7.0 FUTURE TRAVEL FORECAST

The practice of using computer-driven travel demand forecasting models to project future transportation needs began in the 1960s and achieved widespread use in the 1970s. The advent of travel demand forecasting software for personal computers in the 1980s led to almost universal adoption of transportation modeling by metropolitan planning organizations. The updated Mississippi Gulf Coast Area Regional Travel Demand Forecasting Model developed for the 2040 Metropolitan Transportation Plan (MTP) was constructed on Caliper Corporation's *TransCAD 6.0* software platform. The transportation model is driven by a land use and demographic database developed by Gulf Regional Planning Commission (GRPC). GRPC assembled base-year population, housing, employment, hotel and motel, school and casino data used to calibrate the model to actual traffic conditions in 2013 based on annualized average daily traffic (AADT) estimates for hundreds of count locations in the region. Data for the model variables provided the inputs used to estimate the number of trips produced and attracted within individual traffic analysis zones. There are 797 such zones in the study area: 268 in Jackson County, 438 in Harrison County and 91 in Hancock County. In addition there are 16 external stations located on the study area boundary at points where major roadways carry traffic in or out of the three coastal counties from or to other counties in Mississippi or adjacent states. GRPC developed a long-range forecast of future conditions for the years from 2020 to 2040. The forecast data were used to generate trips for the short-term (2020), intermediate (2030) and long-range (2040) planning years. Projected future travel was then assigned to the existing network (including committed improvements already programmed for implementation) in order to identify potential deficiencies likely to occur in the absence of additional improvements.

7.1 GENERALIZED APPROACH TO TRAVEL DEMAND FORECASTING

The Mississippi Gulf Coast Regional Travel Demand Model adheres to the conventional trip-based four-step modeling approach. The principal model components fall within the following four categories:

- ***Trip Generation*** is the process used to estimate the number of person-trips produced within—and attracted to--each traffic analysis zone (TAZ).
- ***Trip Distribution*** is the process by which trip productions and attractions are paired in order to yield zonal interchanges, linking trip origins and destinations across all TAZs.
- ***Mode Choice*** is the process by which person-trips are distributed among available modes represented in the model.
- ***Trip Assignment*** is the process used to assign vehicular trips to specific paths connecting TAZs linked in the trip distribution phase.

Trip Generation

Trip generation is used to determine the number of trips that either begin or end in a given traffic zone. The linking of trips-ends takes place in the trip distribution step following trip generation. The Mississippi Gulf Coast model generates trip productions and attractions for six internal trip purposes:

- Home-Based Work (HBW)
- Home-Based Other (HBO)
- Non-Home-Based (NHB)
- Gaming (GAME)
- Commercial Motor-Vehicle (CMVEH)
- Truck (TRK)

The model also generates trip attractions within the study area for two purposes involving trips with one end outside the metropolitan area:

- External-Internal Auto (EIAUTO)
- External-Internal Truck (EITRK)

For home-based trips, *production* refers to the home end of the trip, and *attraction* applies to the non-home end. This is true for both the trip from home to work (or other location) and the trip from work (or other location) to home: Both are *produced* in the zone of residence. For non-home-based, commercial motor-vehicle, gaming and truck trips, productions and attractions correspond to actual zones of origination and destination. The trip generation model uses cross-classification tables for the both home-based trip purposes and non-home-based travel purpose in order to stratify demand by household size and vehicle availability. For the gaming purpose the model applies linear regression equations that relate productions to occupied housing units and hotel or motel rooms; attractions are based on casino operating data (gaming area and number of gaming positions). For the commercial motor vehicle and truck trip purposes the model applies equations that relate trip productions and attractions to zonal employment and residency. The remaining trip attraction models utilize linear regression equations that relate zonal employment, households and school enrollment to trip attractions.

Trip Distribution

The trip distribution process determines where the trips produced in the trip generation go and, conversely, from where the attracted trips come. The mathematical tool used for this effort is called a gravity model because it makes use of the concepts of mass and impedance (i.e., distance) to quantify the relative attraction of each pair of zones for one another. The model employs the following relational assumptions:

- The number of trips made from zone *i* to zone *j* is inversely related to the distance from *i* to *j* expressed in terms of travel time.

- The number of trips made from zone *i* to zone *j* is directly related to the number of trips produced in *i* and the number of trips attracted to *j*.

Productions and attractions are balanced areawide for all trip purposes in order to ensure that every trip will have two ends, one of which can be identified as the origin, the other being designated the destination. For all purposes except gaming, attractions are balanced to productions; for gaming, attractions are held constant. The trip distribution model converts productions and attractions into

origins and destinations so that every individual trip will have both a beginning and an end. The result is a zonal matrix or trip table representing the number of trips from every zone (*i*) to every other zone (*j*).

Mode Choice

A mode choice model provides a process for estimating the number of trips made by each individual mode for all zonal interchanges. Because transit, pedestrian and bicycle trips represent a very small percentage of all travel in the study area, mode choice is frequently excluded from the model sets developed for smaller urban areas. This has been the approach adopted for the Mississippi Gulf Coast model in the past, and in the current model set the mode-choice step is used to convert person-trips into vehicle-trips based on assumed rates of vehicle occupancy. However, while a formal mode choice component is not included in the updated model, a post-processing transit application is under development and will be available for projecting transit vehicle ridership in the future.

Traffic Assignment

Traffic assignment models are used to estimate link-to-link flows on a streets network. The input to the traffic assignment model consists of flow matrices representing the volume of traffic by travel purpose between origin-and-destination (O-D) pairs. Other inputs include the network topology, link characteristics and link performance functions. The flow between each pair of TAZs is loaded on the network in a manner determined by the relative travel-time impedance of the alternative paths available for each trip. The User Equilibrium approach incorporated in the Mississippi Gulf Coast model utilizes an iterative process, converging on an optimum distribution of traffic which minimizes individual delay such that, in the end, no hypothetical driver can reduce the time required to complete his trip by shifting to another travel path.

7.2 LAND USE AND DEMOGRAPHIC FORECAST

Population and employment forecasts were developed for the years 2020, 2030 and 2040 for all Mississippi counties in order to update the long-range transportation plans and travel demand models for the Mississippi Department of Transportation (MDOT) and the Jackson, Hattiesburg and Mississippi Gulf Coast metropolitan planning organizations (MPOs). This concurrent update of the statewide and metropolitan travel demand models was undertaken by Neel-Schaffer, Inc. and Cambridge Systematics for the MULTIPLAN 2040 consolidated Mississippi planning effort.

The county-level socioeconomic forecasts developed for MULTIPLAN 2040 served as control totals for the individual counties when assigning future population and employment within a county to traffic analysis zones. As noted in the preceding section, these socioeconomic data at the TAZ level are used to generate future trip origins and destinations in the travel demand models.

A variety of data sources were utilized to forecast future population and employment control totals for Mississippi counties in 2020, 2030 and 2040 (see Table 7-1).

Table 7-1:
SOCIOECONOMIC FORECAST DATA SOURCES

SOURCE	DATA	GEOGRAPHIC AVAILABILITY	YEARS
Decennial Census	Population	All Counties	2000, 2010
Annual Population Estimate Program from Census Bureau	Population	All Counties	2013
Mississippi Institutions of Higher Learning (MIHL)	Population	All Counties	2015, 2020, 2025
Woods & Poole Economics, Inc. (W&P)	Population and Employment	All Counties	2020, 2030, 2040
Regional Economic Models, Inc. (REMI)	Population and Employment	17 Counties and aggregate regions	2020, 2030, 2040

Population Forecasts

Population forecasts, or control totals, are a modified average of historical and current trend projections and projections from the Mississippi Institutions of Higher Learning (MIHL), Woods & Poole Economics, Inc. (W&P), and Regional Economic Models, Inc. (REMI). The methodology used to generate forecast values for each plan stage year is described below.

2020 Population Control Totals

County population control totals for 2020 were calculated as an average of the following: W&P 2020 projection for the county, MIHL 2020 projection for the county, an extrapolation of the Census Bureau's estimated growth rate for the county between 2010 and 2013, and an extrapolation of the actual growth rate of the county from 2000 to 2010. The last of these projections, the historical growth rate, was assigned half the weight of the other inputs.

The resulting population control totals were utilized absent any one of the following circumstances:

(1) The resulting average was lower than 2013 Census estimate. In this case, growth is occurring more rapidly than anticipated by the control total and the extrapolation of the 2013 population estimate is utilized.

(2) The resulting average projected a decline of greater than five percent from the 2013 Census estimate. In these cases, population decline was limited to 5 percent because it is assumed that rapid decline in the past is not sustainable. Nine counties were affected by this.

(3) The county was one of the 17 counties where REMI projections are available. For these counties, REMI 2020 projections were averaged with the other projections.

2030 Population Control Totals

In order to account for the 2020 forecast resulting from the methodology described above, the 2030 projections from outside sources (W&P, MIHL and REMI) were adjusted upward or downward depending

on whether or not the forecast was higher or lower than the projection from a given source. For instance, if the forecast methodology resulted in a 2020 population forecast that was lower than an outside source projected, the 2030 numbers for that source's projections were lowered proportionately.

After doing this, county population control totals for 2030 were calculated as an average of the adjusted W&P 2030 projection for the county, an extrapolation of the adjusted MIHL 2025 projection for the county, and the adjusted REMI 2030 projections for the 17 available counties. For counties aggregated into regions in the REMI projections, each county's share of the region's adjusted 2020-2030 growth was estimated based on historical growth and other projections.

In counties where 2030 population control totals were projected to decline from 2020, decline was limited to seven percent from the 2020 control total. Three counties were affected by this.

2040 Population Control Totals

In order to account for the 2030 forecast resulting from the methodology described above, the 2040 projections from outside sources (W&P, MIHL and REMI) were adjusted upward or downward depending on whether or not the forecast was higher or lower than the projection from a given source. For instance, if the forecast methodology resulted in a 2030 population forecast that was lower than an outside source projected, the 2040 numbers for that source's projections were lowered proportionately.

After doing this, county population control totals for 2040 were calculated as an average of the adjusted W&P 2040 projection for the county and the adjusted REMI 2030 projections for the 17 available counties. For counties aggregated into regions in the REMI projections, each county's share of the region's adjusted 2020-2030 growth was estimated based on historical growth and other projections.

Because the MIHL data projects high growth for Jackson County but was not available beyond 2025, the methodology above resulted in a 2040 population control total for Jackson County that was unrealistically low. Therefore, an adjustment was made for Jackson County.

Also, in counties where 2040 population control totals were projected to decline from 2030, decline was limited to seven percent from the 2030 control total. Two counties were affected by this.

Employment Forecasts

Employment control totals for 2020, 2030 and 2040 were acquired from W&P and REMI, but these sources were not utilized for all counties because it was determined that the W&P projections resulted in unrealistic jobs to housing balances and the REMI projections were too difficult to disaggregate to the county level. Therefore, employment control totals for Mississippi counties were based on the population forecasts described above. It is assumed that employment will change at approximately the same rate as population change. However, in order to account for the higher employment growth projected by W&P and REMI, employment growth was increased by an additional two percent over each 10-year period.

For the 17 counties where REMI projections were provided at the county level, an additional step was taken. REMI 2020 projections were compared with the 2010 base estimates (W&P). This rate of increase was then averaged (at a 25-percent weight) with the employment control totals resulting from the methodology outlined above (i.e., indexed to population growth). The reason that greater weight was

not given is that the expected population growth according to REMI had already been factored into the population projections.

While the W&P and REMI data did not factor heavily into the development of employment control totals, their breakdown of employment by industry was utilized later in breaking down employment growth by industry.

Forecast Results

The forecast described above projected total population in the Mississippi Gulf Coast metropolitan planning area (MPA) would increase by a little less than 22 percent between the 2013 base year and the long-range target year of 2040 (see Table 7-2). The number of people living in the three-county area was forecast to grow by 80,000 to over 450,000. The largest share of that increase was allocated to Harrison County, which is expected to add 50,000 residents. But Hancock County was forecast to record the largest relative gain at 33 percent. Jackson County lagged behind the other two, with a projected population increase of only 11 percent.

Establishment-based employment was projected to increase by nearly 27 percent from a little more than 196,000 to more than 249,000 employees. Retail employment is expected to make an especially strong showing, growing by 38 percent, adding nearly 15,000 workers to the ranks of the employed. As with population, projected employment growth was concentrated largely in Harrison County, more than two-thirds of the 52,000 new employees. But Hancock County was forecast to record the largest relative gain—44 percent. As with population, Jackson County lagged well behind the other two counties with regard to relative employment growth, recording a projected gain of only 13 percent.

7.3 FUTURE TRANSPORTATION SYSTEM

The Mississippi Gulf Coast Travel Demand Forecasting Model was calibrated to actual traffic conditions in the base year of 2013. The base-year street and highway network included all major roads—interstate highways, principal arterials and minor arterials, major and minor collectors--that were existing and in service in 2013, as well as some local streets required for system continuity. An Existing-Plus-Committed (E+C) network was subsequently developed to represent the baseline case for testing future network alternatives. The E+C network includes all major roads (and some local streets) still in service in 2015 and incorporates changes to base-year streets and highways made since 2013. It also includes committed improvements, including new facilities and modifications to existing streets and highways, programmed for implementation during the next 5-10 years (see Table 7-3).

Improvements completed since 2013 include the new D'Iberville Boulevard overpass and diverging diamond interchange at I-10, the new I-110 interchange at Big Ridge Road, and the new four-lane overpass on Big Ridge Road spanning I-110 (all in D'Iberville); the widening of Creosote Road in Gulfport; and intersection improvements on Highway 613 and US Highway 90 in Jackson County. Other improvements currently under construction include the widening of Highway 607 in Hancock County and Popp's Ferry Road in Biloxi. Committed projects either programmed or actively under development include the widening and realignment of Popp's Ferry Road in D'Iberville, the extension of Popp's Ferry Road in

Table 7-2:
MISSISSIPPI GULF COAST LAND USE AND DEMOGRAPHIC DATA FORECAST TO THE YEAR 2040

	2013					
COUNTY	TOTAL POPULATION	DWELLING UNITS	HOUSEHOLDS	RETAIL EMPLOYMENT	NON-RETAIL EMPLOYMENT	TOTAL EMPLOYMENT
Hancock	43,929	21,840	17,380	3,089	16,458	19,547
Harrison	187,104	85,180	71,475	24,350	93,400	117,750
Jackson	139,668	60,067	52,205	11,347	48,025	59,372
TOTAL	370,701	167,087	141,060	38,786	157,883	196,669
	2020					
COUNTY	TOTAL POPULATION	DWELLING UNITS	HOUSEHOLDS	RETAIL EMPLOYMENT	NON-RETAIL EMPLOYMENT	TOTAL EMPLOYMENT
Hancock	50,186	25,007	19,865	3,775	20,111	23,886
Harrison	213,275	96,674	81,264	28,450	109,126	137,576
Jackson	146,294	62,780	54,578	11,852	50,157	62,009
TOTAL	409,755	184,461	155,707	44,077	179,394	223,471
	2030					
COUNTY	TOTAL POPULATION	DWELLING UNITS	HOUSEHOLDS	RETAIL EMPLOYMENT	NON-RETAIL EMPLOYMENT	TOTAL EMPLOYMENT
Hancock	54,353	27,137	21,520	4,296	21,693	25,989
Harrison	230,514	104,282	87,903	31,707	115,342	147,049
Jackson	149,758	64,236	55,843	12,765	51,466	64,231
TOTAL	434,625	195,655	165,266	48,768	188,501	237,269
	2040					
COUNTY	TOTAL POPULATION	DWELLING UNITS	HOUSEHOLDS	RETAIL EMPLOYMENT	NON-RETAIL EMPLOYMENT	TOTAL EMPLOYMENT
Hancock	58,531	29,278	23,185	4,882	23,300	28,182
Harrison	237,607	108,515	90,464	34,707	119,397	154,104
Jackson	155,082	66,494	57,807	13,934	53,253	67,187
TOTAL	451,220	204,287	171,456	53,523	195,950	249,473
	2013 TO 2040 PERCENTAGE CHANGE					
COUNTY	TOTAL POPULATION	DWELLING UNITS	HOUSEHOLDS	RETAIL EMPLOYMENT	NON-RETAIL EMPLOYMENT	TOTAL EMPLOYMENT
Hancock	33.2	34.1	33.4	58.0	41.6	44.2
Harrison	27.0	27.4	26.6	42.5	27.8	30.9
Jackson	11.0	10.7	10.7	22.8	10.9	13.2
TOTAL	21.7	22.3	21.5	38.0	24.1	26.8

Source: Neel-Schaffer, Inc.

Table 7-3: MISSISSIPPI GULF COAST AREA TRANSPORTATION IMPROVEMENTS INCLUDED IN THE EXISTING-PLUS-COMMITTED NETWORK

COUNTY	JURISDICTION	ROUTE/LOCATION	FROM (N/W)	TO (S/E)	DESCRIPTION	STATUS
Hancock	MDOT	Hwy 607	I-59	Stennis Space Center	Widen to 4-lane divided road	Under Construction
Harrison	Biloxi	Popp's Ferry Rd	Cedar Lake Rd	Gay Rd/Lamey St	Widen to 4-lane divided road	Under Construction
Harrison	Biloxi	Popp's Ferry Rd	Pass Rd	Beach Blvd (US 90)	Construct new 4-lane divided road	Environmental Review
Harrison	D'Iberville	Big Ridge Rd	D'Iberville Blvd	New SB I-110 On-Ramp	Widen to 4-lane divided road	FONSI 4-25-2014
Harrison	D'Iberville	D'Iberville Blvd	New EB I-10 Off-Ramp	Popp's Ferry Road	Widen to 4-lane divided road	FONSI 4-25-2014
Harrison	D'Iberville	D'Iberville Blvd	Popp's Ferry Rd	Auto Mall Pkwy	Widen to 4-lane divided road	FONSI 4-25-2014
Harrison	D'Iberville	Lamey Bridge Rd	Highland Ave	600' south of Big Ridge Rd	Reconstruct as 4-lane divided road	FONSI 4-25-2014
Harrison	D'Iberville	Popp's Ferry Rd	Belle St	D'Iberville Blvd @ Big Ridge Rd	Widen to 4-lane divided road and realign	FONSI 4-25-2014
Harrison	Gulfport	Creosote Rd	US 49	Three Rivers Rd	Reconstruct as 4-lane divided road	Completed
Harrison	Gulfport	Dedeaux Rd	Three Rivers Rd	Stewart Rd	Widen to 4-lane divided road with bike path	Right-of-Way Acquistion
Harrison	MDOT	Big Ridge Rd	New SB I-110 On-Ramp	Lamey Bridge Rd	Widen to 4 lanes with new I-110 bridge	Under Construction
Harrison	MDOT	D'Iberville Blvd	Promenade Pkwy	New EB I-10 Off-Ramp	Widen to 4 lanes with new I-10 bridge	Completed
Harrison	MDOT	I-10	D'Iberville Blvd	--	Construct new half-interchange	Completed
Harrison	MDOT	I-10	I-110	--	Reconstruct interchange	Under Construction
Harrison	MDOT	I-10	Lamey Bridge Rd	--	Construct new half-interchange	Under Construction
Harrison	MDOT	I-110	Big Ridge Rd	--	Construct new half-interchange	Completed
Harrison	MDOT	Lamey Bridge Rd	I-10 bridge	Highland Ave	Reconstruct as 4-lane divided road	FONSI 4-25-2014
Harrison	MDOT	MS 15	Lamey Bridge Rd	--	Construct roundabout	Planned
Jackson	County	Hwy 609	Old Fort Bayou Rd	--	Intersection improvements	Planned
Jackson	County	Hwy 613	MS 63	Big Point railroad crossing	Intersection improvements	Completed
Jackson	County	LeMoyne Blvd	Brittany Ave	--	Intersection improvements	Planned
Jackson	Gautier	Martin Bluff Rd	Gautier-Vancleave Rd	I-10 Frontage Rd	Widen road and improve intersections	Environmental Review
Jackson	MDOT	I-10	Hwy 609	MS 57	Widen to 6 lanes	Planned
Jackson	Ocean Springs	Ocean Springs Rd	US 90	--	Reconstruct intersection	Completed
Jackson	OSARC	I-10 Connector Rd	Daisy Vestry Rd	Seaman Rd	Construct new/realigned 4-lane road	Right-of-Way Acquistion
Jackson	Pascagoula	Hospital Rd	Old Mobile Hwy	US 90	Add turn lane, sidewalks, bike lanes, lighting	Right-of-Way Acquistion

Source: Gulf Regional Planning Commission (2015).

Biloxi, construction of the I-10 Connector Road in Jackson County, and reconstruction of the I-10/I-110 interchange, among others.

Model output data for the E+C network assignment generated with 2040 input data were compared with 2013 base network results in order to derive an overall picture of how system performance was likely to be affected if no improvements other than those already underway or programmed for implementation were made. The comparison indicated that a projected population increase exceeding 21 percent would likely result in 25 percent more trips (see Table 7-4). The average trip would probably be slightly longer--about eight-tenths of a mile—and require a little more time (two minutes). This would lead to increases in vehicle miles traveled (over 36 percent), vehicle hours traveled (45 percent) and vehicle hours of delay (over 90 percent). The delay share of total travel time would expand from less than 15 percent to almost 20 percent. The added traffic congestion associated with increased delay would reduce average operating speed by more than 1.5 miles per hour. This potential decline in system performance is what the long-range transportation plan seeks to avert by recommending the measures most likely to prevent the increased traffic congestion that will occur in the absence of additional improvements. The projected needs which the plan seeks to address are discussed in the following chapter.

Table 7-4:
MODEL OUTPUT FOR 2040 EXISTING-PLUS-COMMITTED NETWORK COMPARED TO 2013 BASE NETWORK ASSIGNMENT

ITEM	2013 BASE-YEAR NETWORK	2040 E+C NETWORK	2013 TO 2040 DIFFERENCE	PERCENT DIFFERENCE
Population	363,413	442,172	78,759	21.67
Trip Productions/Attractions	1,557,268	1,949,724	392,456	25.20
Vehicle Miles Traveled	13,550,938.23	18,517,811.45	4,966,873	36.65
Vehicle Hours Traveled	381,906.15	546,442.25	164,536	43.08
Vehicle Hours of Delay	56,452.75	108,976.62	52,524	93.04
Trips per Capita	4.29	4.41	0.12	2.90
Average Trip Length (Miles)	8.70	9.50	0.80	9.15
Average Trip Duration (Minutes)	14.71	16.82	2.10	14.28
Average Travel Speed	35.48	33.89	-1.59	-4.49
Percent Delay	14.78	19.94	5.16	--

Source: Mississippi Gulf Coast Area Travel Demand Forecasting Model (2015). Calculations by Neel-Schaffer, Inc.