045 Regional Development Forecast (RDF). A three-step process was used to develop this forecast.

- Regional forecast totals of population and jobs were generated from the REMI (Regional Economic Models, Inc.) model. The model forecasts Southeast Michigan's ability to attract and retain population and jobs relative to all other parts of the United States. Regional totals were developed for all forecast years from the 2015 base year to 2045.
- The regional totals were then used to develop a small-area forecast that disaggregated regional population, households and jobs into 1.8 million land parcels using the UrbanSim model. UrbanSim is a computer simulation model for planning and analysis of urban development. It incorporates the interaction between land use, transportation, and public policy. In doing so, it finds the most desirable land parcels for future population and jobs, and models residential and nonresidential developments as demand changes.
- Land parcels from the small-area forecast were aggregated to traffic analysis zones (TAZs) for use in SEMCOG's travel demand forecasting model.

SEMCOG's Travel Demand Forecasting Model (TDFM)

Vehicle miles of travel (VMT) forecasts for the on-road emissions inventory were developed using version E7 of SEMCOG's Travel Demand Forecasting Model (TDFM), which was implemented in 2018 using SEMCOG's 2015 household travel survey and observation data. The TDFM runs on the TransCAD software platform and utilizes the standard four-step travel modeling process: trip generation, trip distribution, mode choice, and traffic assignment. Detailed documentation on the model is contained in a separate SEMCOG document that is available upon request.

Mapping of Travel Demand Model (TDFM) Functional Classes and Area Types to MOVES Road Types

To use TDFM data in MOVES, the road types used in SEMCOG's model must be reconciled with those used in MOVES. The MOVES model uses four basic road types for on-road activities: Urban-Restricted, Urban Unrestricted, Rural Restricted and Rural Unrestricted. The term "restricted" refers to restricted or limited-access roadways. In the SEMCOG region, this includes all freeway facilities. All other roadways in the SEMCOG region are considered unrestricted facilities. The TDFM also includes several special functional classes that are not part of the regular roadway network (e.g. walk only, external zone connectors, transit-only links). These are not included in SEMCOG's emissions modeling.

As TDFM functional classes do not distinguish between urban and rural facilities, another TDFM variable, Area Type, was used as a surrogate. The TDFM defines five area types (urban business, urban fringe, urban, suburban and rural) and assigns one to each roadway link based on the density of households, population and employment in the traffic analysis zone in which the link resides.

Table 4 shows how each area type and functional class in SEMCOG's TDFM is mapped to the four road types used in MOVES.

Table 4

Mapping of TDFM Functional Class and Area Type to MOVES Road Type

<table>
<tr><th rowspan="2">SEMCOG TDFM Functional Class</th><th colspan="5">SEMCOG TDFM Area Type</th></tr>
<tr><th>Urban Business</th><th>Urban Fringe</th><th>Urban</th><th>Suburban</th><th>Rural</th></tr>
<tr><td>1- Interstate Freeway</td><td colspan="4" rowspan="2">4- MOVES Urban Restricted Road Type</td><td rowspan="2">2- MOVES Rural Restricted Road Type</td></tr>
<tr><td>2- Other Freeway</td></tr>
<tr><td>3- Principal Arterial</td><td colspan="4" rowspan="6">5- MOVES Urban Unrestricted Road Type</td><td rowspan="6">3- MOVES Rural Unrestricted Road Type</td></tr>
<tr><td>4- Minor Arterial</td></tr>
<tr><td>5/6- Collector</td></tr>
<tr><td>7- Local</td></tr>
<tr><td>9- Uncertified Road</td></tr>
<tr><td>99- Centroid connector (local road surrogate)</td></tr>
<tr><td>81- 94 Transit Use Only</td><td colspan="5" rowspan="3">Non-road or outside region. Not used in MOVES</td></tr>
<tr><td>90- External</td></tr>
<tr><td>96- Walk Only</td></tr>
</table>

Vehicle Miles of Travel (VMT)
MOVES2014b provides an option to input annual VMT by the six FHWA Highway Performance Monitoring System (HPMS) vehicle types with the passenger car (HPMS 20) and other 4-tire/2-axle vehicles (HPMS 30) combined as HPMS25.

- HPMS10 – Motorcycle
- HPMS25 - Passenger car and Other 4-tire, 2-axle vehicles
- HPMS40 – Bus
- HPMS50 - Single unit truck
- HPMS60 - Combination truck

Local VMT data used in the MOVES model is derived from SEMCOG's Travel Demand Forecasting Model (TDFM). The model generates average weekday VMT forecasts and does not currently have the capability to allocate this VMT to different vehicle types. Adjustments were required to convert the TDFM data into the format required for MOVES.

HPMS Normalization
In accordance with EPA and FHWA guidance, SEMCOG TDFM VMT was normalized to HPMS VMT by county and road type. Normalization factors were developed by dividing 2015 HPMS VMT by the estimated 2015 VMT from regional TDFM.

Table 5 shows the resulting factors. These factors were applied to TDFM VMT in all analysis years.

Table 5
HPMS Normalization Factors

County	Road Type	
	Restricted	Unrestricted
Livingston	1.06146	0.96310
Macomb	0.92232	0.97739
Oakland	0.90947	1.12472
St. Clair	0.88407	1.41495
Washtenaw	0.92334	0.99751
Wayne	0.92180	1.21861

Distribution of VMT Among HPMS Vehicle Types
Two sets of distribution factors for restricted and unrestricted roadways have been developed to allocate the total VMT of an analysis year among five vehicle classes as described at the beginning of this section.

Every year, MDOT collects permanent traffic recording (PTR) counts, which includes vehicle classification counts from 13 freeway stations through SEMCOG region. These 2015 PTR classification counts were used to develop the average distribution factors for restricted roadways.

Every five years beginning in 2005, SEMCOG has been collecting screen line counts, which are mostly non-freeway counts, throughout the seven-county SEMCOG region. The 2015 screen line traffic count was used to develop VMT distribution factors for unrestricted roadways.

Both counts collected from MDOT and SEMCOG were classified based on FHWA's standard 13 traffic bins. These bins were aggregated to five vehicle classes required by MOVES2014b. The factors derived from these counts are shown in Table 6.

Table 6
VMT Distribution Factors by HPMS Vehicle Type

HPMS Vehicle Type	Restricted	Unrestricted
H10- Motorcycle	0.00276	0.00589
H25- Passenger Car and Other 4-tire, 2-axle vehicles	0.89201	0.90783
H40- Bus	0.00166	0.00442
H50- Single-Unit Truck	0.01931	0.05772
H60- Combination Truck	0.08426	0.02414

Conversion of Average Weekday VMT to Annual VMT
Monthly and weekend adjustment factors were developed using 2014-2016 count data from the 35 PTR stations in Southeast Michigan. Monthly adjustment factors for motorcycles were developed separately due to its significant difference from other vehicle types. Weekend adjustment factors were developed for each of the five vehicle types since significant variations were shown between one another. These adjustment factors (Table 7), along with the HPMS-normalized weekday VMT by vehicle types, were then entered EPA's AADVMT converter of "aadvmt-conveter-tool-moves2014.xls" to compute the annual VMT, monthly and daily VMT fractions needed for MOVES2014b.

Table 7
Monthly and Weekend Adjustment Factors

Month	Monthly Adjustment Factors		Weekend Adjustment Factors				
	Motorcycle	Others	H10	H25	H40	H50	H60
Jan	0.616	0.843	0.740	0.769	0.508	0.313	0.346
Feb	0.649	0.895	0.726	0.748	0.539	0.287	0.324
Mar	0.709	0.973	0.781	0.800	0.565	0.287	0.321
Apr	0.866	1.018	1.064	0.810	0.560	0.301	0.307
May	1.188	1.035	1.008	0.827	0.510	0.318	0.313
Jun	1.394	1.080	1.091	0.828	0.532	0.343	0.322
Jul	1.475	1.064	1.043	0.831	0.617	0.350	0.311
Aug	1.421	1.080	1.077	0.853	0.610	0.367	0.327
Sep	1.294	1.042	1.021	0.853	0.613	0.360	0.329
Oct	0.951	1.044	0.845	0.830	0.630	0.336	0.331
Nov	0.790	0.987	0.724	0.796	0.616	0.320	0.340
Dec	0.643	0.938	0.780	0.789	0.524	0.312	0.348

Table 8
Weekday Hourly Fractions for Restricted Road Types

HOUR	H10	H25	H40	H50	H60	Total
1	0.009	0.009	0.013	0.007	0.019	0.009
2	0.005	0.005	0.011	0.006	0.018	0.006
3	0.005	0.004	0.011	0.007	0.017	0.005
4	0.006	0.005	0.012	0.009	0.020	0.006
5	0.013	0.011	0.018	0.013	0.025	0.012
6	0.039	0.029	0.029	0.024	0.033	0.029
7	0.056	0.056	0.043	0.051	0.044	0.055
8	0.059	0.070	0.060	0.066	0.050	0.068
9	0.052	0.062	0.061	0.078	0.057	0.061
10	0.045	0.048	0.066	0.077	0.063	0.050
11	0.045	0.044	0.063	0.074	0.066	0.047
12	0.048	0.046	0.057	0.074	0.066	0.048
13	0.051	0.048	0.060	0.073	0.064	0.050
14	0.054	0.051	0.063	0.076	0.063	0.053
15	0.064	0.061	0.067	0.078	0.061	0.061
16	0.074	0.075	0.067	0.073	0.056	0.073
17	0.076	0.083	0.059	0.061	0.049	0.080
18	0.072	0.083	0.051	0.046	0.044	0.079
19	0.063	0.063	0.048	0.035	0.041	0.061
20	0.049	0.044	0.037	0.024	0.036	0.043
21	0.038	0.035	0.029	0.017	0.032	0.034
22	0.033	0.029	0.031	0.013	0.029	0.029
23	0.025	0.022	0.023	0.010	0.026	0.022
24	0.018	0.016	0.020	0.008	0.023	0.016

Hourly VMT Fractions

Two different data sources were used to develop hourly VMT fractions for MOVES:

- 2015 screen line traffic counts collected by SEMCOG – All screen line counts include classification data but were only collected on weekdays.
- 2015 PTR counts for locations within the SEMCOG region –This data includes both weekdays and weekends. All the count stations are on freeways and only a limited number of these stations collect classification data.

Using this data, SEMCOG was able to develop weekday hourly VMT fractions for each of five HPMS vehicle types by restricted (shown in Table 8) and unrestricted MOVES road types (shown in Table 9).

Table 9

Weekday Hourly Fractions for Unrestricted Road Types

Hour	H10	H25	H40	H50	H60	Total
1	0.005	0.008	0.004	0.005	0.014	0.008
2	0.004	0.005	0.002	0.004	0.014	0.006
3	0.004	0.005	0.004	0.004	0.014	0.005
4	0.004	0.007	0.003	0.005	0.016	0.007
5	0.009	0.013	0.007	0.009	0.022	0.013
6	0.019	0.028	0.016	0.022	0.030	0.028
7	0.038	0.048	0.065	0.046	0.045	0.048
8	0.061	0.069	0.095	0.066	0.060	0.069
9	0.058	0.060	0.093	0.070	0.068	0.061
10	0.041	0.045	0.063	0.063	0.064	0.047
11	0.043	0.044	0.060	0.061	0.064	0.045
12	0.047	0.047	0.062	0.063	0.067	0.049
13	0.059	0.051	0.055	0.065	0.063	0.052
14	0.061	0.052	0.061	0.063	0.064	0.053
15	0.073	0.062	0.087	0.068	0.063	0.062
16	0.088	0.074	0.100	0.076	0.061	0.074
17	0.102	0.082	0.083	0.078	0.058	0.081
18	0.098	0.083	0.050	0.072	0.055	0.082
19	0.070	0.064	0.032	0.054	0.042	0.063
20	0.042	0.047	0.019	0.036	0.031	0.046
21	0.032	0.039	0.015	0.028	0.027	0.038
22	0.020	0.030	0.011	0.019	0.023	0.029
23	0.013	0.021	0.007	0.013	0.019	0.020
24	0.008	0.014	0.006	0.009	0.017	0.014

However, for weekends, the count data was not robust enough to develop separate factors by road type or by vehicle type so only a single set of hourly VMT factors (Table 10) was developed.

Table 10

Weekend Hourly Fractions for Restricted/Unrestricted Road Types

HOUR	H10	H25	H40	H50	H60	Total
1	0.016	0.018	0.033	0.019	0.033	0.018
2	0.011	0.011	0.023	0.016	0.029	0.012
3	0.008	0.008	0.020	0.015	0.026	0.009
4	0.006	0.006	0.017	0.016	0.025	0.007
5	0.007	0.008	0.018	0.017	0.028	0.009
6	0.013	0.013	0.023	0.022	0.032	0.014
7	0.019	0.020	0.034	0.037	0.038	0.021
8	0.023	0.026	0.051	0.050	0.043	0.027
9	0.033	0.035	0.054	0.061	0.049	0.036
10	0.045	0.046	0.055	0.064	0.053	0.046
11	0.055	0.056	0.057	0.065	0.056	0.056
12	0.065	0.064	0.051	0.067	0.057	0.064
13	0.071	0.070	0.054	0.068	0.056	0.069
14	0.075	0.072	0.048	0.067	0.054	0.072
15	0.077	0.074	0.048	0.063	0.052	0.073
16	0.081	0.076	0.052	0.061	0.050	0.075
17	0.077	0.075	0.053	0.057	0.048	0.073
18	0.071	0.071	0.055	0.053	0.046	0.070
19	0.063	0.063	0.057	0.046	0.045	0.062
20	0.055	0.054	0.050	0.038	0.043	0.053
21	0.046	0.045	0.039	0.031	0.040	0.045
22	0.036	0.037	0.041	0.026	0.036	0.037
23	0.028	0.030	0.035	0.022	0.032	0.030
24	0.020	0.022	0.033	0.019	0.029	0.022

Road Type Distribution

Several steps were involved to produce the VMT road type distribution factors for each HPMS vehicle class. First, the 2015 HPMS VMT numbers were grouped into four MOVES road types (Urban Restricted, Urban Unrestricted, Rural Restricted and Rural Unrestricted). Then, the VMT value for each of the four MOVES road types was divided among five HPMS vehicle types based on the vehicle type distribution factors developed in Table 6. The final VMT road type distribution factors were developed by dividing the calculated VMT for each MOVES road type and each HPMS vehicle type with the total VMT of each HPMS vehicle class. The three counties for SEMCOG's CO maintenance area are more urbanized than the entire SEMCOG region. Therefore, two separated factor tables were developed: one for these three counties, used only for CO analysis (Table 11), and another for the entire SEMCOG region that is used for ozone and PM2.5 analysis (Table 12). The same distributions were used for all analysis years.

Table 11

Road Type Distribution Used in MOVES for Ozone and PM2.5 Analysis

	Road Type Distribution for SEMCOG Region			
HPMS Vehicle Type	Rural Restricted	Rural Unrestricted	Urban Restricted	Urban Unrestricted
H10- Motorcycle	0.01934	0.05799	0.19721	0.72546
H25- Passenger Car or Other 4-tire, 2-axle vehicles	0.03277	0.04686	0.33416	0.58621
H40- Bus	0.01622	0.06058	0.16539	0.75782
H50- Single-Unit Truck	0.01472	0.06182	0.15009	0.77337
H60- Combination Truck	0.06011	0.02420	0.61294	0.30275

Table 12

Road Type Distribution Used in MOVES for CO Analysis

	Road Type Distribution for SEMCOG Region			
HPMS Vehicle Type	Rural Restricted	Rural Unrestricted	Urban Restricted	Urban Unrestricted
H10- Motorcycle	0.00000	0.01445	0.20206	0.78349
H25- Passenger Car or Other 4-tire, 2-axle vehicles	0.00000	0.01183	0.34683	0.64135
H40- Bus	0.01622	0.01505	0.16895	0.81601
H50- Single-Unit Truck	0.00000	0.01533	0.15310	0.83156
H60- Combination Truck	0.00000	0.00627	0.65349	0.34023

Average Speed Distributions

MOVES uses the distribution of vehicle hours of travel (VHT) by average speed to determine an appropriate operating mode distribution. To develop the local average speed distribution for Southeast Michigan, SEMCOG used congested speed and VHT output from the TDFM to compute the VHT fraction in each MOVES speed bin. MOVES requires the user to input hourly speed distributions by road type and vehicle class. While SEMCOG's travel model does not provide hourly speed data, it calculates speeds by five different time periods:

- AM peak, simulating the hours of 6:30-9:00 a.m.
- Mid-day, simulating the hours of 9:00 a.m.-2:30 p.m.
- PM peak, simulating the hours of 2:30-6:30 p.m.
- Evening, simulating the hours of 6:30 p.m.-10:00 p.m.
- Night, simulating the hours of 10 p.m.-6:30 a.m.

For MOVES, separate speed distributions were developed for each of these time periods and applied to all hours within that period. This was done as follows:

- For each time period, the directional congested speed of each roadway link was assigned to one of MOVES 16 speed bins;
- The associated directional VHTs on the links were then aggregated by speed bin and MOVES road type;
- Then, for each road type, the VHT fraction in each speed bin was computed.

For each analysis year, the average speed distributions were developed for two geographic areas (three counties for CO, the entire region for ozone and PM2.5) to account for different congestion levels. As no local data is currently available on speed differentiation between vehicle classes, the same distributions were applied to all vehicle types.

Note: Ramp data was not included in the development of the above speed distributions as it was assumed that MOVES makes an internal adjustment for ramps using the user-supplied ramp fractions.

Ramp Fractions

Ramp fractions used in MOVES were derived from SEMCOG's Travel Demand Forecast Model (TDFM) by calculating the percentage of the VHT on ramps out of the VHT on all restricted facilities. For ozone and PM2.5 analysis, region-wide ramp fractions from the TDFM were computed for each of the transportation conformity years. The data shows significant variation between rural and urban areas. Separate ramp fractions should be used in MOVES for these two area types.

The same method was used to compute the ramp fractions for the CO conformity analysis. However, as the CO maintenance area only includes Wayne, Oakland and Macomb counties, the factors were derived using TDFM data for just these three counties.

Vehicle Population

Year 2015 vehicle registration data from the Michigan Department of State (DOS) was used to develop the base year vehicle population inputs for MOVES. In addition, 2015 school bus fleet records from the Michigan Department of Education (MDOE) and 2017 public transit bus records from the Michigan Department of Transportation (MDOT) were used to supplement the base year vehicle population.

The body style and plate type fields in the DOS database were used to determine the MOVES source type of each vehicle. Table 13 shows how each DOS body style and plate type was mapped to the MOVES source types. Where DOS data did not provide sufficient detail, it was supplemented with information from MOVES default distributions for Southeast Michigan counties.

Future year vehicle population data was based on future growth of regional population, households and jobs of that year from SEMCOG's 2045 regional development forecasts (RDF). The rate of growth between 2015 and each future analysis year was calculated. Table 14 shows the growth factors of regional vehicle population while Table 15 shows at the tri-county (Wayne, Oakland and Macomb) level. This rate was then uniformly applied to all 2015 vehicle population source types to generate the future year population.

Table 13

Mapping between MOVES Vehicle Types and Michigan DOS Body Styles

MOVES Vehicle Type	Michigan DOS Body Style
M11- Motorcycle	Motorcycle
M21- Passenger Car	2-door, 4-door, Convertible
M31- Passenger Truck	Station Wagon, Non-Commercial Pick-up/Van
M32- Light Commercial Truck	Ambulance, Hearse, Panel, Commercial Pick-up/Van
M41- Intercity Bus	Bus (Apportioned this data between MOVES M41 and M43 vehicle types the Fee Code of "B03"; data for M42-transit buses and M43-school buses were added using fleet information from MDOE and MDOT)
M42- Transit Bus	
M43- School Bus	
M51- Refuse Truck	Dump Truck, Mixer, utility, Wrecker, Stake, Tank (Apportioned this data MOVES M51, M52, and M53 vehicle types using split factors from MOVES2014 default run.)
M52- Single-unit Short-haul Truck	
M53- Single-unit Long-haul Truck	
M54- Motor Home	Motor Home
M61- Combination Short-haul Truck	Tractor (Apportioned this data between MOVES M61 and M62 vehicle types using split factors from MOVES2014 default run.)
M62- Combination Long-haul Truck	

Table 14
Regional Vehicle Population Growth Factors

Growth Index from year 2015		Regional Growth Index Based on SEMCOG's 2045RDF						
Forecasted Item	% of	2015	2020	2025	2030	2035	2040	2045
Population	30%	1.000	1.010	1.021	1.038	1.056	1.071	1.081
Households	30%	1.000	1.023	1.048	1.074	1.096	1.110	1.117
Jobs	40%	1.000	1.033	1.032	1.027	1.043	1.058	1.067
Vehicle Population	100%	1.000	1.023	1.034	1.044	1.062	1.077	1.086

Table 15
Tri-County Vehicle Population Growth Factors

Growth Index from year 2015		Tri-County Growth Index Based on SEMCOG's 2045 RDF						
Forecasted Item	% of	2015	2020	2025	2030	2035	2040	2045
Population	30%	1.000	1.004	1.009	1.020	1.035	1.047	1.057
Households	30%	1.000	1.017	1.035	1.056	1.073	1.085	1.090
Jobs	40%	1.000	1.031	1.027	1.020	1.035	1.049	1.057
Vehicle Population	100%	1.000	1.019	1.024	1.031	1.046	1.059	1.067

Detailed documentation on the development of SEMCOG's vehicle population data is contained in a separate SEMCOG mobile emissions model development memo.

Vehicle Age Distribution
Year 2015 DOS vehicle registration was also used to develop the vehicle/source type age distribution used in MOVES. The DOS body style field was used to assign each vehicle to one of six HPMS vehicle types (Table 16). Once HPMS vehicle types had been assigned, the data was aggregated by model year and assigned to the appropriate age category. Model years 2015 and 2016 were considered age 0, 2014 was considered age 1 and so on. Model years 1985 and older were grouped into the age 30+ category. The age distribution for each HPMS vehicle type was then computed.

Table 16
Mapping between HPMS Vehicle Types and Michigan DOS Body Styles

HPMS Vehicle Type	Michigan DOS Body Style
H10- Motorcycle	Motorcycle
H20- Passenger Car	2-door, 4-door, Convertible
H30- Other 4-tire, 2-axle vehicles	Station Wagon; Pick-up/Van ,Ambulance, Hearse, Panel
H40- Bus	Bus
H50- Single-unit Short Truck	Dump Truck; Mixer; Utility; Wrecker; Stake; Tank; Motor Home
H60- Combination Truck	Tractor

By using base year 2015 data, future year age distribution was projected by applying EPA's age projection tool of "age-distribution-projection-tool-moves2014.xls".

Other Local Data Inputs
Temperature and Humidity Data
Temperature and humidity data are required inputs for MOVES. Local temperature profiles were developed for each month of the year. To generate these profiles, the average minimum and maximum daily temperatures for each month in Southeast Michigan were calculated using 2014-2016 National Weather Service (NWS) local climatological data reports for Detroit/Pontiac area. The relative humidity data was developed using the 2014-2016 National Centers for Environmental Information (NCDC) for the Detroit metropolitan airport posted by National Oceanic and Atmospheric Administration (NOAA).

EPA's "MeteorologicalDataConverter_Mobile6.xls" tool was then used to convert these numbers to the required hourly temperature and relative humidity inputs for MOVES. Table 17 shows the average min/max temperatures that were used to develop each month's hourly profile and Table 18 shows the necessary input format used in the tool to develop the relative humidity.

Table 17
Monthly Average Min/Max Temperatures for PM2.5 and CO Runs

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min	14.7	13.5	26.4	37.8	52.1	60.2	63.2	64.1	57.5	45.4	34.2	28.8
Max	29.1	29.7	44.5	59.0	72.6	80.1	83.2	82.6	76.5	62.9	51.4	40.4

Table 18

Hourly Relative Humidity by each Month

Month	HOUR ID											
	Hour 1 (6:00 AM)	Hour 2 (7:00 AM)	Hour 3 (8:00 AM)	Hour 4 (9:00 AM)	Hour 5 (10:00 AM)	Hour 6 (11:00 AM)	Hour 7 (12:00 Noon)	Hour 8 (1:00 PM)	Hour 9 (2:00 PM)	Hour 10 (3:00 PM)	Hour 11 (4:00 PM)	Hour 12 (5:00 PM)
	Hour 13 (6:00 PM)	Hour 14 (7:00 PM)	Hour 15 (8:00 PM)	Hour 16 (9:00 PM)	Hour 17 (10:00 PM)	Hour 18 (11:00 PM)	Hour 19 (12:00 AM)	Hour 20 (1:00 AM)	Hour 21 (2:00 AM)	Hour 22 (3:00 AM)	Hour 23 (4:00 AM)	Hour 24 (5:00 AM)
ENTER MOBILE6 HOURLY RELATIVE HUMIDITY												
1	78.8	79.0	78.3	78.1	74.0	76.8	79.3	77.8	79.0	78.8	78.0	79.2
	73.4	73.4	77.5	77.3	76.7	73.0	69.1	67.3	67.9	70.0	69.6	72.6
2	79.1	77.3	77.3	74.7	70.7	73.7	76.4	76.6	78.1	78.7	77.8	78.8
	68.8	67.9	71.4	73.4	72.5	66.7	66.5	63.7	64.5	61.5	60.8	67.3
3	77.5	75.3	73.6	69.7	64.3	72.8	74.5	73.7	75.8	77.0	76.3	77.6
	62.3	63.2	66.9	71.3	69.7	63.1	60.5	56.6	57.5	58.1	55.3	61.1
4	74.4	69.6	62.7	60.4	55.7	69.5	71.2	70.5	74.9	76.1	73.0	75.6
	57.8	57.8	64.9	67.8	66.3	55.6	51.1	48.9	51.1	54.6	50.0	55.1
5	76.4	72.8	66.9	61.6	59.3	71.1	74.5	74.1	77.7	77.8	77.2	79.4
	56.4	57.9	63.9	66.2	66.4	57.0	54.6	52.2	53.9	58.4	53.4	55.8
6	78.5	73.7	67.7	62.9	59.7	73.2	76.9	76.6	79.4	80.6	81.2	81.1
	59.8	60.6	67.1	69.5	69.2	59.5	54.9	53.4	55.2	55.0	52.7	55.8
7	74.4	68.8	53.8	47.2	45.1	67.6	73.9	75.3	78.0	79.6	80.1	80.6
	45.3	49.4	60.5	64.1	65.1	40.5	38.0	37.8	37.0	38.1	38.5	40.3
8	85.9	82.1	74.1	69.2	65.3	79.3	83.1	83.5	86.6	86.9	86.8	88.4
	66.3	65.4	71.0	74.6	76.4	62.6	58.0	56.8	60.6	61.8	58.3	65.5
9	88.5	85.2	78.2	72.9	69.1	83.5	85.8	86.3	87.9	88.3	88.1	88.7
	69.8	69.7	75.5	78.5	80.0	63.6	62.3	60.2	59.0	58.3	58.6	62.0
10	85.9	85.0	80.4	74.5	69.9	79.7	83.1	82.8	84.3	85.0	84.5	85.3
	69.3	69.7	73.9	77.0	77.8	67.6	62.4	60.5	60.4	60.4	59.9	64.8
11	81.8	81.3	78.9	75.9	71.6	76.3	80.7	78.9	80.7	80.5	79.8	81.7
	71.4	71.1	75.2	76.0	75.1	68.1	63.4	61.1	62.8	65.2	63.1	69.2
12	83.1	82.4	82.7	81.3	77.3	80.6	83.5	82.2	83.1	84.1	83.3	83.8
	77.0	76.8	79.5	79.7	79.2	75.4	73.1	71.2	73.4	73.4	72.4	76.2

The same dataset was used for both PM2.5 and CO MOVES runs. Since both emissions are highest during winter months, only data from December, January, and February are used in the conformity analysis for these two pollutants.

For ozone analysis, different temperature inputs are used. The objective is to simulate the on-road emissions that are likely to occur on days when meteorological conditions are conducive to high ozone formation (i.e., hot summer days). Thus, the maximum summer temperature used in MOVES was calculated by averaging the maximum local temperatures on the 10 highest ozone days in the year of 2014 to 2016. Similarly, the minimum summer temperature was calculated by averaging the minimum local temperatures on the same 10 highest ozone days. This yielded a maximum temperature of 86.9 degrees and a minimum of 60.0 degrees. These numbers were entered into the month of July to simulate a typical summer day for ozone conformity analysis.

Fuel Supply/Fuel Formulation

SEMCOG reviewed both the Fuel Supply and Fuel Formulation default values from MOVES2014 for the seven counties (Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw and Wayne counties) in Southeast Michigan. Special attention was given to the Raid Vapor Pressure (RVP) of summer fuel since the legal limit of summer RVP is 7.0 in Southeast Michigan region. SEMCOG confirmed with the EPA that the RVP of 8.0 for E10 fuel was attributable to the one psi waiver for ethanol in the default database for the region. Thus, it was decided to use the default values in MOVES' runs for SEMCOG's regional conformity analysis.

Table 19

Projects Included in Conformity Analysis

FISCAL YEAR / PERIOD	PROJECT Temp ID	COUNTY	JURISDICTION	PROJECT NAME	PROJECT LIMITS	PROPOSED WORK	Length	AQ Exempt	FIRST MODEL YEAR	RTP Source
2017	10671	Macomb	MCDR	23 Mile Road	North Avenue to Fairchild	Widen from 2 to 5 lanes		Non-Exempt	2020	2040RTP
2017	10880	Macomb	MDOT - Metro	M-59	M-53 to East of Romeo Plank	Reconstruct roadway		Exempt	2020	2040RTP
2017	1132	Oakland	RCOC	Dequindre Road	Long Lake to Burningbush	Widen from two to five lanes		Non-Exempt	2020	2040RTP
2017	10205	Oakland	RCOC	Napier Rd	9 Mile Rd to 10 Mile Rd	Pave gravel roadway and construct round-about at 10 Mile		Exempt	2020	2040RTP
2017	12649	Oakland	RCOC	Baldwin Road	Morgan to Gregory	Widen from 2 lanes to 4 or 5 lanes (varies)		Non-Exempt	2020	2040RTP

FISCAL YEAR / PERIOD	PROJECT Temp ID	COUNTY	JURISDICTION	PROJECT NAME	PROJECT LIMITS	PROPOSED WORK	Length	AQ Exempt	FIRST MODEL YEAR	RTP Source
2017	10205	Oakland	RCOC	Napier Rd	9 Mile Rd to 10 Mile Rd	Pave gravel roadway and construct round-about at 10 Mile		Exempt	2020	2040RTP
2017	12649	Oakland	RCOC	Baldwin Road	Morgan to Gregory	Widen from 2 lanes to 4 or 5 lanes (varies)		Non-Exempt	2020	2040RTP
2017	12992	Oakland	Southfield	Franklin Road	West of 11 Mile to Tele-graph	Rehabilitate roadway and construct roundabout at 11 Mile Rd		Exempt	2020	2040RTP
2017	12992	Oakland	Southfield	Franklin Road	West of 11 Mile to Tele-graph	Rehabilitate roadway and construct roundabout at 11 Mile Rd		Exempt	2020	2040RTP
2017	22903	Washtenaw	Ann Arbor	Nixon-Dhu-Varren-Green Roundabout	Dhu Varren Road/Green Road	The proposed project will reconstruct the intersection(s) of Nixon Road with Dhu Varren Road and Green Road. The proj-ect will include the construction of a modern roundabout and realignment of Dhu Varren Road, including all associated utilities. The round		Non-Exempt	2020	2040RTP
2017	12864	Washtenaw, Wayne	MDOT - Uni-versity	US-12; Wiard Rd; Ecorse Rd	US-12 from East of I-94 to East of Ecorse Rd; Wiard Rd. from US-12 to south of Tyler Rd; Ecorse Rd from County Line to 1000 ft East of county line	Operational and Roadway Improvements to support the proposed Amer-ican Center for Mobility		Exempt	2020	2040RTP
2017	12983	Wayne	MDOT - Metro	M-10	Under ML King (Stim-son)	Bridge Re-placement and approach work, removal of a segment of the M-10 service drive.		Exempt	2020	2040RTP

FISCAL YEAR / PERIOD	PROJECT Temp ID	COUNTY	JURISDICTION	PROJECT NAME	PROJECT LIMITS	PROPOSED WORK	Length	AQ Exempt	FIRST MODEL YEAR	RTP Source
2018	12774	Macomb	MCDR	23 Mile Road	North Avenue to Card Road	Widen from 2 to 5 Lanes		Non-Exempt	2020	2040RTP
2018	1147	Oakland	RCOC	Baldwin Road	from Gregory to Waldon	Widen from 2 lns to 4 or 5 lns (varies); 5 new roundabouts		Non-Exempt	2020	2040RTP
2018	1341	Oakland	Troy	John R Road	from Long Lake to South	Widen from 2 to 3 lanes		Non-Exempt	2020	2040RTP
2018	12074	Oakland	MDOT - Metro	I-75BL (Perry St.)	Loop to Giddings Rd., Pontiac	Road Diet Pavement Markings		Non-Exempt	2020	2040RTP
2019	12956	Wayne	Wayne DPS	Cherry Hill Rd	Canton Center Rd to Haggerty Rd	Widening the Road to 3 lane section		Non-Exempt	2020	2040RTP
2016.202	12940	Wayne	MDOT - Regional	Gordie Howe International Bridge	Detroit to Windsor	Bridge access road infrastructure improvements		Non-Exempt	2025	2040RTP
2016	2011372	Oakland	MDOT - Metro	I-75	from North of Coolidge road to South BoulevArd	Reconstruct and add one lane in each direction		Non-Exempt	2020-2025	2040RTP
2018	13059	Wayne	MDOT - Regional	I-75	N of 13 Mile Rd to Coolidge Hwy, Oakland County	Reconstruct and widen		Non-Exempt	2025	2040RTP
2018	13060	Wayne	MDOT - Regional	I-75	8 Mile Rd to N of 13 Mile Rd, Oakland County	Reconstruct and widen; drain tunnel construction		Non-Exempt	2025	2040RTP
2019	12611	Oakland	RCOC	Dequindre	Utica Rd to N of Auburn Rd	Widen to 5 Lanes		Non-Exempt	2025	2040RTP

FISCAL YEAR / PERIOD	PROJECT Temp ID	COUNTY	JURISDICTION	PROJECT NAME	PROJECT LIMITS	PROPOSED WORK	Length	AQ Exempt	FIRST MODEL YEAR	RTP Source
2020	45RTP-3	Livingston	LCRC	Old US-23	Grand River Ave to Spencer Rd	Widen from two to five lanes and reconstruct	1.1	Non-exempt	2025	2045RTP
2020	45RTP-8	Livingston	MDOT	M-59 (Highland Rd)	Cullen Rd to 950 ft E of Hartland Woods Dr	Construct center-left turn lane	0.7	Non-Exempt	2025	2045RTP
2020	45RTP-29	Macomb	MCDR	23 Mile Rd	900 ft W of Card Rd to 900 ft W of Heydenreich Rd	Reconstruct and widen from two to five lanes	1.1	Non-exempt	2025	2045RTP
2020.2021. 2022.2023. 2024	45RTP-112	Macomb	RCMC	Mound Rd	I-696 to M-59	Reconstruct; add one lane each direction from 17 Mile Rd to M-59; add ITS, safety and ped/bike features.	9.4	Non-exempt	2025	2045RTP
2020. 2021	45RTP-110	Oakland	RCOC	Currie Rd	Eight Mile Rd to Ten Mile Rd	Pave gravel roadway	2.0	Exempt	2025	2045RTP
2021	45RTP-55	Macomb	MDCR	23 Mile Rd	Nine hundred (900) ft W of Heydenreich Rd 600 ft E of Romeo Plank Rd	Reconstruct roadway and widen from two to five lanes	1.0	Non-exempt	2025	2045RTP
2021	50008	Regional	MDOT	M-153	W. of Sheldon Road to W. of Lotz Road	Reconstruct to boulevard, no added lanes	2.2	Non-Exempt	2025	2045RTP
2021.202	45RTP-115	Oakland	Troy C.	Rochester Rd	Barclay Dr to Trinway Dr	Widen from five lanes to four-lane boulevard	1.0	Non-exempt	2025	2045RTP
2022	45RTP-75	Macomb	MCDR	Romeo Plank Rd	Two thousand eight hundred (2800) ft N of 21 Mile Rd to 1000 ft N of 23 Mile Rd	Reconstruct and widen from two to five lanes; possible conversion of 22 Mile Rd and Romeo Plank Rd to a roundabout.	1.7	Non-exempt	2025	2045RTP

FISCAL YEAR / PERIOD	PROJECT Temp ID	COUNTY	JURISDICTION	PROJECT NAME	PROJECT LIMITS	PROPOSED WORK	Length	AQ Exempt	FIRST MODEL YEAR	RTP Source
2023	45RTP-98	Macomb	MCDR	North Ave	21 Mile Rd to 1000 ft N of 22 Mile Rd	Reconstruct roadway and widen from two to five lanes	1.1	Non-exempt	2025	2045RTP
	45RTP-142	Wayne	MDOT	I-94	I-96 to Conner Ave (between Chene and Conner)	Trunkline modernization	6.6	Non-exempt	2025	2045RTP
2025-2034	45RTP-142	Wayne	MDOT	I-94	I-96 to Conner Ave (between Cass and Chene)	Trunkline modernization	6.6	Non-exempt	2030	2045RTP
2035-2045	45RTP-142	Wayne	MDOT	I-94	I-96 to Conner Ave (between I96 and Cass)	Trunkline modernization	6.6	Non-exempt	2040	2045RTP
2024	45RTP-108	Oakland	Various	Beck Rd	12 Mile Rd to West Rd	Widen from three to five lanes	1.0	Non-exempt	2030	2045RTP
2025-2034	45RTP-165	Oakland	Novi C.	Beck Rd	Eight Mile Rd to Ten Mile Rd	Widen from two to five lanes	2.0	Non-exempt	2030	2045RTP
2025-2034	45RTP-167	Oakland	RCOC	Orchard Lake Rd	13 Mile Rd to 14 Mile Rd	Widen from five lanes to four-lane boulevard	1.0	Non-exempt	2030	2045RTP
2025-2034	45RTP-168	Oakland	RCOC	Pontiac Trail	Decker Rd to Welch Rd	Widen from two to five lanes	0.5	Non-exempt	2030	2045RTP
2025-2034	45RTP-177	Wayne	WDPS	Canton Center Rd [AC, ACC]	Geddes Rd to Palmer Rd	Add center-left turn lane; HMA resurfacing	1.1	Non-exempt	2030	2045RTP
2025-2034	45RTP-133	Macomb	Various	26 Mile Rd	Eight hundred (800) ft E of M-53 (Christopher Columbus Fwy) to 1000 ft E of Schoenherr Rd	Reconstruct roadway and widen from two to five lanes	1.4	Non-exempt	2035	2045RTP

FISCAL YEAR / PERIOD	PROJECT Temp ID	COUNTY	JURISDICTION	PROJECT NAME	PROJECT LIMITS	PROPOSED WORK	Length	AQ Exempt	FIRST MODEL YEAR	RTP Source
2025-2034	45RTP-134	Macomb	MCDR	Hayes Rd	23 Mile Rd to 1000 ft N of 24 Mile Rd	Reconstruct roadway and widen from two to five lanes	1.1	Non-exempt	2035	2045RTP
2025-2034	45RTP-135	Macomb	MCDR	Hayes Rd	One thousand (1000) ft N of 24 Mile Rd to 1000 ft N of 25 Mile Rd	Reconstruct roadway and widen from two to five lanes	1.1	Non-exempt	2035	2045RTP
2025-2034	45RTP-136	Macomb	MCDR	Hayes Rd	One thousand (1000) ft N of 25 Mile Rd to 1000 ft N of 26 Mile Rd	Reconstruct roadway and widen from two to five lanes	1.1	Non-exempt	2035	2045RTP
2025-2034	45RTP-137	Macomb	MCDR	North Ave	One thousand (1000) ft N of 22 Mile Rd to 1000 ft N of 23 Mile Rd	Reconstruct roadway and widen from two to five lanes	1.1	Non-exempt	2035	2045RTP
2025-2034	45RTP-164	Oakland	Wixom C.	Beck Rd	West Rd to Pontiac Trail	Widen from three to five lanes	1.0	Non-exempt	2035	2045RTP
2025-2034	45RTP-169	Oakland	RCOC	Southfield Rd	Mt Vernon St to Beverly Rd	Widen from five lanes to four-lane boulevard	4.0	Non-exempt	2035	2045RTP
2035-2045	45RTP-197	Oakland	RCOC	12 Mile Rd	E of Beck Rd to W of Dixon Rd	Widen from two to four lane boulevard	1.5	Non-exempt	2040	2045RTP
2035-2045	45RTP-199	Oakland	Novi C.	Meadowbrook Rd	Ten Mile Rd to 12 Mile Rd	Widen from three to five lanes	2.0	Non-exempt	2040	2045RTP
2035-2045	45RTP-198	Oakland	Novi C.	Beck Rd	Ten Mile Rd to Grand River Ave	Widen from two to five lanes	1.5	Non-exempt	2045	2045RTP
2035-2045	45RTP-200	Oakland	RCOC	Ten Mile Rd	South Lyon E CL to Haggerty Rd	Widen from two to five lanes	10.0	Non-exempt	2045	2045RTP

2035-2045	45RTP-198	Oakland	Novi C.	Beck Rd	Ten Mile Rd to Grand River Ave	Widen from two to five lanes	1.5	Non-exempt	2045	2045RTP
2035-2045	45RTP-200	Oakland	RCOC	Ten Mile Rd	South Lyon E CL to Haggerty Rd	Widen from two to five lanes	10.0	Non-exempt	2045	2045RTP

Appendix B: Consultation Agency List

Table 20
Consultation Agency Outreach by Category and Organization Name

Category	Organization Name
Aviation	Federal Aviation Administration (FAA)
	MDOT
	Oakland County
	Wayne County Airport Authority
Border Crossing	Detroit International Bridge Company
	U.S. Coast Guard, Ninth District
Bridge	MDOT
Community and Economic Development	Advancing Macomb
	Ann Arbor/Ypsilanti Regional Chamber
	Automation Alley
	Community Foundation For Southeast Michigan
	Detroit Chinese Business Association
	Detroit Region Aerotropolis
	Detroit Regional Chamber
	Downriver Community Conference
	Kirco
	Michigan Economic Development Corporation
	Novi Chamber Of Commerce
	Urban Development Corporation (UDC)
	Windsor Essex Economic Development Corporation
Conservation	Detroit Riverfront Conservancy
	The Nature Conservancy Of Michigan
	United States Department Of Agriculture
	United Way For Southeastern Michigan
Education	Central Michigan University Center for Driving Evaluation, Education, and Research
	Detroit Public Schools
	Macomb Community College
	Monroe County Community College
	Oakland Community College
	University Of Windsor
	Washtenaw Community College
	Wayne State University

Environmental Justice	AARP-Michigan
	Adult Well-Being Services
	Ann Arbor Center For Independent Living
	Arab Community Center For Economic And Social Services
	Area Agency On Aging 1-B
	Area Agency On Aging 1-C (Southern/Western Wayne)
	CARE Of Southeastern Michigan
	Detroit Community Initiative
	Detroiters Working For Environmental Justice
	Easter Seals Michigan, Inc.
	Goodwill Industries
	Michigan Developmental Disabilities Council
	Michigan Information Center
	NAACP
	New Detroit
	Southwest Detroit Environmental Vision
	Think Detroit PAL
Environmental Mitigation	City of Detroit
	EcoWorks
	Federal Highway Administration
	Michigan Department Of Environmental Quality
	Michigan Department Of Natural Resources
	Michigan Environmental Council
	US Army Corps Of Engineers
	US Environmental Protection Agency
Freight	Detroit-Wayne County Port Authority
	Federal Railroad Administration
	Detroit-Windsor Truck Ferry, Inc.
	MDOT
	MDOT - Metro Region
	Nicholson Terminal & Dock Company

General	City of Ann Arbor
	City of Detroit
	City of Wayne
	County Road Association Of Michigan
	Genesee County
	Livingston County
	Livingston County Road Commission
	Macomb County
	Macomb County Department Of Roads
	MDOT
	MDOT - University Region
	Michigan Department Of State
	Michigan Municipal League
	Monroe County
	Monroe County Road Commission
	National Association of Regional Councils
	Oakland County
	Office of Congressman John Conyers, Jr
	Road Commission For Oakland County
	St. Clair County
	St. Clair County Road Commission
	Toledo Metropolitan Area Council Of Governments
	Toledo Metropolitan Area Council Of Governments
	Washtenaw Area Transportation Study
	Washtenaw County
Historic Preservation	State Historic Preservation Office (SHPO)
Land Use Management/Planned Growth	Michigan Land Use Institute
Nonmotorized	League of Michigan Bicyclists
	The Greenway Collaborative, Inc.
Safety	AAA of Michigan
	MDOT
	Michigan Center for Advancing Safe Transportation
	Michigan Office of Highway Safety Planning
	Michigan Secretary of State
	Michigan State Police
	Traffic Improvement Association Of Michigan
	Traffic Safety Association of Macomb County

Tourism	Ann Arbor Area Convention & Visitor’s Bureau
	Blue Water Area Convention and Visitors Bureau
	Detroit Metro Convention And Visitors Bureau
	Huron-Clinton Metroparks
	Michigan Economic Development Corporation
	Ypsilanti Convention and Visitors Bureau
Transit	Amtrak
	Ann Arbor Area Transportation Authority
	Blue Water Area Transportation Commission
	Blue Water Area Transportation Commission
	Detroit Department Of Transportation
	Detroit Transportation Corporation
	JARC
	Lake Erie Transit
	Livingston Essential Transportation Service (LETS)
	M-1 Rail Office
	North Oakland Transportation Authority
	People’s Express
	People’s Transit
	Suburban Mobility Authority For Regional Transportation
	Transportation Riders United
	Wayne State University
Tribal Interest	Grand Traverse Band of Ottawa & Chippewa Indians
	Hannaville Indian Community
	Inter-Tribal Council of Michigan
	Keweenaw Bay Indian Community
	Little River Band of Ottawa Indians
	Little Traverse Bay Bands of Odawa Indians
	Nottawaseppi Huron Band of Potawatomi Indians
	Pokagon Band of Potawatomi Indians
	Sault Ste. Marie Tribe of Chippewa Indians
Wildlife	US Fish And Wildlife Service

Appendix C: Environmental Justice Technical Analysis

Introduction

The Environmental Justice office of U.S. Environmental Protection Agency defines it as: "Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies. Meaningful Involvement means that:

- people have an opportunity to participate in decisions about activities that may affect their environment and/or health;
- the public's contribution can influence the regulatory agency's decision;
- their concerns will be considered in the decision making process; and
- the decision makers seek out and facilitate the involvement of those potentially affected."

Title VI of the 1964 Civil Rights Act (42 U.S.C. 2000d-1) states that, "No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." In the same spirit, President Clinton issued Executive Order 12898 on February 11, 1994, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. The stated purpose of this order is to make achieving environmental justice part of (each Federal agency's) mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Similar orders followed from the U.S. Department of Transportation (USDOT) and Federal Highway Administration. The USDOT order specifically defines the five populations that must be included in environmental justice (EJ) analyses.

SEMCOG's Approach

Transportation investments have both positive and negative impacts that may be localized in a particular community or portion of a community. Environmental justice requires that these impacts be distributed fairly among population groups especially focusing on population groups that have been traditionally disadvantaged. SEMCOG, in its response to this important challenge, enhanced a process to assess the impacts of the transportation planning process, on the target populations.

The target populations consist of minorities (African-American, Asian-American, Native American, and Hispanics), low-income households, senior citizens, and households without cars. SEMCOG identified three principles to ensure environmental justice considerations were properly integrated into the transportation planning process:

- Adequate public involvement of target populations in regional transportation decision making,
- Assess (i.e., travel time) whether there were disproportionately high and adverse impacts on the target populations resulting from federal programs, and
- Ensure that the target populations receive an equitable share of benefits of federal transportation investments.

Although the quantitative measures included with this analysis cannot consider every possible aspect of environmental justice, SEMCOG believes they are good indicators as to whether significant environmental justice issues are present.

This appendix provides demographics information for the Southeast Michigan seven county region and the results of the identified measures applied to the transportation projects in the 2045 Regional Transportation Plan (RTP).

Demographics

Demographic data for the special or target population used in SEMCOG's Environmental Justice analysis was compiled from synthesized households and population based on Census 2015 American Community Survey (ACS). Since Census 2015 doesn't provides 100 percent count data, SEMCOG synthesized disaggregated households and persons with essential attributes such as age, race, income and auto ownership using Census five-year ACS estimates and PUMS samples. In order to further analyze the data through travel demand model, data was then aggregated to Traffic Analysis Zones (TAZs). There are 2,811 internal TAZs in the SEMCOG region. The impacted demographic groups are described below along with maps showing the regional distribution of those groups.

Special Population

Minority Population: The U.S. Department of Transportation (DOT) Order (5610.2) on EJ defines "Minority" as the following:

- Black (having origins in any of the black racial groups of Africa).
- Hispanic (of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).
- Asian American (having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands).
- American Indian and Alaskan Native (having ori¬gins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition).

In addition SEMCOG includes the following groups as defined by the U.S. Census Bureau:

- Black or African American alone - not Hispanic or Latino.
- American Indian and Alaska Native alone - not Hispanic or Latino.
- Asian alone - not Hispanic or Latino.
- Native Hawaiian and Other Pacific Islander alone —not Hispanic or Latino.
- Some other race alone - not Hispanic or Latino.
- Persons of two or more races - not Hispanic or Latino.

Based on Census 2015, the SEMCOG region had a minority population of 1,446,089 which equates to about 30.6 percent of the total population. Figure 1 indicates the location of minority populations in the region. Traffic Analysis zones located in central cities and urban communities have higher proportions of minority population in the Southeast Michigan region.

Low Income Households

Poverty thresholds vary among different federal agencies and for different programs; hence SEMCOG used a derived measure to estimate low-income households. SEMCOG's Environmental Justice analysis includes all households that are in the lowest income quartile as low income households. SEMCOG's travel demand model uses households at TAZ level which are generated by synthesizing individual households at block group level from 2015 PUMS (Public Use Microdata Sample). These synthesized households were categorized into four income quartiles based on their household income. Lowest income quartile for SEMCOG region was identified as $26,143, and all households with household income at or below $26,143 are considered as low-income households for the purpose of this Environmental Justice analysis.

In 2015, there were 465,635 (25 percent of all households) low-income households in the region. Figure 2 shows the location and distribution of low-income households in the Southeast Michigan region. While higher proportions of low-income households are spread across the region, Detroit has considerable higher number of TAZs which have more than 60 percent of the households in low income category.

Senior Population

Southeast Michigan region, along with the nation is going through the demographic shifts associated with aging of baby boomers. Mobility barriers and age are linked together. Not every senior individual has mobility challenges, but the likelihood of a challenge increases as an individual ages. Population aged 65 and older is considered as senior population.

In 2015, the SEMCOG region had 696,810 persons (14.8 percent) who were 65 years of age or older. Figure 3 shows the distribution of senior population in the region. Similar to the national trends, minority population in the Southeast Michigan region tend to be younger than white population and as a result central and older cities that have higher concentrations of minority population have much lower concentrations of senior population. On the contrary, exurban and emerging suburban communities have much higher proportions of persons who are 65 or older (Figure 3).

Zero Car Households

Persons in households that have no vehicles available are critical part of “transit dependent” population, i.e., those who must rely on public transit for their daily travel needs and who have limited mobility. It is recognized that not owning a personal automobile may be a lifestyle choice for some, but for others automobile ownership is unattainable due to various constraints, including income or disability.

In 2015, Southeast Michigan had 158,368 households or 8.5 percent of households had no personal vehicle at their disposal. Figure 4 illustrates the distribution of zero car households in SEMCOG region. Central cities and block groups surrounding these central cores had relatively higher proportions of households with no vehicle available.

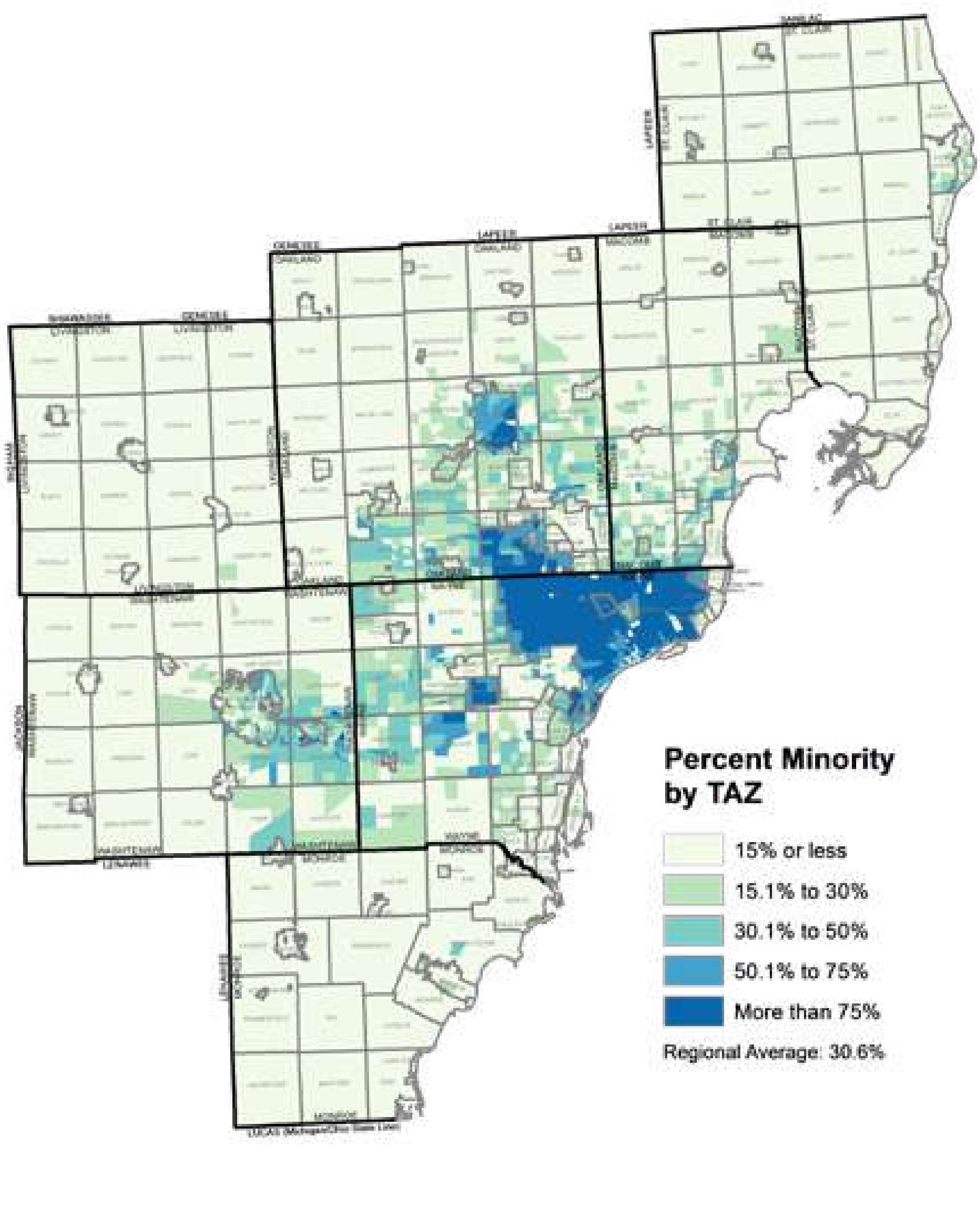
Estimating 2045 Target and non-Target Populations by Zone

In order to create population-based measures, it is necessary to estimate the target and non-target population within each TAZ. SEMCOG utilizes a separate land use simulation model called UrbanSim to simulate land development for future years in the seven County region of SEMCOG. UrbanSim simulates the location decision for both new and existing households and firms, place households and jobs in parcels, and anticipate parcel level changes in Land development based on any known future events and land development constraints.

Input data for UrbanSim model consisted of a list of all households, with current locations (by building), household size (number of members), age of the household head, race, number of workers, children and autos. Household data along with persons in those households were synthesized using 2011-2015 American Community Survey estimates at Census Block Group level. Subsequently, these households and persons were placed on individual building using building's housing attributes and synthesized household attributes.

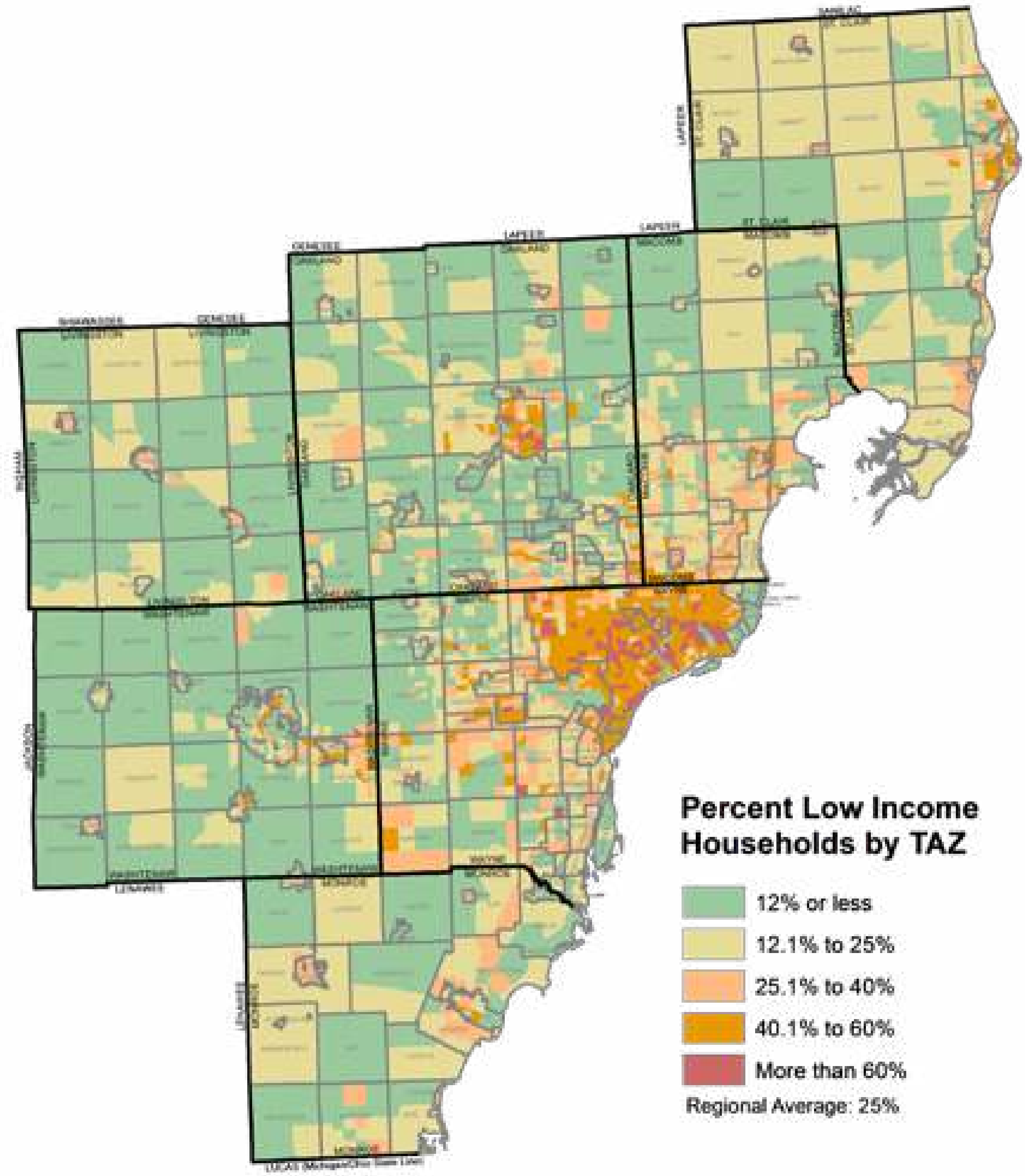
The output from the UrbanSim model is parcel level socio-economic data including households by type (income, age, race, household size, presence of children, vehicles available, and number of workers), jobs by type (industry and number of employees), and land use by type for all future years till 2045. The parcel level output data is aggregated to TAZs and the results are used as inputs for SEMCOG's travel demand model and for the Environmental Justice Analysis.

Figure 1
Distribution of Minority Population, 2015, Southeast Michigan



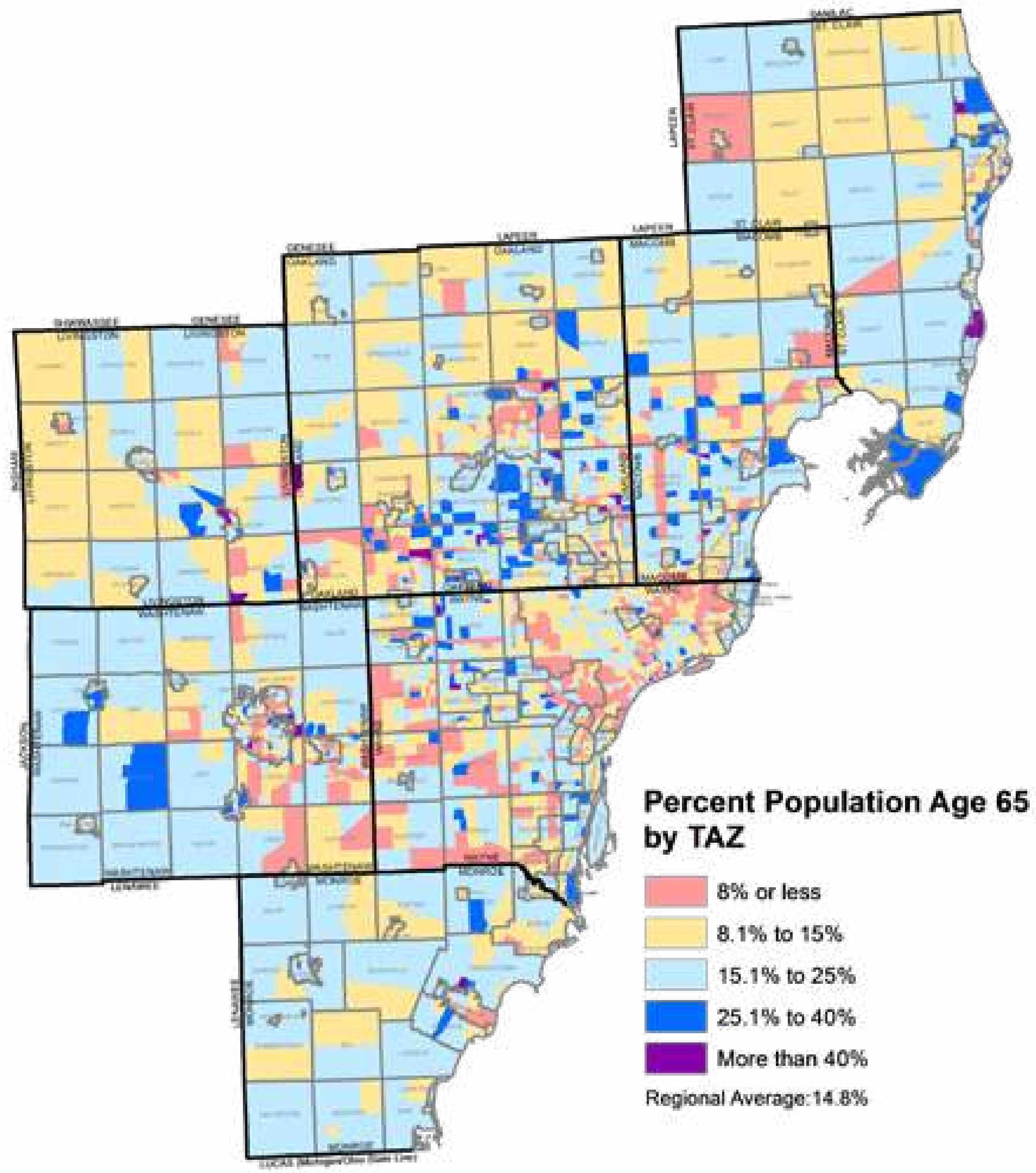
Source: SEMCOG

Figure 2
Distribution of Low Income Households, 2015, Southeast Michigan



Source: SEMCOG

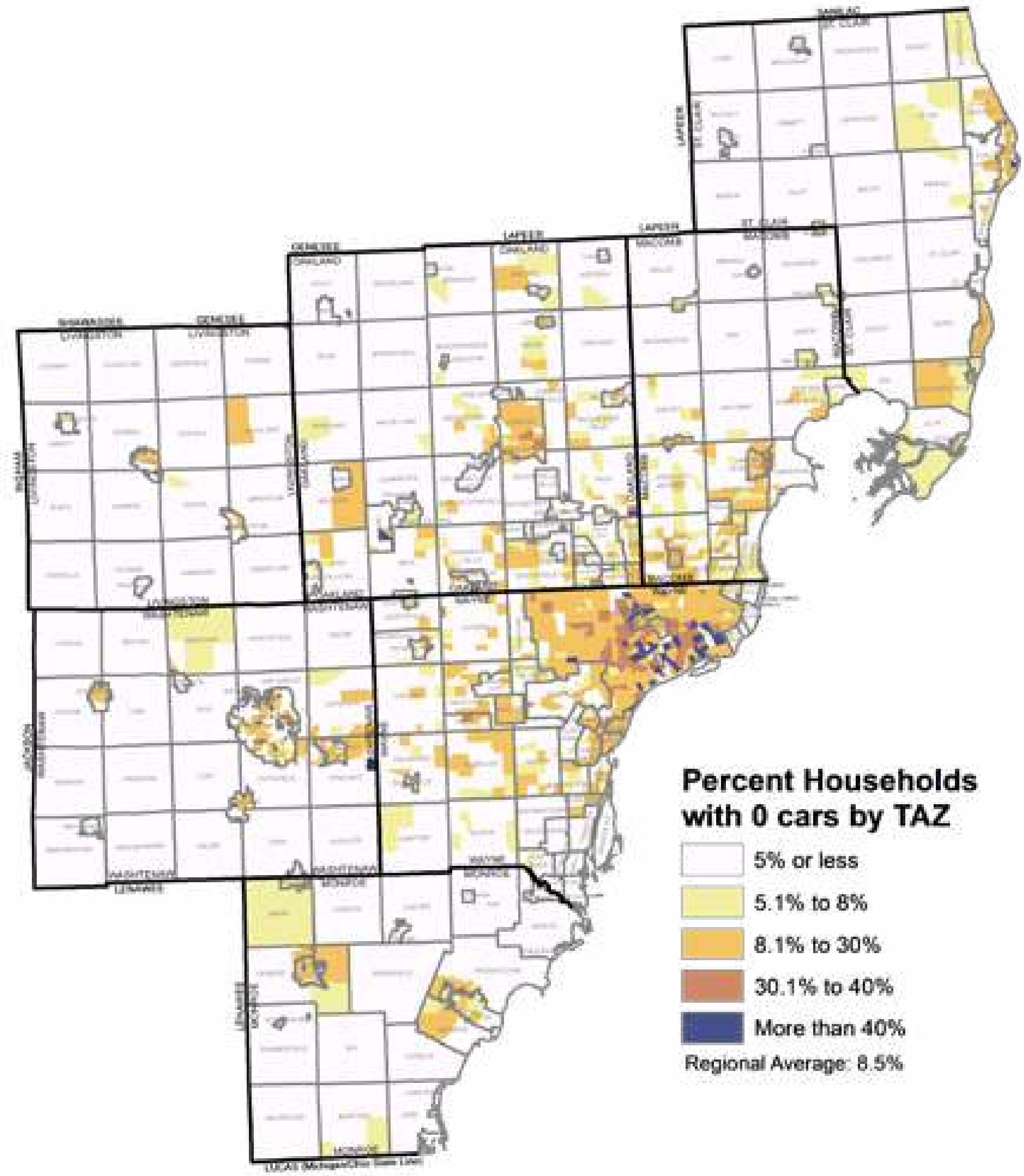
Figure 3
Distribution of Senior Population, 2015, Southeast Michigan



Source: SEMCOG

Figure 4

Distribution of Households with No Vehicles Available, 2015, Southeast Michigan



Source: SEMCOG

Quantitative Measures

Measures Methodology

This section describes all the quantitative measures identified for this technical analysis. The accessibility or travel time measures were developed based on travel time estimates from SEMCOG's four-step travel demand forecast model (TDFM). These estimates are available for highway and transit networks, for current and future build and no-build conditions. Section 2 describes demographics data used in the process.

Measures Identified for Application

Several measures are identified for this analysis based on the data and tools available. Measures are calculated for three scenarios;

- 2015 base year
- 2045 no-build conditions assuming no new transportation projects constructed after 2015 despite the population and socioeconomic growth
- 2045 build conditions assuming all the projects in the long range plan are constructed

Average number of job opportunities

This measure estimates the average number of jobs accessible from each origin or home TAZ to every other destination or work TAZ within a specified travel time. The 2045 Regional Plan employment input to the model use Bureau of Economic Analysis Equivalent Job (BEA-EJ) dataset. These jobs includes wage and salary principal jobs, self-employed jobs, and secondary jobs. Travel time estimates, commonly known as travel-time skims, for the A.M. peak period are used for auto and transit modes. Time thresholds of 25 minutes by auto and 50 minutes by transit are selected; these times reflect the regional average trip length for work trips. Employment data for each TAZ is available from SEMCOG's Regional Demographics and Socio-economic Forecast.

Job opportunities within 25 minutes by auto and 50 minutes by transit are aggregated from each origin TAZ. These jobs numbers are weighted by each group within the TAZ. Average number of jobs was calculated for each group by aggregating weighted jobs for each group for the region divided by group regional totals.

Average shopping opportunities

This measure estimates the average retail shopping area (acres) accessible within a specified travel time. SEMCOG maintains building data layer representing digital footprint of each building in the region. Retail square footage (converted to acres) was extracted from the footprints layer and aggregated by Traffic Analysis Zones.

Time thresholds of 15 minutes by auto and 30 minutes by transit are selected; these times reflect the regional average trip length for shopping trips. Shopping opportunities within 15 minutes by auto and 30 minutes by transit during the mid-day period are calculated from each TAZ. The number of shopping centers accessible from each TAZ is then weighted by each target population group within the TAZ to get a weighted average of the number of shopping centers accessible to each group.

Average number of non-shopping opportunities
This measure estimates the average number of non-shopping opportunities accessible within a specified travel time. SEMCOG currently maintains GIS coverage of K-12 schools, libraries, parks, hospitals and medical centers. For 2045 RTP, this data will be used to measure non-shopping opportunities. The measurement methodology is same as for shopping or job opportunities.

Time thresholds of 15 minutes by auto and 30 minutes by transit are selected; these times reflect the regional average trip length for other trips. Non-shopping opportunities within 15 minutes by auto and 30 minutes by transit during the mid-day period are calculated from each TAZ. The number of non-shopping opportunities accessible from each TAZ is then weighted by each target population group within the TAZ to get a weighted average of the number of shopping centers accessible to each group.

The next three measures analyze the population groups covered by a major destination location.

Percent of population close to a college
This measure estimates the percentage of population groups within a specified travel time to a college location. First, a list of major college campuses in the region is established. From these college locations, the share of population groups within specified travel times are calculated.

TDFM skims for A.M. peak period are used to calculate travel time from each college TAZ to every other TAZ. Population groups in each TAZ that is within 25 minute by auto or 50 minute by transit are aggregated and divided by the total population for that group to get percentage of each population group covered by colleges within a specified travel time.

Percent of population close to a hospital
This measure is developed in the same manner as for colleges. A list of major hospitals in the region is established. This list does not include smaller medical facilities and clinics. From these hospital locations, the share of population groups within specified travel times are calculated.

TDFM skims for mid-day time period are used to calculate travel time from each hospital to each TAZ. Population groups in each TAZ that is within 15 minutes by auto or 30 minute by transit are aggregated and divided by the total population for that group to get percentage of each population group covered by hospital within a specified travel time.

Percent of Population close to a major retail center
This measure also used the same measurement methodology as for colleges. A list of major retail centers in the region is established. This list includes major regional shopping malls, lifestyle centers (such as Partridge Creek, Clinton Twp), destination centers (such as IKEA, Canton) and outlet malls. From these major retail locations, the share of population groups within specified travel times are calculated.

TDFM skims for mid-day time period are used to calculate travel time from major retail centers to each TAZ. Population groups in each TAZ that is within 15 minutes by auto or 30 minutes by transit are aggregated and divided by the total population for that group to get percentage of each population group covered by major retail centers within a specified travel time.

Average travel time for work purpose

This measure estimates the average travel time for work purpose. TDFM provides an estimate of person trips and travel time for work from each origin TAZ to employment TAZ. The total person trips are multiplied by target population shares (based on socio-economic distribution) for each TAZ to get trips for minority, seniors, and zero car households. Only exception is the low-income group, where the trips made by low income group are readily available from the TDFM. Travel time skims for work purpose are then weighted by population groups to calculate average travel time for work purpose for auto. Transit skims are used to calculate average transit travel time.

Average travel time for shopping purpose

This measure estimates the average travel time for shopping purpose. TDFM provides an estimate of person trips and travel time for shopping purpose from each origin TAZ to destination TAZ. The total person trips are multiplied by target population shares (based on socio-economic distribution) for each TAZ to get trips for minority, seniors, and zero car households. Only exception is the low-income group, where the trips made by low-income groups are readily available from the TDFM. Travel time skims for shopping purpose are then weighted by population groups to calculate average travel time for shopping purpose. Transit skims are used to calculate average transit travel time.

Average travel time for other purposes

This measure estimates the average travel time for other purposes. TDFM provides an estimate of person trips and travel time for other purposes from each origin TAZ to destination TAZ. The total person trips are multiplied by target population shares (based on socio-economic distribution) for each TAZ to get trips for minority, seniors, and zero car households. Only exception is the low-income group, where the trips made by low income group are readily available from the TDFM. Travel time skims for other purposes are then weighted by population groups to calculate average travel time for other purposes. Transit skims are used to calculate average transit travel time.

Average travel time for all purposes

This measure estimates the average travel time for all internal purposes. Internal purposes include home based work, shopping, school, other, non-home based work and non-home based other. TDFM provides an estimate of person trips and travel time for all purposes from each origin TAZ to destination TAZ. The total person trips are multiplied by target population shares (based on socio-economic distribution) for each TAZ to get trips by each population group. Travel time skim for mid-day is then weighted by population groups to calculate average travel time for all purposes. Transit skims are used to calculate average transit travel time.

Per capita transportation funding

In developing the regional transportation plan, each project was initially assigned a set of counties that the project is geographically located in. Further work was done to localize individual projects along roads and at intersections where possible. For these projects, a buffer was applied to represent the area impacted by the project. Projects involving freeways were buffered by 2.5 miles, while all other projects that could be mapped were buffered by 0.5 miles.

In order to analyze transportation investment by population group, representation of each project – weighted by project cost – was geographically overlaid with the representation of the selected population groups by Traffic Analysis Zone (TAZ) in 2015 and as forecasted by SEMCOG in 2045. Each of the four population groups – minorities, low-income households, seniors, and no car households – were analyzed separately. As a result of the overlay, project costs were distributed on a per capita basis for the minority and senior population, and on a per household basis for low-income and no car households. Per capita and per household investment is then summarized by adding up total investment by population group and dividing by the total of persons or households in the population group in 2015 and 2045. Finally, these numbers are compared to equivalent numbers for the balance of the population or households to assess equity.

Results

Average Number of Job opportunities

Figures 5 and 6 show the target population on average have access to more jobs as compared to non-target population in each scenario. When compared across scenarios, the build conditions shows access to more jobs than no-build scenario by auto. The improvement in accessibility appears to be benefiting target and non-target groups in the same way. It appears that for this measure, there are no prominent disproportionate negative impacts of the transportation projects among the population groups.

Figure 5

Average Number of Jobs within 25 Minutes – AM peak by auto

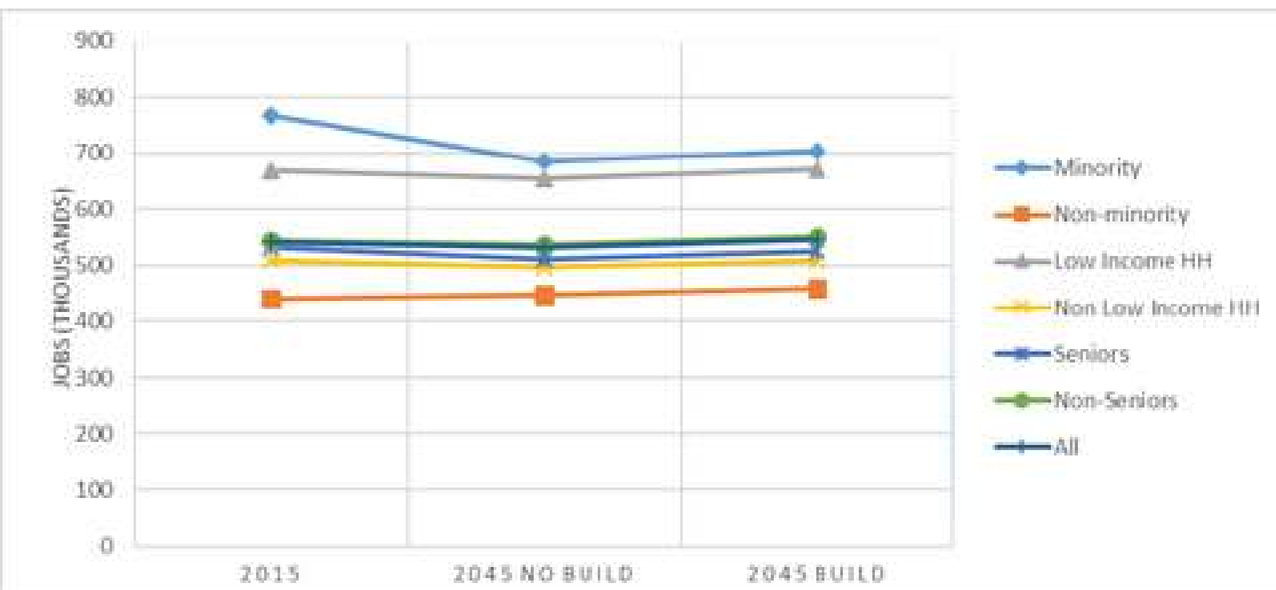
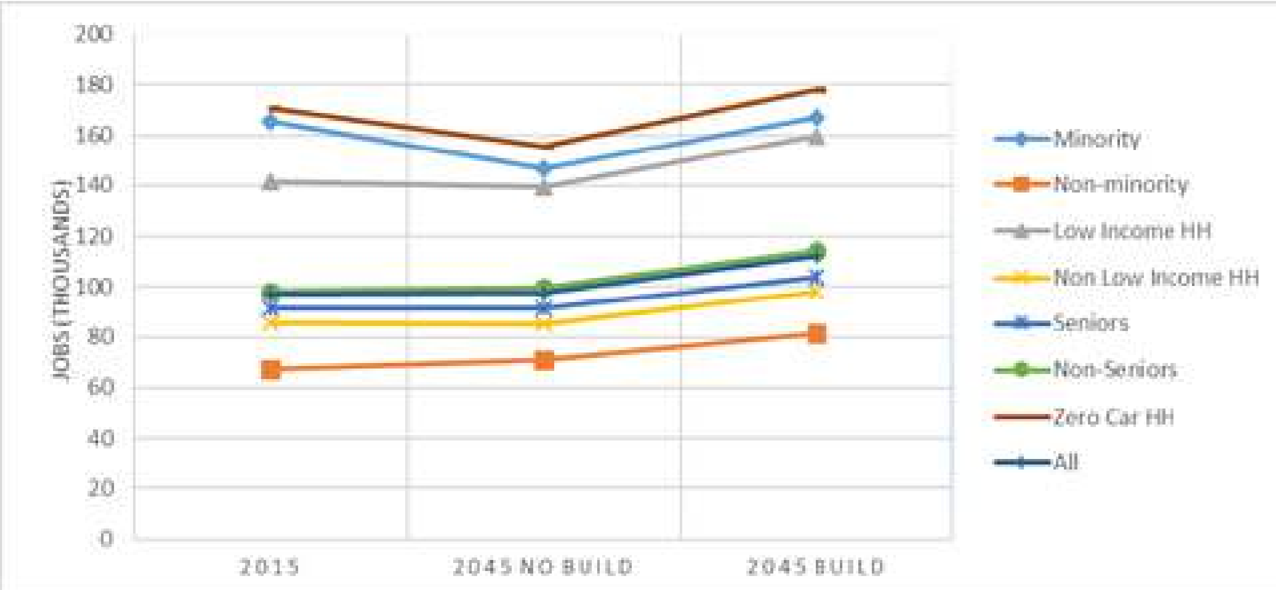


Figure 6
Average Number of Jobs within 50 Minutes - AM peak by transit



Average Shopping Opportunities

Figures 7 and 8 show the target populations on average have access to more shopping opportunities (acres) as compared to non-target population in each scenario. When compared across scenarios, the build condition shows access to more shopping opportunities than no-build scenario by auto. The improvement in accessibility appears to be benefiting target and non-target groups in the same way.

It appears that for this measure, there are no prominent disproportionate negative impacts of the transportation projects among the population groups.

Figure 7
Average Shopping Opportunities within 15 Minutes - Mid-day period by auto

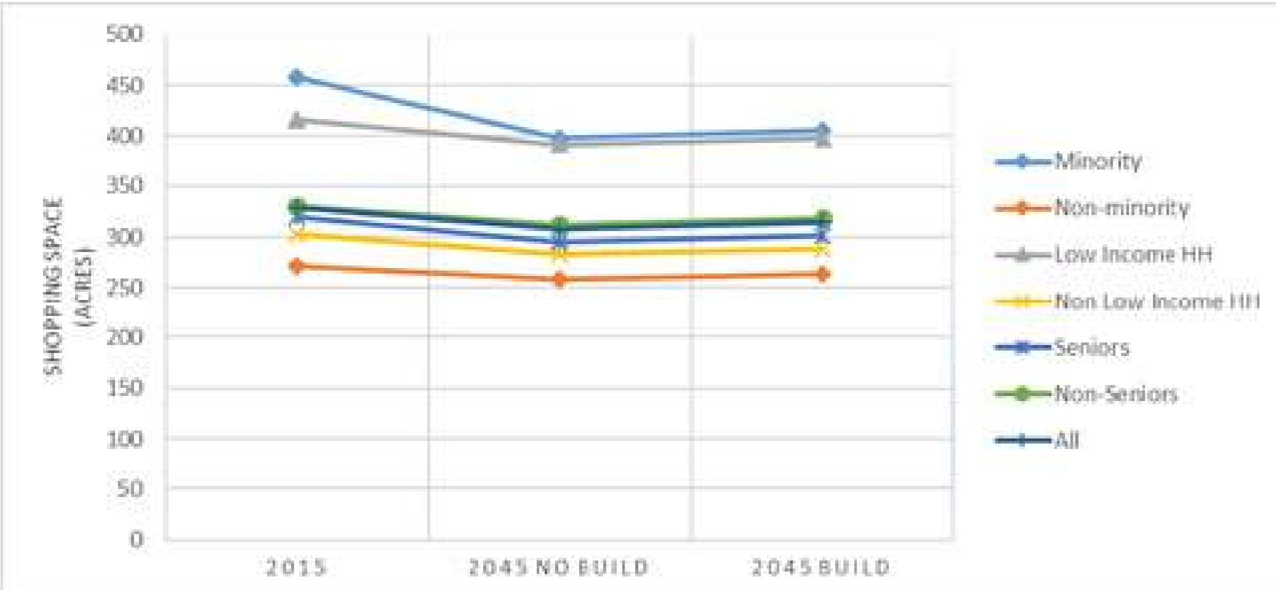
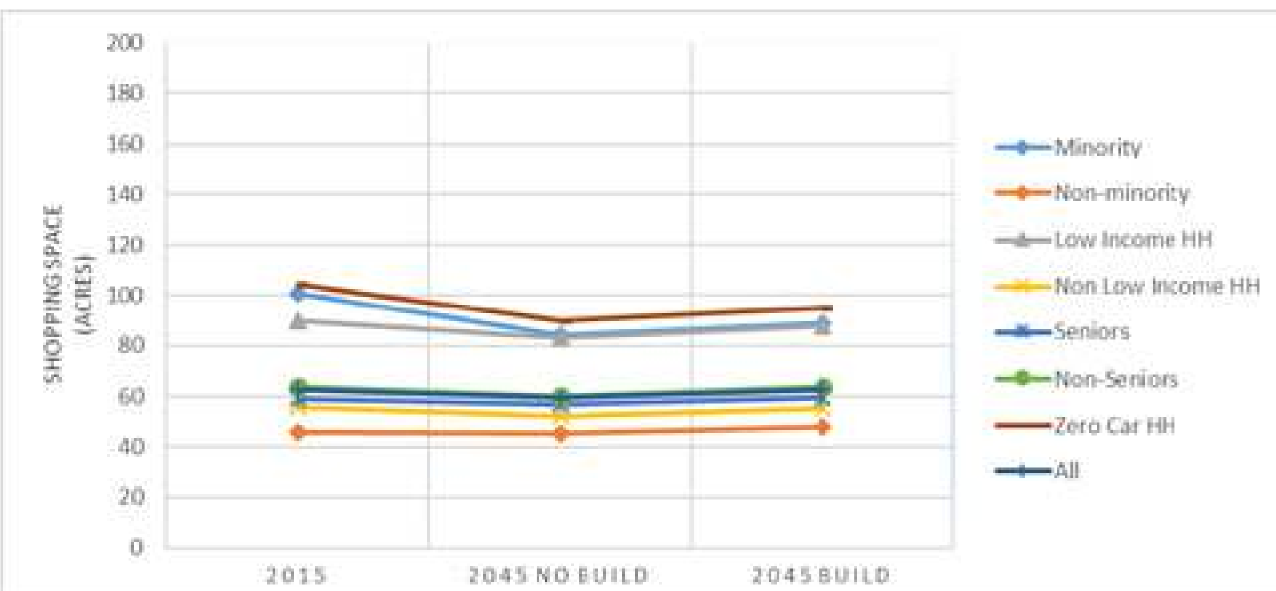


Figure 8
Average Shopping Opportunities within 30 Minutes - Mid-day period by transit



Average Number of Non-Shopping opportunities

Figures 9 and 10 show the target population on average have access to more non-shopping opportunities as compared to non-target population in each scenario. When compared across scenarios, the build condition shows access to more non-shopping opportunities than no-build scenario by auto. The improvement in accessibility appears to be benefiting target and non-target groups in the same way.
It appears that for this measure, there are no prominent disproportionate negative impacts of the transportation projects among the population groups.

Figure 9

Average Non-Shopping Opportunities within 15 Minutes - Mid-day period by auto

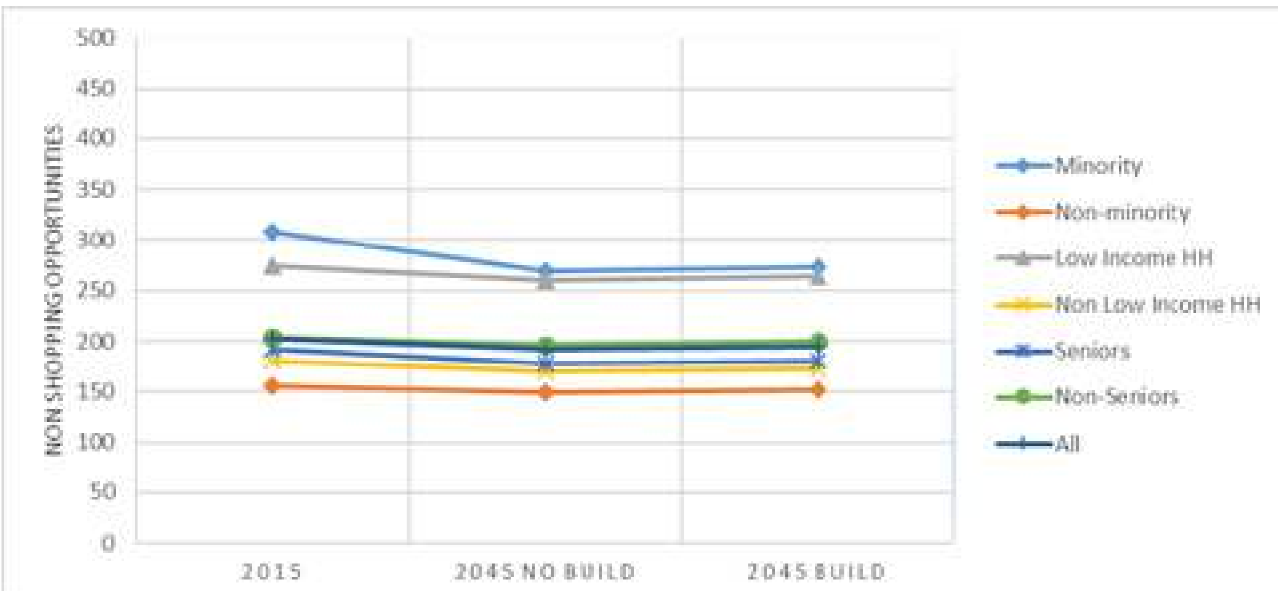
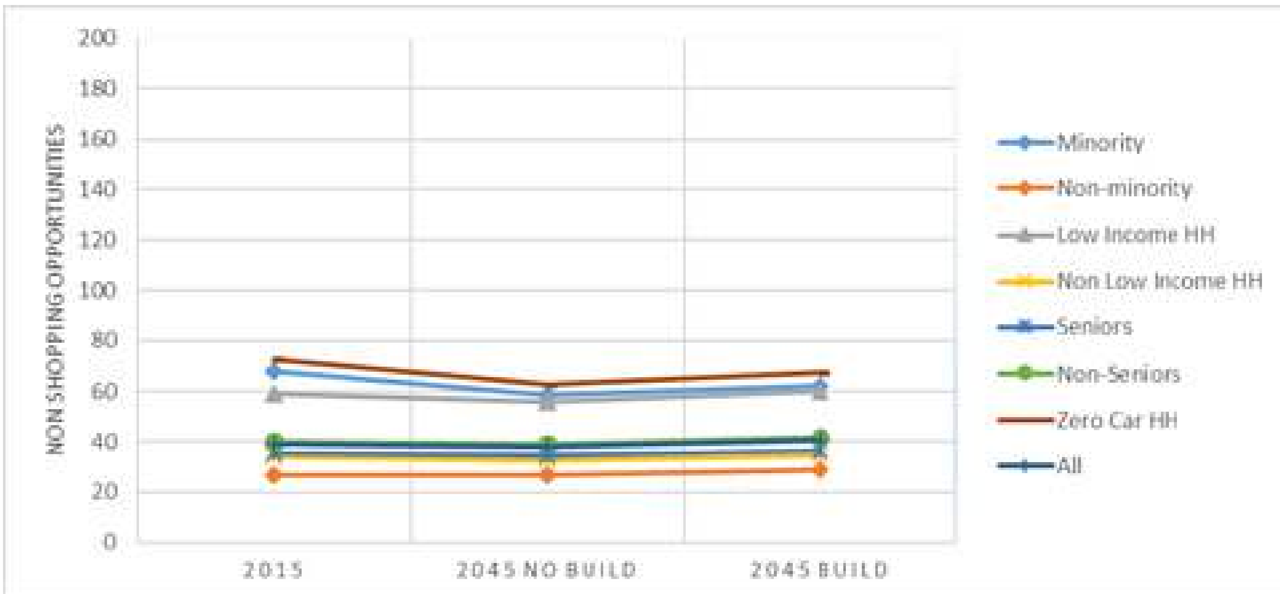


Figure 10
Average Non-Shopping Opportunities within 30 Minutes - Mid-day period by transit



Percent of Population close to a College

Figure 11 shows a higher percentage of target groups within 25 minutes by auto in the A.M. peak period to a college campus as compared to non-target groups. This is true for each scenario. When compared across scenarios, the build condition shows slightly higher percentages then no-build scenario. The improvement in accessibility appears to be benefiting target and non-target groups almost similarly.

It appears that for this measure, there are no prominent disproportionate negative impacts of the transportation projects among the population groups.

Figure 11
Percent Population within 25 minutes AM peak to a College by Auto

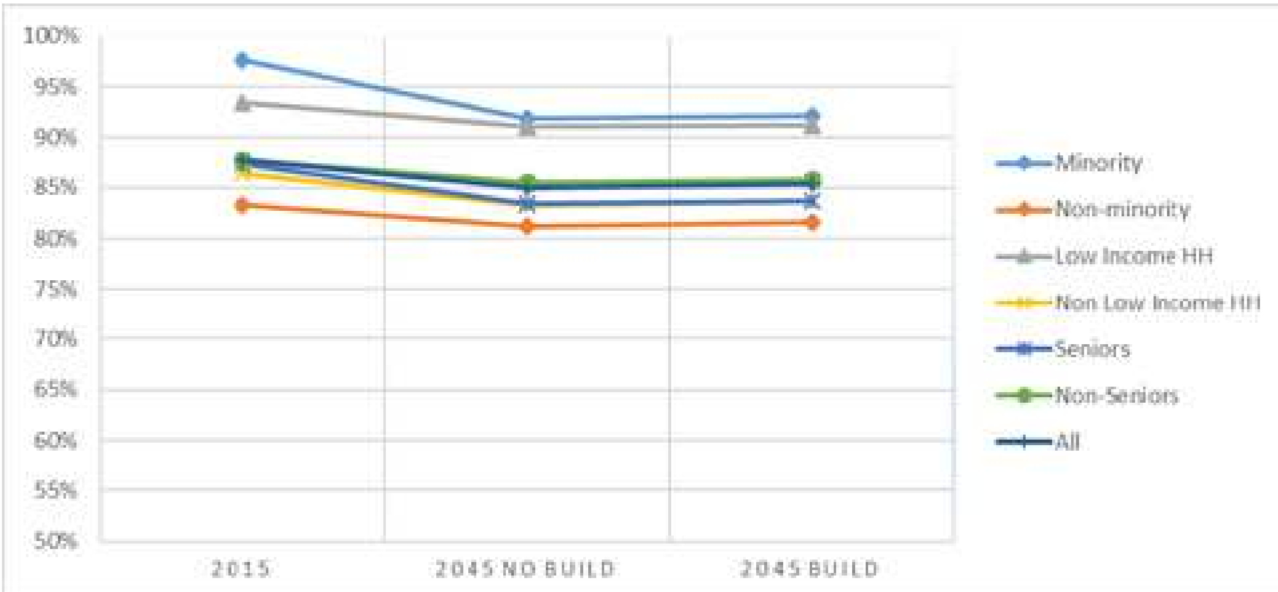
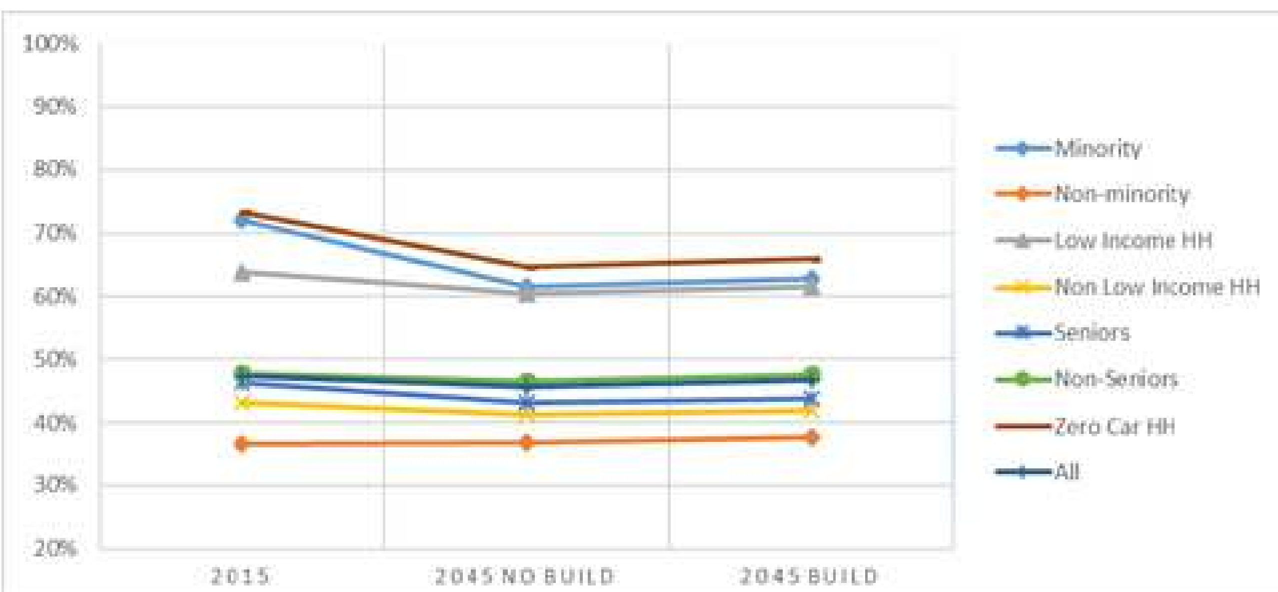


Figure 12
Percent Population within 50 minutes AM peak to a College by Transit



Percent of Population close to a Hospital

Figure 13 shows a higher percentage of target groups within 15 minutes by auto during the mid-day period to a major hospital as compared to non-target groups. This is true for each scenario. When compared across scenarios, the build condition shows slightly higher percentages then no-build scenario. The improvement in accessibility both by auto and transit appears to be benefiting target and non-target groups almost similarly.

It appears that for this measure, there are no prominent disproportionate negative impacts of the transportation projects among the population groups.

Figure 13

Percent Population within 15 Minutes Mid-day Period to a Hospital by Auto

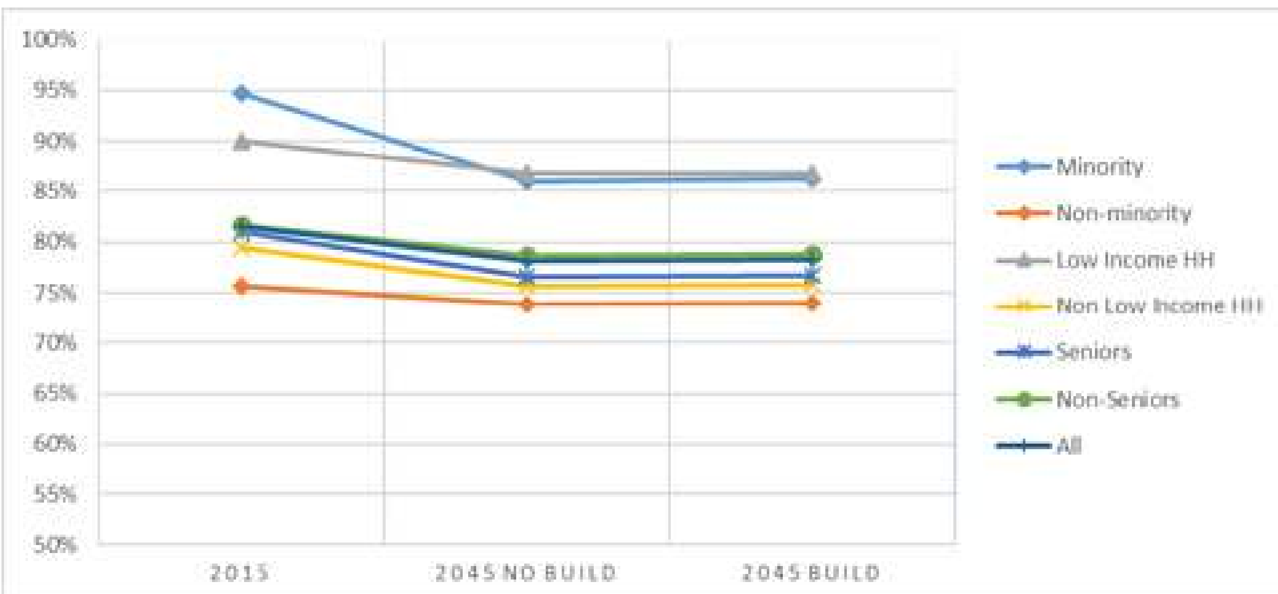
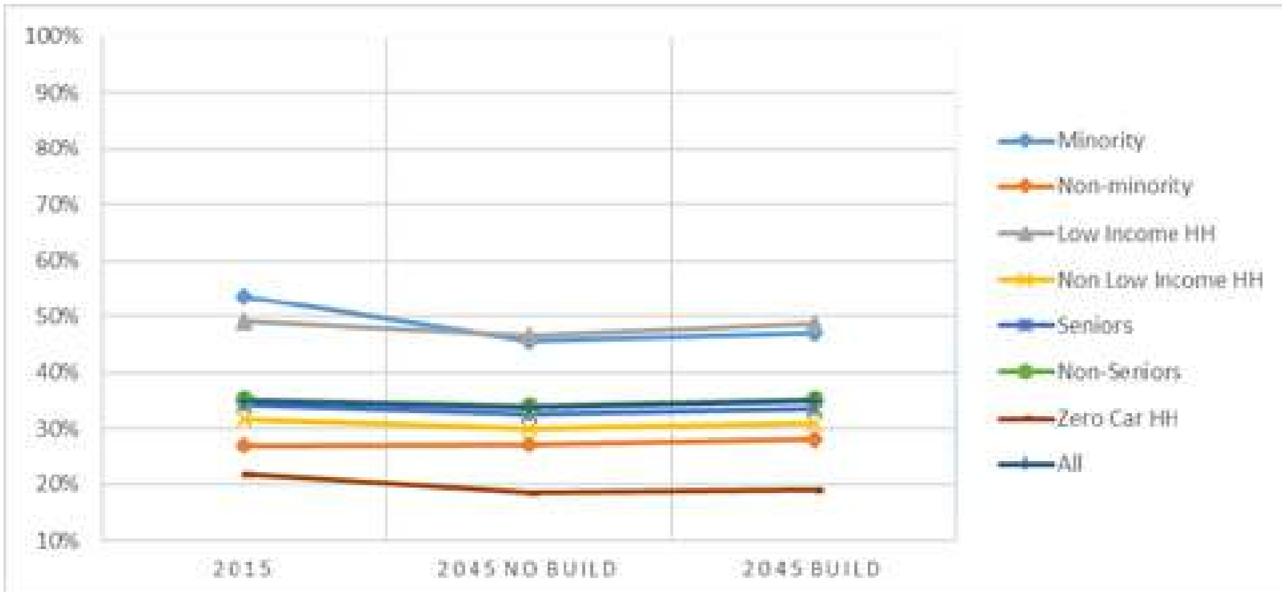


Figure 14

Percent Population within 30 Minutes Mid-day Period to a Hospital by Transit



Percent of Population close to a Major Retail Center

Figure 15 shows a higher percentage of target groups within 15 minutes by auto during the mid-day period to a major retail center as compared to non-target groups. This is true for each scenario. When compared across scenarios, the build condition shows slightly higher percentages then no-build scenario. The improvement in accessibility appears to be benefiting target and non-target groups almost similarly.

It appears that for this measure, there are no prominent disproportionate negative impacts of the transportation projects among the population groups.

Figure 15

Percent Population within 15 Minutes Mid-day Period to a Major Retail by Auto

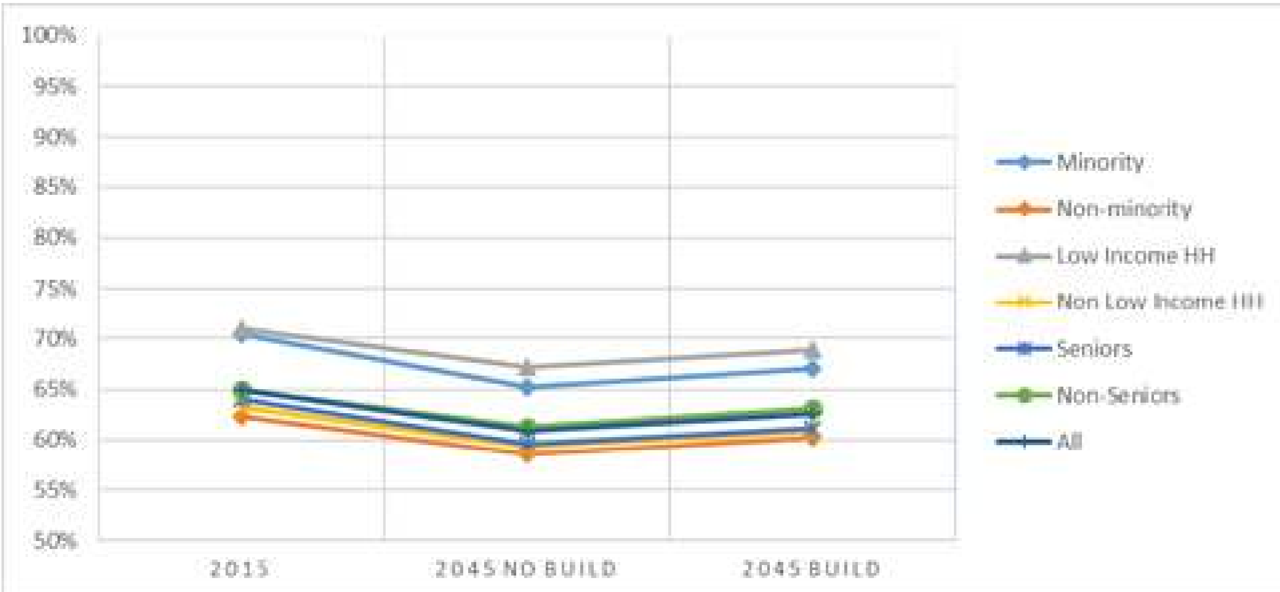


Figure 16

Percent Population within 30 Minutes Mid-day Period to a Major Retail by Transit

Average Travel Time for Work Purpose

Figure 17 shows that the regional average auto travel time for work trip is less for target groups as compared to non-target groups, in each scenario. When compared across scenarios, the build scenario travel times are less for each population group than no-build. Travel time savings are relatively similar for each of the target or non-target group. Transit travel times for some target population groups are slightly higher as compared to non-target group in some instances, but in most cases the difference is within 5 percent. However, the benefits of travel time savings due to improved service seems just.

Figure 17
Average Auto Travel Time for Work

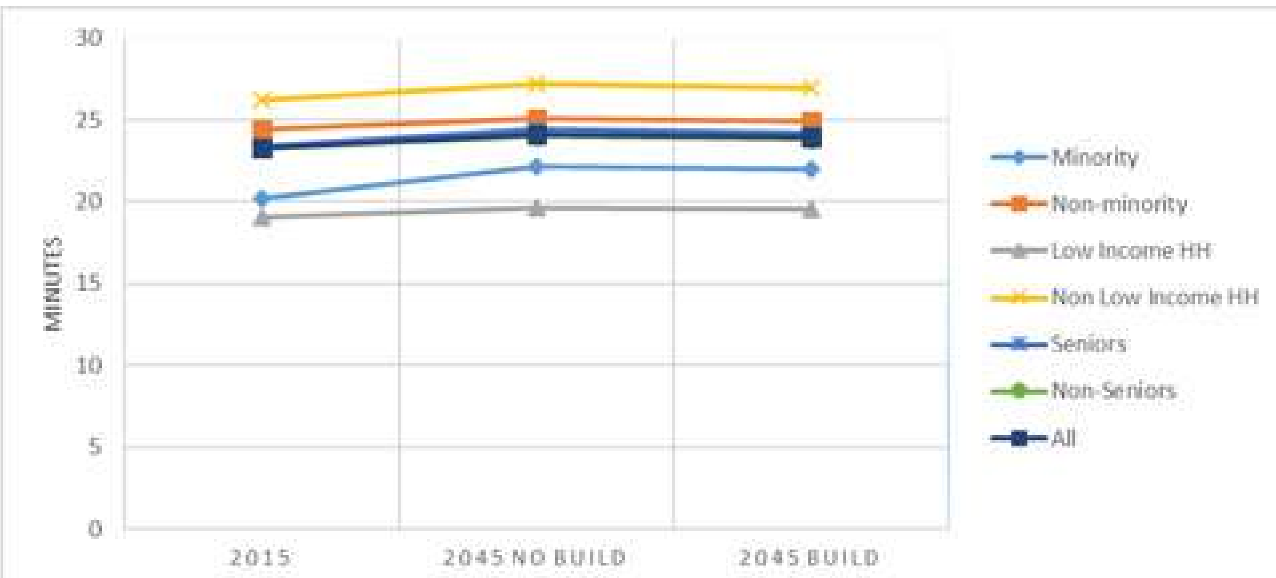
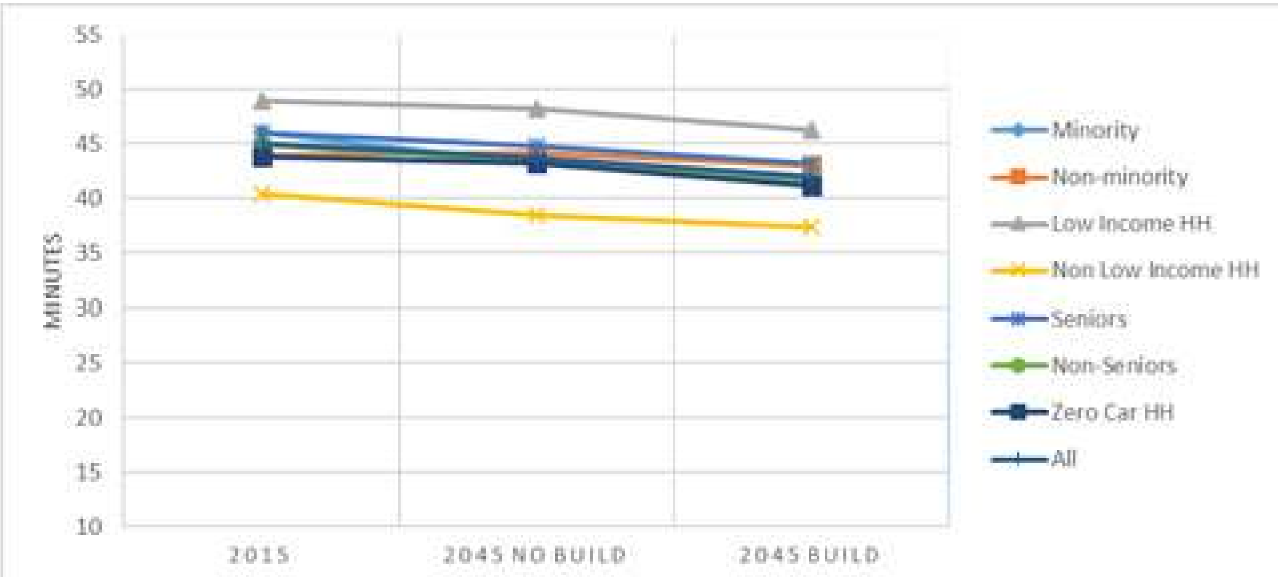


Figure 18
Average Transit Travel Time for Work



Average Travel time for Shopping purpose

Figure 19 shows that the regional average auto travel time for shopping trip is less for target groups as compared to non-target groups, in each scenario. When compared across scenarios, the build scenario travel times are less for each population group than no-build. Travel time savings are relatively similar for each of the target or non-target group. Transit travel times for some target population groups are slightly higher as compared to non-target group in some instances, but in most cases the difference is within 5 percent. However, the benefits of travel time savings due to improved service seems just.

Figure 19

Average Auto Travel time for Shopping

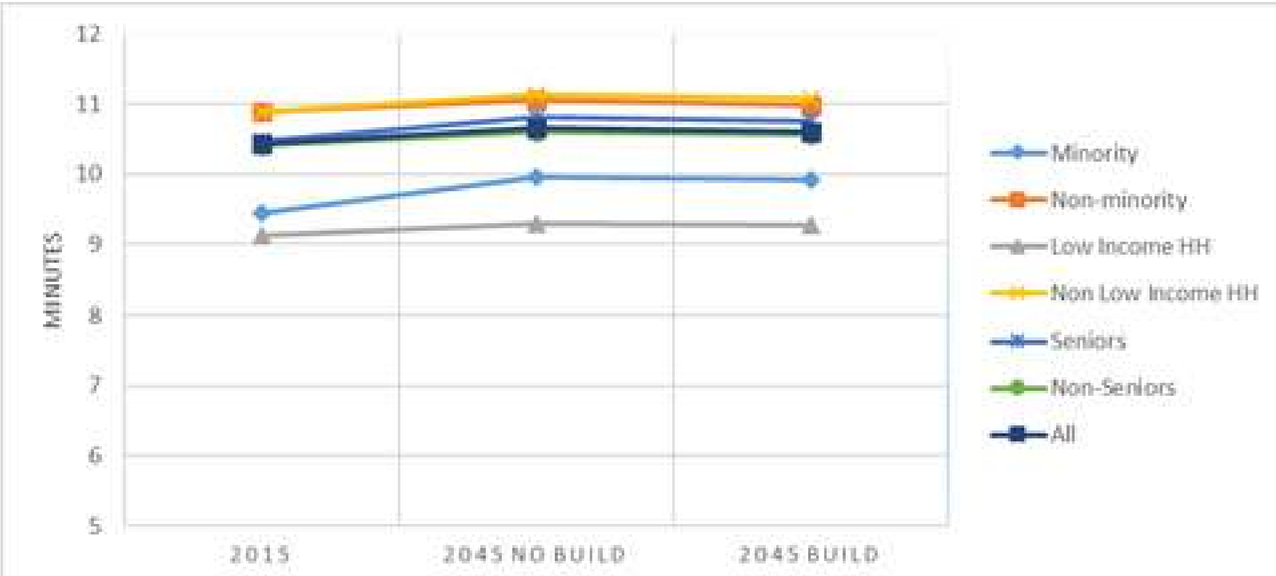
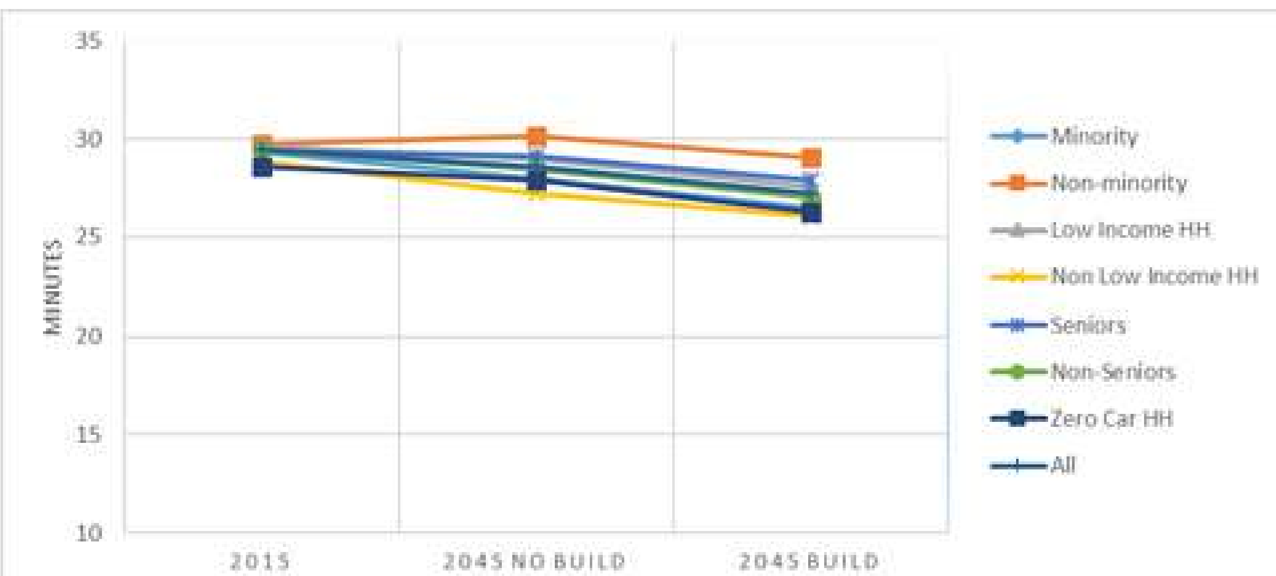


Figure 20

Average Transit Travel time for Shopping



Average Travel Time for Other Purposes

Figure 21 shows that the regional average auto travel time for other purpose trip is less for target groups as compared to non-target groups, in each scenario. When compared across scenarios, the build scenario travel times are less for each population group than no-build. Travel time savings are relatively similar for each of the target or non-target group. Transit travel times for some target population groups are slightly higher as compared to non-target group in some instances, but in most cases the difference is within 5 percent. However, the benefits of travel time savings due to improved service seems just.

Figure 21
Average Auto Travel Time for Other Purpose

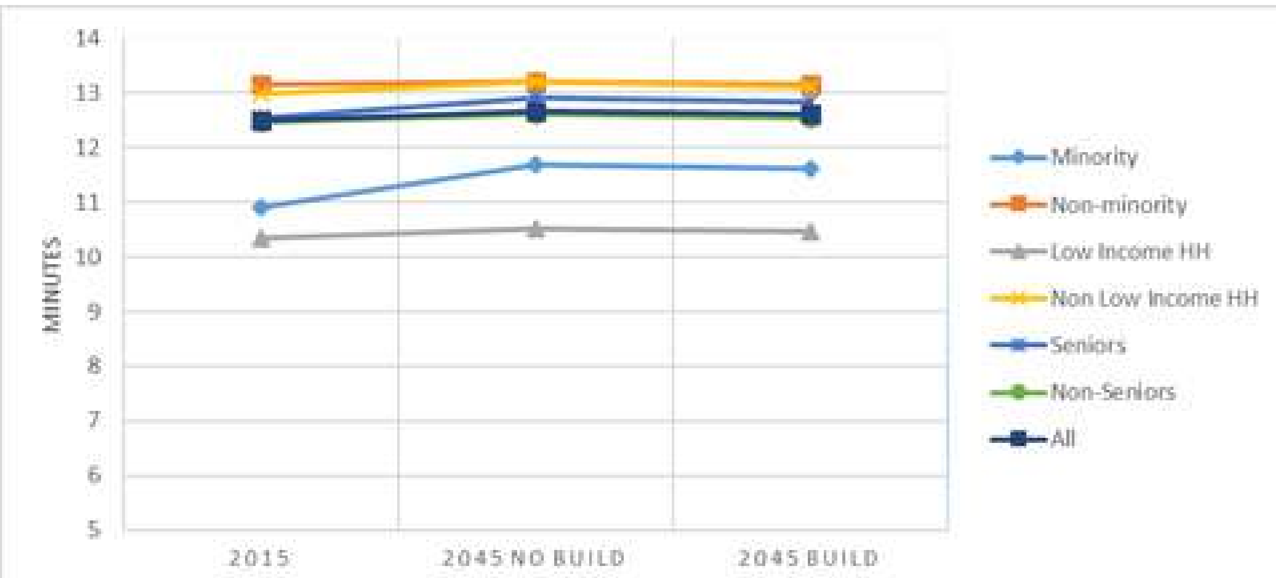
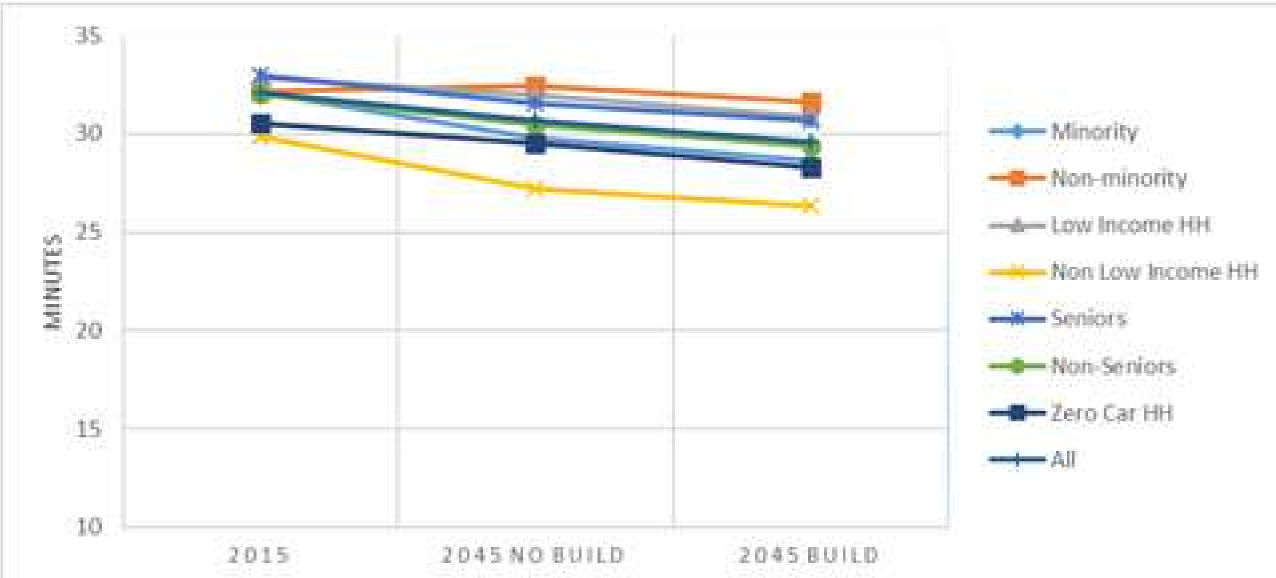


Figure 22
Average Transit Travel time for Other purpose



Average Travel Time for All Purposes

Figure 23 shows that the regional average auto travel time for all purposes combined is less for target groups as compared to non-target groups, in each scenario. When compared across scenarios, the build scenario travel times are less for each population group than no-build. Travel time savings are relatively similar for each of the target or non-target group.

Figure 23
Average Auto Travel Time for All Purposes

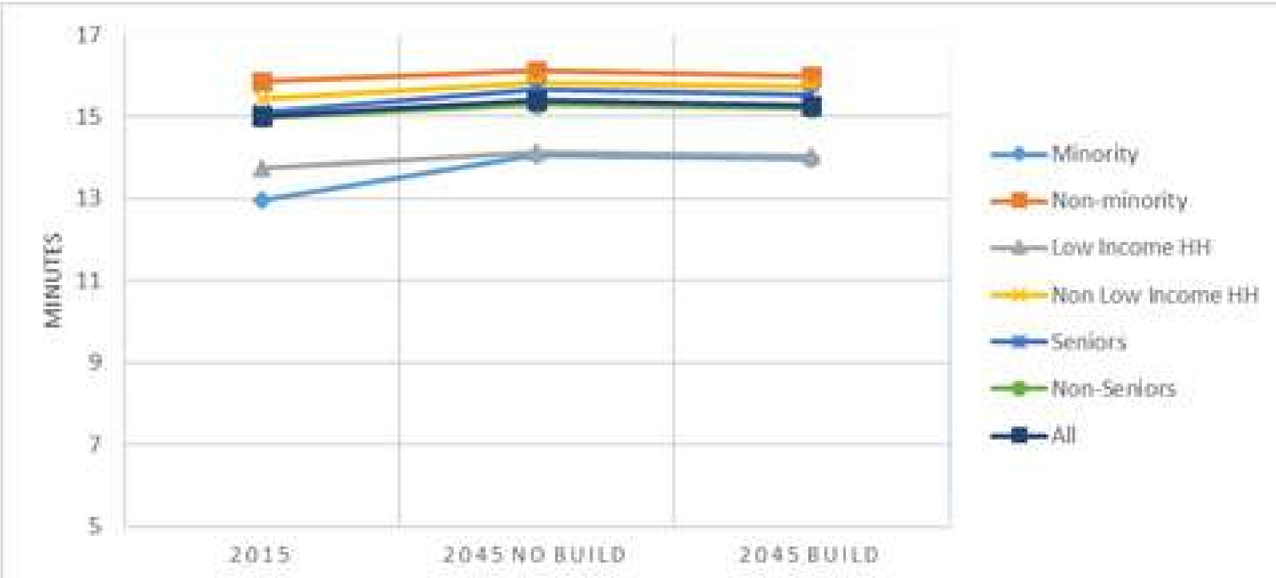


Figure 24
Average Transit Travel Time for All Purposes

Per Capita Transportation Funding

Table 21 shows that the minority population in 2015 accrues a benefit from these projects of nearly $2,000 more per person in project costs compared to the balance of the population and $1,300 more for the forecasted 2045 minority population. Low income households in 2015 and those forecasted in 2045 are getting allocated roughly $2,500 and $2,000 respectively more per household in project costs compared to the balance of households. Additional analysis shows equity for seniors (persons age 65 or older) and for no car households.

Table 21

Per Capita Transportation Funding

	Minorities	Non-Minorities
Population in 2015	1,446,083	3,276,681
% of Population in 2015	30.6%	69.4%
% of Total Project Costs	35.2%	64.8%
Per Capita Funding in 2015	$8,674	$7,059
Per Capita Funding in 2045	$7,844	$6,513

	Low Income	Non-Low Income
Households in 2015	465,635	1,396,869
% of Households in 2015	25.0%	75.0%
% of Total Project Costs	27.5%	72.5%
Per Household Funding in 2015	$21,081	$18,510
Per Household Funding in 2045	$18,748	$16,617

	Seniors	Non-Seniors
Population in 2015	696,810	4,025,954
% of Population in 2015	14.8%	85.2%
% of Total Project Costs	14.5%	85.5%
Per Capita Funding in 2015	$7,427	$7,575
Per Capita Funding in 2045	$6,841	$7,031

	No Car Households	Households with Cars
Households in 2015	158,368	1,704,136
% of Households in 2015	8.5%	91.5%
% of Total Project Costs	10.2%	89.8%
Per Household Funding in 2015	$22,948	$18,800
Per Household Funding in 2045	$19,662	$16,904

Summary

The purpose of this analysis was to demonstrate the impact of the transportation plan on the various demographic groups in the region using quantitative measures, and to assess if there is a disproportionate negative impact of the plan on the target groups. Although these measures cannot encompass all the environmental justice issues, SEMCOG believes they are good indicators as to whether significant environmental justice issues are present.

In general, the measures did not suggest environmental justice issues at the regional system-wide level. In all the transportation scenarios, the target groups seem to have access to more jobs, shopping and other activities, or are close to a college, hospital or major shopping center. Average travel times for various purposes are also lower for target groups.

Comparing current and future no-build condition shows regional development pattern impact, without the transportation system improvements. Future land use policy should be studied to minimize the development impact on accessibility.

Appendix D: Illustrative Projects

Table 22
Illustrative Project List 2045 RTP

	FAC	COUNTY	LEAD AGENCY	YEAR(S)	PROJECT TITLE	PROJECT LIMITS	PROPOSED WORK	PROJECT TOTAL
1	MDOT	Oakland	MDOT	2020	I-96 Active Traffic Management	I-275 to Livingston County Line	Installation of Active Traffic Management System	$5,700,000
2	Washtenaw	Washtenaw	Ann Arbor	2020	Ann Arbor Station Final Design	Ann Arbor	Intermodal station	$5,000,000
3	Washtenaw	Washtenaw	Ann Arbor	2021	Ann Arbor Station Phase I Construction	Ann Arbor	Intermodal station	$55,000,000
4	N/A	Wayne	Detroit International Bridge Company	2021	Ambassador Bridge Enhancement Project	Ambassador Bridge US Customs Plaza to Canadian Customs Plaza	Construct replacement span	$500,000,000
5	Washtenaw	Washtenaw	Ann Arbor	2022	Bandemer Path and Tunnel	Bandemer to Barton (tunnel); Bandemer to Huron River Dr (path)	Construct non-motorized facilities	$5,000,000
6	Washtenaw	Washtenaw	Ann Arbor	2022	Main St Depot to M-14 Active Transportation	Depot to M-14	Construct non-motorized facilities	$5,000,000
7	Wayne	Wayne	WDPS	2025	5 Mile Road	Beck Rd to Napier Rd	Reconstruct roadway, add safety and ITS features	$6,000,000
8	Washtenaw	Washtenaw	Ann Arbor	2025, 2030-2045	Treeline Urban Trail	Main N/Argo to Miller; Miller to Washington; Washington to William; William to Stimson	Non-motorized Trail Development	$74,788,131
9	Washtenaw	Washtenaw	WCRC	2030-2034	Bemis Rd	Whittaker Rd to Rawsonville Rd	Pave gravel roadway	$4,000,000
10	Washtenaw	Washtenaw	WCRC	2030-2034	Mansfield St	Michigan Ave (US-12 BR) to Congress St	Reconstruct roadway	$1,500,000
11	Washtenaw	Washtenaw	Ann Arbor	2030-2035	State St	I-94 to Oakbrook	Reconstruct as boulevard and add non-motorized facilites	$20,000,000
12	Washtenaw	Washtenaw	Ann Arbor	2035-2039	Ann Arbor Station Phase II Construction	Ann Arbor	Intermodal station	$32,000,000
13	Washtenaw	Washtenaw	WCRC	2035-2039	Bemis Rd	Carpenter Rd to Stony Creek Rd	Pave gravel roadway	$4,000,000

	FAC	COUNTY	LEAD AGENCY	YEAR(S)	PROJECT TITLE	PROJECT LIMITS	PROPOSED WORK	PROJECT TOTAL
14	Washtenaw	Washtenaw	WCRC	2035-2039	Ellsworth Rd	Wagner Rd to Maple Rd	Pave gravel road-way	$750,000
15	Washtenaw	Washtenaw	WCRC	2035-2039	Fletcher Rd	Scio Church Rd to I-94	Pave gravel road-way	$3,600,000
16	Washtenaw	Washtenaw	WCRC	2035-2039	Merritt Rd	Stony Creek Rd to Hitchingham Rd	Pave gravel road-way	$1,000,000
17	Washtenaw	Washtenaw	WCRC	2035-2039	State Rd	Textile Rd to Morgan Rd	Widen from two lanes to four-lane boulevard	$16,000,000
18	Washtenaw	Washtenaw	WCRC	2035-2039	State St	Morgan Rd to Ells-worth Rd	Widen from two lanes to four-lane boulevard	$15,000,000
19	Washtenaw	Washtenaw	WCRC	2040-2045	Seven Mile Rd	Main St to Seven Mile Rd	Construct new two-lane road	$1,600,000
20	Washtenaw	Washtenaw	WCRC	2040-2045	State St	US-12 (Michigan Ave) to Textile Rd	Widen from two lanes to four-lane boulevard	$12,000,000
21	Washtenaw	Washtenaw	WCRC	2040-2045	Willow Rd	Stony Creek Rd to Platt Rd	Pave gravel road-way	$2,400,000

Appendix E: Public Comment

Public Outreach Report

To complement data analysis in the 2045 Regional Transportation Plan, SEMCOG sought out the perspectives of people who use the regional transportation system. SEMCOG employed multiple methods in engaging residents and stakeholders. Across these methods, people shared input about the breadth of transportation topics that will be covered in the 2045 RTP including road and bridge conditions, safety, transit, environmental impacts, congestion, bicycle and pedestrian access, freight transportation, and international border crossings.

This report summarizes the results by topic area and gives an overall view of the public's level of satisfaction with the region's transportation system and their attitudes toward prioritizing transportation improvements. The results of the public outreach will help to inform the decision making process for investing in transportation in the future which will be outlined in the 2045 RTP.

The entire report can be found at semcog.org/RTP.

Table 23
Public Comments Recieved for the 2045 RTP

First Name	Last Name	Title	Organization	City	County	Date	Note
Pat	Williams	Supervisor	Charter Township Of Canton	Canton	Wayne	9/20/2018	I would like to ave entered into the formal records of our meeting today the following comments that I am making on behalf of Supervisor Nix of Northville Twp at this request: Northville Township is respectfully requesting that the 2045 & the 2020-2023 Road Plan for SEMCOG include or contain additional lanes on Beck Road between 6 and 8 Mile Roads. There is a significant project called the Villages that is coming to 5 Mile and Beck Road that is underway. The City of Novi and Oakland Conty are currently working together to expand the number of lanes from 8 Mile to I-96. In the end, there is great need for an appropriately sized thoroughfare from M-14 to I-96 on Beck Rd. Briefly on behalf of Canton Township - I believe all are aware that we recently passed a millage which will allow for Ford Road to finally become a boulevard. In order for the Ford Road Boulevard project to be successful, we will need SEMCOG and Wayne County to add the North and South Haggerty Road loons work required for this project into the Road Plans.
Joel	Batterman			Detroit	Wayne	2/22/2019	History of regional planning in Detroit; need to emphasize priorities other than capacity expansion.

First Name	Last Name	Title	Organization	City	County	Date	Note
Mark	Flanders	Citizen		Detroit	Wayne	7/16/2018	Further expansion in Oakland County would occur on West & East Eight Mile Road. It will would be placed on the wide median between the Cities of Northville and Saint Clair Shores. Power lines would be buried in median median to expedite installation of Light Rail between those two (multi- direction) cities in Oakland' County. Further, this expansion of bi-directional Light Rail on West and East Mile Road; would necessitate the burial of Electric light power on the median of this widely Oakland This burial of electric power, would ensure the expansion of mass transit to both West & East Eighth Mile Road. This event would further bring unity to Northville & St . Clair Shores. Northward expansion of light rail would further peace & prosperity in both Oakland & Macomb Counties.
Todd	Scott	Executive Director	Detroit Greenways Coalition	Detroit		2/9/2017	Subject: Public comment for project #23332 - Sub-Project of 12806 Douglas MacArthur Bridge (2018) This project should improve the current bike lanes on the bridge. They are too narrow and are unprotected from the vehicle lanes. They do not meet the city of Detroit's minimum standards. They also collect debris which effectively narrows them. One outbound lane could be removed to provide the necessary extra width for bicycles. Bicycle improvements are also called for between Jefferson and the bridge. The curb-to-curb bike lane transitions on the island should also be addressed to improve their safety. Permanent in-ground bicycle and pedestrian counters should also be installed as part of this project.
David	Palmer	Director Of Business Partnerships	Workforce Intelligence Network	Detroit	Wayne	7/5/2017	I was just engaging in a discussion about the RTP survey. Nice user interface! Would it be possible to also have the survey tool be made available in Arabic?
Alyson	Burtle	Citizen				11/5/2018	Please make contiguous sidewalk from Roseville to St Clair Shores along 11 Mile road over I-94.
David	Gordon					4/3/2017	Hello SEMCOG: Thank you for sending the invitation to comment. I must say, the process feels daunting and might be more welcomed by the public if it was broken down into smaller pieces. "2017 Spring Amendment - 26 additions, 10 deletions, 28 cost modifications and free changes in project scope." This is not only a lot to review, but when I clicked on your link, it opens a spreadsheet that lacks an index or summary, any explanation, and the typeface is blurry to the point of being worthless. Please fix it. Here's my overarching comments about roads in Michigan: 1. Don't build another foot of roads until you've got enough money in the budget to maintain what we've got. 2. Allow congestion to constrict sprawl. When congestion gets sufficiently bad, look to public transportation alternatives. People will choose their cars over public transportation until it's overwhelmingly inconvenient to use your car. 3. Please disabuse yourself of the bias that growth is the answer to the challenges of the people of Michigan, human beings in general, or the planet. I look forward to an updated invite with links to something useful. Thank you.

First Name	Last Name	Title	Organization	City	County	Date	Note
Steve	Innes					2/8/2017	Subject: Public comment for project #23332 - Sub-Project of 12806 Douglas MacArthur Bridge (2018) When doing a new road covering this year, it would be a great time to expand and increase safety for the bike lanes. They are very narrow and there is no protection from cars. There are 3 lanes leaving the island and only 2 on. One of the lanes can be used for safer bike traffic. Also, the crossover at the island side is dangerous. I can't believe there hasn't been an accident yet.
Douglas	Lapp					2/9/2017	I am writing today to make a request that consideration be taken for bicycle lanes on MacArther Bridge in 2018 while other repairs and upgrades are made. Currently the bridge has 2 lanes Eastbound onto Belle Isle and 3 lanes Westbound towards Jefferson Ave. Having ridden my bicycle on and off the island, I know how it feels when cars try to pass you while staying in the lane, rather than slowing down till they can move over a lane to pass. It seems like a logical step, to remove one of the lanes Westbound toward Jefferson Ave. and create a protected (cement barrier or other form of separation) lane, either one on each side for each direction, or one larger protected lane for multi direction bicycle traffic. Obviously the road is setup in a fashion that separate uni-directional lanes would make the most sense. Either way, I would like to see plans to facilitate a better environment for cyclists, walker, runners and alternative modes of transportation to and from Belle Isle.
Jeff	Spakowski					2/9/2017	As an avid cyclist in the city of Detroit, I am writing today to share my thoughts about the renovations that will take place in 2018 at the Douglas MacArthur Bridge. Quite simply, riding my bike from Jefferson to Belle Isle is the most unsafe I feel riding in Detroit. Vehicles routinely drive in the existing bike lanes, which are often filled with glass. There are 5 lanes of traffic. Please consider removing one vehicle lane and using the recovered space as protected bike lanes. With the launch in the spring of 2017 of Detroit's first bike share program, more and more visitors to Detroit will want to visit Belle Isle via bicycle. Thank you for reading and considering adding bike lanes along the bridge to reflect all the protected bikes lanes going in throughout the city we all love.
Maria	Urquidi			Detroit			As a Detroit resident who uses my bicycle for transportation, I would like to add my voice to those advocating for BUFFERED bike lanes on the MacArthur Bridge. Cars drive much too fast on the bridge and the current bike lanes do not leave any room for error. I worry about families with children trying to cycle to Belle Isle across the bridge as well as inexperienced cyclists who have rented a bike to explore the park. Unprotected bike lanes are an idea whose time has passed; please follow current practices and protect the growing number of people in Detroit who ride bicycles for fun, exercise, transportation or out of necessity.

First Name	Last Name	Title	Organization	City	County	Date	Note
Dorina	DuFresne					3/10/2017	I wish bike lanes were not in the road with cars! It is scary as a driver to pass them and scary as a parent of a athlete that bikes to see these people on the road. To many distracted drivers as well as debris on the road that can make them fall with those skinny tires. Widen side walks to make room for bikers! It would be safer for everyone! I would Love more safe biking and walkable access so I wouldn't need a car to go to a store, park or school etc. I live where you have to walk on a road to get anywhere even the nearby park, scary. A Lady a few years ago was hit in the early AM and was left in the ditch almost died there. Thank you, Dorina DuFresne
Ken	Durham	Citizen					I JUST WANTED TO SAY THAT WE ARE SENIOR CITIZENS, RETIRED FOR 20+ YEARS ON A FIXED INCOME. TAX INCRESES IN THE LAST SEVERAL YEARS ICLUDED INCLUDED: SEMTA TAX, DOUBLING THE PREVIOUS TAX RATE STERLING HEIGHTS TAX FOR ROADS AND PUBLIC SAFETY STERLING HEIGTS TAX INCREASE FOR PARKS AND CITY BUILDING IMPROVEMENTS COUNTY TAX INCREASE FOR THE SEWER CAVE-IN. STATE GAS TAX AND LICENSE PLATE TAX WE ARE CURRENTLY FACING INCREASED TAXES FROM: STERLING HEIGHTS FOR ADDITIONAL MONEY FOR ROAD REPAIRS MCCC RENEWED AND INCREASED TAXES COUNTY INCREASING TAXES FOR COUNTY ROAD REPAIRS RTA TAXES WE DON'T WANT THE BUS SERVICES OR THE DEDICATED LANES. WHY CAN'T A NO VOTE MEAN NO? WHY CAN'T THOSE WHO WON'T USE THE SYSTEM BE EXEMPT? THERE IS NO TRUST FOR THOSE WHO WILL BE IN CHARGE OF THIS PROJECTS: HUGE SALERIES CRONY HIRING DELAYS COST OVER-RUNS PAY-OFFS BACKROOM DEALS AND, MORE AND MORE MONEY WILL BE NEEDED TO KEEP THE PROJECT GOING AND EVER GROWING. THE WAYNE COUNTY JAIL FIASCO AS AN EXAMPLE OF WASTE AND FRAUD. PLEASE DON'T DO THIS TO THE LEAST WHO CAN AFFORD TO PAY FOR IT.
Gloria	Heller					9/14/2017	Comment for the 2045 Regional Transportation Plan: As a resident of Macomb County, where transportation needs are distinct from Oakland and Wayne County, the caller was against Macomb County's participation in and contribution to a regional transit system. Caller was against the November 2016 Regional Transit Authority vote for to raise local revenues for transit and against any future requests for raising local revenues for regional transit funding. In addition the caller indicated that buses were not safe to travel on, spread disease, and contribute to street drug distribution.

First Name	Last Name	Title	Organization	City	County	Date	Note
Jim	Licata	Citizen				12/27/2018	Please consider these comments and suggestions for the Mound Rebuild. • The rebuild should be part of a broad upgrade plan to help Michigan become a national leader of smart roads and cities across the U.S. • Work with transportation companies, automotive companies and suppliers in the area to align with needs of vehicles now and in the future • Minimize traffic flow disruption and maximize safety during construction • The resulting topography should look nice and clean with landscaping that is pleasant and fitting for our climate • Make provisions (save money) to provide continuous landscaping service for the boulevard • Install traffic signals that (work correctly and) help the flow of traffic on Mound road and crossroad (east/west) travelers • Support local school traffic concerns and keep allow for safe and efficient bus transportation • Install state of the art signage and provide excellent communication about traffic conditions to travelers • Bike paths should be safe and connect with existing bike paths in the area
Ron	Ponichter	Citizen				1/3/2019	Subject: mound reconstruction in 2020-2022 1. Ban semi-trucks on southbound lanes between 6am & 9am; 2. Ban semi-trucks on northbound lanes between 3pm&6pm 3. check regularly for overweight trucks and impound them; 4. require semi-trucks speed limitations of 10 miles per hour less than all other vehicles; 5. restrict semi-trucks to one desig-nated lane;
Ann	Bollin	Representa-tive, Dist. 42	Michigan State House of Represen-tatives	Lansing	Ingham	11/21/2017	Areas of concern for Brighton Township w/r/t the 2045 RTP. 1. I-96/Grand River Ave. Interchange has several problems that are getting worse. First, the condition of the bridges are poor. Second, the tight cloverleaf design with commercial uses packed around it intensifies the effect of peak hour traffic. In particular, Hilton Road has little space to exit onto Grand River before accessing I-96. Left-turning Hilton traffic often backs up on Grand River. Third, new Michigan Medicine facility opening will add to existing congestion. Suggests routing Michigan Med-icine traffic to Latson Road exit to reduce pressure on Grand River exit. 2. Pleasant Valley Road bridge over I-96 is closed due to a truck strike in September 2017, reducing access from Brighton Township to Grand River Avenue and parts of Brighton Township south if I-96.

First Name	Last Name	Title	Organization	City	County	Date	Note
Kevin	Marek	Citizen		Rochester		1/17/2019	I attended a public meeting in Troy prior to the holidays. I hope that my comments at this time, can be considered. I noticed that a significant portion of the information provided was focused on road projects. I suppose that this is appropriate considering that most travel by road. I think, however, that it is important to begin placing more emphasis on other modes of travel, as this will be necessary at some point in the future, and those regions that have the infrastructure in place will be at an advantage. It should be noted that taking private property off the tax rolls in order to expand and build more roads, reduces the funding available to pay for such expansions. Some cities are beginning to reverse this long trend by returning streets to private ownership, increasing population density which leads to greater walkability and more heavily used public transit. Public transit is almost always less costly to build than new roads. And when more people are walking and using public transit, traffic congestion will be reduced. In the decades that I have tried to use public transit in metro Detroit, I have been frustrated by unavailable and unreliable service. Transit operators, be it drivers or office staff, are not customer focused, and this needs to be addressed if ridership is to be increased. I saw some reference at the public meeting about a consolidated payment system. This is essential. Such consolidated systems have been in place by other regional transit systems for years, and there is no reason why the Q-line, SMART, the people mover, D-DOT should each have a unique fare collection system. SE Michigan has a lot of multi-lane roads with wide medians. This requires transit users to walk significant distances to access bus stops, if not upon arrival, then for the return trip. A creative use of medians for transit needs to be investigated. If bus stops were to be located in the median, users would be required to walk only half way across busy streets thus making transit more appealing. Larger, but fewer bus stops would be required if they were in the median and shared by passengers traveling in both directions. More people at the bus stops would likely make them feel safer too, leading to increased usage. I saw nothing at the public meeting about commuter rail or Amtrak. By making these an option for daily metro commuters or those traveling outside of the region, cars will be removed from area roads, reducing traffic congestion and the expense of road expansion. The state has made a significant investment in the rail line between Detroit and Chicago, but has not increased the number of trains on the route. Trains throughout the day are needed, including a bridge between the Chicago-Detroit route and the NYC-Buffalo route. Connecting these 2 routes that now serve 2 sep-

First Name	Last Name	Title	Organization	City	County	Date	Note
Alex	Elkins	Citizen				2/14/2019	I drive 60 miles each day for work. Yes, the roads need repairs, but more appalling is the lack of real alternatives to gas-guzzling cars in southeast Michigan. Working people and commuters should have fast and free passenger rail in the most densely populated area of the state. Rail is cost-efficient, better for the environment, faster, and safer. We are on the brink of ecological catastrophe, a reality which your plan fails to recognize. Stop widening highways, build rail lines.
Paul	Gross	Meteorologist	WDIV - TV4	Detroit	Wayne		I have made this suggestion several times over the years, but there is one project not being considered that would have a noticeable impact on improving traffic flow for a very obvious morning rush hour trouble spot: the M-10 (Lodge) Freeway / Davison interchange. If you monitor morning rush hour traffic on southbound M-10, every single day you'll find a significant backup starting at the Davison and normally extending all the way up to 7 Mile… sometimes even farther north than that. The reason is so simple that I'm surprised nobody else has discussed this: the Davison Freeway enters the Lodge Freeway with entrance ramps and slow traffic on both sides of the freeway. So, you have traffic rapidly slowing in both the right and left lanes, with the center lane slow because everybody is trying to get out of those two curb lanes. Every single day you see the traffic quickly ramp up back to normal freeway speeds just south of the Davison. There is no question that the daily morning back-up is being caused by the interchange design. I've driven the Lodge for over thirty-five years now, so I know this firsthand. If the interchange were redesigned so that Davison traffic entering the southbound Lodge FIRST merged onto a single right lane entrance ramp, you would significantly improve one of our area's most dependable morning rush hour slow-downs. Traffic was so much lighter when this interchange was designed decades ago…I'm sure the interchange would have been designed differently if the engineers back then knew the amount of traffic the Lodge handles today. Clearly, the current heavy traffic volume will not diminish in the decades ahead. If promoting better traffic flow is any part of your long term goals, then you would consider this idea.

First Name	Last Name	Title	Organization	City	County	Date	Note
Alan	Connor	Citizen		Ann Arbor		8/11/2017	RTP Public Comment I have read the draft of your comprehensive public transit plan for the SEMCOG region. It looks to be very practical and pragmatic for the urban areas of the region. The use of Bus Rapid along the major business corridors and routes to and from major places of employment and commerce is a positive for reducing commuter automobile traffic, congestion, accidents and GHG emissions. It also increases pedestrian and bicycle safety. Although I am a community planner and developer by trade, I have not done much transportation or large city urban development planning. Most of my work has been in rural regions and small towns. I do not see much in your plan that enables rural residents to get to urban located employment, stores and services. I know you cannot have bus service on every back road. And automobile density and tail pipe emissions are not much of a problem in rural areas. I wonder, though, if it would be possible and logical to locate park and ride places along bus lines in less urban locations and at commuter rail stations that would be convenient for rural residents. Not all rural residents are farmers. But farmers need to get to the city occasionally. The bicycle and pedestrian rights of way and the border to border trail are also positives for safety, health and enjoyment of nature. Just my off the cuff thoughts for whatever they are worth.
Buzz	Brown	Government IT And Fiscal Efficiencies	Munetrix	Auburn Hills	Oak-land	7/5/2017	FYI: the recent Transportation Plan survey was the most confusing survey I have had to complete. Twice I tried to respond but could not get the survey to re-spond. What was most discouraging is the last screen would not allow me to enter a comment; therefore this email was sent.
Joel	Batterman			Detroit	Wayne	3/14/2019	Need to think carefully about proposed road capacity projects.
Claire	Nowak-Boyd	Citizen		Detroit	Wayne	3/14/2019	Pro-public transit
Thomas	Zerafa	TRU-MOSES		Oak Park	Oakland	6/22/2017	Why our region needs to revisit a ballot plan for 2018.
Mason	Herson-Hord	Citizen		Detroit		3/14/2019	Highway expansions are a social and ecological disaster, robbing my generation of our future.
Megan	Owens	Executive Director	Transportation Riders United	Detroit	Wayne	3/14/2019	Oppose widenings/"capacity" projects, need greater investment in public transit.

Appendix F: Travel Demand Forecasting Process

Introduction

The regional Travel Demand Forecast Model (TDFM) quantifies the amount of travel expected to take place on the transportation system. The results are used to estimate the impacts of constructing new or improved highways, implementing alternative transportation services or demand management activities. This information is used in the Metropolitan Planning Organization process to aid decision-makers in selecting transportation plan alternatives, policies, and programs. In addition, the results provide detailed information, such as traffic volumes for local engineers and planners to use in facility design.

The TDFM is developed and calibrated based on information collected in the 2010 SEMCOG regional transit on-board survey, 2005 and 2015 SEMCOG household travel survey, 1996 regional commercial vehicle survey, 1995 external station survey, 2015 traffic counts and purchased 2015 transportation Big Data - StreetLightData. These surveys recorded number of trips made, trip purpose, origin and destination of the trip, travel mode, how transit was accessed, time of day the trips were made, and other pertinent information concerning both the trips and travelers. Socio-economic forecast from 2045 Regional Development Forecast was used as input to the travel models.

Model Description

The TDFM is run on personal computers using TransCAD, a Windows-based urban transportation planning model program. The major elements of the system mirror the hierarchy of decisions faced by travelers: whether to make a trip, where to make a trip, what mode to use, when to travel, and what route to take. The TDFM is based upon forecasts of urban activity and a model of the highway and transit networks. The TDFM models intra-regional person travel, regional commercial vehicle travel and travels to the outside of region.

The E1 version of the TDFM was completed in October 2002. Subsequent improvements produced versions E2 and E3 and these models were used for the 2030 RTP process. The E4 and E5 versions were used for the 2035 cycle TIP and RTP development and updates. The E6 version, completed in 2012, was used for the 2040 RTP travel forecasts and subsequent TIP developments. The E7, the most recent version developed with TransCAD 8.0, will be used to produce final 2045 RTP travel forecasts.

Traffic Analysis Zones

The modeling area usually represents the areas desired for forecasting travel demand and analysis of policy alternatives. The model area for the SEMCOG model is the SEMCOG seven county planning region itself. This region must be divided into traffic analysis zones (TAZ) for modeling purposes. The zone system and transportation networks are linked to the level of detail needed for the model. The model area also includes “external” zones, or stations, representing areas reflecting the “other” ends of trips with only one end inside the study area. These external zones represent roadways crossing the model area cordon.

Since the E5 model, SEMCOG has developed a much more detailed zonal system than the system used previously. This work was coordinated with the St. Clair County Transportation Study (SC-COTS), the Toledo Metropolitan Area Council of Governments (TMACOG), and the Washtenaw Area Transportation Study (WATS). Today, the E7 zone system divides the seven-county model area into 2,811 internal zones (up from 1,442 in the E4 model) and 88 external stations (up from 63 in the original E4 model). Hence, there are a total of 2,899 zones. The internal zones are numbered sequentially from 1–2811, while the external stations are number sequentially from 2812–2899. All socio-economic data used in the model are posted at TAZ level.

Highway Network

Descriptions of the highway network provide information on "supply" side of the urban transportation. The TDFM contains detailed information of highway infrastructure such as location, length, number of lanes, functional classification, and uses this information to assess transportation supply capability in the region.

For the functional classification, the TDFM uses national functional classification (NFC) grouping system, supplemented by special flag to distinguish the highway mobilities within each group. The NFC includes seven groups: interstate, other Freeways, other Principal Arterials, minor arterials, major collectors, minor collectors, and local. For the area type, the TDFM uses urban business, urban fringe, urban, suburban, and rural definitions. Minimum travel paths are then calculated using travel time, distance and generalized cost on the highway system.

To ensure geo-accuracy of the highway networks, the SEMCOG E7 travel model base year network has been completely rebuilt using the Michigan Geographic Framework (MGF) 16.0. Similar to the E6 model, the E7 model also uses a multi-year network management system to maintain highway network and planning project consistencies among all the modeling years.

Transit Network Modeling

In parallel with the highway system, the transit network reflects a system supply available to transit riders. The transit model has been completed rebuilt for the E7 model. The base year transit systems were developed according to year 2015 published schedule provided by regional service providers (DDOT, SMART, AATA, etc.). Walk access links and park & ride lots were re-constructed as a part of the network configuration. For the future year networks, the transit systems were built based on the current year - 2018 published schedule provided by each transit agency.

In addition to the network development, three tasks were carried out to enhance the E7 transit model:

- Update transit network parameters, rules and settings, such as mode definition, in-vehicle travel times, out of vehicle travel times, SMART bus pickup and drop off rules in city of Detroit area.
- Updated transit time-of-day model to be consistent to transit operation schedules, and
- Reviewed and improved the accuracy of parking cost data in E7 model using new surveyed parking lot information.

These important updates were to ensure that the transit model is in line with the latest FTA guidelines on transit modeling and is technically reasonable.

Socioeconomic Forecast

SEMCOG's long-range socio-economic forecast provides an understanding of the region's future economic and demographic outlook. It depicts the location and intensity of future employment and household activities across the region.

The first step in the process of producing SEMCOG's 2045 Forecast began with work on a new regional forecast for the years 2015 to 2045. This regional forecast relied upon the results from the macroeconomics forecast model - REMI (Regional Economic Models, Inc.), which compared each county in the region to the rest of the United States in competition for jobs, labor, income, and future population growth. SEMCOG convened a Forecast Advisory Committee composed of regional experts to review and improve the regional forecast produced by economists at the University of Michigan.

The second step was to understand how individual households and employers in the region will interact in the context of county and regional growth. To allocate regional forecasts to small areas, SEMCOG used UrbanSim, a micro-simulation model for planning and analysis of urban development that replicates the interaction between land use, transportation, and public policies. The UrbanSim model simulates both real estate development choice and residential and employment location decision making processes. The residential and nonresidential developer model looked at the profitable locations preferred by location real estate developers, while location choice simulation explicitly represents the location preferences by eligible households and employment and their specific characteristics. The simulation model allowed SEMCOG to simultaneously predict future land use changes, along with corresponding household and employment location updates, all at land parcel level. At the end, future households and jobs are placed into the most desirable land parcels, and new residential and nonresidential developments, by following the demands, render their future geographic distribution.

The final step was to summarize parcel level outcomes to provide forecasts for each city, village, and township for the purpose of community planning, as well as traffic analysis zones (TAZs), for transportation planning. All community and TAZ forecasts were reviewed by SEMCOG, the Forecast Advisory Committee, and communities in the region.

At the TAZ level, the forecast demographics included disaggregated households and persons with attributes such as household income (in quartiles), household size (one, two, three, four, and five or more persons), number of workers (zero, one, two, and three or more workers), auto ownership (zero, one, two, and three or more vehicles), age and race information of each household member. Forecast base year household characteristics were synthesized using American Community Survey (ACS) data and adjusted to SEMCOG and REMI population estimates. Aggregated employment forecasts included number of jobs in eighteen employment sectors, such as manufacturing, information, finance, hospital, retail, and wholesale, etc.

Vehicle Availability Model

Though socioeconomic demographics include information about household level auto ownership produced by an UrbanSim-based land-use model, the land-use model does not have a behavioral vehicle availability model. An explicit vehicle availability model gives greater control over the effect of household and area characteristics on the vehicles available in each household.

The vehicle-availability model was developed in the E7 model improvement project to estimate auto ownership for each household at the disaggregate level. The choice alternatives include four auto ownership segments: zero, one, two, and three or more vehicle categories. An ordered response logit (ORL) model was used to simulate a sequential choice by households, first determining whether to have any vehicles at all, and then how many to have. The ORL structure used in the E7 model is shown in Figure 25.

The ORL model requires a single utility equation that is consistent for all possible choices, with the E7 utility function defined as follows:

U = 0.537 * HH Workers
+ 1.211 * HH Drivers
- 0.889 * HH Drivers & Income < $30K
+ 0.303 * HH Drivers & Income $60K-$100K
+ 0.429 * HH Drivers & Income > $100K
- 0.324 * HH 75 or older
- 0.085 * Transit Accessibility

In the utility specification, a variable with a positive coefficient implies that increasing the variable increases the expected number of vehicles that the household would own. Therefore, households with more workers and/or drivers will have more vehicles. Conversely, the negative coefficients estimated for senior households and transit accessibility imply that senior households and households with good transit accessibility are likely to own fewer autos

The E7 model then aggregates the resulted vehicle availabilities and other household characteristics from landuse model into the cross-classified market segments required by the trip production model.

Trip Generation

Trip generation process forecasts number of trips that will be made within and through the region. This, in general, refers to the demand side of travel.

The primary driver behind the E7 model update is the utilization of Bureau of Economic Analysis Equivalent Job (BEA-EJ) data for zonal employment data. The trip generation model update focused primary on six major tasks:

- Trip generation model redesign;
- Estimation of Trip production rates with re-expanded 2005 household survey data;
- Validation of Trip production rates with 2015 household survey data;
- Estimation of trip attraction rates with new employment data;
- Three-tier new modeling approaches for university related trips; and
- Updated worker-income rates for household income and employment segment.

The trips modeled in the generation model are classified into three groups: internal trips, internal/external trips and commercial vehicle trips. This section describes only internal trip generation, and generations for other two groups are discussed in later sections.

The internal travel has seven purposes:

- Home-based work: trips between a worker's home and place of employment;
- Home-based shopping: trips between home and shopping destinations;
- Home-based school: trips between home and school (K-12) destinations;
- Home-based university: trips between home and about 30 regional colleges and universities;
- Home-based other: trips between home and any other destination for any other purpose;
- Non-home-based work: trips that have one end at work and the other end from locations other than home; and
- Non-home-based other: trips include all travel not related to work where both ends are not home.

The E7 model follows a standard practice in trip generation that described in FTA's Urban Transpiration Planning System document.

As households have exhibited stability in trip-making activities over time and household characteristics are easier to identify and forecast, the home is used as the basis to predict travel. Cross-classification analysis is used to group households with common socio-economic characteristics (eg. auto ownership and household size) together to create relatively homogenous groups.

Households with different income levels, in general, have different travel behavior in trip making. Trip generation model should be sensitive to these differences. This is also an important factor in environmental justice analysis, a mandate analysis in transportation planning. Four income quartiles were defined for households in each TAZ and this market segmentation approach was applied to all the internal trip purposes in E7 models.

Regression analysis is used to predict the trips generated by employment and households at different destinations. The E6 model aggregated 16 employment categories into six and used this as a base for attraction models. During the E7 model development stage, the new defined 18 employment categories with significantly employment number changes were analyzed at the district level to find a better statistical fit for the trip attraction model.

Special Generators

Travel activities within some TAZs are significantly different from regional averages and the differences in predicted trips are large enough to change planning decisions on specific roadways or transit facilities. These activities may include airports, recreation and amusement areas, regional shopping centers, military and government complexes, hospitals, and colleges and universities. Trips from these types of land uses may be separately generated based on their specific trip generation characteristics. Since SEMCOG's E6 model, the Detroit Metropolitan Airport (DTW) has been identified as such a special generator and a separate estimation for passenger travel is adopted. The FAA observed base year enplanement and originating percentage statistics were used as a base for air passenger trip generation. Both SEMCOG and DTW authority agreed that FAA projected growth rate should be used for future years.

An airport specific origin choice model was developed and applied to allocate air passenger trips across the region. The airport model was calibrated based on DTW cordon line traffic counts collected during the spring and fall of 2011.

Trip Distribution

Trip distribution determines the travel volume between TAZs, therefore, it must consider both the relative attractiveness and accessibility of all possible destinations in the modeling area.

There are two types of distribution models: gravity model and destination choice model. The gravity model is an aggregated model that is based on the observation that traffic flow between any two zones increases as a function of the activity in those zones, but decreases as a function of the distance between the zones. It is just as gravity force between two objectives decreases as distance increases.

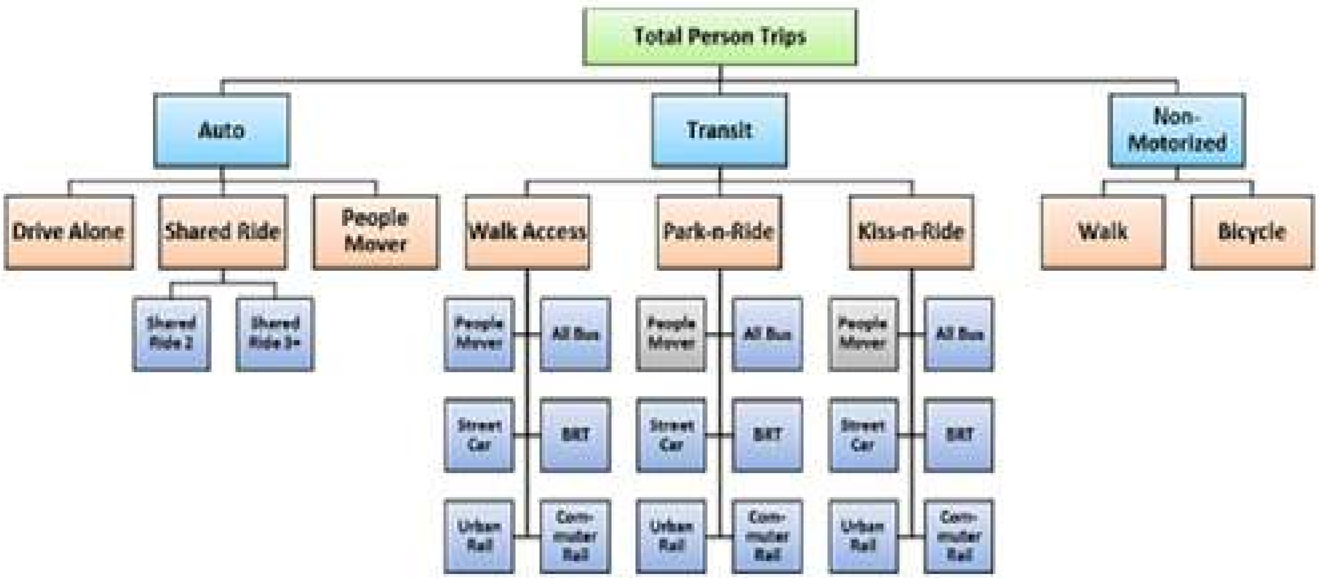
In contrast, the destination choice model uses a different approach to predict travel between zones. A multinomial logit model is used to calculate probability among all internal zones and trips between the zone pairs are then distributed accordingly. By nature, this approach belongs to disaggregated modeling category. In the E7 model, the variables employed in the destination choice model were income, zonal accessibility, piecewise linear distance between zones, the availability of walkable transit, the density of mixed land use and size of attractions. All internal trip purposes were developed using the destination choice model, while commercial vehicle trips were developed with three separate gravity models.

Mode Choice

Mode choice determines which motorized mode-vehicle or transit-travelers will use. The mode choice model was enhanced to a nested logit structure from previous multi-nomial structure.

The E7 mode choice model was revised based on the changes made for SEMCOG's transit corridor studies and followed FTA's suggestions. The E7 mode choice model revised the five periods in E6 to a classic approach of two-period (peak/off peak) choice model. The mode choice structure from transit corridor studies was reviewed and revised based on best practices and working closely with FTA.

Figure 25
SEMCOG E7 Mode Choice Model Structure



The new mode choice model contains three levels of nested structure with the first level grouped by auto, transit, and non-motorized trips. Model parameters were re-estimated based on the 2015 household survey and 2010 regional on-board transit survey. These parameters were calibrated based on local observations and/or adjusted to comply with FTA New Starts modeling guidelines.

Different from E6, the E7 model has considered nonmotorized trips through its destination choice modeling process and continued to include it in the E7 mode choice. Under the transit nest, the set of access modes have been expanded to differentiate between park-and-ride and kiss-and-ride. All transit sub-mode alternatives such as street car, BRT, urban rail, and commuter rail were segmented under each access mode. People Mover is under both Auto and Transit mode. From the 2010 transit onboard survey, relatively quite a portion of travelers were observed using auto to remote parking and the people mover for travel, in addition to travelers using people mover for transit trips. Therefore, the People Mover was added as a sub mode under “Auto” to capture this group of travelers.

Time of Day Process

The E7 time of day process further divides the peak period into AM and PM peak, the off-peak period into mid-day, evening and night. The defined five periods are the same for highway and transit though there is no transit service during night time.

Highway time of day factors were developed using 2015 Household survey and updated by 2015 traffic counts. The transit TOD factors were developed with 2010 transit onboard survey and updated using 2015 transit counts.

Highway Assignment

The highway assignment model uses a multi-user simultaneous equilibrium assignment algorithm. In an equilibrium assignment, all travelers are assigned to their optimal path; no traveler can have a shorter path available. Trips from all TAZs are considered as one assignment iteration. Typically, multiple iterations are required before networks can reach full equilibrium. After each iteration, the link travel times are readjusted, and the next assignment is performed. The model has five assignments according to time-of-day stratification. All assignments use modified Bureau of Public Roads (BPR) formulas as their volume-delay functions by functional class to obtain more realistic speed output. The outputs from the assignments include volume to capacity ratio, link volume, and speed. Since the E6 model, for the purpose of transportation economic analysis, a generalized cost function has been incorporated into the assignment routine. The base year highway assignment model was calibrated based on the 2014-16 observed traffic counts from SEMCOG's Regional Traffic Count Database (RTCD). Nearly 6,000 counts were used in the calibration, and the overall results met or exceeded the FHWA calibration standards.

As both trip distribution and mode choice can be affected by changes in highway and transit travel time, SEMCOG's model includes a feedback loop, which ensures that travel times used in the trip distribution process are equivalent to travel times produced in the highway assignment. A speed balance procedure is used to accomplish this task. Resultant highway assignment travel times are compared to those used in trip distribution. If the difference between the two exceeds a predetermined threshold, the highway assignment travel times are adjusted and fed back into trip distribution and the model is rerun. This iterative process continues until the difference in travel times is below a specified threshold. This process may require five to ten full model runs to reach the termination criteria.

Commercial Vehicle Model

The structure of the Commercial vehicle model in the TDFM is parallel to the passenger model. It comes with a conventional trip generation, a gravity model for the trip distribution, and a multi-class equilibrium assignment. Three classes of commercial vehicles, light vehicle, medium vehicle and heavy vehicle, were modeled separately but with the same structures. In the E7 model, the commercial vehicle sub-model was completely re-calibrated with the new employment data and SEMCOG 2014-2016 vehicle classification counts.

External Trip Model

In addition to the commercial vehicle model, the E7 model uses a separate external trip model to estimate trips that travel to and from our region. A different approach is used to estimate the trip distribution. Growth factor method was used to project future traffic volume in and out along the region cordon line. Both 2015 statewide household survey, Canadian border crossing survey, and the purchased Big Data were used in the E7 external trip model estimation. Year 2015 cordon line traffic counts were used as a base for E7 external trip model calibration.

Future Enhancements

The SEMCOG travel model is now an enhanced four-step travel demand model. It is capable of estimating passengers on a new bus service, riders on a new rapid transit line, or the response to certain travel demand management policies, such as imposing higher parking fees. SEMCOG will continue to improve the E7 model with focus on the following areas:

- Updating the DTW Airport model using the cordon line counts collected in 2018 and other available data,
- Studying the trip patterns of hospital areas to determine if a special generator is needed,
- Enhancing the features of model applications and
- Visualizations to improve operational efficiency.

In November 2017, SEMCOG, together with Minneapolis-St. Paul Metropolitan Council and Kansas Mid-America Regional Council, under FHWA TMIP program funding support, completed its third TMIP peer review. The primary objective of this peer review was to assist agencies in gaining a better understanding of the types of data sources available for model development, validation, and application as well as for other planning purposes and how these different data sources can best be used to support agency decisions. A few specific recommendations on Big Data include:

- informed purchasing,
- guidelines on key metrics,
- Using various Big Data sources, and
- other research topics.

SEMCOG will continue to explore various usages of Big Data and consider data fusion approaches as resources allow.

In addition, a recently completed commercial vehicle survey will be used to update the existing model and develop a new commercial travel model. Earlier of this year, SEMCOG has joined an ActivitySIM partner team, which creates shared ownership by pooling funds together to build an open-source activity-based model (ABM) platform. In next few years, SEMCOG intends to develop an ActtivitySIM-based personal ABM using the 2015 household survey and the new 2019 transit on-board survey.

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