I-10 Mobile River Bridge and Bayway

Draft May 2018

Traffic and Revenue Study Report

DRAFT

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Appendix C – RSG Stated-Preference Survey Report

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Chapter 1 – Introduction

1.1 Study Description

This report provides documentation of a comprehensive-level traffic and revenue (T&R) study of the proposed I-10 Mobile River Bridge and Bayway (I-10 MRB&B) project. The study was conducted on behalf of Alabama Department of Transportation (ALDOT). CDM Smith developed a travel demand model to forecast future year traffic and estimate T&R on the proposed I-10 MRB&B project. This report documents the development of this travel demand model, and contains summaries of the data collection activities, the stated-preference survey and independent forecasts prepared for use with this model. This report also contains a description of the project alignment, the interchange configurations, the tolling plan, along with the 2025-2074 annual T&R estimates.

1.2 Report Organization

This report consists of 12 chapters as follows:

Chapter 1 – Introduction: This introductory chapter consisting of a project description, and general traffic characteristics in the project study area.

Chapter 2 – Existing Traffic Conditions: This chapter contains a description of overall traffic conditions, major travel pattern routes in the study area, traffic volume variations on I-10 and other relevant routes, and the traffic counts used to calibrate the base-year 2015 I-10 MRB&B travel demand model.

Chapter 3 – Travel Pattern Data: Travel pattern data was obtained from AirSage and StreetLight Data for this study. These two companies obtain travel pattern data from cell phone and GPS location data. This chapter contains a description of the two data sources, summarizes an analysis of the datasets, and provides an explanation of how the datasets were used in the I-10 MRB&B travel demand model.

Chapter 4 – Socioeconomic Forecasts: Fishkind & Associates were hired for this study to produce independent socioeconomic forecasts of the two-county study area. This chapter contains summaries of their methodology and results (with comparisons to forecasts produced by the relevant planning agencies in the two counties) and an explanation of the data used in the I-10 MRB&B travel demand model. The full Fishkind & Associates socioeconomic survey report is provided in Appendix A, and the detailed socioeconomic forecasts are provided in Appendix B.

Chapter 5 – Stated-Preference Survey: Resource Systems Group, Inc. (RSG) was hired for this study to conduct a stated-preference (SP) survey, which estimates drivers' willingness to pay tolls. The final product of the survey is Value of Time (VOT) parameters that are used in the travel demand model. This chapter contains a summary of the SP survey methodology and results. The full RSG SP survey report is provided in Appendix C.

Chapter 6 - Model Development: This chapter provides a description of how the 2015 base-year travel demand model was developed. It describes the highway network, the trip generation and trip distribution steps, the development of the separate passenger car and truck models and the development of the external model. Base-year model calibration statistics are also presented. The chapter concludes with a description of how the future-year travel demand models were developed from the base-year model. There are three future year models: 2020, 2030 and 2040.

Chapter 7 – Interchange Configurations & Toll-Free Traffic Estimates: This chapter provides descriptions of the proposed physical interchange alternatives along I-10 and provides the toll-free traffic volume forecasts on each Mobile River crossing by model year.

Chapter 8 – Toll Scenario Testing: This chapter describes the tolling plan for the I-10 MRB&B project. It provides a description of the toll diversion process used in the travel demand model to estimate the toll transactions and revenue. Then the chapter summarizes the toll rate sensitivity tests for this toll scenario. Finally, the chapter contains an analysis of the market share (and traffic volume) of each Mobile River crossing at each toll rate.

Chapter 9 – Expected Toll Revenue Estimates: This chapter outlines the toll rate structure and basic assumptions used to calculate the annual expected toll revenues and summarizes the 2025-2074 expected annual toll revenues under the proposed toll rates. These are the expected revenues prior to including the toll discounts, surcharges or fees, and prior to deducting the costs of toll collection operations and maintenance costs.

Chapter 10 – Gross Toll Revenues with Discounts, Surcharges and Fees: This chapter outlines the frequent-user toll discounts, video tolling surcharges and invoice fees proposed for the I-10 MRB&B project. The chapter contains a summary of the methodology CDM Smith developed to estimate the revenue impacts of the discounts, surcharges and invoice fees. The chapter concludes with the 2025-2074 estimated annual revenue impacts of the discounts, surcharges and invoice fees.

Chapter 11 – Net Toll Revenue Estimates: This chapter provides estimates of toll collection costs on the I-10 MRB&B, both capital costs and annual operations and maintenance (O&M) costs. The chapter concludes with 2025-2074 estimated annual toll collection costs, and revenues net of all costs.

Chapter 12 – Sensitivity Tests: This chapter outlines the sensitivity tests conducted to test the upside and downside revenue potential for the project. The assumptions were varied for nine underlying variables: value of time, vehicle operating cost, socioeconomic forecasts, annualization factors, external-zone traffic volume growth rates, trip frequency distribution, toll price elasticity and video tolling percentages.

1.3 Project Description

The proposed I-10 MRB&B project is located in Mobile, Alabama in the southern part of the state, near the Gulf of Mexico. Figure 1-1 shows the project study area with the project highlighted in red. I-10 currently travels through the Wallace Tunnel across the Mobile River. East of the Mobile River, I-10 then traverses Mobile Bay on the I-10 Bayway. The I-10 Bayway consists of a pair of concrete viaduct bridges, approximately 7.5-miles long.

Figure 1-2 shows a closer view of the project. The I-10 MRB&B project is expected to consist of the following elements (and these elements have been assumed in the travel demand model developed for this study):

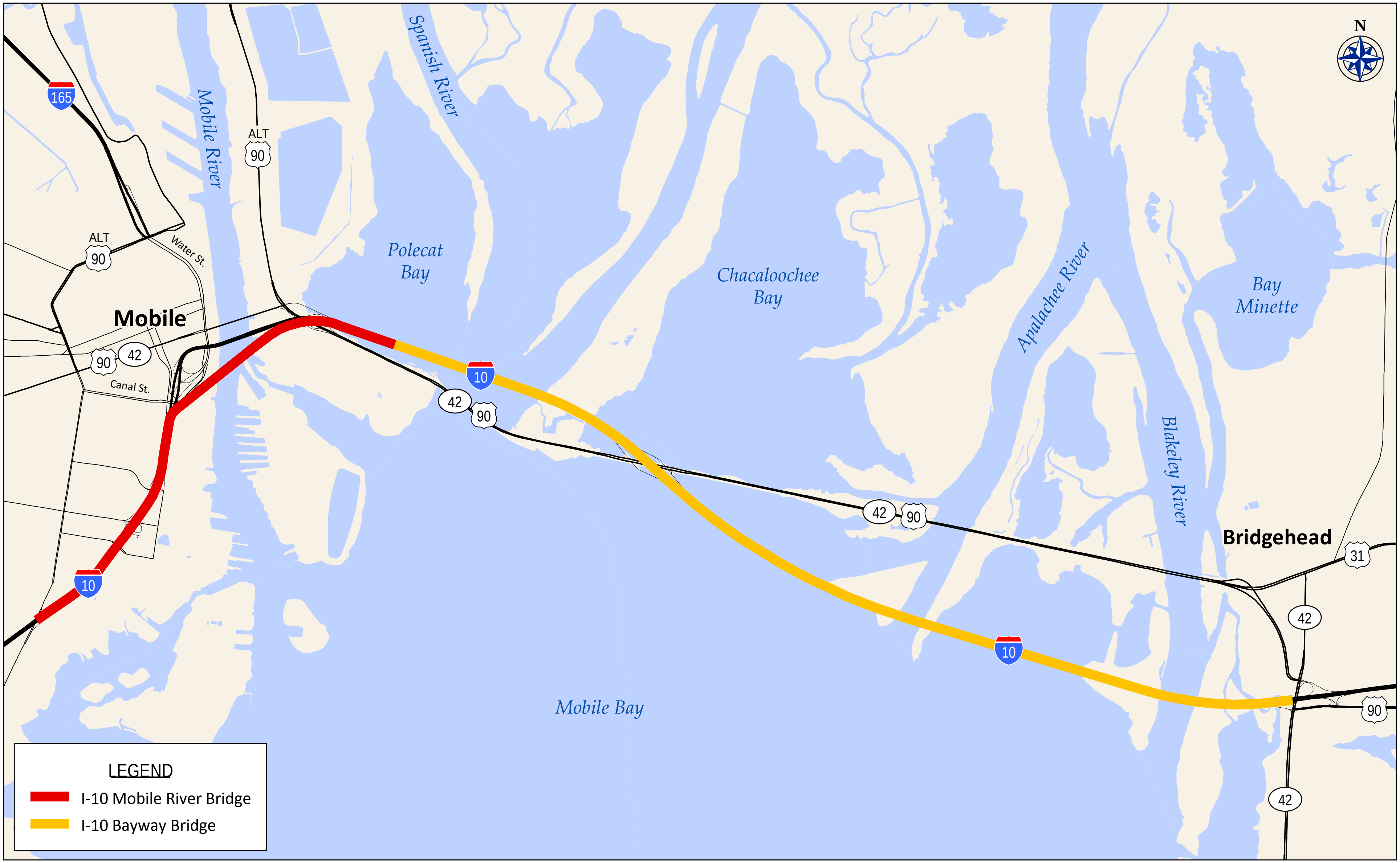
1. Building a bridge over the Mobile River
2. Reconstructing, raising and widening (from 4 to 8-lanes) the I-10 Bayway across Mobile Bay
3. Reconstructing, reconfiguring or removing seven interchanges along the existing I-10 route, including ancillary improvements to some portions of the US-98 Causeway.

Upon completion of the I-10 MRB&B project, the I-10 designation would be removed from the Wallace Tunnel and moved onto the new bridge. However, the Wallace Tunnel would remain in service, as a tolled tunnel, to serve downtown Mobile traffic.

ALDOT and the Federal Highway Administration (FHWA) completed a Draft Environmental Impact Statement (DEIS) of the I-10 MRB&B project in July 2014. Figure 1-2 shows the preferred project alignment (B-prime) from the DEIS; this is the alignment assumed in the present T&R study. In the DEIS, the I-10 Mobile River Bridge is assumed to be six-lanes (three per direction) and the I-10 Bayway is assumed to be eight-lanes (four per direction). CDM Smith has assumed the same numbers of lanes in the present T&R study.

Figure 1-1 – I-10 Mobile River Bridge and Bayway Location Map

F1-1 I-10 Mobile River Bridge Location Map.png



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I-10 MOBILE RIVER BRIDGE AND BAYWAY PROJECT ALIGNMENT

FIGURE 1-2

The Purpose and Need Statement of the draft EIS states, "The first need is to increase the capacity of I-10 to meet existing and predicted future traffic volumes. The existing traffic volumes result in ongoing traffic flow or congestion problems." In the project area, I-10 carries an average of 75,000 vehicles per day as of 2015. This route is severely capacity constrained in the project area. Traffic congestion is common in the I-10 Wallace Tunnel and on the I-10 Bayway for a large portion of the day.

1.4 General Traffic Characteristics of Two-County Region

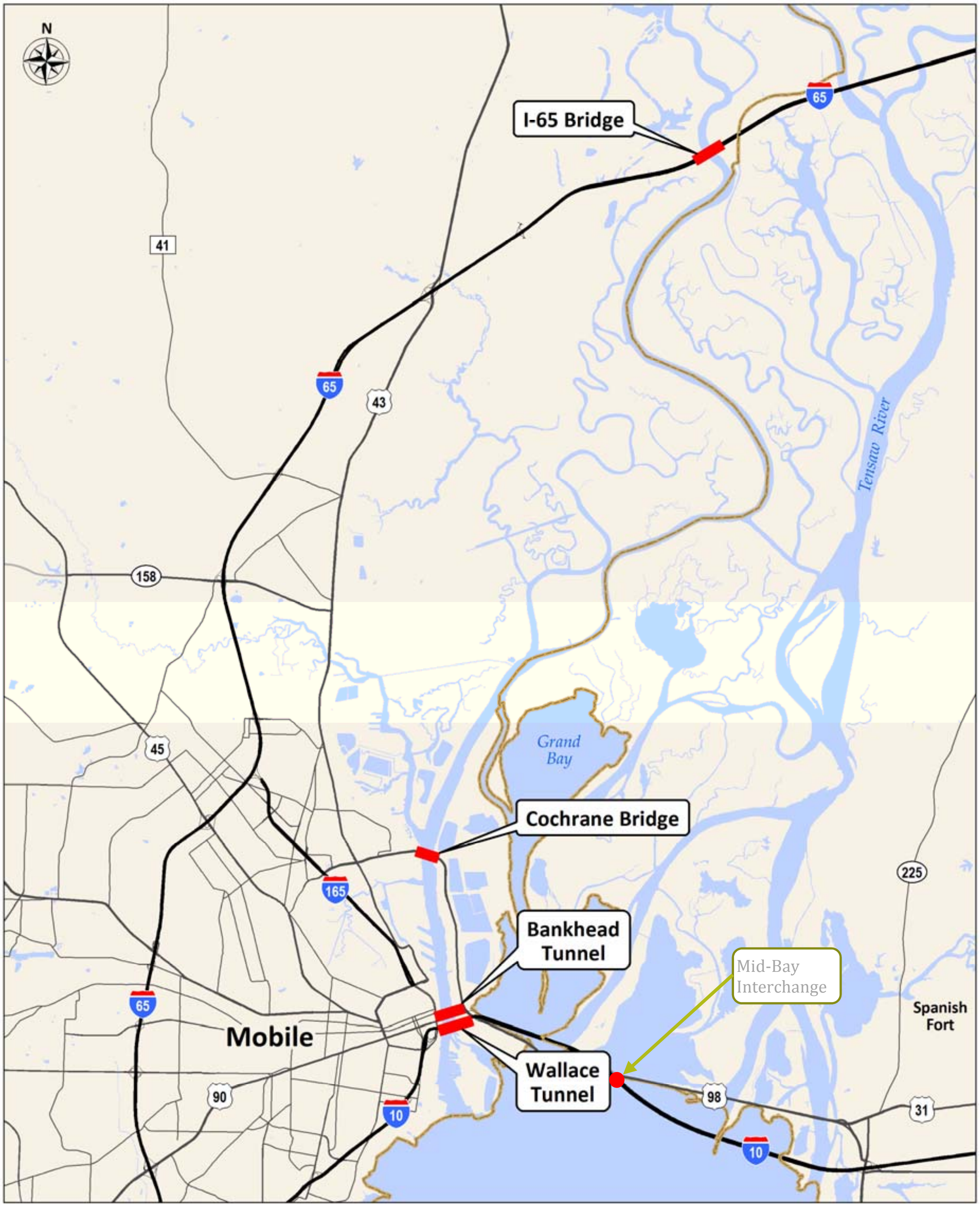
The first section of this chapter contains an overview of the traffic characteristics of the study area, including a discussion of the unique geography of the Mobile River/Bay area, and the major routes within the study area. The traffic characteristics of the two-county area vary widely. Much of the two-county region is rural; this includes the northern and eastern portions of Baldwin County and western portion of Mobile County. The Mobile Central Business District ("Downtown Mobile"), by contrast, is a dense urban area. The Eastern Shores area of Baldwin County is a fast-growing area with suburban traffic characteristics. Finally, the Alabama Gulf Shores area is a tourism destination with large variations in traffic volumes between the high summer season (May-August) and the low winter season (September-February).

1.4.1 Mobile River versus Mobile Bay

The I-10 MRB&B project crosses both Mobile River and Mobile Bay (which can be seen in Figure 1-3). While the names can generally be used somewhat interchangeably, there are some important distinctions. Within the project area, these two bodies of water are adjacent to one another, separated by Pinto Island (with Mobile River on the west, and the much larger Mobile Bay on the east). The Mobile River is approximately 1,000-feet wide in the project area. Whereas, Mobile Bay is approximately six-miles wide within the project area. The I-10 Wallace Tunnel, Bankhead Tunnel (US-90/98) and Cochrane Bridge all traverse the Mobile River, while the I-10 Bayway and the US-90/98 Causeway cross Mobile Bay. I-65 is another crossing between Mobile and Baldwin Counties. However, it crosses the Mobile River north of Mobile Bay (in the river delta north of Mobile Bay) and generally serves a different geographic market, compared to the more southerly routes.

Most vehicles cross both the Mobile River and Mobile Bay during a single trip. For example, a trip from downtown Mobile to Spanish Fort (in Baldwin County) must cross both bodies of water. However, there are a significant number of trips that begin/end on Pinto Island. This island contains, among other facilities, the Austal shipbuilding yard, BAE Systems (formerly British Aerospace) Southeast Shipyards, and the Alabama State Port Authority Pinto Island Terminal. These trips will cross either Mobile River or Mobile Bay, but not both.

Figure 1-3 – Mobile River/Mobile Bay Crossings



F1-3 Bridge and Tunnel Crossings.png

Another distinction is that these two bodies of water are crossed by similar, but not identical, sets of routes. There are currently three ways to cross the Mobile River. The I-10 Bridge would add a fourth crossing over the lower Mobile River.

1. Cochrane Bridge (US-90 Alt)
2. Bankhead Tunnel (US-90/US-98)
3. Wallace Tunnel (currently designated I-10)

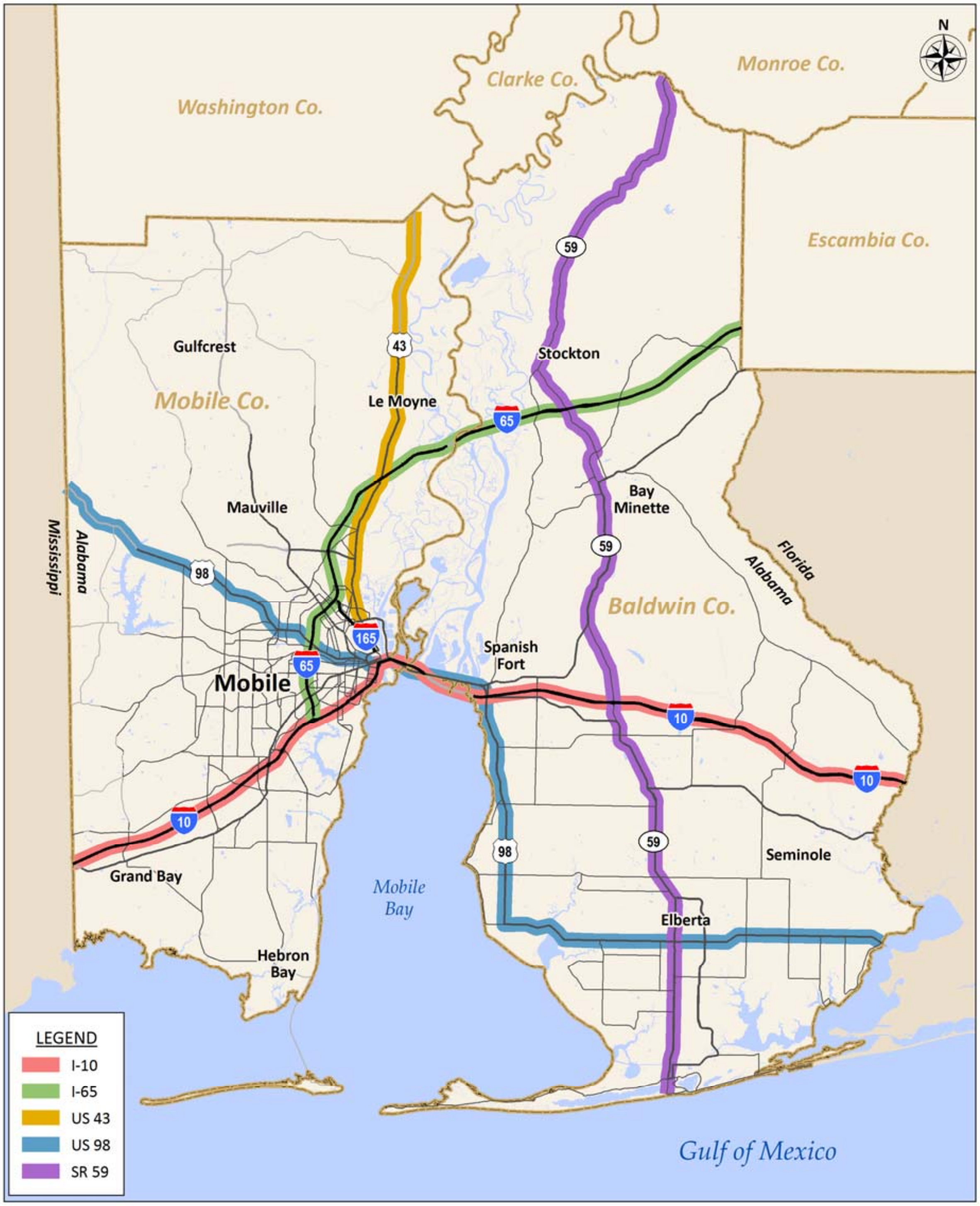
Mobile Bay, by contrast, is crossed by only two routes. The existing I-10 Bayway will be reconstructed, as part of the I-10 MRB&B project. However, upon completion of the project, there would still be only two routes that cross Mobile Bay.

1. I-10 Bayway
2. US-98/US-90 Causeway

1.4.2 Major Routes in Study Area

There are five major routes in the study area meriting individual description. These five routes are highlighted in Figure 1-4.

Figure 1-4 – Major Routes in I-10 Mobile River Bridge and Bayway Study Area



F1-4 Major Routes in Study Area.png

- **Interstate 10 (I-10):** I-10 is a 2,460-mile long transcontinental highway that extends from Santa Monica (Los Angeles), California on the west to Jacksonville, Florida on the east. Sixty-six (66) miles of I-10 traverse southern Alabama. Within Alabama, I-10 is generally two-lanes in each direction, except for the portion in central Mobile between the I-65 interchange and the Wallace Tunnel. I-10 traverses the Mobile River via the Wallace Tunnel, and then traverses Mobile Bay via the I-10 Bayway. The Wallace Tunnel was completed in 1973, and Bayway was completed in 1978. Prior to 1978, drivers had to use the US-98 Causeway to cross Mobile Bay.

  Travel pattern surveys from AirSage and StreetLight Data indicate that a significant proportion of the traffic on I-10 in Alabama are long-distance trips that drive clear through Alabama without stopping (i.e., the start from a point west of the Mississippi State line and travel to a destination east of the Florida State line, or vice-versa). I-10 is a nationally important trucking route. I-10 also serves as the primary route to travel between Mobile and Baldwin Counties. Average annual daily traffic (AADT) volumes on the Alabama portion of I-10 range from a low of 28,000 vehicles per day (VPD) at the Florida State line, to a high of 98,200 VPD immediately west of I-65. The AADT on the Mobile River and Mobile Bay portions of I-10 are approximately 75,000 VPD west of the Mid-Bay interchange, and 67,150 VPD east of the Mid-Bay interchange.

- **US Highway 98 (US-98):** US-98 completely bisects the two-county study area. On the west, at the Mississippi State line, US-98 enters the northwestern portion of Mobile County as a two-lane highway. As the route approaches central Mobile in a southeast/northwest orientation, it becomes a four-lane highway flanked by suburban retail development. US-98 then approaches downtown Mobile from the west as Dauphin Street, and then crosses under the Mobile River via the Bankhead Tunnel, which opened in 1941, and was originally a toll tunnel. Tolls were removed in 1973 when the Wallace Tunnel opened. US-98 then crosses Mobile Bay via the 6-mile long Causeway. Upon reaching Baldwin County, US-98 travels due south for 17-miles, traveling through the towns of Daphne and Fairhope. US-98 then turns due east, and travels for another 28-miles before reaching the Florida State line where it eventually enters Pensacola. US-98 is four-lanes for a 40-mile section in the center of the Mobile/Baldwin County region (including on the Causeway portion of US-98), from the town of Semme in Mobile County to Fairhope in Baldwin County; the remainder is two-lanes. The US-98 speed limits are generally 55 mph, with some suburban and urban sections having speed limits of 35 mph (including in the Bankhead Tunnel).

  Travel pattern surveys indicate that, unlike I-10, US-98 primarily serves shorter-distance trips within Mobile and Baldwin Counties. There are virtually no trips that travel from Mississippi clear through to Florida using US-98. The AADT volumes on US-98 are lowest in southern Baldwin County and northwestern Mobile County (ranging from approximately 6,000 to 12,000 VPD). The highest volume portions are the sections (of Moffett Road) that flank I-65 west of downtown Mobile, which range from 30,000 to 44,000 VPD. The north-south suburban portion of US-98 in Baldwin County also has high volumes that range from 26,000 to 36,000 VPD. The AADT volumes on the US-98 Causeway are approximately 17,000 VPD.

- **Interstate 65 (I-65):** I-65 is an 887-mile long transnational interstate route that starts on the south at I-10 within the city of Mobile. It is an important intra-urban artery within the city of Mobile. The route then crosses the Mobile River into Baldwin County—travels through the Alabama cities of Montgomery, Birmingham and Huntsville—and ends on the north in Gary, Indiana (in the Chicago metropolitan region). I-65 is also a significant regional and national truck route. While I-65 does cross the Mobile River delta within the study area, it is located significantly north of the other crossings.[1] Therefore, it is not a strong competitor to the I-10 Bayway or the US-98 Causeway. For example, a trip between downtown Mobile and the I-10 Daphne interchange is approximately 9.5-miles via the I-10 Bayway, but would be 50-miles via I-65. Trips that use I-65 to cross the Mobile River, yet remain within the Mobile-Baldwin County region, generally start or end in the sparsely-populated northern portion of Baldwin County (such as the town of Bay Minette).

- **US Highway 43 (US-43):** US-43 is a major route that connects industrial facilities situated along the Mobile River in the northern portions of Mobile County with interstate routes and facilities within central Mobile. US-43 has a direct connection with the Cochrane Bridge, allowing truck traffic to reach facilities (such as Austal and Arc oil terminals) on Pinto Island or connect with the I-10 Bayway. US-43 also has an interchange with I-65 that allows long-distance traffic to travel north toward Montgomery, or south toward I-10. US-43 also has a connection to I-165 (via New Bay Bridge Road), which gives traffic direct access to the Port of Mobile main docks complex, the Mobile central business district (CBD) and the Mobile Container Terminal (south of the CBD).

- **Alabama State Route 59 (SR-59):** SR-59 is a north-south route that is 77-miles long within Baldwin County. It traverses the entirety of the county from the northern county boundary, south to the Alabama Gulf Coast beaches. The route is a vital link that brings traffic from I-10 down to the Alabama Gulf Coast beaches, it also provides access between the northern portion of the county (including the County Seat of Bay Minette) and the rest of the county. The 31-mile portion of SR-59, north of Bay Minette, is a two-lane highway. While the 46-mile portion between Bay Minette and the Gulf Coast beaches is four lanes or wider. Much of the route functions as a traditional at-grade arterial. However, the southernmost 11-miles is heavily developed with retail stores, contains dozens of signalized intersections and functions more like a suburban arterial. The speed limits on the route are generally 55

[1] I-65 is located 10-miles north of the Cochrane Bridge, and 13-miles north of the I-10 Wallace Tunnel. I-65 then travels on a northeast trajectory that takes it farther away from I-10; at the first interchange in Baldwin County (at SR-225), I-65 and I-10 are more than 20-miles apart.

mph north of I-10, and vary on the portion south of I-10 between 35 mph and 55 mph. Traffic volumes on SR-59 generally increase in the southbound direction. Between I-10 and US-98 the AADT volumes range from 23,000 to 30,000. South of US-98, the volumes increase from 35,000 to 42,000. Finally, on the bridge over the Intra-Coastal Waterway, just north of the Gulf Coast beaches, the AADT volume peaks at 56,000.

Chapter 2 – Existing Traffic Conditions

This chapter contains a description of the traffic-volume characteristics of the roadways in the study area, particularly along routes that cross the Mobile River and Mobile Bay. The first section has highlights of average annual daily traffic (AADT) volumes throughout the study area. The second section has hourly traffic volume characteristics on I-10, US-98 and I-65. The third and fourth sections contain descriptions of the monthly and day-of-week traffic volume variations along I-10. The fifth section features the historic traffic volume growth characteristics on I-10, US-98 and I-65. The sixth section of this chapter contains a description of the way in which the traffic counts were used for the base-year model calibration.

2.1 Average Annual Daily Traffic

Figure 2-1 shows 2015 AADT volumes along key routes and Mobile River crossings in the study area.[2] The highest traffic volumes within the study area are segments of I-10 and I-65 that are within the city of Mobile, as well as I-10 where it crosses the Mobile River and Mobile Bay. I-10, immediately west of I-65 has an AADT of 98,200 VPD. The segment of I-65, immediately south of US-98, has an AADT volume of 92,730 VPD. The I-10 Wallace Tunnel and the west half of the I-10 Bayway have AADT volumes of approximately 75,000 VPD. Given that traffic is delayed in the Wallace Tunnel and on the Bayway for a significant portion of each day, this indicates that these volumes are capacity constrained. Other areas with high traffic volumes include the Eastern Shores communities, and the Alabama Gulf Coast area (both in Baldwin County). The following bullet points describe the daily volumes along major routes in the study area:

- **I-10:** The volumes along I-10 are lowest in the rural areas at the Florida and Mississippi State lines and gradually build up to a peak at the I-10/I-65 interchange. The I-10 AADT volumes are just 28,530 VPD at the Florida State line, 44,170 VPD at the Mississippi State line, and nearly 100,000 VPD at the I-10/I-65 interchange.

- **I-65:** The most heavily traveled section of I-65 is between I-10 and I-165 (all within the city of Mobile), where AADT volumes range from 72,410 to 92,730 VPD. North of I-165, the volumes on I-65 gradually decrease as the surrounding area becomes more rural. The AADT volumes are 66,720 VPD just north of Interstate 165 (I-165), approximately 45,000 VPD north of Industrial Blvd., 21,580 VPD across Mobile River/Bay, the volume drops to a low of 17,230 VPD in Baldwin County (between the SR-59 and SR-287 interchanges), but then increases to 22,130 VPD at the eastern boundary of the study area.

[2] 2015 AADT counts obtained from ALDOT at: https://aldotgis.dot.state.al.us/atd/default.aspx

- **US-98:** US-98 has notably high traffic volumes on three segments within the study area.

    1. Segment flanking I-65: AADT volume is approximately 42,000 VPD.
    2. Segment across Mobile River/Bay: AADT volume is approximately 22,000 VPD.
    3. North-south oriented segment south of I-10 in Baldwin County: AADT volume is approximately 34,000 VPD.

- **Government Street (US-90):** AADT volumes on Government Street, between I-65 and Bankhead Tunnel, are approximately 22,000 VPD (with volumes as high as 30,570 VPD just west of the Mobile CBD).

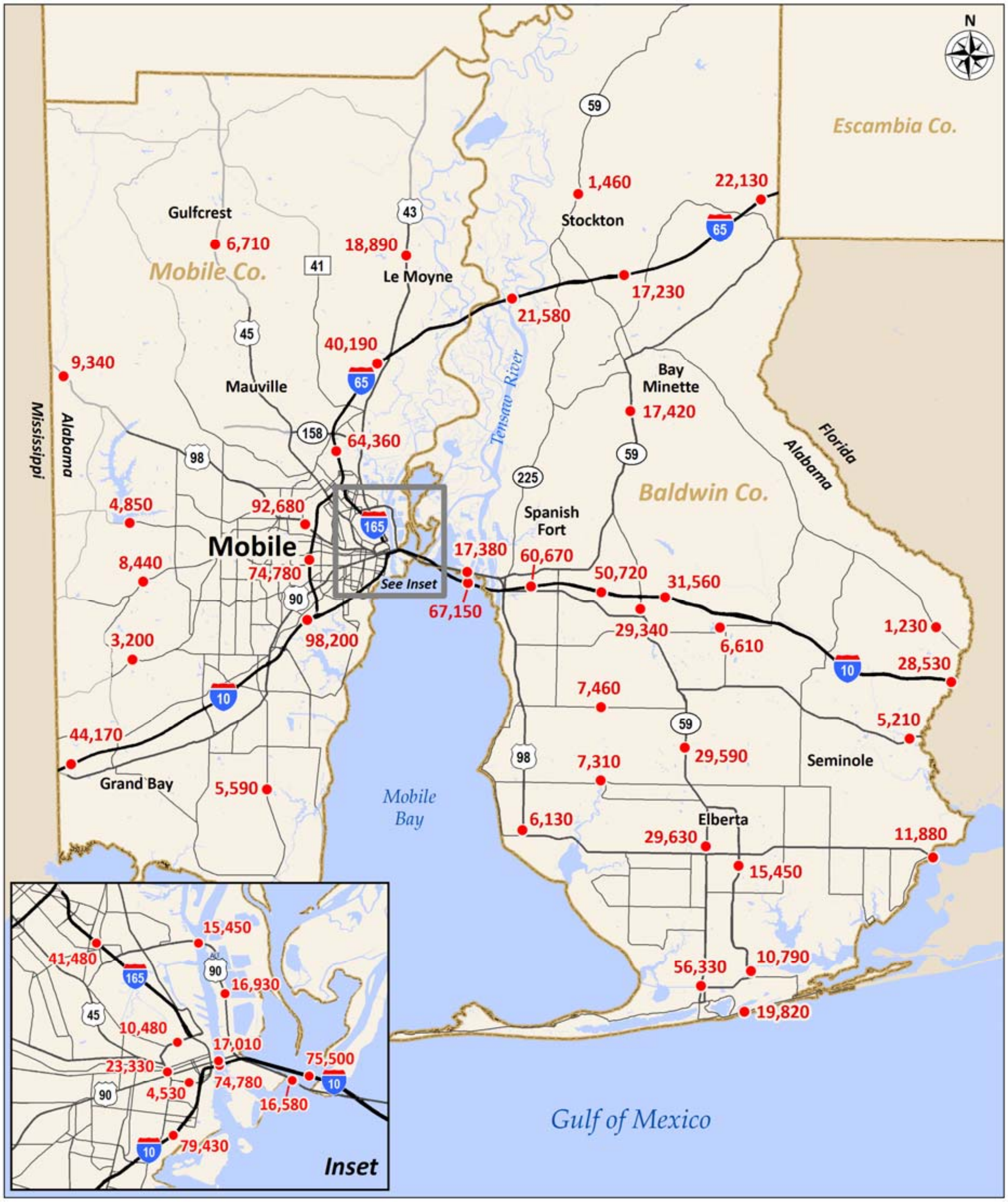
- **Interstate 165 (I-165):** is a 5-mile spur route that connects I-65 with downtown Mobile. The segment of I-165 between I-65 and Alt. US-90 (which connects to the Cochrane Bridge) has an AADT of 42,000 VPD.

- **US-43 and US-45:** AADT volumes on both routes, where they connect to I-65, are approximately 26,000 VPD.

- **SR-59:** AADT volumes are approximately 25,000 to 30,000 VPD between I-10 and Foley (US-98). Volumes increase toward the south, reaching a peak of 56,330 on the bridge over the Intra-Coastal Waterway, immediately north of the Gulf Coast beaches.

- **SR-182 (Perdido Beach Blvd.):** AADT volumes on SR-182 are approximately 20,000 to 25,000 VPD east of SR-59.

Figure 2-1 – 2014-15 Average Annual Daily Traffic Volumes



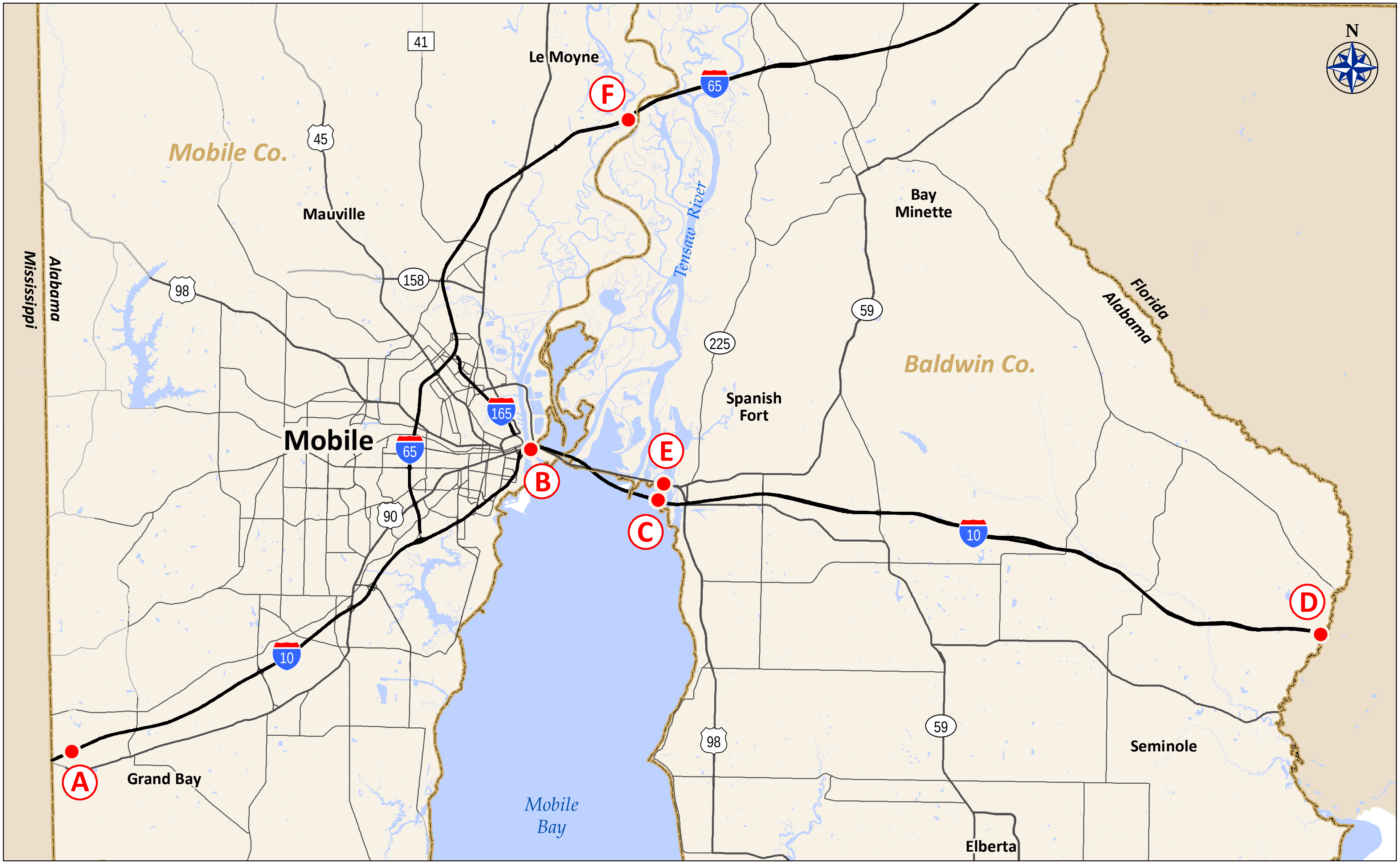
F2-1 Average Annual Daily Traffic.png

2.2 Hourly Traffic Characteristics

Hourly traffic volume characteristics vary widely throughout the study area, and even vary widely on different sections of the same route. To illustrate these differences, this section contains six hourly traffic volume profile graphs at locations along I-10, US-98 and I-65. The six hourly traffic volume locations are shown in Figure 2-2. This map has the hourly counts as Locations A through F. The corresponding hourly volume graphs (for Locations A through F) are shown in Figure 2-3 through Figure 2-8. The first four graphs are all locations along I-10. Figure 2-4 shows the hourly volumes in the I-10 Wallace Tunnel, while Figure 2-5 shows volumes on the eastern portion of the I-10 Bayway. Both graphs indicate a typical urban traffic volume profile with distinct morning (AM) and afternoon (PM) peak periods. On the portion of I-10 that crosses the Mobile Bay and the Mobile River, westbound toward Mobile is the peak AM direction and eastbound toward Baldwin County is the peak PM direction. At both locations, the westbound AM peak volume is approximately 3,200 vehicles per hour (VPH), and the midday volume is approximately 2,000 VPH in both directions. However, there is a difference in the eastbound PM peak period volumes: On the eastern I-10 Bayway, there is a distinct PM peak of approximately 2,500 VPH at 4:00 PM, while the westbound volumes are trending lower. In the Wallace Tunnel, there is also a PM peak of approximately 2,500 VPH at 4:00 PM, but there is also a concurrent westbound PM peak of equal magnitude (of approximately 2,500 VPH). This shows that the I-10 Bayway and I-10 Wallace Tunnel are both used for commuting purposes. Congested traffic operations on either side of the Tunnel limit how much traffic can commute per hour.

Figure 2-3 and Figure 2-6 contain the hourly volumes on I-10 at the west and east extremities of the study area (at the Mississippi and Florida State lines respectively). The hourly profiles at both of these locations generally indicate a rural volume pattern. In Figure 2-3, volumes are relatively low (approximately 1,000 VPH in each direction) with no distinct directionality or peak. Volumes gradually build over the course of the day, and both directions peak in the 3:00-4:00 PM timeframe. The profile at the Florida State line (Figure 2-6) does show a small AM Peak in the eastbound direction (toward Pensacola), and there is a small PM peak of approximately 1,700 VPH in both directions during the 4:00 PM hour. These volume profiles show that I-10 at the Mississippi State line is generally not used for commuting to/from work, but that I-10 at the Florida State line may have some limited commuting use (between Baldwin County and Pensacola).

Figure 2-7 has the hourly volumes on the US-98 Causeway at approximately the same location within Mobile Bay, as Figure 2-5 on the I-10 Bayway. The US-98 graph, like the I-10 Bayway graph indicates distinct AM and PM peak periods, and clear directionality of traffic in the peak periods. The only difference between the I-10 Bayway and US-98 Causeway graphs is the volumes on US-98 are roughly half the I-10 volumes. Finally, Figure 2-8 has the hourly volumes on I-65 across Mobile Bay. Even though this location is north of the I-10 Bayway and US-98 Causeway, the volumes on I-65 at this location clearly fit a rural profile pattern. There is no AM Peak, traffic in both directions build-up to a PM peak, and there is no directionality exhibited in the traffic volumes. This shows that I-65 is generally not used for commuting purposes (even though it has a direct connection to central Mobile).



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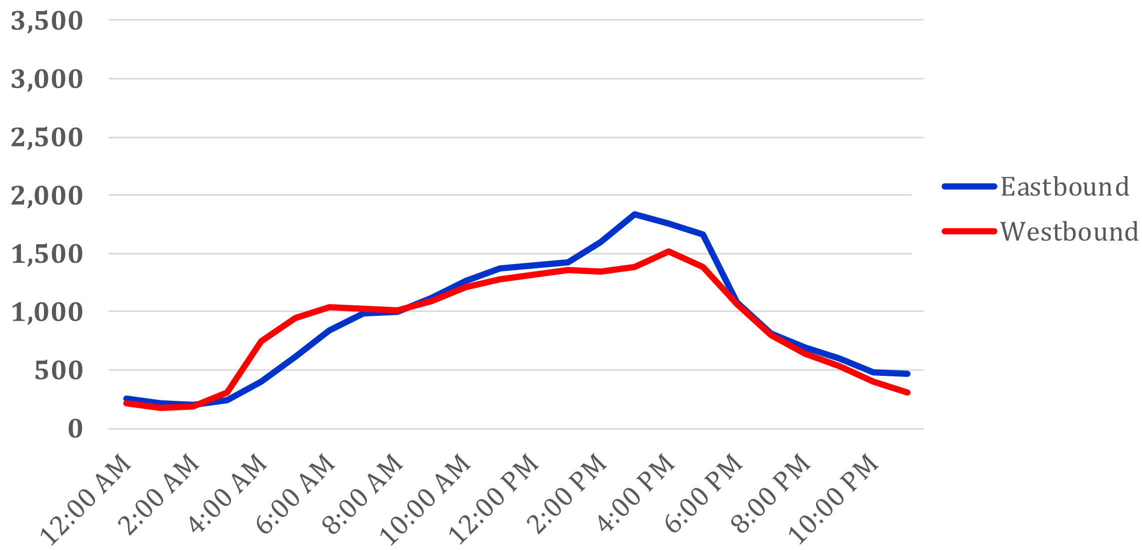
HOURLY COUNT LOCATIONS

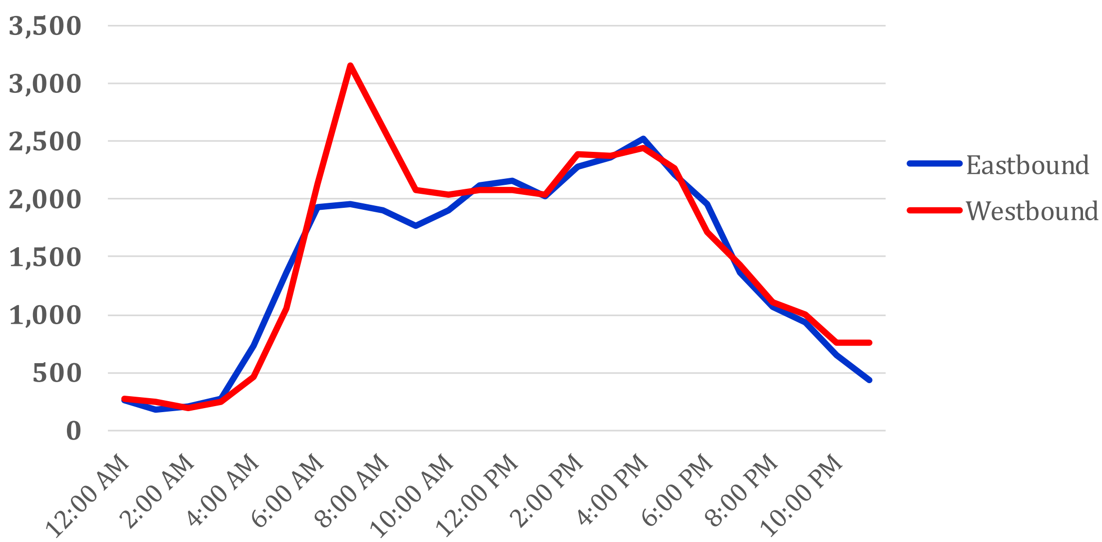
FIGURE 2-2

Figure 2-3 – Hourly Traffic Volumes, Location A: I-10 at Mississippi State Line[3]



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-3) I-10 Wallace Hourly Graph

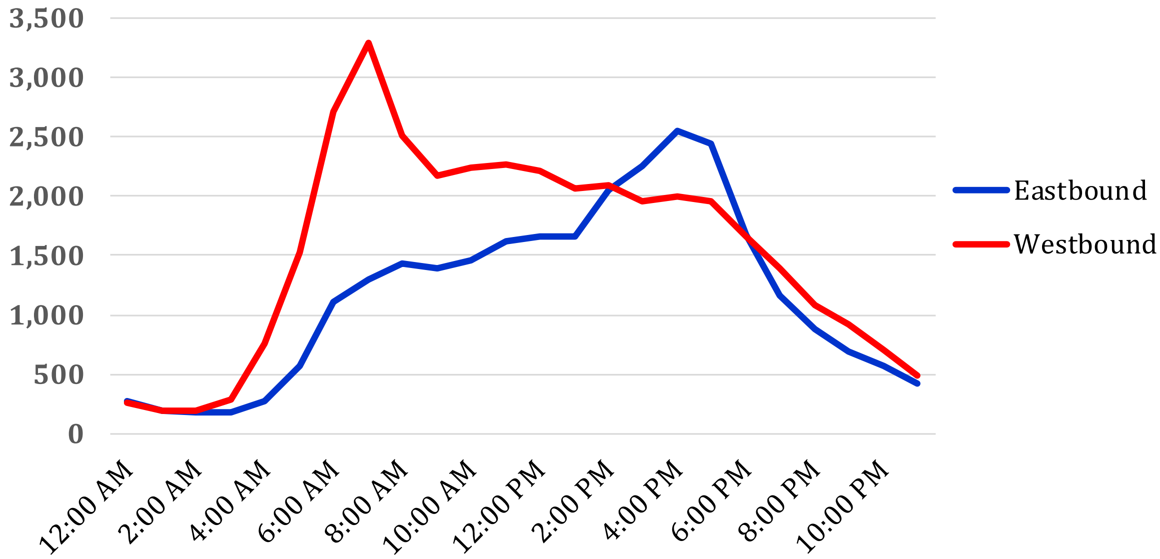
Figure 2-4 – Hourly Traffic Volumes, Location B: I-10 Wallace Tunnel[4]



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-4) I-10 Bayway Hourly Graph

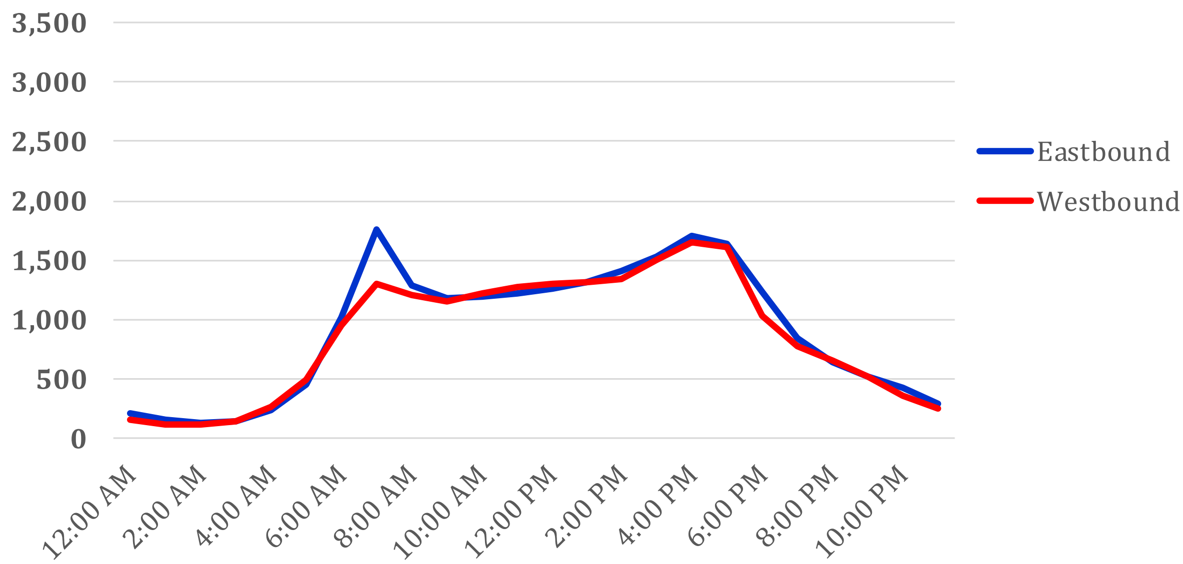
[3] Traffic Volume Source: ALDOT 2014-15 Permanent Traffic Counter ATR-65
[4] Traffic Volume Source: Vehicle Classification Hourly Traffic Counts collected by ALDOT in March 2016.

Figure 2-5 – Hourly Traffic Volumes, Location C: Eastern I-10 Bayway[5]



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-5) I-10 Bayway Hourly Graph

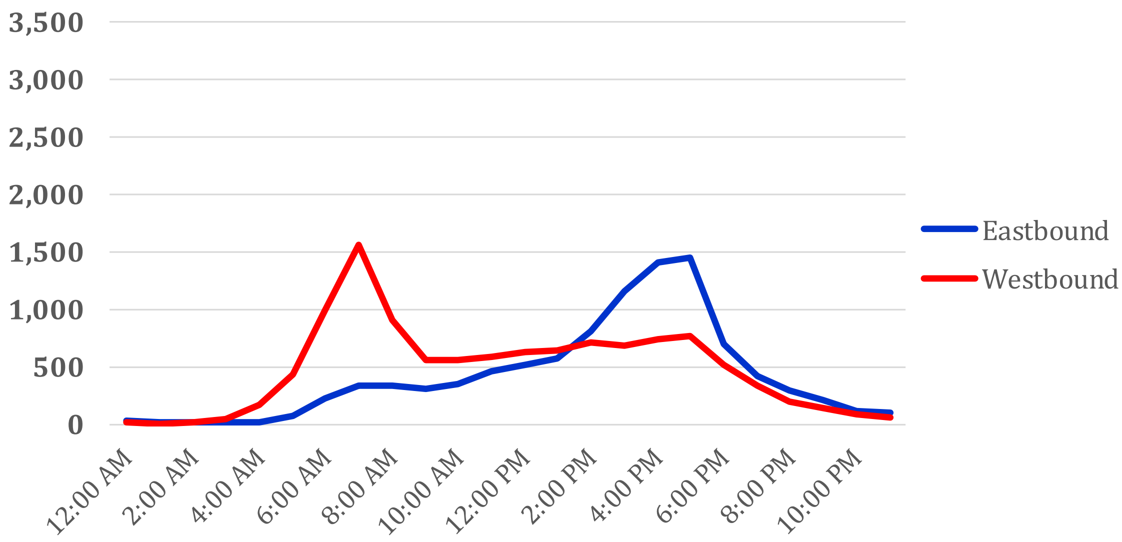
Figure 2-6 – Hourly Traffic Volumes, Location D: I-10 at Florida State Line[6]



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-6) I-10 at Florida Hourly

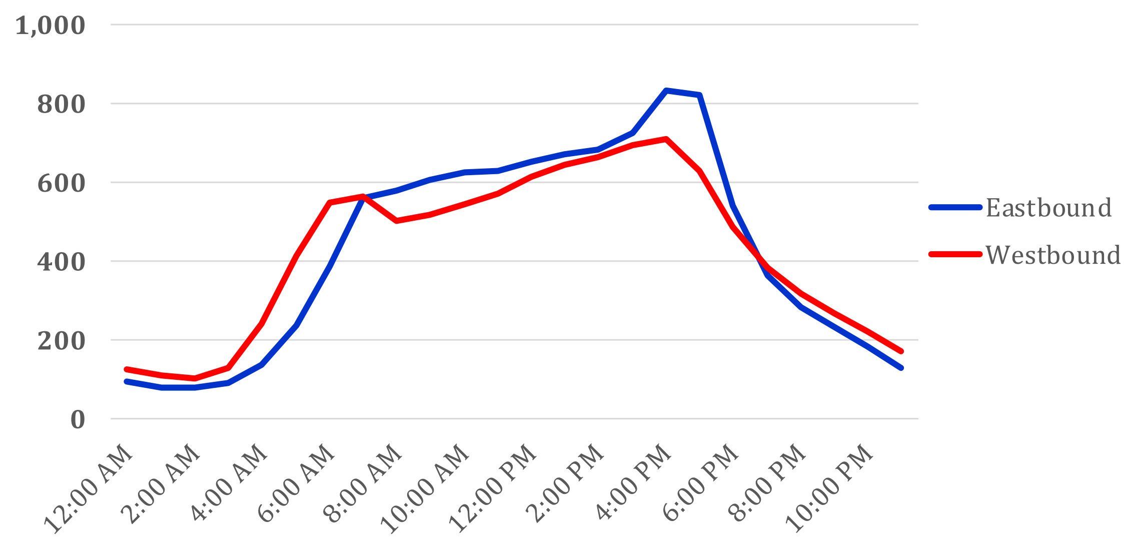
[5] Traffic Volume Source: Vehicle Classification Hourly Traffic Counts collected by ALDOT in March 2016.
[6] Traffic Volume Source: ALDOT 2014-15 Permanent Traffic Counter ATR-981

Figure 2-7 – Hourly Traffic Volumes, Location E: US-98 Causeway[7]



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-7) US-98 Hourly Graph

Figure 2-8 – Location F: I-65 Bridge – Hourly Traffic Volumes[8]



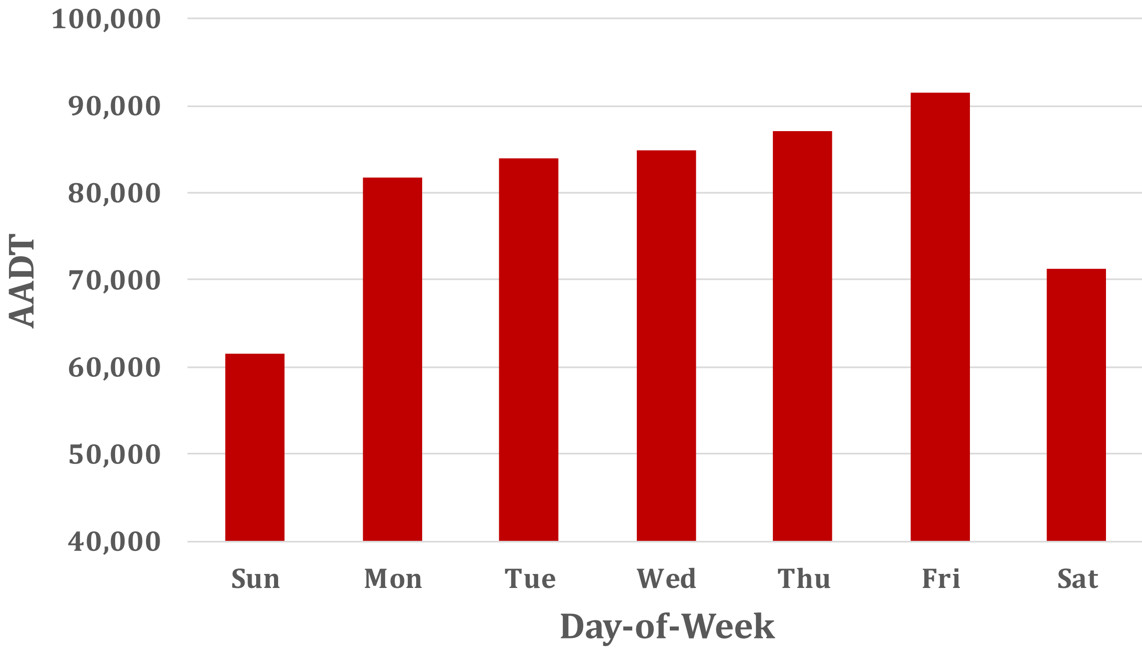
Source File: ALDOT I-10 MRB Industry Forum--Report Tables v3.0.xlsx / Tab: F2-8) I-65 Bridge Hourly Graph

[7] US-98 Causeway hourly traffic counts collected by ALDOT in March 2016.
[8] I-65 hourly traffic counts collected by ALDOT in March 2016

2.3 Weekly Traffic Variation

Figure 2-9 contains traffic volume variations by day-of-week on I-10 approximately 4-miles west of the Wallace Tunnel.[9] The graph shows that the daily traffic volumes trend upward between Monday and Friday. From Monday through Thursday, the volumes range from approximately 82,000 to 87,000 VPD. On Friday, the daily volume jumps to nearly 92,000 VPD. On Saturday and Sunday, the daily volumes are significantly lower. On Saturday, the daily volumes are 20 percent lower than the weekday average, while on Sunday the daily volumes are 40 percent lower than the weekday average.

Figure 2-9 – I-10 Weekly Volume Variation



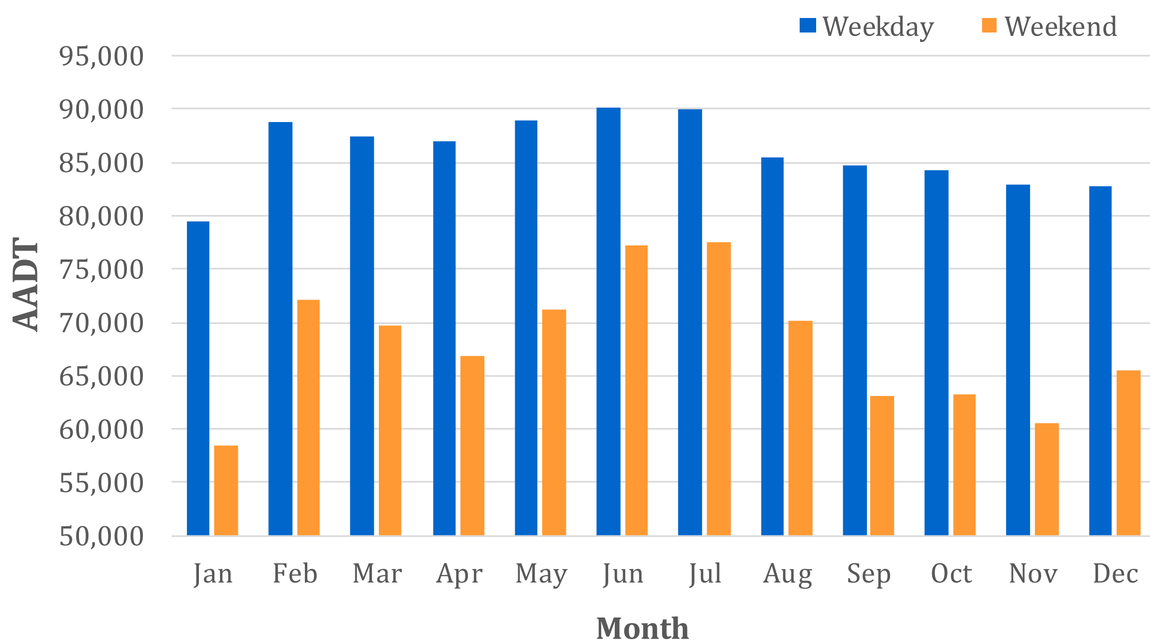
Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-9) Weekday Variation

[9] Full year 2014 and 2015 traffic data was obtained from ALDOT Permanent Counter ATR-718.

2.4 Monthly Traffic Variation

Figure 2-10 contains the AADT volume by month on I-10, approximately 4-miles west of the Wallace Tunnel.[10] The traffic volumes are also broken-out by weekdays (Monday-Friday) versus weekend days (Saturday and Sunday). The AADT for all days of the week is 80,400 VPD, while the AADT for weekdays is 86,000 VPD and for weekend days it is 68,000 VPD. The weekday AADT volumes vary by month from approximately 80,000 to 90,000 VPD. January is 8 percent below the weekday AADT, and June/July are 5 percent above the AADT. Therefore, the weekdays exhibit moderate seasonal variation. On the other hand, the weekend days exhibit stronger seasonal variation. They range from 58,500 VPD in January (which is 14 percent below the AADT) to 77,400 VPD in June/July (which is 14 percent above the AADT).

Figure 2-10 – I-10 Monthly Volume Variation



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-10) Monthly Variation

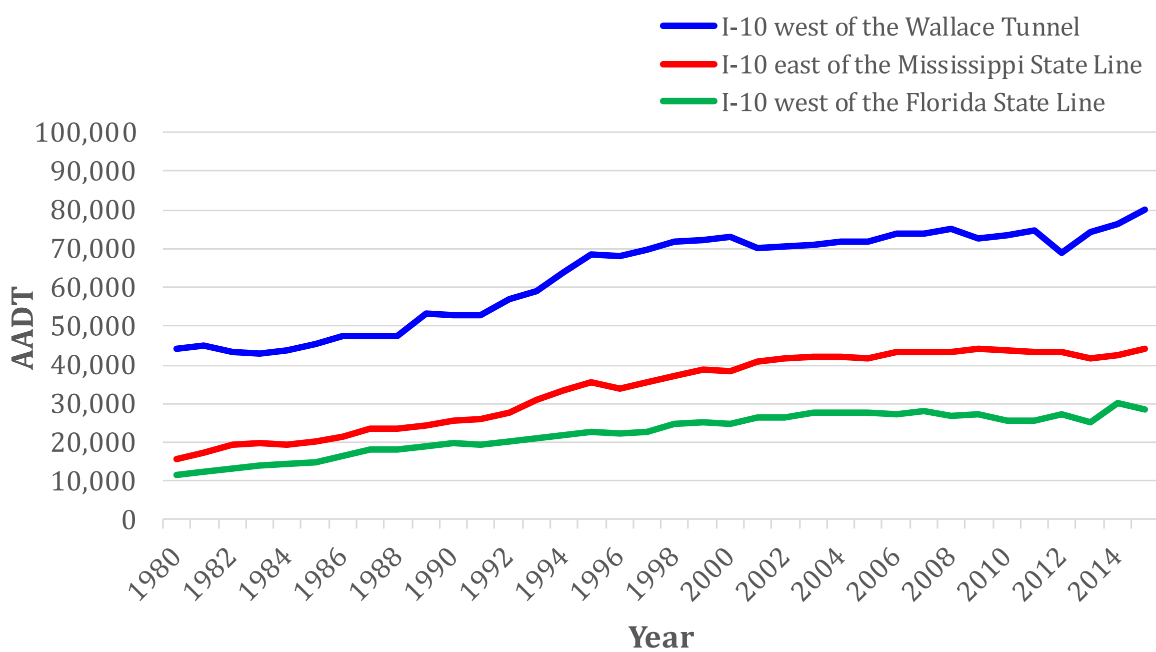
[10] Full year 2014 and 2015 traffic data was obtained from ALDOT Permanent Counter ATR-718.

2.5 Historical Volume Growth

Figure 2-11, Figure 2-12 and Figure 2-13 have the historical traffic volumes and growth in AADT volumes on I-10, US-98 and I-65 respectively.

Figure 2-11 has the AADT volumes between 1980 and 2015 at three locations along I-10. The blue line represents the volume immediately west of the Wallace Tunnel, while the green and brown lines represent the volumes at the Mississippi and Florida State lines. Traffic volumes at all three locations have increased significantly over the past 35 years. The volume at the Florida State line has increased from 11,500 to 28,500 VPD; the volume at the Mississippi State line has increased from 15,500 to 44,200 VPD; and the volume near the Wallace Tunnel has increased from 44,200 to 80,200 VPD. Traffic volumes near the Wallace Tunnel are far higher than at the two state line locations. However, the compound average annual growth rate (CAAGR) in traffic near the Wallace Tunnel is only 1.7 percent, which is approximately half the growth at the two state line locations (2.6 and 3.0 percent at Florida and Mississippi respectively). Traffic volume growth at all locations on I-10 has slowed in the past ten years (particularly at the rural locations). The 2005-2015 CAAGR was 1.1 percent near the Wallace Tunnel, 0.6 percent at the Mississippi State line and 0.3 percent at the Florida State line.

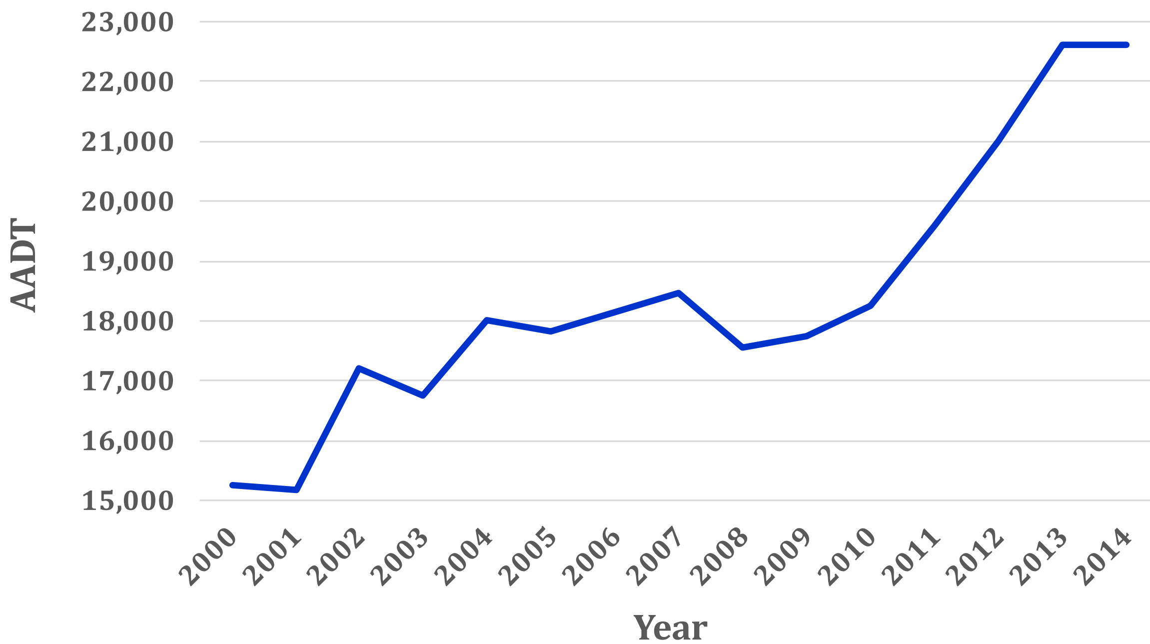
Figure 2-11 – I-10 AADT Volumes: 1980 to 2015



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-11) I-10 Historical ADT

Figure 2-12 has the AADT volume on the US-98 Causeway (between the Mid-Bay and Daphne interchanges) from 2000 through 2014. This graph shows that volumes on this portion of US-98 have increased nearly 50 percent or 7,400 VPD over the past 14 years (from 15,200 to 22,600 VPD). This equates to a CAAGR of 3.1 percent per year.

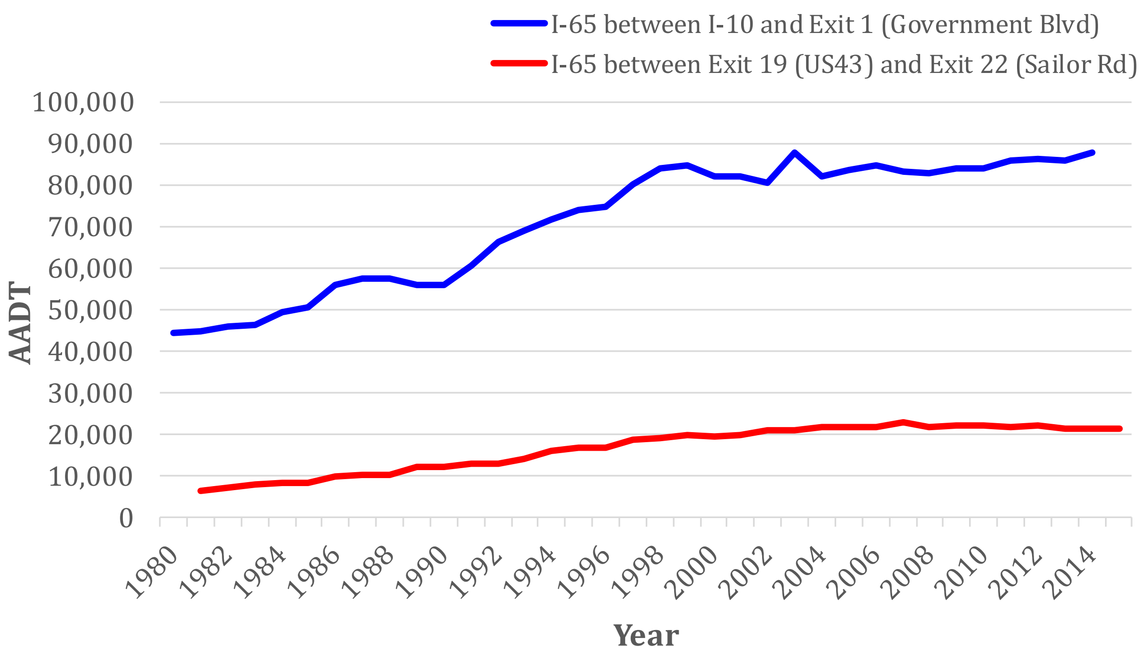
Figure 2-12 – US-98 Causeway – 2000 to 2014 AADT Volumes



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-12) US-98 Historical ADT

Figure 2-13 contains the historical AADT volumes on I-65 at two locations in the study area. The first location is immediately north of where I-65 starts north of I-10, in a suburban environment. The second location is immediately west of the Mobile River (between the Sailor Road and US-43 interchanges), in a rural environment. There is a significant volume difference between the two locations. The 2014 AADT was 87,800 VPD at the southern suburban location, whereas it was less than one-quarter that amount (21,600 VPD) at the rural location. The AADT volume at the rural location has increased sharply from 6,400 VPD in 1980 to 21,600 VPD in 2014: an increase of 240 percent, or 3.7 percent per year. However, in the past ten years (2004-2014), the AADT volumes at the rural location have been flat: the volume decreased a mere 100 vehicles from 21,700 VPD in 2004 to 21,600 VPD in 2014. At the suburban location, the volumes have increased less significantly over the past 34 years (2.0 percent CAAGR), but they have continued to increase in the past ten years (albeit at a slower 0.7 percent CAAGR).

Figure 2-13 – I-65 AADT Volumes: 1980 to 2014



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F2-13) I-65 Historical ADT

2.6. Area-Wide Traffic Volumes by Time Period

Hourly traffic counts were used to calibrate the time-of-day travel demand model developed for this T&R Study. CDM Smith used the following seven steps to identify traffic count locations, obtain the data, and to clean, process and adjust the traffic volumes.

1. Identify Traffic Volume Screenlines
2. Identify Major Roads Crossing Each Screenline (i.e., Traffic Volume Count Locations)
    a. Determine **Existing** (Permanent Counter) Traffic Volume Count Locations
    b. Determine **Proxy** Traffic Count Locations
    c. Determine Screenline locations where **new hourly counts** are needed
3. Calculate Hourly Traffic Volumes by direction for all locations
4. Calculate truck percentages by direction by hour
    a. Manual counts used truck percentages directly
    b. AADT counts provide percentage of daily traffic composed of commercial vehicles (CV%), used manual count hourly CV% profile as proxies to obtain hourly CV%
    c. Permanent Counter used nearby AADT count to obtain daily CV%, nearby manual count was used as proxy for hourly CV% variation
5. Calculate hourly volumes by location by direction by hour by passenger cars (PC) and commercial vehicles (CV)[11]
6. Condense data from hourly to four time periods
7. Calculate Average Annual to Weekday factors to convert from AADT to Average Weekday Traffic (AWT)

STEP 1: Identify Traffic Volume Screenlines

Figure 2-14 illustrates the eleven traffic volume screenlines that were developed to calibrate the I-10 MRB&B travel demand model. The objective is to adjust the model such that the model-assigned volumes match the actual traffic counts across the screenline. CDM Smith created eleven screenlines for the I-10 MRB&B model. These screenlines were designed to focus primarily on the project, and to include all major roads in the study area. For example, Screenlines D, E and F cut directly through the project area, and ensure that in the base-year model the east-west traffic across Mobile River/Bay closely matches actual traffic counts.

STEP 2: Identify Traffic Count Locations (Major Roads Crossing Each Screenline)

Once the traffic volume screenlines were determined, CDM Smith then determined all of the significant highways/roadways crossing through the screenline. Traffic counts were obtained for all of these highways/roadways where they intersected the screenline. There are 83 highways/roadways locations crossing the eleven screenlines where traffic counts needed to be obtained. All of these count locations are illustrated on Figure 2-15.

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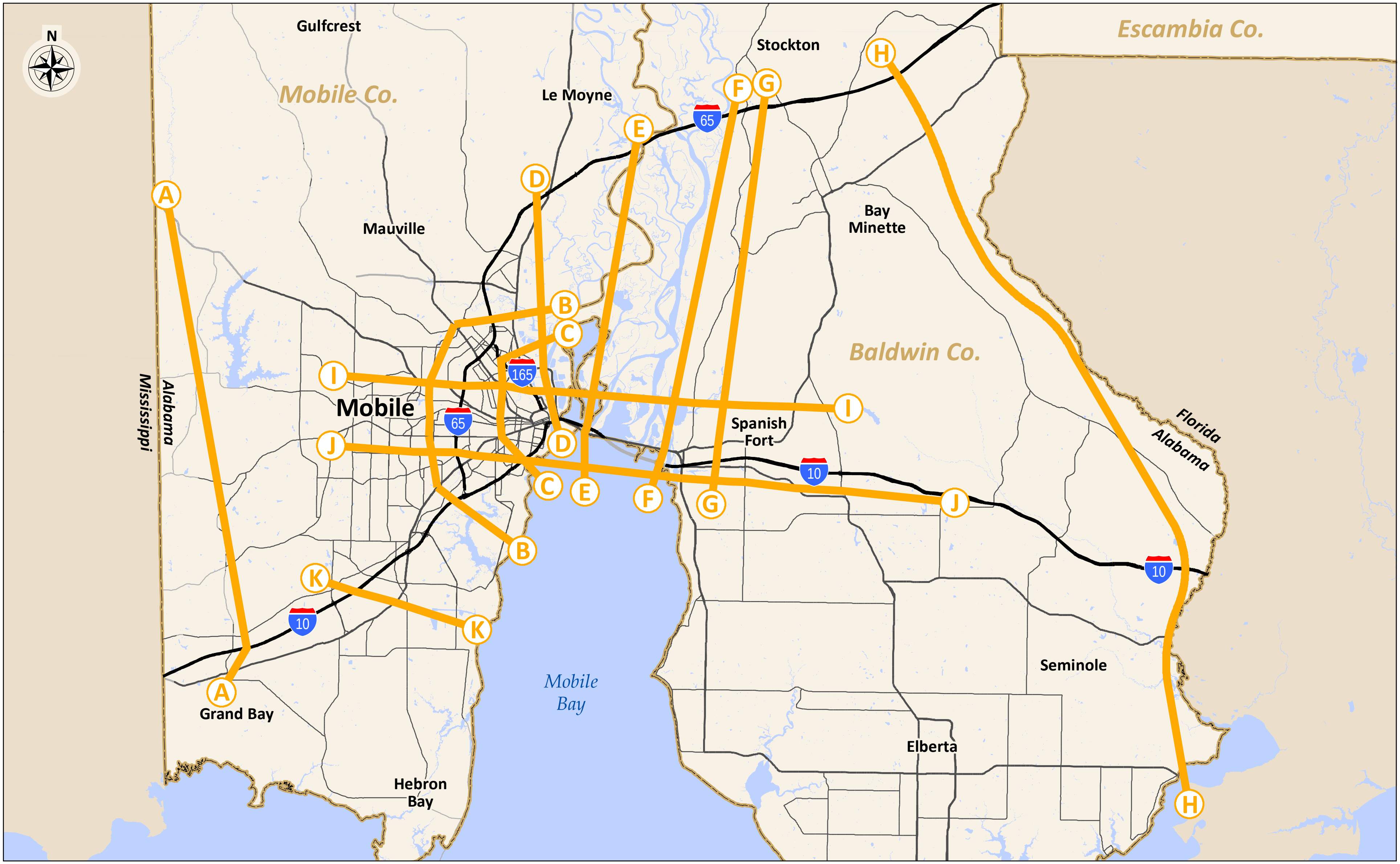
[11] The terms Commercial Vehicles (CVs) and trucks are used interchangeably in this report, and both terms generally refer to medium and large trucks with three or more axles.

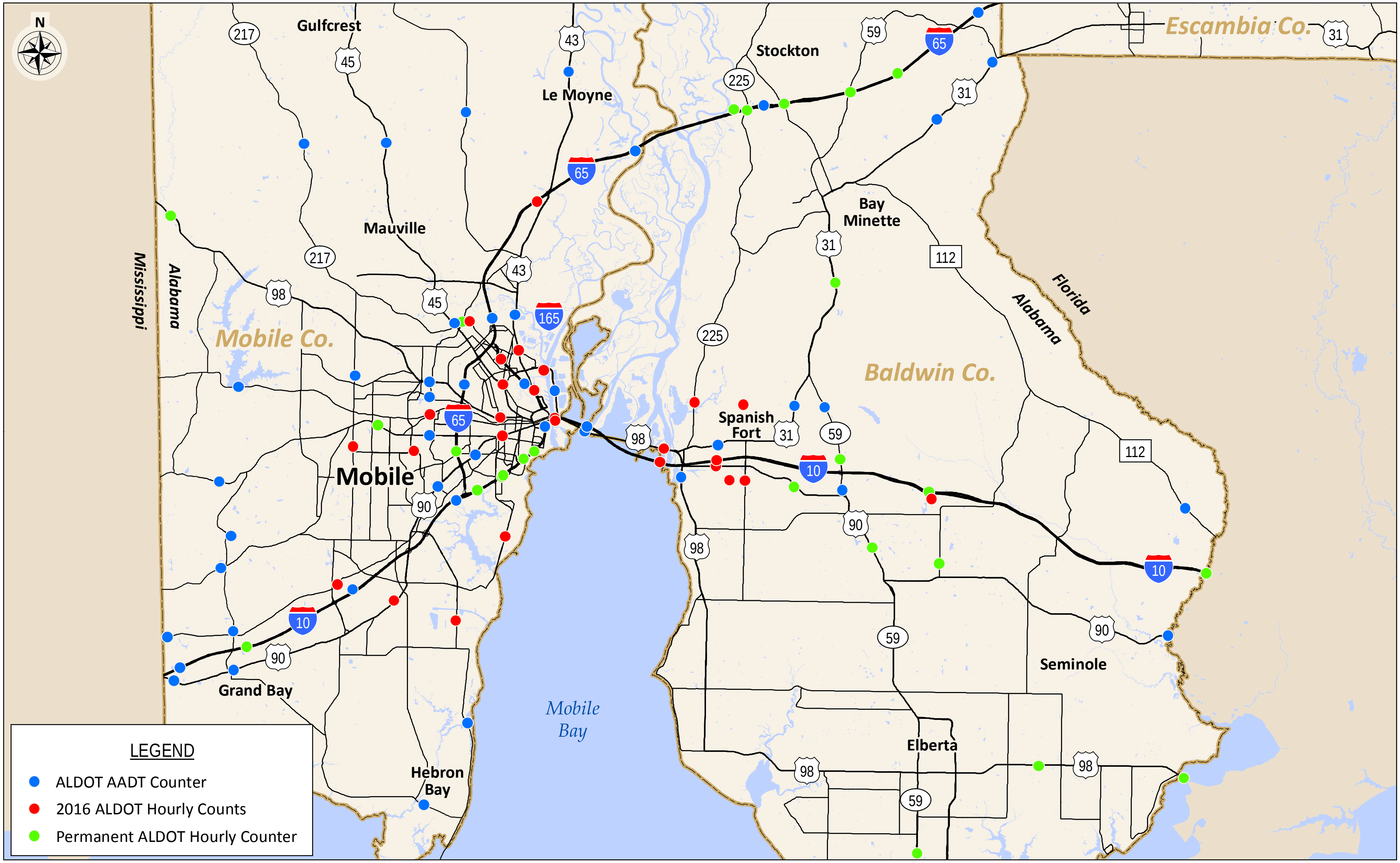


X:\TFT Group\Projects\AL 112768 I-10 Mobile River Bridge Comprehensive T&R Study\ArcMap\Traffic Volume Screenlines.mxd \ 3-17-17

CDM Smith

TRAFFIC VOLUME SCREENLINES

FIGURE 2-14



CDM Smith

TRAFFIC COUNT LOCATIONS

FIGURE 2-15

STEP 3: Calculate Hourly Traffic Volumes by Direction for All Locations

Hourly traffic counts for the 83 screenline locations identified on Figure 2-15 were obtained from three sources:

- **Hourly Tube Counts:** ALDOT collected hourly vehicle classification counts for a one-week period at 27 locations in March/April 2016 specifically for this study. The counts provided hourly volumes by direction, broken into 13 vehicle classes.
- **ALDOT Permanent Counter Stations**: ALDOT maintains permanent count stations throughout the state. Each counter provides comprehensive hourly count data by direction for all hours and days. However, no vehicle classification information is available with this count data. There are 11 permanent counters located along the study screenlines.
- **Average Annual Daily Traffic Counts:** ALDOT collects AADT counts throughout the state each year. The AADT counts are provided through a map interface at ALDOT's traffic count website.[12] The AADT count record provides the current truck percentage, and up to ten years (2005-2014) of historical AADT counts at that location.

The vehicle counts from the first two sources could be used directly in the calculation of the final model calibration volumes. The only adjustment made to data from the first two sources was to balance the daily total volumes such that they were equal by direction. However, the AADT counts are only daily (24-hour) counts. Nearby "proxy" hourly traffic counts were used to estimate the percentage of daily traffic per hour. These percentages were then multiplied by the AADT count to obtain the corresponding estimated hourly volumes by direction. For example, Table 2-1 contains an illustration of the calculation process required to convert an AADT count on SR-59 just north of the town Loxley to a directional time-period volume, using a permanent counter also on SR-59, located approximately 3-miles north (just north of I-10). The assumption in using "proxy" profiles is that while the total daily volumes may be different at the two locations, the distribution of traffic over the course of a day is likely similar between the AADT count location and its "proxy" count location.

[12] https://aldotgis.dot.state.al.us/atd/default.aspx

Table 2-1 – Example of Converting AADT to Directional Volume by Time Period

Time Period	Hours	Permanent Counter ATR-734 Volumes (on northbound SR-59, north of I-10)	Percent of Daily Traffic per Time Period	2014 AADT on northbound SR-59, north of Loxley (half of total AADT volume)	Estimated Volumes by Time Period on northbound SR-59, north of Loxley (from ATR-734 "proxy" volume profile)
AM Peak	6:00 AM-9:00 AM	2,220	19%		2,740
Midday	9:00 AM-4:00 PM	5,680	49%	14,380	7,030
PM Peak	4:00 PM-7:00 PM	1,980	17%		2,450
Overnight	7:00 PM-6:00 AM	1,750	15%		2,160
	Total	11,630	100.0%		14,380

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T2-1) AADT Proxy Example

STEP4: Calculate Truck Percentages by Direction by Hour

After calculating the hourly volumes by direction at each location, the volumes needed to be split from vehicles into two vehicle types: PC and heavy trucks (also known as CV). A single daily truck percentage was not sufficient to split the vehicle counts into PC/CV, since the percentage of trucks varies by hour of day. Therefore, CDM Smith needed to obtain truck percentages for each hour of the day by direction at each location.

The hourly vehicle classification counts provided truck percentages (and truck volumes) for each hour of the day. Therefore, the traffic counts at those locations could be split directly from the raw data. These vehicle classification counts contained 13-classes; CDM Smith assumed that vehicles in Classes 1, 2 and 3 are PCs, and vehicles in the remaining classes (4 through 13) are trucks/CVs. Figure 2-16 contains vehicle-silhouette illustrations of the FHWA 13 vehicle classes.

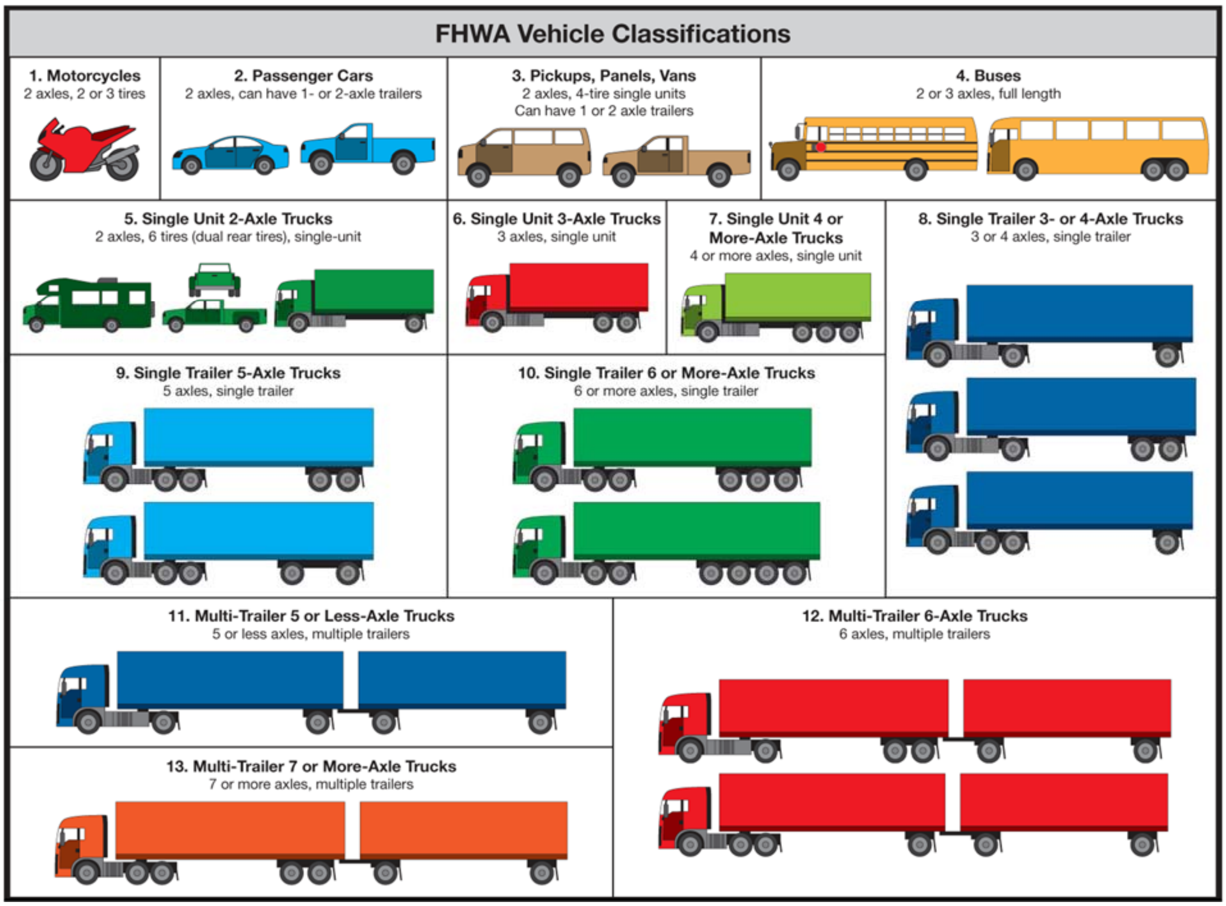
At the AADT count locations, the AADT record provides the percentage of all trucks (TADT) and the percentage of trucks comprised of heavy trucks (Heavy) at that location.[13] However, the heavy truck percentage at the AADT locations is only the average daily percentage. To obtain the hourly truck percentage, a "proxy" set of hourly percentages by direction was borrowed from the nearest and most-relevant classification count location. For example, on I-10, just west of the I-65 interchange, only an AADT count is available. The most relevant vehicle classification count location (from which hourly truck percentages can be obtained) was in the I-10 Wallace Tunnel. Table 2-2 illustrates the calculation steps used to estimate the hourly truck percentage at the AADT count location on I-10. First the truck percentage at the "proxy" vehicle classification count is calculated for all hours. Second, the average daily truck percentages at the "proxy" and AADT

[13] The TADT percentage must be multiplied by the "Heavy" percentage to obtain the percentage of traffic that is heavy trucks. For the purposes of splitting the vehicles into two classes, CDM Smith assumed that heavy trucks are part of the truck/CV class, while the remainder of the vehicles (which includes both PCs and small trucks) are part of the PC class.

locations are used to calculate a truck percentage adjustment factor (8.3% ÷ 9.1% = 91.2%). Finally, the hourly truck percentages at the "proxy" location are multiplied by the adjustment factor to obtain the estimated hourly truck percentages at the AADT location.

The ALDOT permanent counter data does not provide any vehicle classification (truck percentage) information. Therefore, CDM Smith located the AADT count location closest to the permanent counter to obtain a "proxy" daily truck percentage. CDM Smith then followed the procedure outlined above to convert the daily percentage into a set of hourly percentages by direction.

Figure 2-16 – FHWA Vehicle Classification Chart



F2-16 FHWA_Classification_Chart_FINAL.png

Table 2-2 –Estimate of Truck Percentage by Time Period at AADT Count Location

Time Period	Hours	Hourly Truck Percentage at Proxy Location	Daily Truck Percentage at AADT Count Location	Truck Percentage Adjustment Factor	Estimated Hourly Truck Percentage at AADT Count Location
AM Peak	6:00 AM-9:00 AM	6.8%	8.3%	8.3% / 9.1% = 92%	6.3%
Midday	9:00 AM-4:00 PM	10.1%			9.3%
PM Peak	4:00 PM-7:00 PM	7.5%			6.9%
Overnight	7:00 PM-6:00 AM	10.4%			9.5%
	Total	9.1%			8.3%

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T2-2) CV% Proxy example

STEP 5: Calculate Hourly Volumes by PC/CV

Once directional hourly volumes and hourly truck percentages were obtained (in Steps 3 and 4 respectively) for all locations, then CDM Smith was able to calculate the hourly volumes by PC and CV for all hours and locations.

STEP 6: Condense Data from Hourly to Four Time Periods

Once the hourly volumes by PC/CV were obtained in Step 5, they were condensed/summed from 24-hours down to four time periods as follows:

- Time Period 1 – AM Peak – 7:00 AM to 9:00 AM (two hours)
- Time Period 2 – Midday – 9:00 AM to 3:00 PM (six hours)
- Time Period 3 – PM Peak – 3:00 PM to 6:00 PM (three hours)
- Time Period 4 – Overnight – 6:00 PM to 7:00 AM (thirteen hours)

STEP 7: Convert Counts from Average Annual to Weekday Traffic Volumes

The travel demand model developed for the I-10 MRB&B study was calibrated to average weekday traffic model, not average daily traffic. The last step of the traffic count process was to determine a factor to convert the time-of-day counts from Average Annual counts (reflecting an average of all days of the week, including Saturdays/Sundays) to Average Weekday counts (reflecting only Monday through Friday).

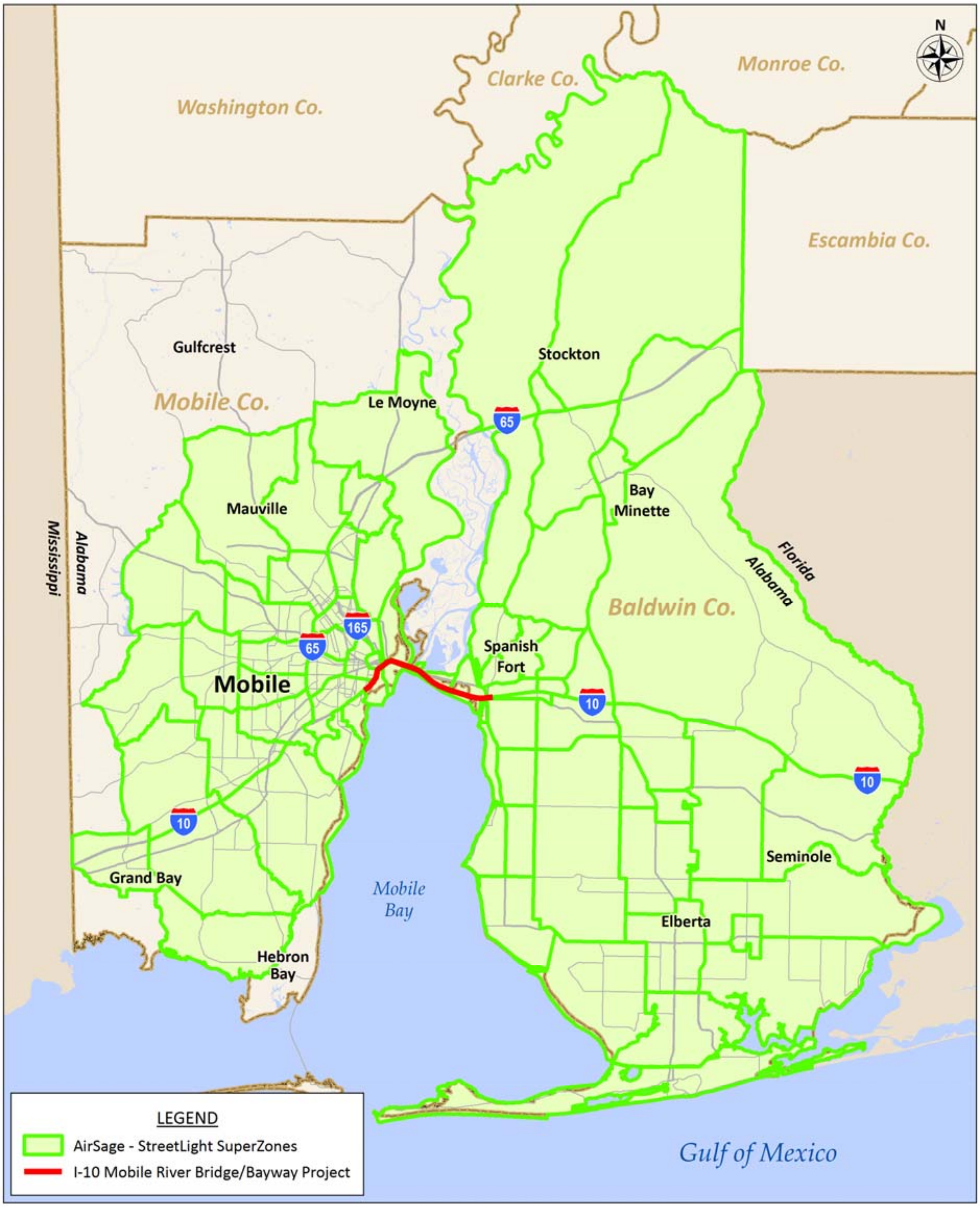
Chapter 3 – Travel Pattern Data

For this study, CDM Smith obtained travel pattern data from two vendors: StreetLight Data Inc. and AirSage Inc. StreetLight Data is based on GPS data from smartphones and in-vehicle navigation devices. AirSage data is based on location information from cellular devices. A traditional travel pattern survey was not conducted for this study. Together, the StreetLight Data and AirSage information provided more comprehensive, less-biased and more cost-effective travel pattern data than could be obtained through a traditional survey. This chapter contains descriptions of the data sources, the planning zones used for both sources, illustrations the travel pattern data obtained from each source (including comparisons between the two sources), and finally an account of how the travel pattern data was incorporated into the travel demand model.

3.1 Planning Areas

Figure 3-1 shows a map of the two-county study region for the I-10 MRB&B project. Superimposed over the map are the boundaries of 97 geographic units, known as "Planning Areas." There are 74 internal Planning Areas, and 23 external Planning Areas. Both AirSage and StreetLight Data provided the travel pattern data as origin-destination tables containing the number of vehicles (or "relative frequency" of vehicles) traveling from an origin Planning Area to a destination Planning Area. As shown in Chapter 6 in Figure 6-2, the I-10 MRB&B travel demand model contains 463 geographic units known as Traffic Analysis Zones (TAZs). To obtain sufficiently large sample sizes and to reduce the cost of purchasing the AirSage and StreetLight Data information, the 463 TAZs were aggregated to the 97 Planning Areas shown in Figure 3-1.

Figure 3-1 – AirSage and StreetLight Data Planning Areas



F3-1 AirSage and Streetlight.png

3.2 AirSage

3.2.1 Description of Data

Cell phones and other mobile devices regularly send electronic “pings” to cell phone towers (approximately every 30 seconds or more), so that the cellular phone networks know to which cell tower to route a call or text message for that phone. From these “pings” cellular carriers also obtain regular information about the location of the phone. The precision of this location information increases when the cell phone is within communication range of two or more cell towers, as the location can be calculated through triangulation. The precision also increases where cell towers are located closer together.

AirSage contracts with major cell phone carriers to obtain anonymous mobile device location data with timestamps. AirSage then analyzes and calculates origin-destination tables from this data. AirSage then factors the data according to the number of mobile devices that reside within each Planning Area and the census population within that Planning Area. AirSage provided two types of matrices: a full matrix of all zone-to-zone movements, and a “select link” matrix that presented only vehicle trips that passed through one of the three bridges across Mobile Bay: I-65, I-10 Bayway or US-98 Causeway. AirSage provided these I-10 MRB&B travel pattern matrices for the months of April 2015 and July 2015 broken down into four time periods as follows:

Table 3-1 – AirSage Time Periods

Time Period	Start Time	End Time	Duration (hours)
AM Peak	6:00 AM	9:30 AM	3.5
Midday	9:30 AM	3:00 PM	5.5
PM Peak	3:00 PM	6:30 PM	3.5
Overnight	6:30 PM	6:00 AM	11.5

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T3-1) AirSage Time Periods

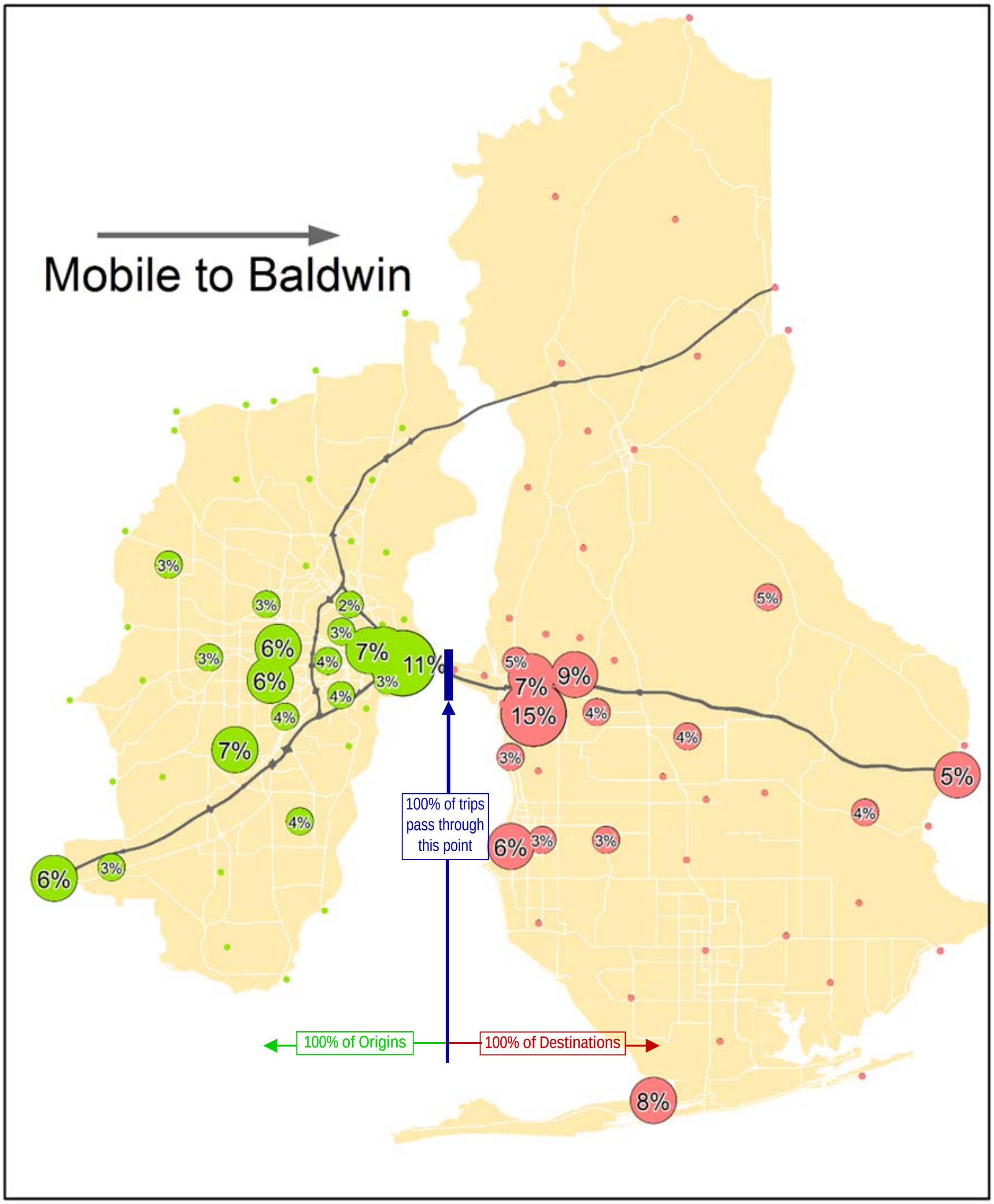
AirSage has both limitations and advantages compared with StreetLight Data. The location accuracy of AirSage varies according to how closely spaced the cell towers are for a given provider. In rural areas, location accuracy is generally poorer due to wider spacing of cell towers, and better in urbanized areas. By contrast, the accuracy of StreetLight Data (which is obtained from GPS-based sources) is accurate to within five meters (16-feet), regardless of the location on the globe. One example of this limitation is that AirSage could not distinguish whether vehicles traveled across Mobile Bay via the I-10 Bayway or the US-98 Causeway. As the two routes traverse Mobile Bay, they cross each other at the Mid-Bay interchange, and are never more than 4,500-feet apart. Therefore, AirSage needed to provide the travel pattern data for both routes combined. Additionally, AirSage cannot distinguish between vehicle types (passenger cars versus trucks), whereas StreetLight Data claims this capability. However, since a vast majority of drivers have a cell phone, AirSage has a far larger sample size from which to deduce travel patterns in a region: AirSage may have travel information for up to 40 percent of the residents of an area, whereas StreetLight Data typically has a sample size of 0.5 percent (one-half of one percent).

3.2.2 Analysis of AirSage travel patterns

CDM Smith analyzed the AirSage data to understand travel patterns and perform reasonableness checks. For example, the AirSage origin-destination matrix was assigned to the highway network to determine if the assigned traffic volumes on major highways were close to actual traffic counts. The trip length frequency distribution was also compared against the distributions used by the Mobile Area Transportation Study (MATS) and Baldwin County Highway Department Planning Office (BCHD). Finally, CDM Smith checked whether certain zone-to-zone movements were logical, or had a reasonable number of trips between them.

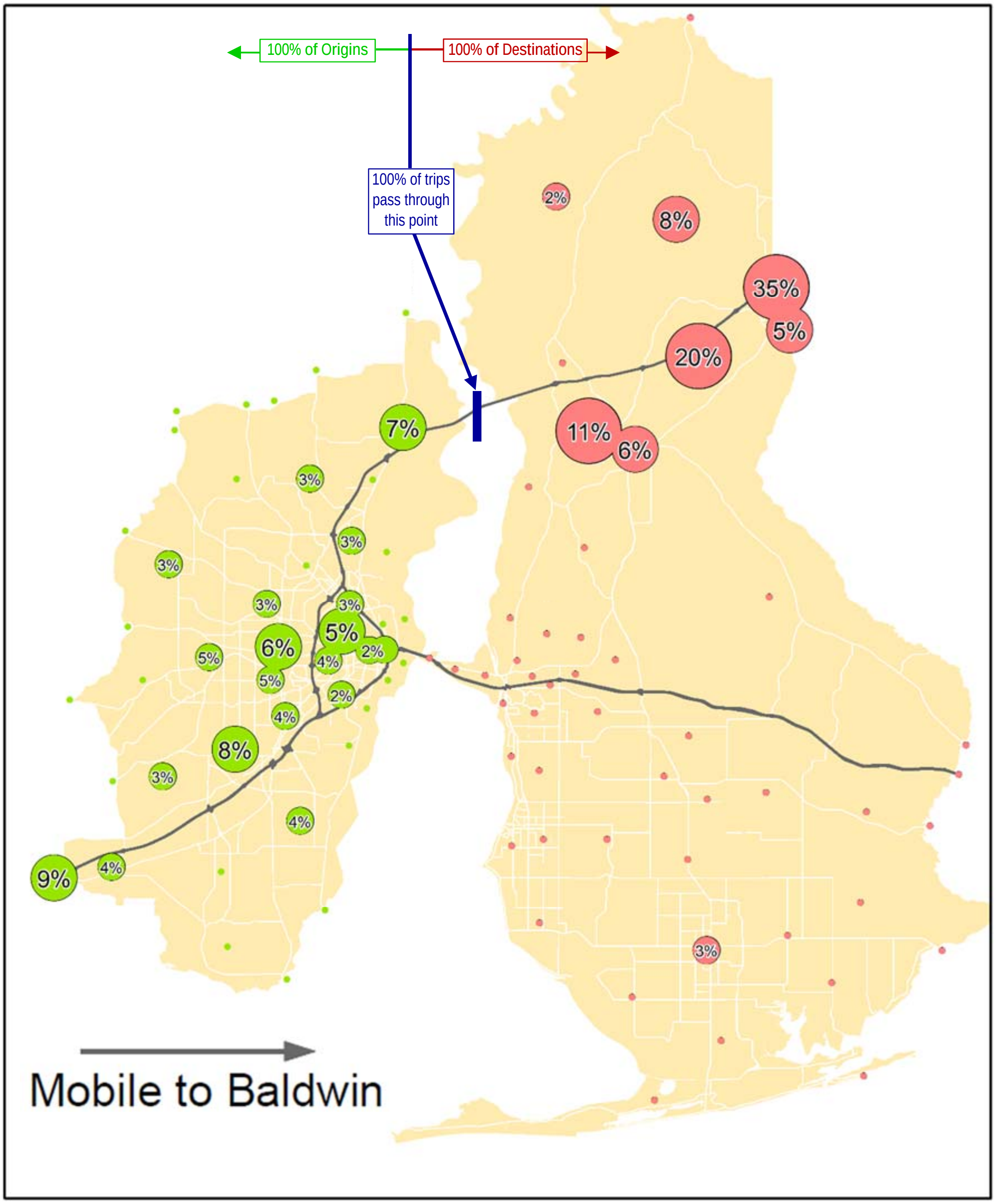
Since the I-10 MRB&B project straddles Mobile Bay, CDM Smith focused mainly on the travel patterns of vehicles traveling between Mobile and Baldwin Counties (via I-10, US-98 or I-65). Figure 3-2 and Figure 3-3 show the travel pattern of vehicles crossing Mobile Bay via I-10/US-98 and I-65 respectively. Both show travel in the eastbound direction only. The travel pattern is expressed as a percentage of the total vehicles crossing Mobile Bay on the respective route (I-10/US-98 or I-65). The green bubbles indicate the origin Planning Area (in Mobile County), and the red bubbles indicate the destination Planning Area (in Baldwin County). Small bubbles without percentages indicate that less than 2 percent of the crossing traffic traveled from or to that Planning Area. For example, as shown in Figure 3-2, six percent (6%) of the traffic crossing I-10/US-98 in the eastbound direction had an origin on I-10 at the Mississippi State line. In general, the travel pattern on the I-10/US-98 routes (Figure 3-2) show that the trip origins and destinations are located in the central and southern portions of the counties, and that the trips are clustered closer to Mobile Bay. By contrast, the map for I-65 (Figure 3-3) shows that the destinations (red bubbles) are located farther north within Baldwin County (along the I-65 route). Figure 3-3 also shows that the origins and destinations of I-65 trips are not clustered next to Mobile Bay, as they are for trips on I-10/US-98.

Figure 3-2 – Vehicles crossing Mobile Bay via I-10/US-98 per AirSage



F3-2 slide11_AirSage_I-10_US98_Apr15 (Dan Begert).png

Figure 3-3 – Vehicles crossing Mobile Bay via I-65 per AirSage



F3-3 slide12_AirSage_I-65_Apr15 (Dan Begert).png

3.3 StreetLight Data

3.3.1 Description of Data

StreetLight Data travel pattern data, which they refer to as "metrics," are obtained from Global Positioning System (GPS) location data. GPS is a space-based radio-navigation system owned by the U.S. government consisting of 32 orbiting satellites. As drivers that use INRIX, Inc. navigation applications on their smart phone or in-vehicle navigation devices, the GPS location time and coordinate information is recorded by INRIX. StreetLight Data then processes this GPS data into origin-destination matrices. StreetLight Data is also able to distinguish between PC and CV GPS devices and present the travel pattern data separately for those two vehicle types. Two sets of StreetLight Data metrics were obtained:

1. **Select Link Analyses:** Select Link Analyses provide the origin zone and destination zone of vehicles that passed through a specific roadway segment. For example, the I-10 Wallace Tunnel was one of the selected links. The StreetLight Data metrics indicated the proportion of Wallace Tunnel traffic that originated from each Planning Area, and the proportion of traffic destined for each Planning Area. StreetLight Data provided select link origin-destination matrices for 12 roadway links, including all four bridges/tunnels that cross the Mobile River.

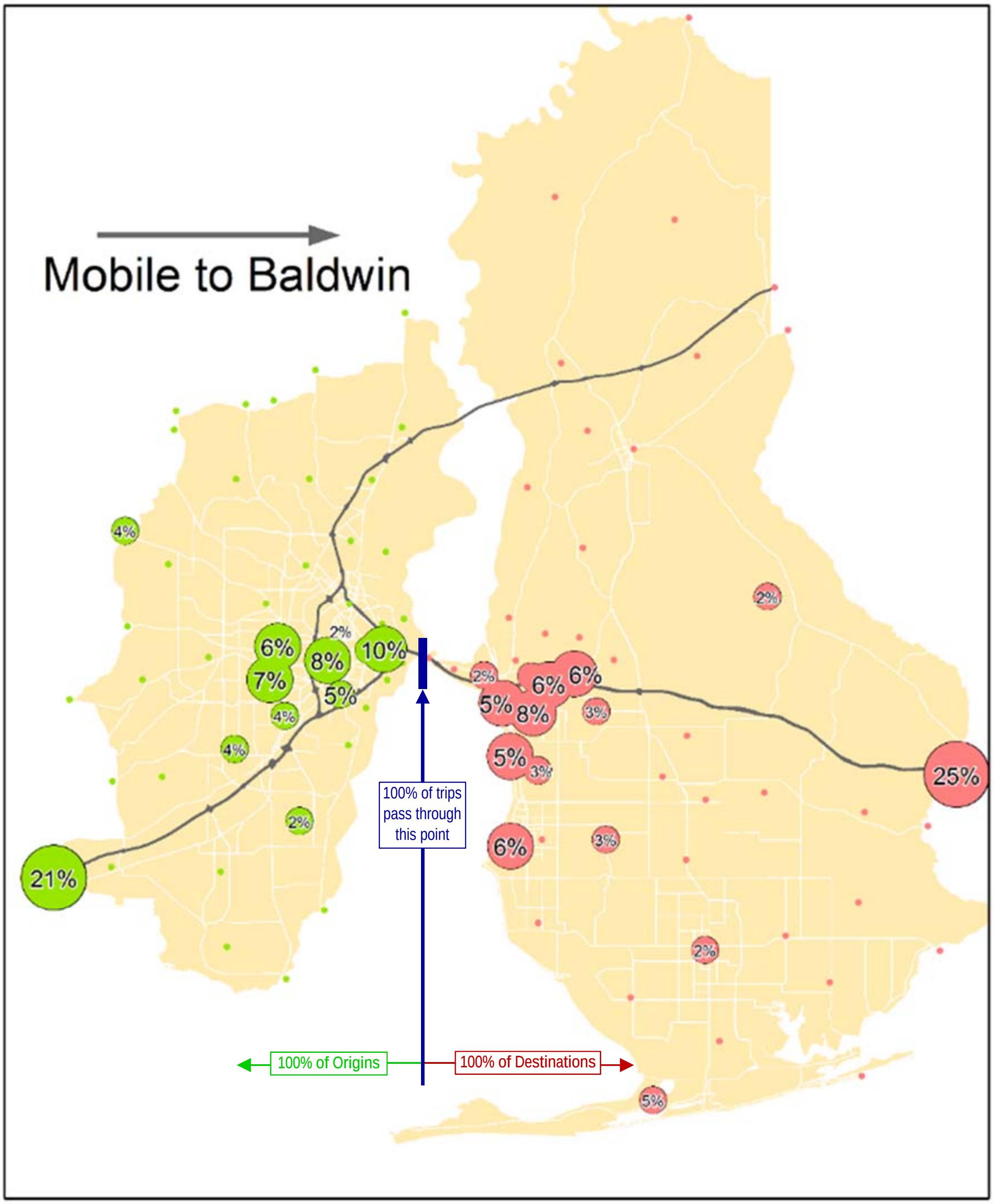
2. **Interchange Movements:** For major highway interchanges, StreetLight Data provided the proportion of traffic that exits from one route to another or stays on the same route. For example, at the I-10/I-65 interchange in southwest Mobile, their metrics showed what percentage of traffic on southbound I-65 exited to westbound I-10 versus exiting to eastbound I-10. StreetLight Data provided interchange movement data for seven (7) interchanges.

These metrics were obtained from one full calendar year of GPS data (January 1 to December 31, 2015), and they were provided separately by weekday/weekend, time-of-day (four time periods), and by PC/CV.

3.3.2 Analysis of StreetLight Data by Mobile Bay Crossing

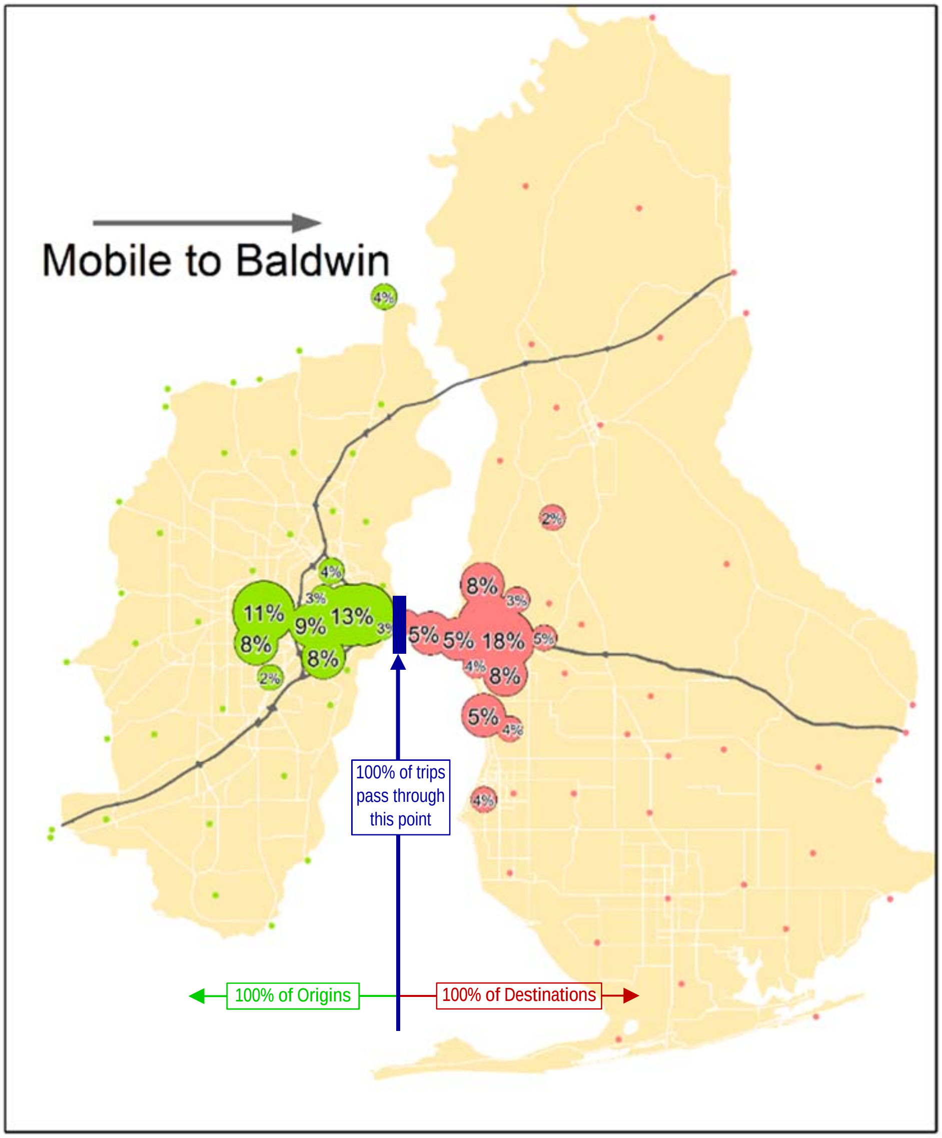
Because the GPS-based StreetLight Data metrics are accurate within 5-meters, StreetLight Data could provide travel pattern information for vehicles that cross Mobile Bay on I-10 versus US-98. Figure 3-4 and Figure 3-5 show the travel pattern of passenger cars traveling eastbound across Mobile Bay via I-10 and US-98 respectively. As Figure 3-4 shows, vehicles traveling on I-10 have origins and destinations that are more geographically dispersed, i.e., vehicles traveling on I-10 tend to have a longer trip length than those traveling on US-98. According to StreetLight Data, 21 percent of vehicles on the I-10 Bayway have origins that start west of the Mississippi State line, and 25 percent of the vehicles continue farther east of the Florida State line (note that these are not necessarily the same vehicles). By contrast, as shown in Figure 3-5, virtually no vehicles on the US-98 Causeway are long-distance trips; and virtually all of the origin and destination bubbles are clustered next to Mobile Bay (around the Causeway itself).

Figure 3-4 – Vehicles crossing Mobile Bay via I-10 per StreetLight Data



F3-4 slide13_01_StreetLight_I-10_PC (Dan Begert).png

Figure 3-5 – Vehicles crossing Mobile Bay via US-98 per StreetLight Data

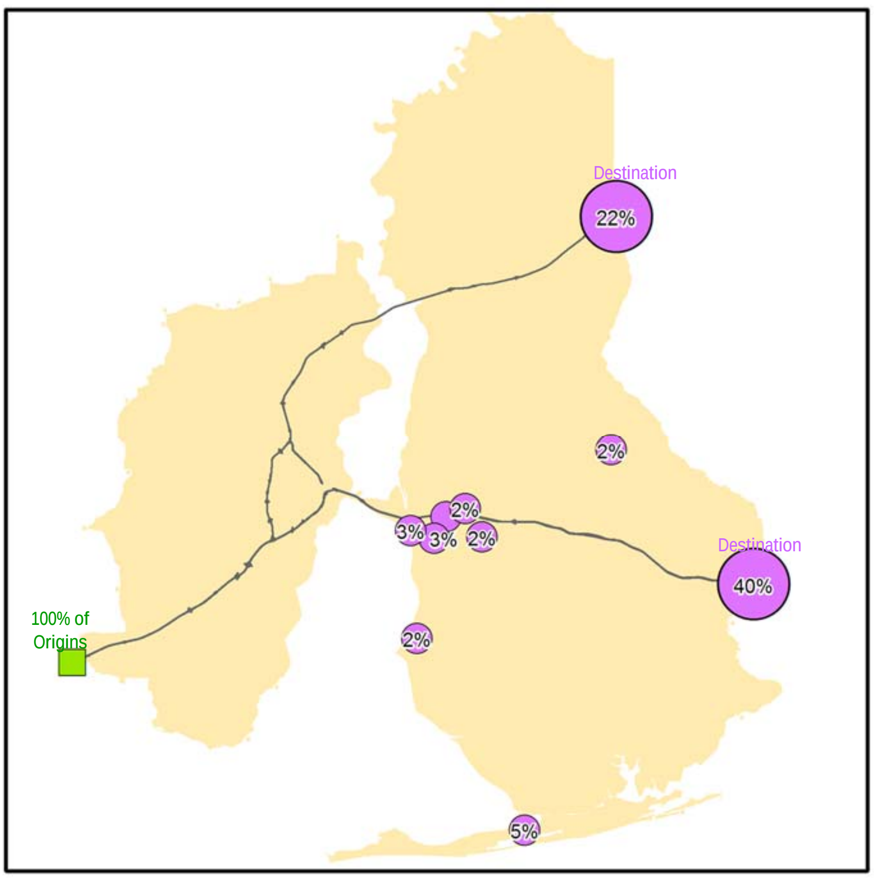


F3-5 slide13_02_StreetLight_US98_PC (Dan Begert).png

3.3.3 Analysis of StreetLight Data by Cars vs. Trucks

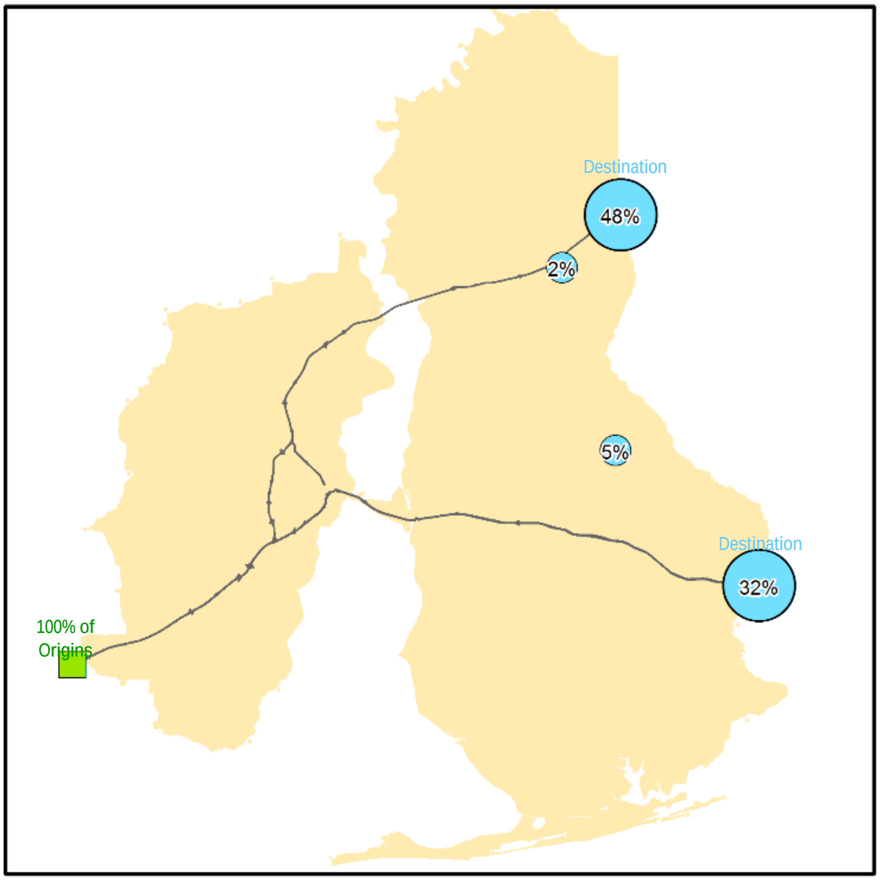
StreetLight Data metrics also show the differences in travel patterns of passenger cars versus commercial vehicles (trucks). Figure 3-6 and Figure 3-7 both show the destination of trips that meet two criteria: (1) originate on I-10 at the Mississippi State line and (2) cross Mobile Bay via I-65, I-10 or US-98. The first figure shows passenger cars, whereas the second figure shows commercial vehicles. Figure 3-6 shows that a majority of the passenger cars (62 percent) are "External-to-External" trips that travel completely across the study area: 22 percent exit the study area via I-65, and 40 percent exit via I-10 (the remaining 38 percent have destinations in Baldwin County). Figure 3-7 shows that an even higher proportion (80 percent) of the commercial vehicles are "External-to-External" trips: 48 percent on I-65 and 32 percent on I-10. Interestingly, the percentage of commercial vehicles exiting the study area on I-65 is more than double the passenger car percentage: 48 versus 22 percent. This reflects the importance of I-65 as a connection between Gulf of Mexico ports/factories and factory/warehouse destinations farther north (such as the Hyundai factory in Montgomery or destinations as far north as Chicago).

Figure 3-6 – Passenger Cars: I-10 Mississippi to Baldwin County (StreetLight Data)



F3-6 slide14_01_StreetLight_TAZ061_I-10_PC (Dan Begert).png

Figure 3-7 – Commercial Vehicles: I-10 Mississippi to Baldwin County (StreetLight Data)

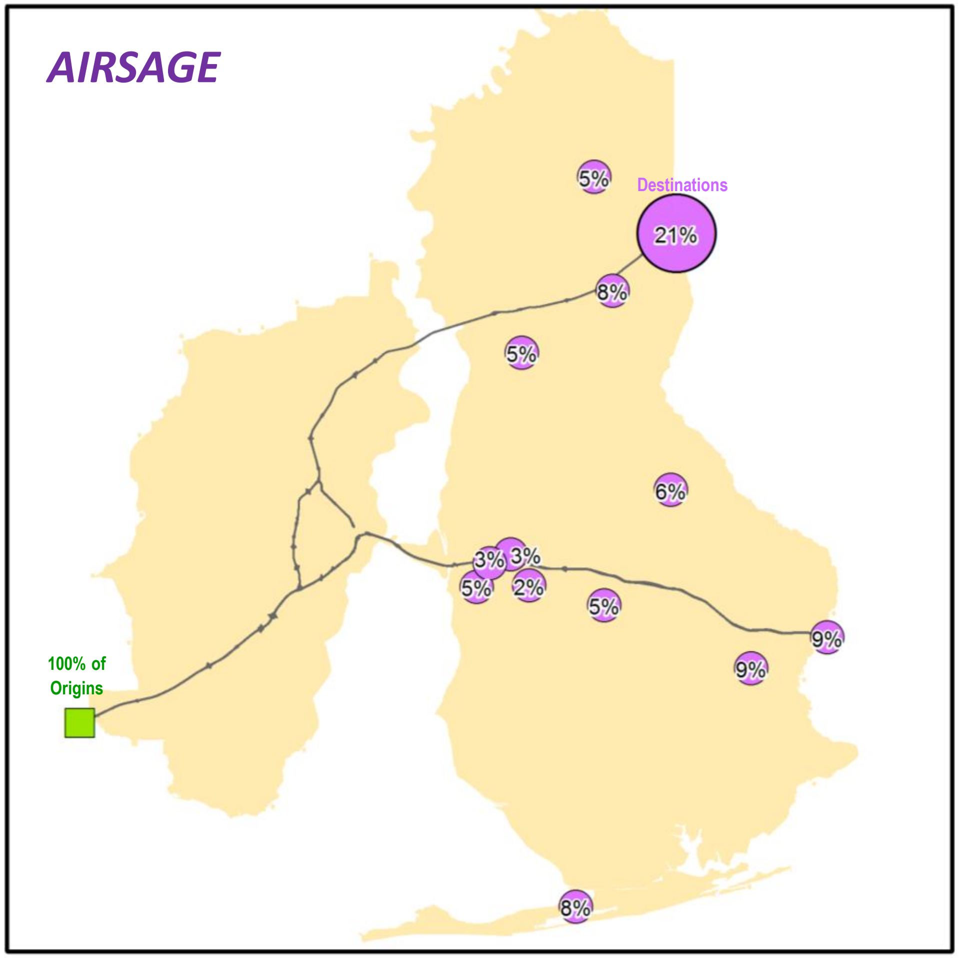


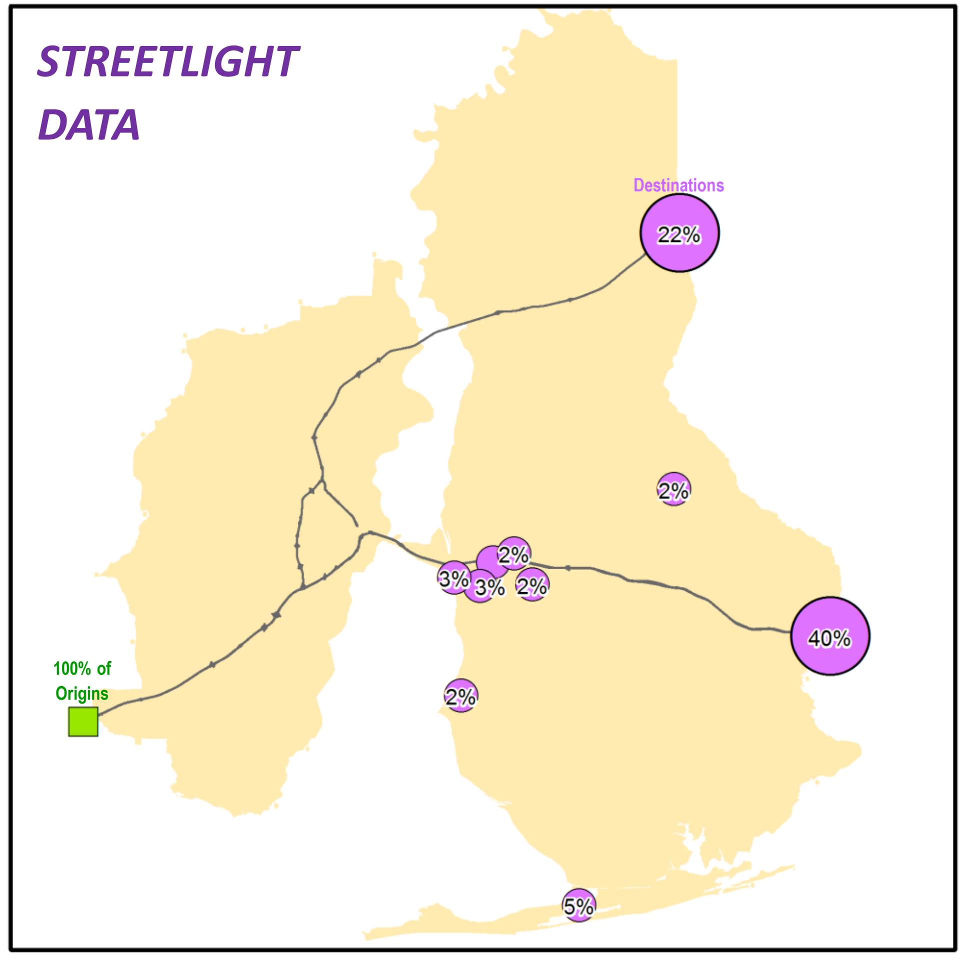
F3-7 slide14_04_StreetLight_TAZ061_I-10_CV (Dan Begert).png

3.4 Comparisons of AirSage / StreetLight Data Travel Patterns

Figure 3-8 compares the AirSage and StreetLight Data sources. Both maps show trips that meet two criteria: (1) originate on I-10 at the Mississippi State line and (2) cross Mobile Bay via I-65, I-10 or US-98. The map on the left shows AirSage (all vehicle types), whereas the map on the right shows StreetLight Data (for passenger cars only). The content of the two maps show that the two sources are generally in agreement with one another. For example, both sources show that approximately 20 percent of this traffic exits the study area on the north via I-65 (21 percent according to AirSage and 22 percent according to StreetLight Data). However, for trips traveling between I-10 at the Mississippi State line and I-10 at the Florida State Line, the two sources disagree. StreetLight Data estimates that 40 percent of the trips originating from I-10 at the Mississippi State line travel to I-10 at the Florida State Line, whereas AirSage estimates only 9 percent. Both ends of I-10 in the study area (at the Mississippi and Florida State lines) are located in rural areas, where cell phone towers are spaced farther apart (consequently reducing AirSage's location accuracy). Therefore, CDM Smith believes StreetLight Data may be more reliable in estimating these external-to-external trips.

May 30, 2018





I-10 at Mississippi State Line to Baldwin County: AirSage vs. StreetLight Data

FIGURE 3-8

Chapter 4 – Socioeconomic Forecasts

Socioeconomic measures, such as population and employment, are an important determinant of future traffic demand in a region. The MATS and BCHD travel demand models were developed based on each agency's own set of socioeconomic forecasts. For this study, Fishkind & Associates ("Fishkind") produced independent socioeconomic forecasts of the Mobile-Baldwin County, Alabama region. The data from Fishkind was used directly in the "trip generation" step to develop the base-year (2015) and future year (2020, 2030 and 2040) I-10 MRB&B travel demand models.

Fishkind produced socioeconomic forecasts at the TAZ-level. For each TAZ, they provided forecasts for each of the following five socioeconomic measures for four years (2015, 2020, 2030 and 2040), plus TAZ-level estimates for the 2010 Census Data:

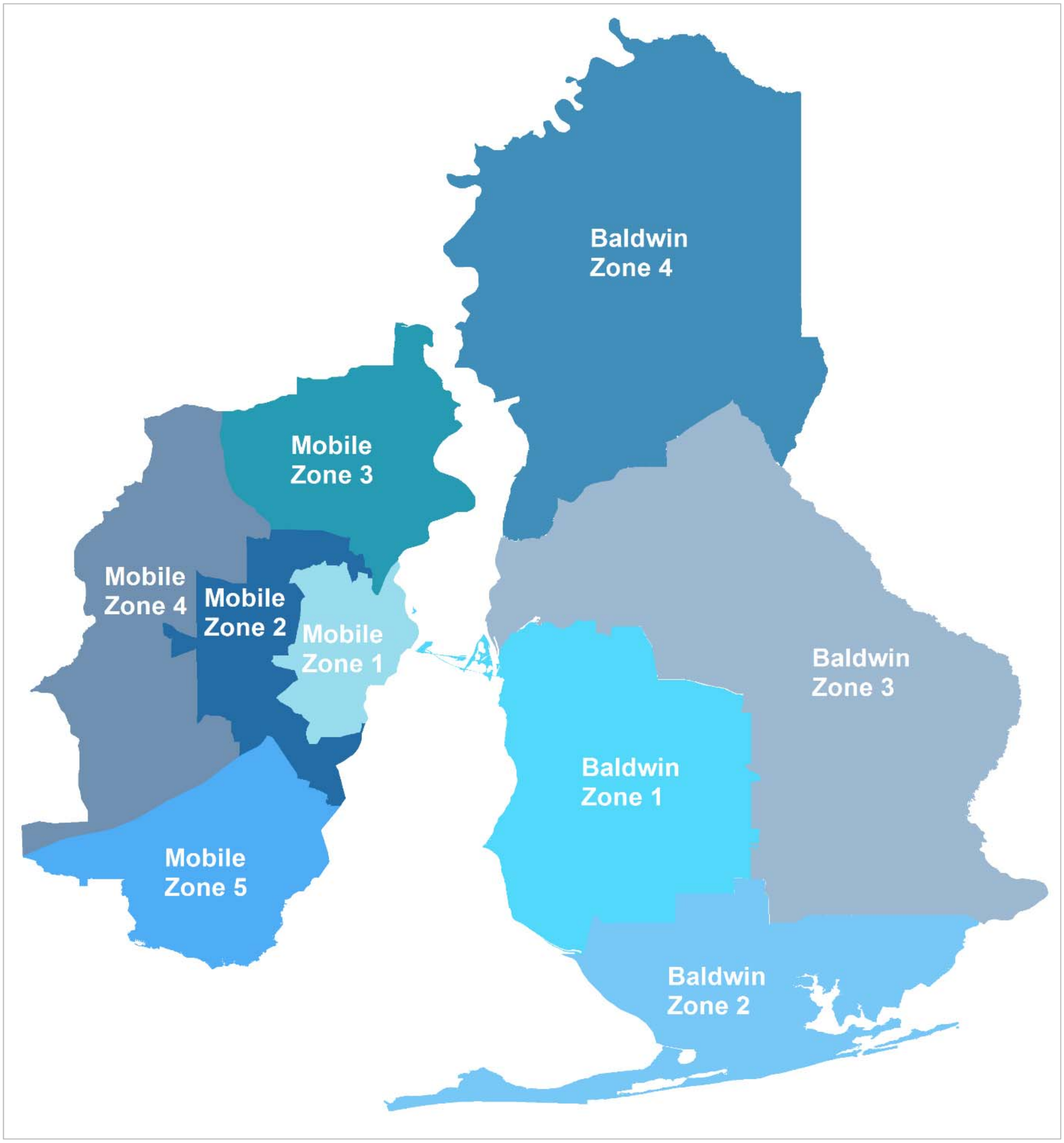
1. Number of Households by low, medium and high income ranges
2. Number of Employees by category (retail, service and other)
3. Primary/Secondary School enrollment
4. College/University enrollment
5. Number of College/University dorm room occupants

Fishkind's full report and socioeconomic forecast tables are provided as Appendix A to this report. This chapter summarizes Fishkind's methodology and results, and compares the socioeconomic forecast to those developed by MATS and BCHD.

4.1 Methodology

Fishkind's report, in Appendix A, describes its forecasting methodology in detail. Fishkind first established control totals for Mobile County (MATS) and Baldwin County (BCHD) study areas for each socioeconomic measure (Households, Employment by retail, service and other, etc.). One hurdle in creating the forecasts for the Mobile County TAZs is that the MATS model area does not contain all of Mobile County. Therefore, Fishkind had to make some assumptions about the percentage of each socioeconomic measure that falls within the MATS area (versus the rural non-MATS area). Fishkind then created nine (9) super-zones, which are shown in Figure 4-1: there are five in the MATS area, and four in Baldwin County. The super-zones are regions within the study area that share common household and employment characteristics. In its forecasts, Fishkind allocated similar socioeconomic growth rates to all TAZs within these super-zones. Fishkind states that, "These zones were created using an index of attractiveness, which is a collection of criteria that make areas within each county more likely to see growth. These criteria include: 1) transportation access in terms of highway, rail and/or airports, 2) coastal development / retiree activity, 3) juxtaposition to current employment centers, and 4) other factors."

Figure 4-1 – Fishkind Mobile/Baldwin County Super-Zones



F4-1 Fishkind Superzones (Dan Begert).png

4.2 Comparison: Fishkind vs. Planning Agency

This section compares Fishkind's forecasts against the planning agency (MATS and BCHD) forecasts for two socioeconomic measures: households and employment. The graphs and text below show comparisons between Fishkind and the two agencies separately: Fishkind versus MATS, and Fishkind versus BCHD.

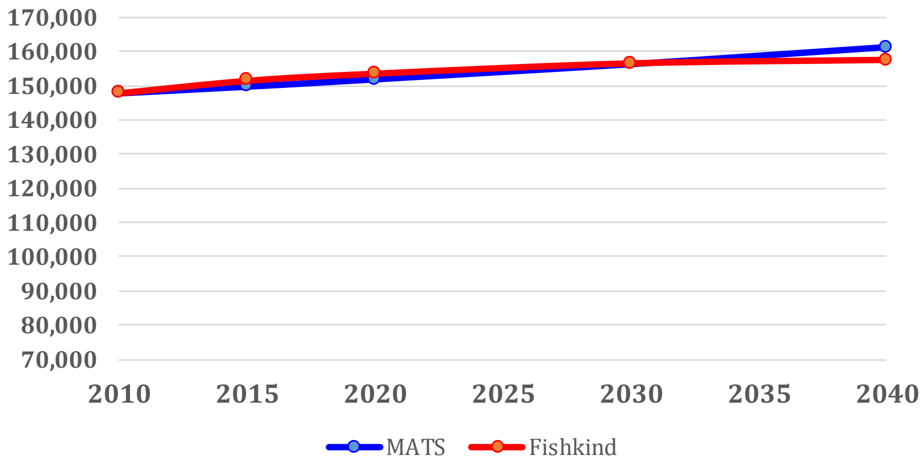
4.2.1 Households

The socioeconomic measures of population and number of households are strongly correlated. However, for travel demand planning purposes, number of households is used for trip generation. Figure 4-2 and Figure 4-3 show the 2010 through 2040 household forecasts for Fishkind versus MATS and BCHD respectively.[14] Overall, the Fishkind household estimates are similar to the planning agency estimates. In 2010, the pairs of estimates are identical, since they are all based on actual 2010 Census Data. In the 2015 and 2020 forecast years, Fishkind's household estimates are slightly higher than both planning agencies. In 2030, the sources are almost identical. But in the final year (2040), the Fishkind estimates are somewhat lower than the MPO forecasts, 2.3% lower in Mobile County and 7.4% lower in Baldwin County.

The two household graphs are shown in the same scale to emphasize the divergent growth rates of the two counties. The MATS planning area of Mobile County is a low growth area and forecast by Fishkind to have only a 6 percent increase in households over the 30-year (2010 to 2040) time period. Conversely, Baldwin County is a high-growth area, and Fishkind forecasts a 65 percent increase in the number of households between 2010 and 2040.

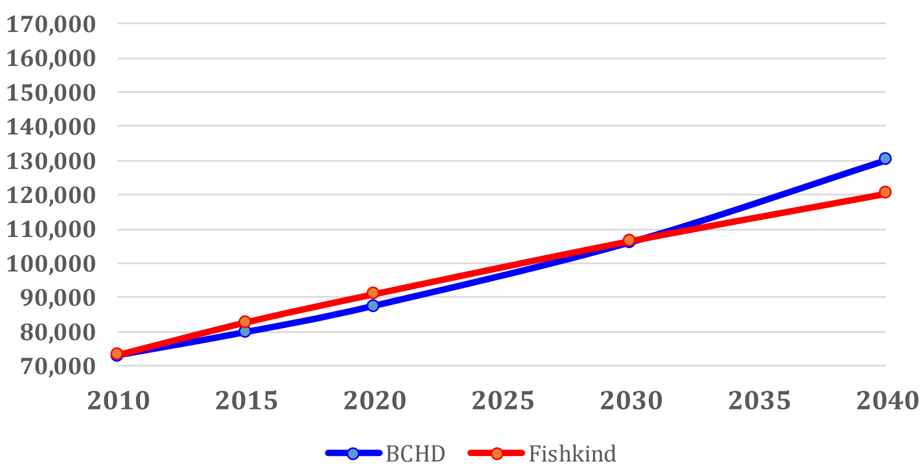
[14] MATS produced household forecasts for 2010 and 2040 only. The MATS household forecasts for the interim years 2015, 2020 and 2030 were estimated through interpolating between 2010 and 2040. BCHD produced household forecasts for 2010 and 2040 only. The BCHD household forecasts for the interim year 2015 were estimated by interpolating between 2010 and 2020, and the forecasts for years 2030 and 2040 were estimated by extrapolating from the 2010-2020 growth rates. Nevertheless, in 2040, Baldwin County will still have fewer households than the MATS area of Mobile County.

Figure 4-2 – 2040 Households Forecast: MATS versus Fishkind



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F4-2) Households Mobile

Figure 4-3 – 2040 Households Forecast: BCHD versus Fishkind



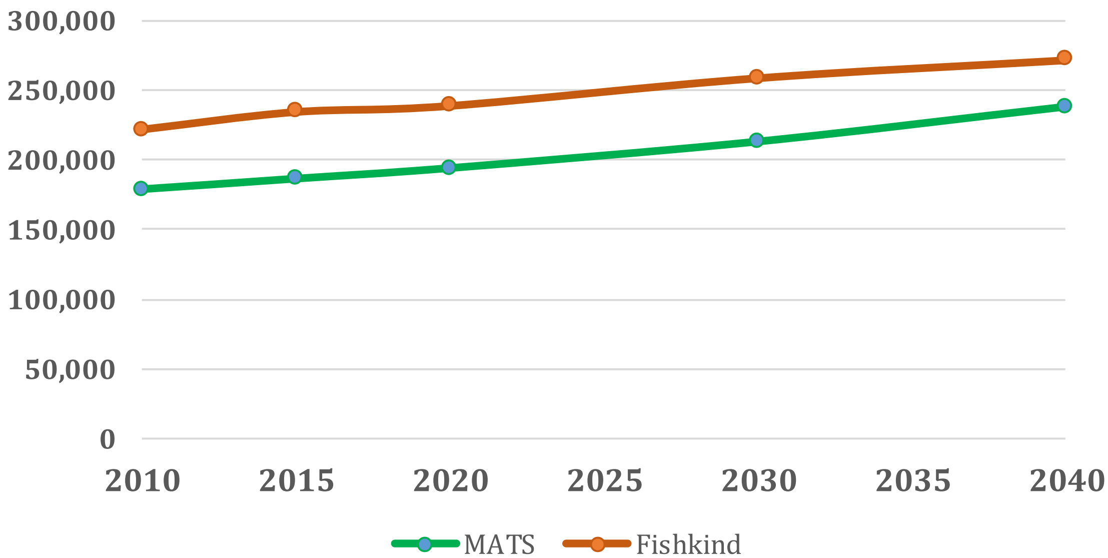
Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F4-3) Households Baldwin

4.2.2 Employment

Figure 4-4 and Figure 4-5 show the 2010 through 2040 employment forecasts for Fishkind versus MATS and BCHD respectively. Only the total employment is shown here, although Fishkind and both planning agencies provided employment for the retail, service and other categories. For the MATS portion of Mobile County, Fishkind estimated significantly higher employment compared to the MATS forecasts in all years. The Fishkind estimates are on-average 21 percent higher, with a range of 14 to 26 percent higher. This large difference is due to Fishkind using the broader employment definition used by the U.S Department of Commerce's Bureau of Economic Analysis (BEA), as opposed to the narrower definition used by the U.S. Department of Labor's Bureau of Labor Statistics (BLS).[15] In Baldwin County, by contrast, the Fishkind employment forecasts are approximately 5 percent lower than the BCHD forecasts. Overall (for the two-county region), the Fishkind employment forecasts are on-average 11 percent higher than the Planning Agency forecasts.

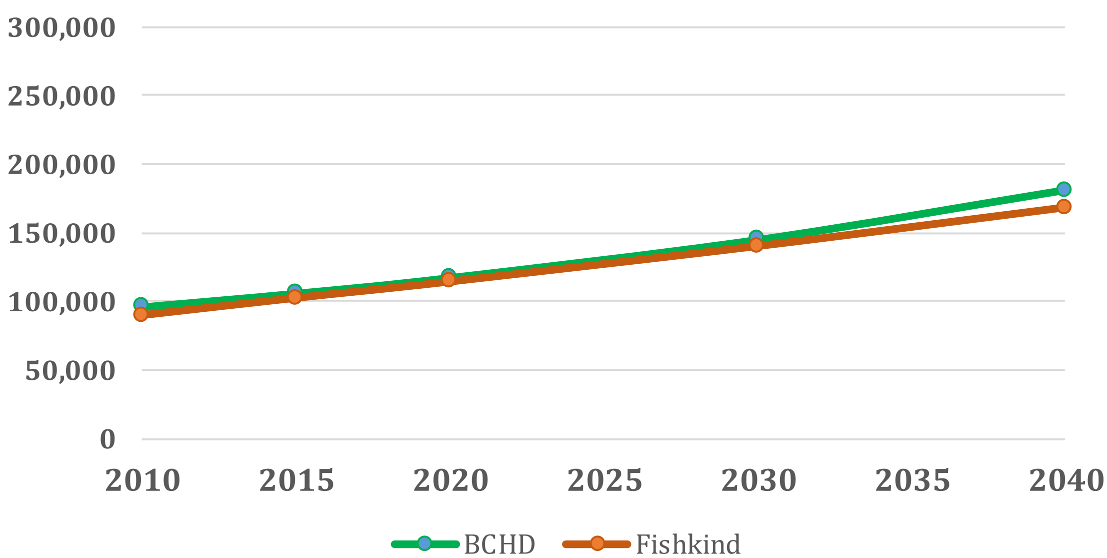
[15] The BEA website (https://www.bea.gov/faq/index.cfm?faq_id=104) provides the following explanation of the differences between BEA and BLS employment measures, "The BEA estimates of employment and wages differ from the BLS data because BEA makes adjustments to account for employment and wages not covered, or not fully covered, by the state Unemployment Insurance (UI) and the Unemployment Compensation for Federal Employees (UCFE) programs. First, BEA adds estimates of employment and wages to the BLS data to bridge small gaps in UI coverage: For nonprofit organizations not participating in the UI program (several industries), for students and their spouses employed by public colleges or universities, for elected officials and members of the judiciary (state and local government), for interns employed by hospitals and by social service agencies, and for insurance agents classified as statutory employees (insurance agencies). Second, BEA uses additional source data to estimate most or all of the employment and wages for the following: Farms, farm labor contractors, private households, private elementary and secondary schools, religious membership organizations, railroads, military, and U.S. residents who are employed by international organizations and by foreign embassies and consulates in the United States. Third, BEA adjusts employment and wages for misreporting under the UI and UCFE programs."

Figure 4-4 – 2040 Employment Forecast: MATS versus Fishkind[16]



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F4-4) Employment Mobile

Figure 4-5 – 2040 Employment Forecast: BCHD versus Fishkind



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F4-5) Employment Baldwin

[16] Fishkind employment forecasts are higher than MATS forecasts due, in part, to different definitions of employment. MATS used the Bureau of Labor Statistics definition of employment, whereas Fishkind used the broader Bureau of Economic Analysis definition.

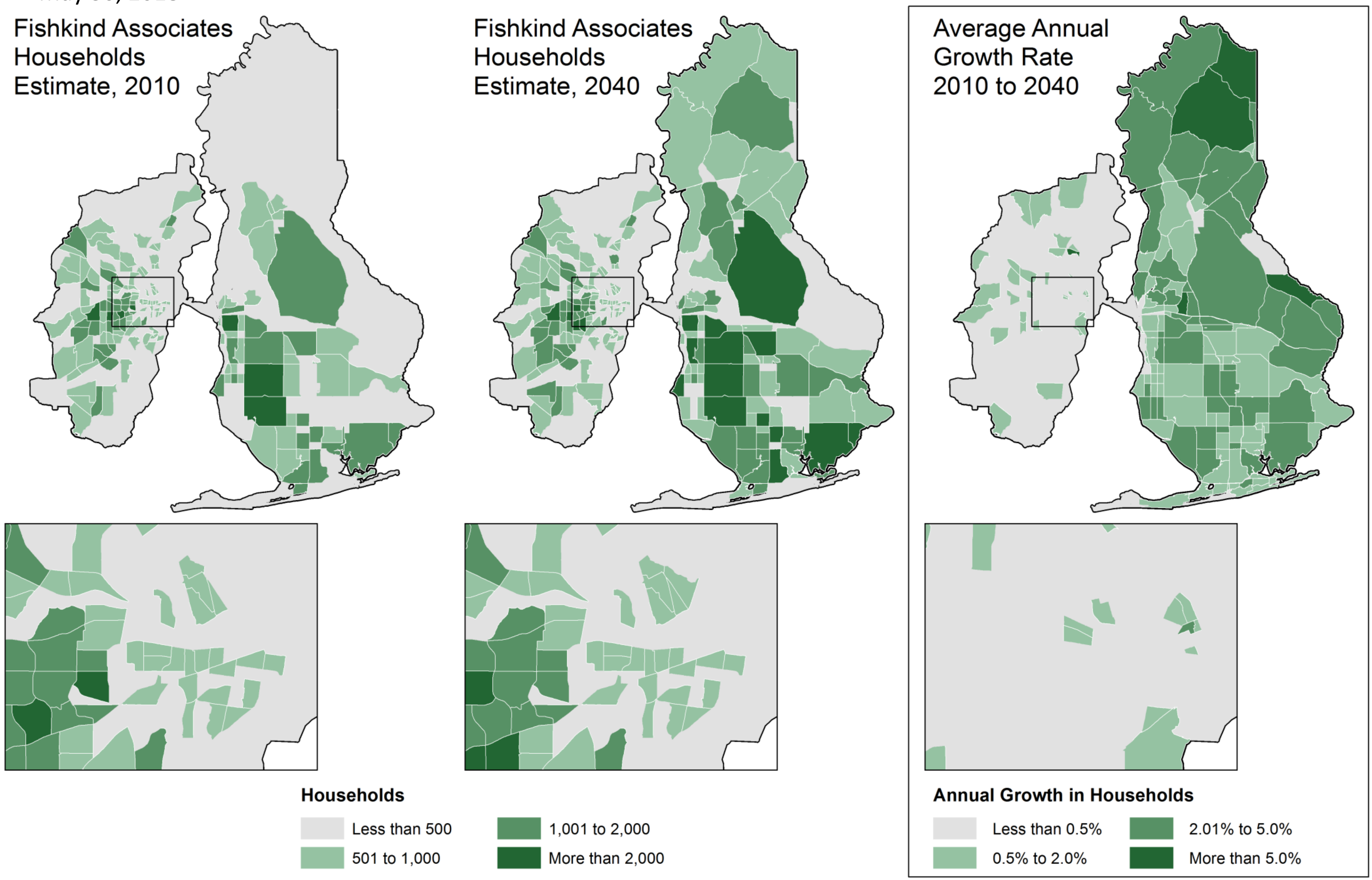
4.3 Number of Households

4.3.1 Fishkind 2010 to 2040 Household Forecasts

Figure 4-6 illustrates the density of households per square mile in each TAZ. The left map illustrates the 2010 Census data, the center map illustrates Fishkind's 2040 forecasts, and the right map indicates the average annual percentage growth rate in households per TAZ. The 2010 (left) and 2040 (center) maps show the greatest concentration of households are in central Mobile County, and to a lesser extent in the Eastern Shores area of Baldwin County. A comparison of these two maps shows that in Mobile County, Fishkind has relatively low growth for much of the county, and slightly negative growth in portions of the county along the Mobile River and scattered TAZs in the central portions of the city of Mobile. Fishkind forecasts higher household growth for virtually all of Baldwin County, as illustrated by the mostly light green TAZs throughout the county. However, Fishkind forecasts somewhat lower growth in those portions of Baldwin County that already have a significant amount of development, which includes the Eastern Shores area (Spanish Fort, Daphne and Fairhope) and the towns of Bay Minette and Foley.

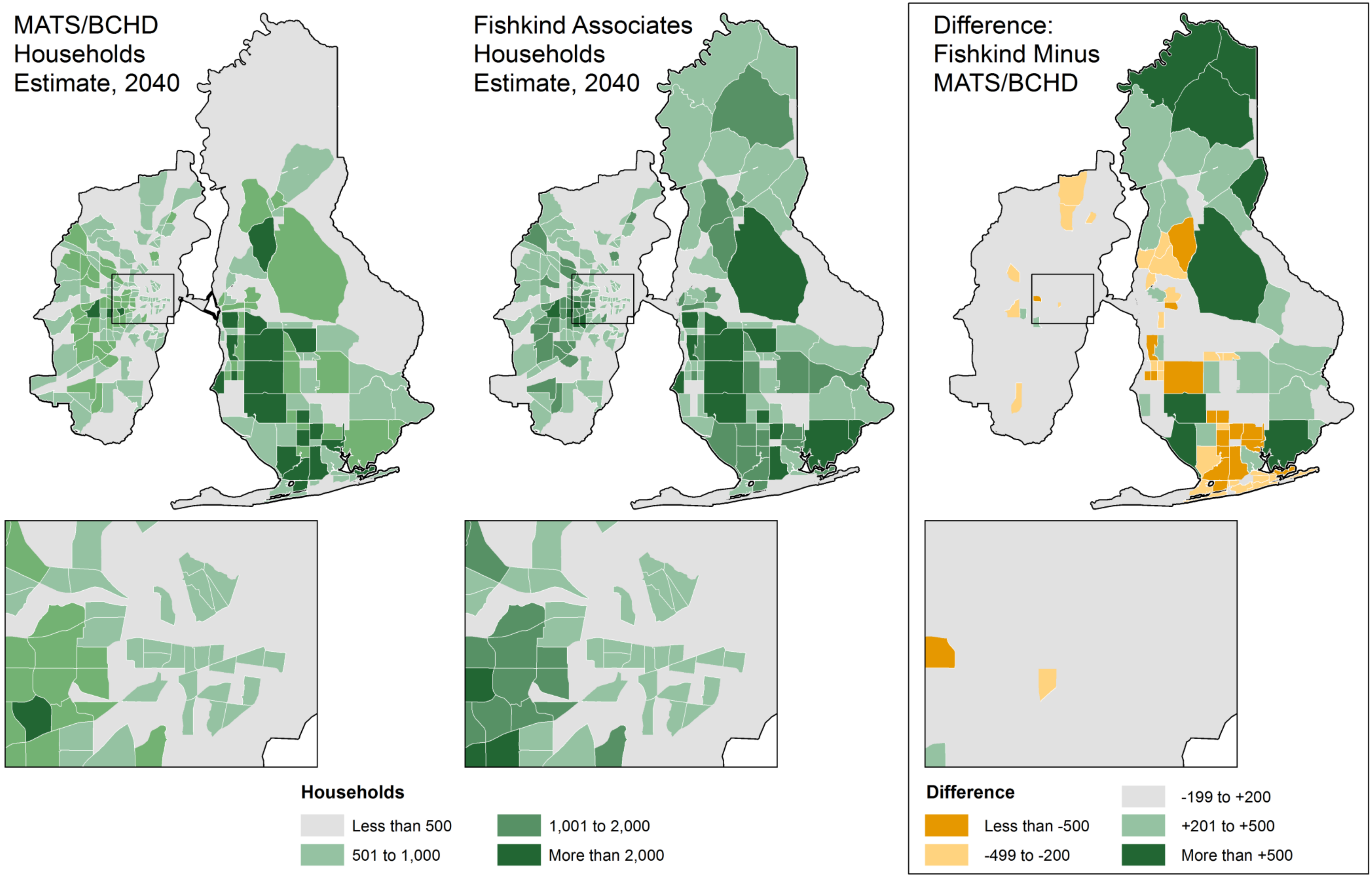
4.3.2 2040 Household Forecasts: MATS/BCHD versus Fishkind

Figure 4-7 compares the 2040 Household Forecasts prepared by Fishkind versus those produced by the Planning Agencies (MATS/BCHD). The left map shows the MATS/BCHD 2040 forecasts, the center map shows the Fishkind 2040 forecasts, while the right map shows the absolute difference per TAZ between the two sets of 2040 forecasts. As shown in Section 4.2, the overall Fishkind 2040 household forecasts are somewhat lower than either of the MPO forecasts. However, at the TAZ level, there is significant variability between the two sets of forecasts. In Mobile County, the Fishkind forecasts are generally lower in the southern half of the county and are higher in downtown Mobile and in the northwestern portion of the county (along the US-98 corridor). In Baldwin County, the Fishkind forecasts are significantly lower within two regions: The Gulf Coast area (in and around the municipalities of Foley, Gulf Shores and Orange Beach), and the Eastern Shores area (in and near the municipalities of Fairhope and Spanish Fort). However, the Fishkind forecasts are higher than the MATS/BCHD forecasts in most of the rest of Baldwin County.



Fishkind: 2010-2040 Number of Households Forecasts

FIGURE 4-6



Number of Households: Fishkind vs. MPO Forecasts

FIGURE 4-7

4.4 Employment

4.4.1 Fishkind 2010 to 2040 Employment Forecasts

Figure 4-8 illustrates the density of employment per square mile in each TAZ. The left map illustrates the 2010 Census data, the center map illustrates Fishkind's 2040 forecasts, and the right map indicates the average annual percentage growth rate in employment per TAZ. The right map shows that Fishkind forecasts uniformly high employment growth in Baldwin County (with the exception of a few TAZs on the eastern edge of the county). In Mobile County, Fishkind forecasts moderate employment density growth for much of the county, including the downtown area. However, Fishkind forecasts low employment growth in the portion of the county away from downtown Mobile.

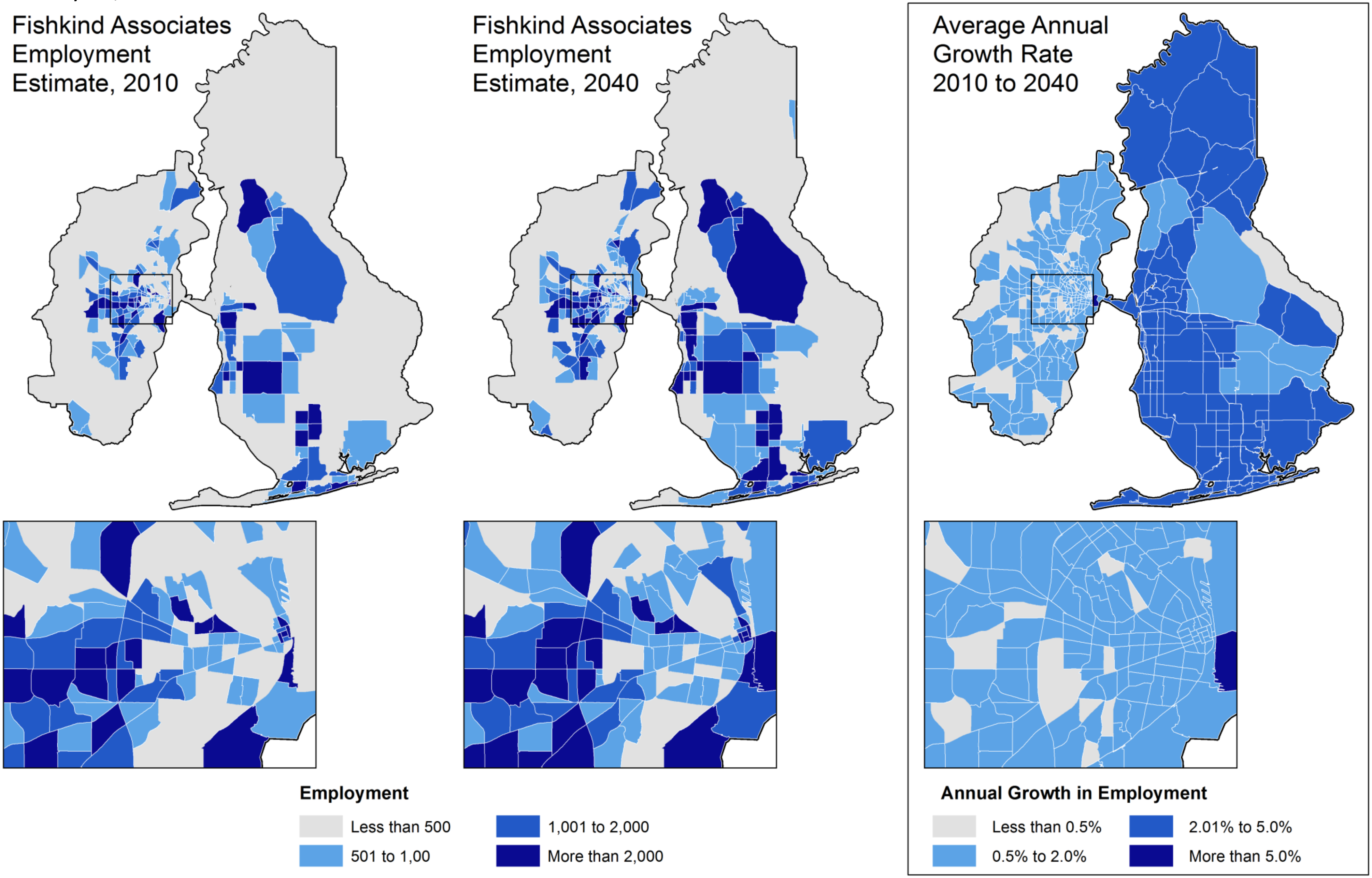
4.4.2 2040 Employment Forecasts: MATS/BCHD versus Fishkind

Figure 4-9 compares the 2040 employment forecasts prepared by Fishkind versus those produced by the planning agencies. The left map shows the MATS/BCHD 2040 forecasts, the center map shows the Fishkind 2040 forecasts, while the right map shows the absolute difference per TAZ between the two sets of 2040 forecasts. As shown in Section 4.2, the Fishkind 2040 employment forecasts for Mobile County are significantly higher than the MATS forecasts, while the Fishkind and BCHD forecasts are very similar. However, at the TAZ level, there is significant variability between the two sets of forecasts. The "Absolute Difference" map shows that in Mobile County, much of the employment growth is concentrated within the central portion of the county, while very little growth is expected in the rural "collar" portion of the county. Additionally, Fishkind forecasts outright decline in employment in areas with high concentrations of industrial/port activities. For Baldwin County, the Fishkind versus MATS/BCHD employment forecasts do not show a clear trend in variability. However, the Fishkind forecasts do show less employment growth in areas flanking I-10 and SR-59 that currently have a high concentration of retail shops.

4.5 Low-High Forecasts

In addition to its primary forecasts described above, Fishkind also prepared alternative low and high population and employment forecasts. These alternative low-high forecasts will be used by CDM Smith in a future report, as part of a larger assessment of potential downside (and upside) revenue risks to the I-10 MRB&B project.

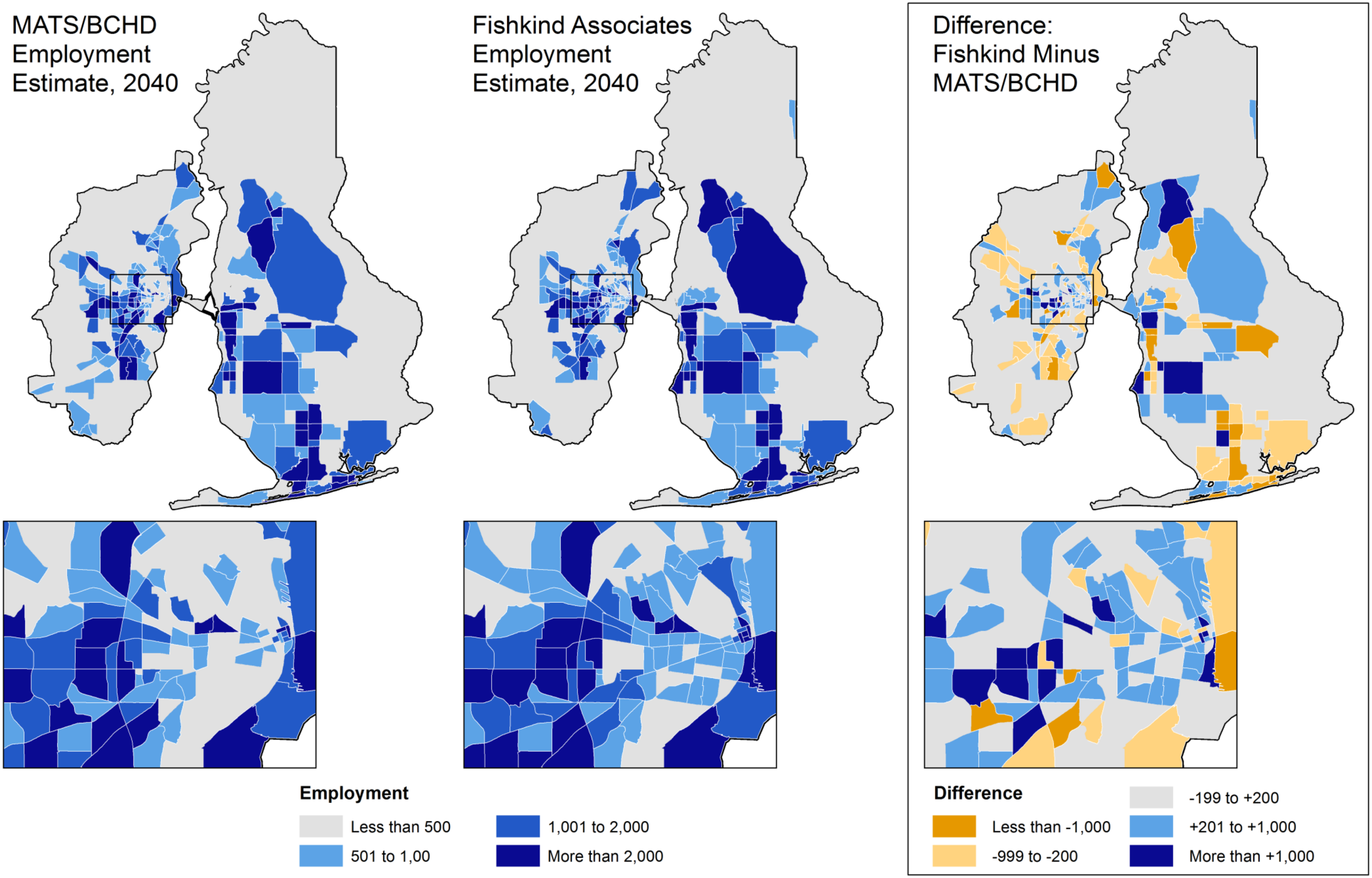
May 30, 2018



Fishkind: 2010-2040 Employment Forecasts

FIGURE 4-8

May 30, 2018



Employment: Fishkind vs. MPO Forecasts

FIGURE 4-9

Chapter 5 – Stated-Preference Surveys

Resource Systems Group (RSG) conducted a stated-preference (SP) survey for the I-10 MRB&B project in April/May 2016. RSG specializes in conducting SP surveys. The I-10 MRB&B SP survey focused on drivers that currently cross the Mobile River in the project area via the Wallace Tunnel (I-10), Bankhead Tunnel (US-90/98) or Cochrane Bridge, but excluded the I-65 Bridge. The primary purpose of the survey was to assess current tunnel/bridge users' willingness to pay tolls. This willingness is quantified as Value of Time (VOT), which is expressed in dollars per hour. VOT is a parameter used directly in the travel demand model to calculate toll diversion. Section 8.2 ("Toll Diversion Methodology") provides more details about how VOT is incorporated into the model. The full report on the SP survey is provided in Appendix C. This chapter summarizes I-10 MRB&B SP survey; explaining survey administration, the survey questions, and the results of the survey.

5.1 Survey Administration

Separate SP surveys were conducted for passenger cars (PC), and commercial vehicles (CV) or trucks.

5.1.1 Passenger Car Survey

RSG obtained 1,449 completed PC surveys. Respondents for the PC survey were obtained through four sources:

- **Postcards Sent to Residents (554 Respondents):** 15,000 postcards were mailed to Mobile and Baldwin County residents inviting them to participate in the survey. Figure 5-1 and Figure 5-2 respectively show the front and back of this postcard.
- **Posting on ALDOT Website (192 Respondents):** ALDOT posted a link to the survey on its Mobile Division Office website. This link was then publicized by various local media outlets.
- **"Research Now" Panel (186 Respondents):** RSG contracted with Research Now, an online market research firm, to provide a sample of individuals who met the geographical criteria to participate in this survey.
- **Local Business Employees (517 Respondents):** RSG contacted numerous businesses in the study area and asked them to distribute an e-mail to employees that contained a link to the survey.

Figure 5-1 – Stated-Preference Survey Post Card (front)

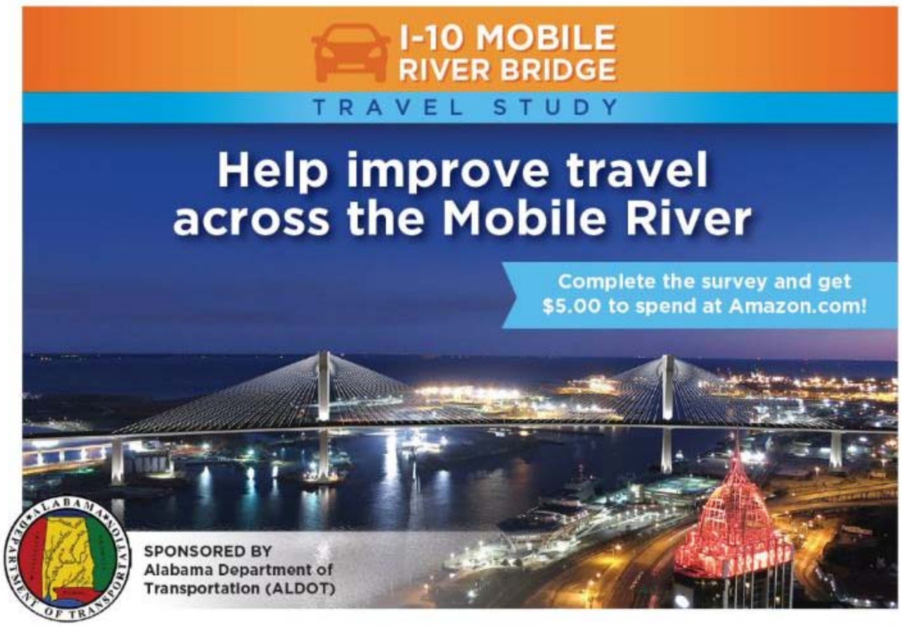
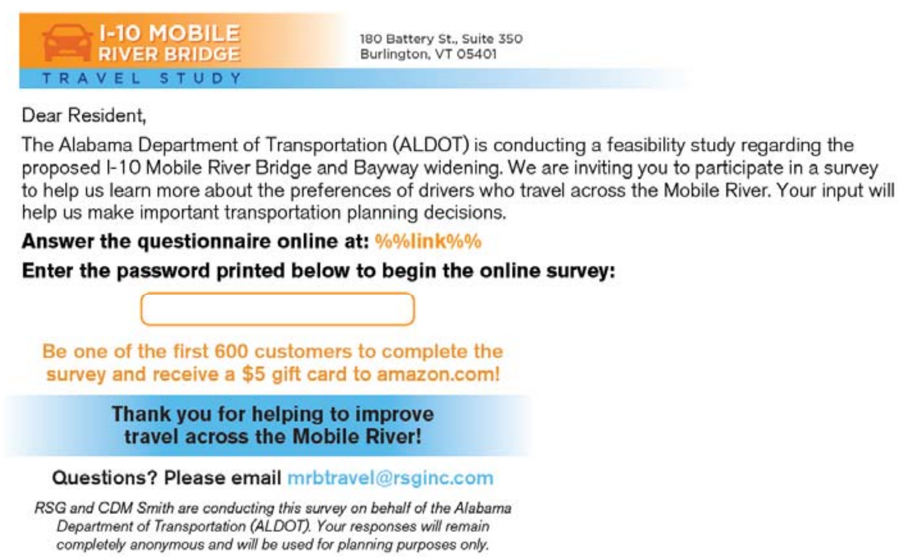


Figure 5-2 – Stated-Preference Survey Post Card (back)



I-10 MOBILE
RIVER BRIDGE
TRAVEL STUDY

180 Battery St., Suite 350
Burlington, VT 05401

Dear Resident,

The Alabama Department of Transportation (ALDOT) is conducting a feasibility study regarding the proposed I-10 Mobile River Bridge and Bayway widening. We are inviting you to participate in a survey to help us learn more about the preferences of drivers who travel across the Mobile River. Your input will help us make important transportation planning decisions.

Answer the questionnaire online at: %%link%%

Enter the password printed below to begin the online survey:

Be one of the first 600 customers to complete the survey and receive a $5 gift card to amazon.com!

Thank you for helping to improve travel across the Mobile River!

Questions? Please email mrbtravel@rsginc.com

RSG and CDM Smith are conducting this survey on behalf of the Alabama Department of Transportation (ALDOT). Your responses will remain completely anonymous and will be used for planning purposes only.

F5-1 and F5-2 ALDOT I-10 Postcard (DRAFT March 2, 2016).pdf

5.1.2 Commercial Vehicle Survey

The CV survey obtained respondents through in-person (truck driver) intercepts at "Travel Centers" (i.e., truck stops) and "Welcome Centers" (i.e., rest stops). Truck drivers who agreed to participate, then completed the questionnaire on-site using RSG laptops. CV surveys were administered in-person, instead of online as the PC surveys were, because past experience has shown that truckers have very low response rates to online surveys. The in-person intercepts were scheduled at eight sites over four days to ensure that a large enough number of CV questionnaires were completed for statistical analysis purposes. In total, RSG obtained **232** completed CV questionnaires (including 5 from Austal USA commercial drivers that were completed online).

5.2 Survey Questionnaires

The PC and CV questionnaires followed the same general format. Both the PC and CV questionnaires contained five sections, or categories of questions. The first four sections were common to both surveys. However, the final section was different in each survey. The PC surveys concluded with demographic questions, and the CV surveys concluded with "company information" questions pertaining to the type of trucking services they provide, their employer and its policies regarding tolls.

5.2.1 Qualification Questions

The qualification questions ensured that the respondents had made a recent trip crossing the Mobile River via the Wallace Tunnel (I-10), Bankhead Tunnel (US-90/98) or the Cochrane Bridge.

5.2.2 Trip Characteristic Questions

Respondents were then asked to think about their most recent one-way trip across the Mobile River and respond accordingly. They were asked several questions, including:

a. Which river crossing they used,
b. What day of week the crossing occurred,
c. Time-of-day in which the trip started,
d. Whether and how much delay they encountered,
e. Street addresses of the trip origin and destination, and
f. Whether they owned a toll transponder.

5.2.3 Stated Preference Questions

This section was the "heart" of the survey, and consisted of ten SP experiments. Figure 5-3 is a screenshot of a sample SP experiment question. The "experiments" asked respondents to compare the travel time of a toll-free route, against the travel time plus toll of a toll route, and indicate which route they would choose. In the example, the respondent is being asked (in essence) whether they would pay a 95-cent toll for a 9-minute travel time savings.

5.2.4 Debrief and Opinion Questions

If the respondent never chose the toll route in the SP experiment section, they were asked why they never chose it. All respondents were asked whether they were in favor of or opposed to the I-10 MRB&B project, and why. Finally, they were asked whether they agreed or disagreed with various statements about tolling, such as, "I support using tolls to pay for highway improvements that relieve congestion."

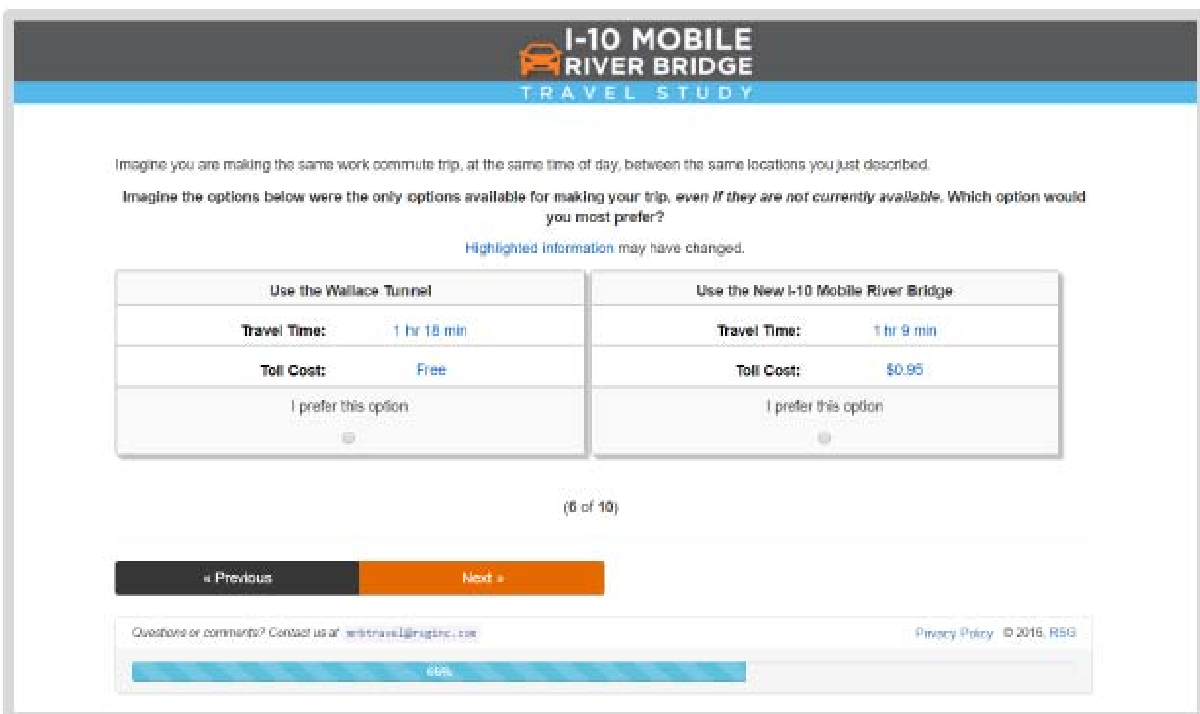
5.2.5 Demographic Questions (PC Survey Only)

This section asked PC respondents about their home ZIP code, age, income range, employment status and other demographic questions.

5.2.6 Company Information Questions (CV Survey Only)

This section asked a variety of questions about the company for which the trucker worked, such as where the company is based, the truck fleet size, the typical length of their trips, whether they have a flexible or fixed delivery schedule, who pays for any tolls they might encounter and how those toll costs were passed-along to customers.

Figure 5-3 – Sample Stated-Preference Experiment



F5-3 from RSG Appendix A Screen Captures.pdf

5.3 Value of Time Estimates

The Values of Time (VOTs) for the I-10 MRB&B project were estimated using a statistical technique called a multinomial logit model. For passenger cars, RSG estimated VOTs by household income and by time period (using the same time period hours used in the travel demand model). The final PC VOTs by time-of-day and household income are shown in Table 5-1. The overall average PC VOT for this survey was $8.31. The VOTs ranged from $5.94 in the overnight time period for the lowest income category to $10.65 during the AM-peak period for the highest income category.[17]

For trucks, RSG calculated a single VOT to be used in all time periods, since there were fewer completed surveys from which to conduct more detailed statistical analyses. The median VOT for trucks was estimated at $27.50 per hour.

Table 5-1 – Passenger Car Values of Time by Income and Time Period

Income Midpoint	Peak		Off Peak	
	AM	PM	Midday	Overnight
$17,500	$7.72	$7.13	$6.01	$5.94
$37,500	$8.85	$8.18	$6.90	$6.82
$62,500	$9.62	$8.89	$7.50	$7.40
$87,500	$10.12	$9.35	$7.89	$7.79
$112,500	$10.49	$9.70	$8.18	$8.08
$125,000	$10.65	$9.84	$8.30	$8.20

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T5-1) RSG VOTs

[17] RSG also estimated PC VOTs for weekend days. However, the I-10 MRB&B travel demand model is a weekday-only model.

5.4 Comparison of VOT Results to Other Relevant SP Studies

RSG provided sample VOTs from other recent SP surveys to provide some context for the VOTs obtained through the I-10 MRB&B survey. The sample projects that RSG selected were "point" tolls (like the I-10 Bridge), as opposed to tolled corridors. Table 5-2 shows peak-period VOTs from the Alabama and other surveys, sorted from lowest to highest VOT. The table shows that the Alabama peak-period tolls are on-par with the other surveys, and not significantly higher or lower.

Table 5-2 – Comparison of VOTs from Recent SP Surveys

State	Year	Description	VOT
Alabama	2016	PM Peak	$9.35
Virginia	2015	Peak - Home Based Work	$9.38
Tennessee	2011	Peak	$9.94
Alabama	2016	AM Peak	$10.12
Connecticut	2013	Peak Work	$10.30

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T5-2) RSG VOT Comparisons

Chapter 6 – Model Development

This chapter contains a description of the time-of-day travel demand model used to prepare T&R estimates for the I-10 MRB&B project. Figure 6-1 is a map showing the I-10 MRB&B project superimposed over a map of the Gulf Coast region of Alabama. The I-10 MRB&B project straddles the model areas of two existing travel demand models, developed by Mobile Area Transportation Study (MATS) and Baldwin County Highway Department (BCHD). CDM Smith obtained the travel demand modeling files from both agencies. CDM Smith utilized the TAZ boundaries and roadway network files from the MATS and BCHD models and utilized the MATS daily trip generation formulas. All other model inputs were developed by CDM Smith and its subconsultants. The base-year for the I-10 MRB&B model is 2015. CDM Smith also developed three future-year models: 2020 (which was the originally assumed project opening year), 2030 and 2040.

This chapter contains summaries of the model's TAZs and roadway network. This is followed by a description of the development of the 2015 time-of-day trip tables, which were developed separately for Passenger Cars (PC) and Commercial Vehicles (CV). Next, there is an account in the chapter that describes the model calibration, which includes the 2015 base model traffic assignment results. Finally, there is a review of the future-year models, with summaries of the future-year "no build" model results.

6.1. Traffic Analysis Zones

CDM Smith obtained the TAZ boundary GIS shapefiles for the MATS and BCHD model areas from the respective agencies.[18] CDM Smith then combined these two sets of TAZ boundaries into a single shapefile. The MATS model contained 312 TAZs, and the BCHD model contained 149 TAZs. Two TAZs within Mobile Bay (one from the MATS model and one from the BCHD model) were split to provide more precise traffic loading in the I-10 MRB&B project area. This split added two new TAZs to the I-10 MRB&B model and brought the total number in the I-10 MRB&B model to 463 internal TAZs. The boundaries of the 463 internal TAZs are shown in Figure 6-2.

The I-10 MRB&B model also has 23 external zones (or stations), as shown in Figure 6-3. The external zones are the roadway segments at the periphery of the model area where vehicles pass from places outside the model area into the model area itself (or vice-versa). For example, I-10 where it crosses from Mississippi to Alabama is external zone 467.

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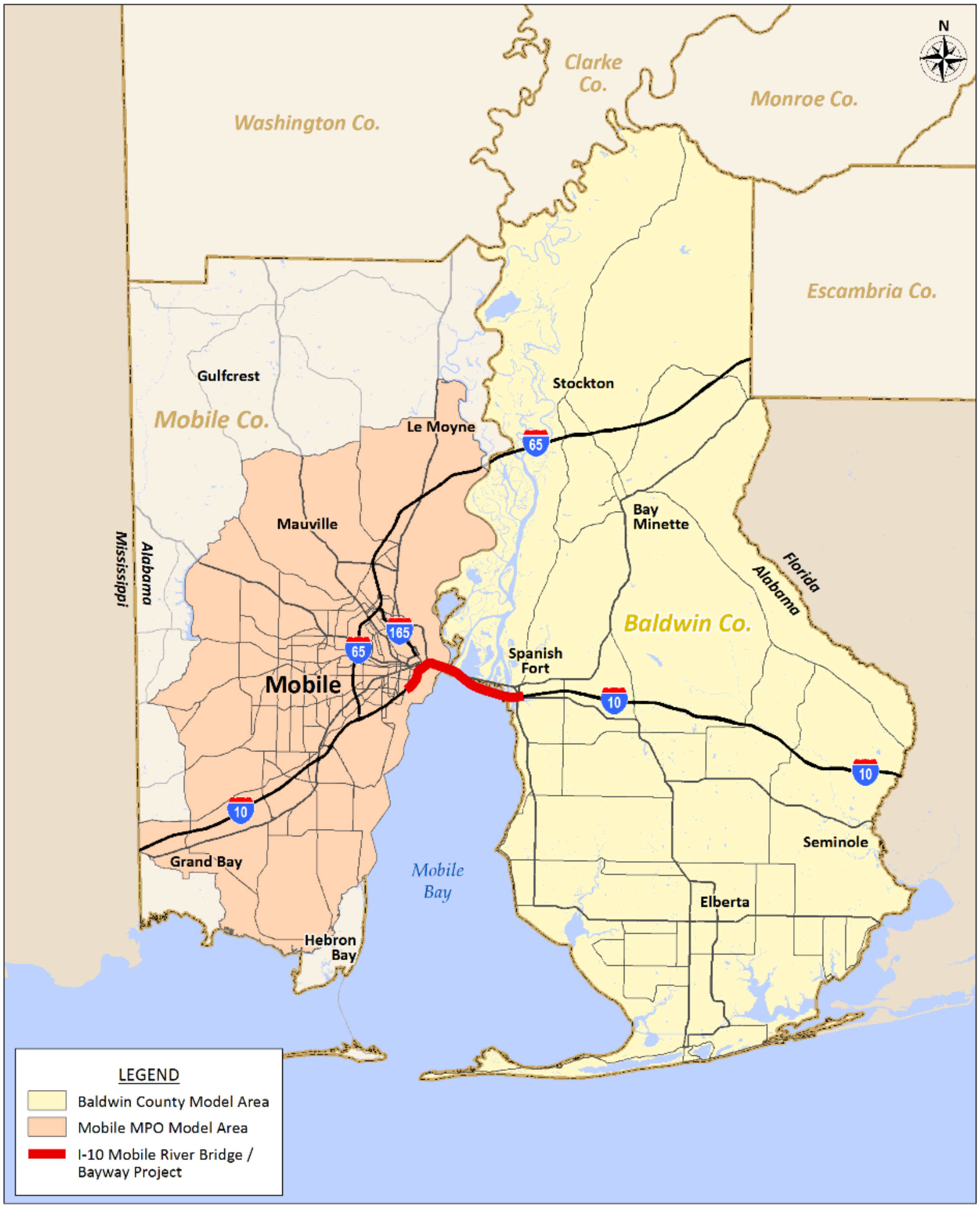
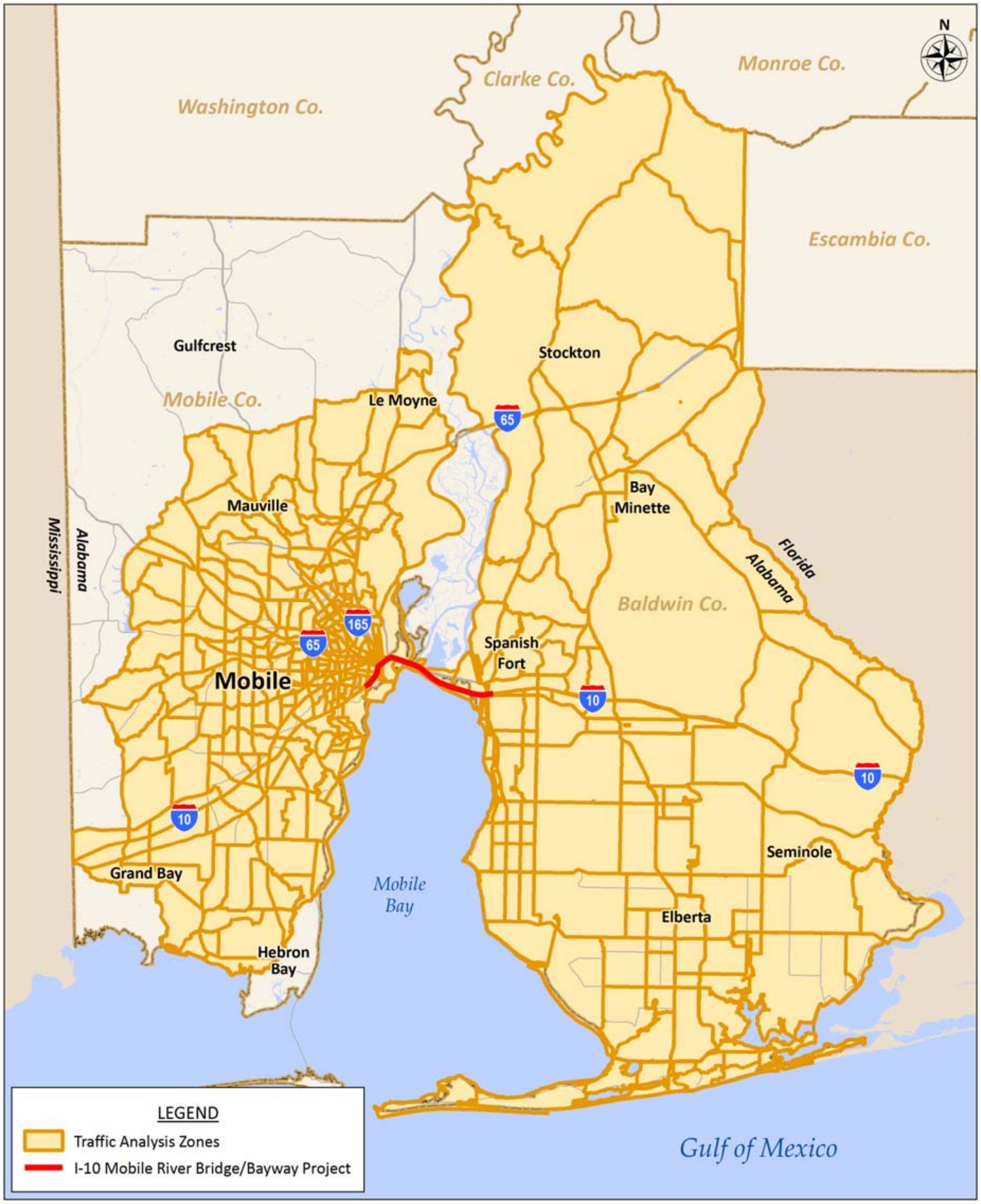
[18] Note that the MATS model (and by extension, the I-10 MRB&B model) does not cover the entirety of Mobile County. The far southeastern, western and northern portions of the county are excluded.

Figure 6-1 – Mobile and Baldwin County Model Areas



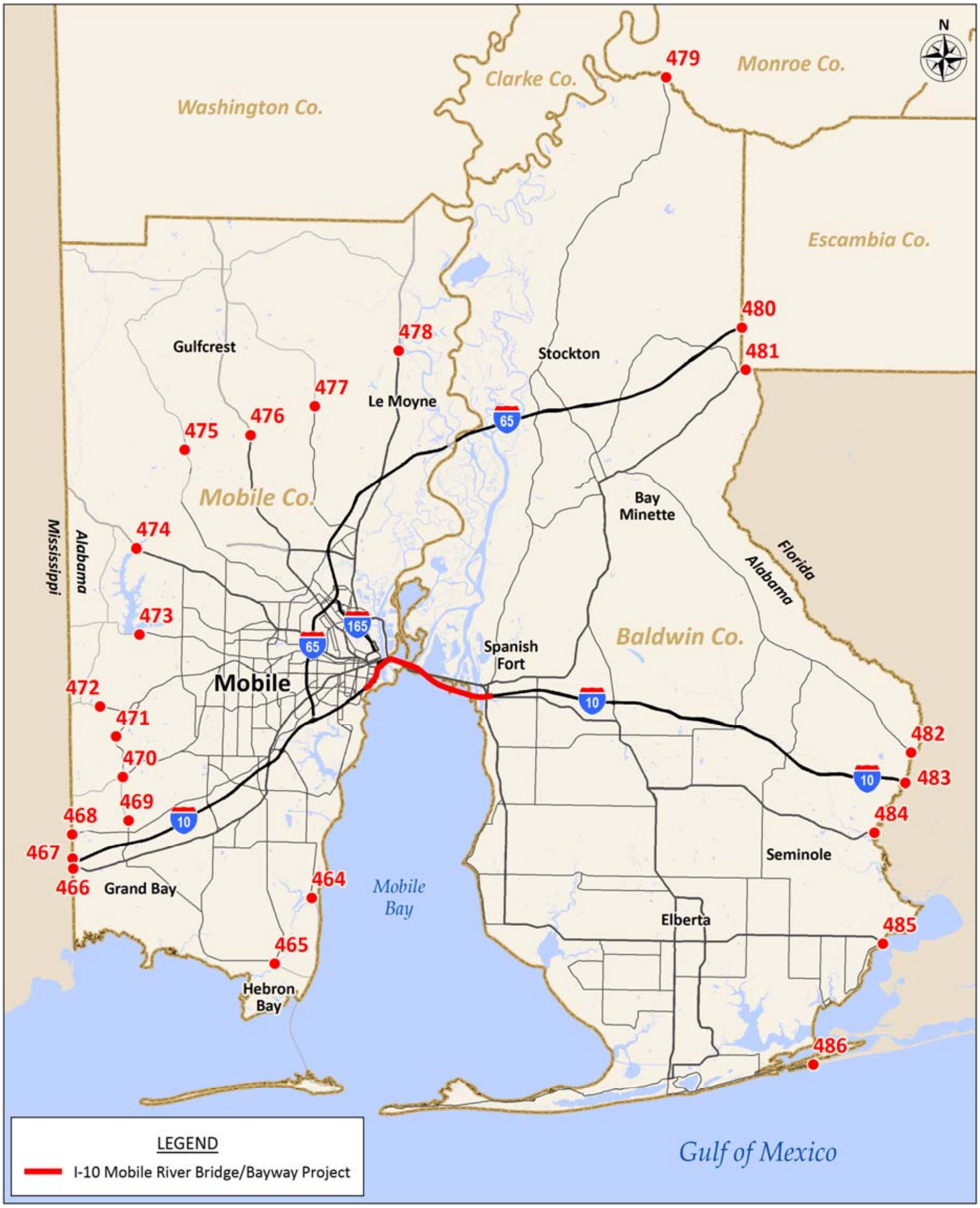
F6-1 Mobile & Baldwin Counties Map.png

Figure 6-2 – Internal Traffic Analysis Zone (TAZ) Boundaries



F6-2 Traffic Analysis Zone Boundaries.png

Figure 6-3 – Location of External Zones



F6-3 Map of External TAZs.png

6.2 Base-Year 2015 Roadway Network

CDM Smith obtained the base-year roadway network files from the MATS and BCHD models. Each of their network files have the year 2010 as the base. CDM Smith first combined these two roadway networks in the Citilabs Cube travel demand modeling program. The roadway networks share only three common links, which all cross Mobile Bay using: I-65, I-10 and US-98. CDM Smith connected the two networks at these three common links and added additional interchange details on I-10 and US-98 where they cross Mobile Bay.

The only new route or major capacity improvement project completed in the Mobile-Baldwin County region between 2010 and 2015 was the Baldwin Beach Express (BBE), which opened on August 15, 2014. The 13-mile long BBE is located in central Baldwin County immediately south of I-10. This route was added to the combined 2010 roadway network file to update it to reflect 2015 conditions.

CDM Smith then reviewed and updated all link attributes, including: capacity, free-flow speed and link group. Generally, the MATS attributes were adopted. CDM Smith also reviewed all the link attributes, such as capacity, number of lanes (implied through the capacity) and free-flow speed, to ensure they accurately reflect current roadway conditions. Finally, since the I-10 MRB&B model is a time-of-day model, CDM Smith converted the daily link capacities to hourly capacities. Daily models typically reflect the average congestion levels over the course of a day, and therefore the daily capacity is usually 10-times the hourly capacity. Therefore, CDM Smith divided the daily capacity on all links by 10 to obtain the implied hourly capacity. CDM Smith then generally multiplied the hourly capacity by the number of hours per time period to reflect the link capacity within each time period.[19] Table 6-1 shows the number of hours assumed in each time period for capacity purposes.

Table 6-1 – Hourly Capacity Factors

Time Period	Start-End Time	Actual Hours in Time Period	Hourly Capacity Factor per Time Period
AM Peak	6:00 AM-9:00 AM	3	2.4
Midday	9:00 AM-4:00 PM	7	6.0
PM Peak	4:00 PM-7:00 PM	3	2.8
Overnight	7:00 PM-6:00 AM	11	5.0

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T6-1) Capacity by time period

[19] These calculations were executed in the Cube traffic assignment script, not directly in the link attributes.

6.3 Passenger Car Model Development

CDM Smith developed separate PC and truck/CV time-of-day trip tables. The two sets of trip tables were developed using somewhat different methods (particularly in the trip generation and trip distribution steps). The PC model development is described in this section (Section 6.3), while the CV model development is summarized in the following section (Section 6.4).

As illustrated in Section 6.1, the I-10 MRB&B model has two types of zones, internal and external. Internal zones are located within the model area. Conversely, external zones are located on the periphery of the model area. Based on this distinction, there are three types of trips:

1. **Internal-to-Internal (I-I) Trips:** Internal trips within the model area and comprise the majority of the vehicle trips in the model. For example, a trip from downtown Mobile to Orange Beach would be an Internal trip in the I-10 MRB&B model.

2. **External-to-External (E-E) Trips:** E-E trips originate at an external zone, pass through the model area, and end at another external zone. For example, a trip from I-10 at the Mississippi State line to I-10 at the Florida State line is an E-E trip in the I-10 MRB&B model.

3. **Internal-to-External (I-E) and External-to-Internal (E-I) Trips:** I-E and E-I trips are referred to jointly as I-E/E-I trips. These trips have one end of the trip within the model, and the other end of the trip at an external zone. For example, a trip from downtown Mobile to the Florida State line on I-10 would be an I-E trip in the I-10 MRB&B model. The reverse movement would be an E-I trip.

These three trip types (within the overall trip table) were developed using different methods, as outlined in the sections that follow.

6.3.1 Daily Trip Generation (Passenger Cars)

Trip generation, the first step of the travel demand model development, involves calculating the number of vehicle trips produced by and attracted to each TAZ. The result is a table of Productions and Attractions (P-A Table).[20]

The number of productions and attractions for each TAZ are calculated using trip rate formulas and the TAZ-level socioeconomic data. To calculate the trip productions and attractions, CDM Smith used the trip rate formulas from the MATS model, and the TAZ-level socioeconomic data forecasts prepared by Fishkind & Associates (as described in Chapter 4). The list below shows categories of socioeconomic data required to calculate the P-A Table.

[20] A note on terms used in this chapter: The term "P-A" table refers to a table that shows the number of trips produced by and attracted to each zone, but it is produced prior to the trip distribution step, therefore it does not show to which (or from) zones those trips travel. A "P-A matrix" is produced in the trip distribution step, and it does show in which zone trips are produced and to which zones they are attracted. However, a "P-A matrix" is not a balanced trip table, as it only shows the production-to-attraction zone direction of travel.

1. Low-Income Households
2. Medium-Income Households
3. High-Income Households
4. College Dorm Rooms
5. Primary/Secondary School Students
6. Retail Employment
7. Service Employment
8. Other Employment

CDM Smith used the MATS trip generation formulas to estimate internal trips for three standard trip purposes:

1. Home-Based Work (HBW)
2. Home-Based Other (HBO)
3. Non-Home Based (NHB)

The MATS formulas were also used to estimate the number of E-I trip productions, and the corresponding number of I-E trip attractions. E-E trips are estimated in a separate process described in Section 6.3.5. In total, the 2015 base-year production-attraction table contained 1.8 million vehicle trips.

6.3.2 Daily Trip Distribution (PC, Internal Trips)

Trip distribution is the second step in the travel demand model development. In this step, a gravity model is used to estimate the number of trips that travel from one zone (the trip productions) to all the other zones. The gravity model estimates to which zones the trip productions are attracted to, based on the number of trip attractions in the destination zone, and the separation between the origin and destination zones. The result of the trip distribution step is a production-attraction matrix (not to be confused with a balanced trip table). Since the trip generation was calculated at a daily level, this P-A matrix is also daily (not time-of-day).[21]

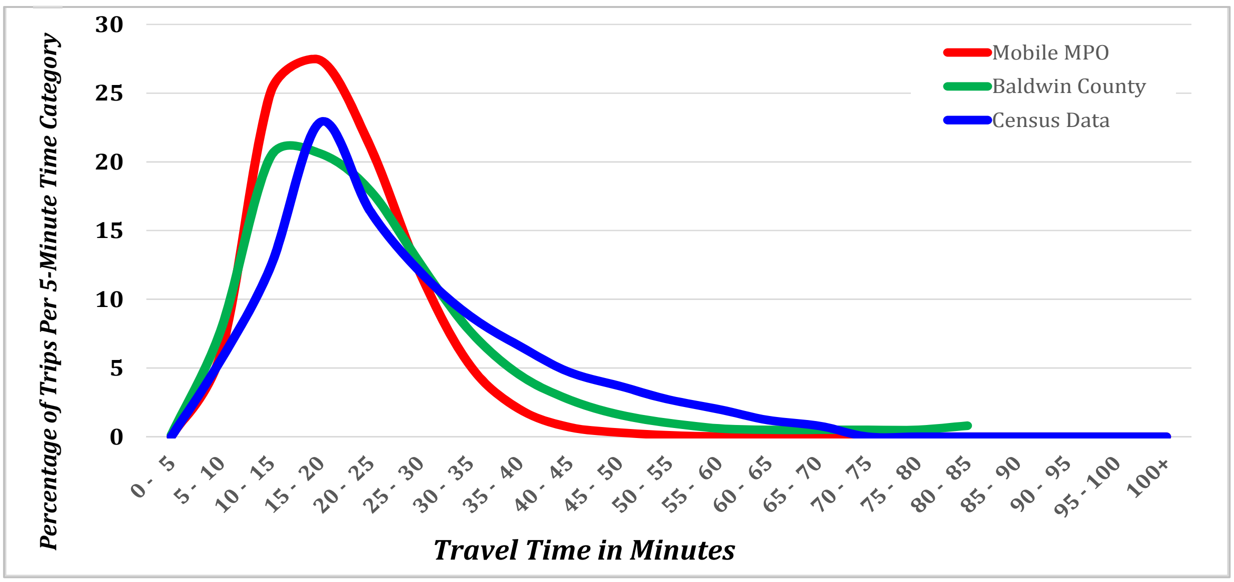
A friction factor table is one of the inputs to a gravity model. CDM Smith developed a friction factor table specifically for the I-10 MRB&B model. During model calibration, a friction factor table was calculated from a Trip Length Frequency Distribution (TLFD) observed from Census data. Figure 6-4 is a graph showing three TLFDs for Home-Based Work trips. The horizontal axis of the graph shows the trip length in 5-minute increments, and the vertical axis shows the percentage of trips that fall within the corresponding 5-minute trip length increment. The red and green lines in the

[21] Note that a P-A matrix is not the same as a trip table. A P-A matrix only shows trips traveling from a production zone to an attraction zone. Additionally, in a P-A matrix, zones do not have an equal number of trips produced by and attracted to the zone. Conversely, a trip table contains both the P-A trips and the reciprocal (A-P) trips. Additionally, the trip table is balanced, which means the number of trips originating from and destined to the zone are equal.

graph show the TLFDs used by MATS and BCHD respectively, and the blue line shows the TLFD developed for the I-10 MRB&B model.

Since the I-10 MRB&B model area is larger than either the MATS or BCHD model areas, the TLFDs from those two models were too short (in time duration) for the I-10 MRB&B model. CDM Smith created an "observed" TLFD for the I-10 MRB&B model from U.S. Census American Community Survey travel data obtained through the FHWA Census Transportation Planning Products (CTPP) website. To create the friction factor table from the resulting "observed" TLFD, CDM Smith used an iterative trip distribution process to get the friction factors to produce a P-A matrix that matched the CTPP "observed" TLFD. Similar TLFDs and friction factor tables were developed for the I-10 MRB&B model passenger car HBO and NHB trip purposes.

Figure 6-4 – HBW Trip-Length Frequency Distribution



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F6-4) Trip Length Freq Dist

6.3.3 Splitting to Time-of-Day Trip Tables

In the trip distribution step (Section 6.3.2), CDM Smith obtained daily P-A matrices by trip purpose (HBW, HBO and NHB). To split the daily P-A matrices into uncalibrated time-of-day trip tables, CDM Smith utilized the procedure and factors outlined in NCHRP 365.[22] Table 42 of that report provides a, "Diurnal distribution [of trips] by purpose and direction," for each hour of the day. CDM Smith compressed this table into the four time periods of the I-10 MRB&B travel demand model. The resulting factors by time period are shown in Table 6-2. These factors were used to convert the HBW, HBO and NHB passenger car P-A matrices into a single uncalibrated 2015 passenger car trip table. This uncalibrated trip table contained Internal and I-E/E-I trips, but no E-E trips. Those trips are discussed in the next two sections (Sections 6.3.4 and 6.3.5).

Table 6-2 – Daily to Time-of-Day Conversion Factors

Time Period	Hours	HBW		HBO		NHB	Total
		From Home	To Home	From Home	To Home		
AM Peak	6:00 AM-9:00 AM	30.6%	1.2%	10.6%	1.3%	4.5%	14.2%
Midday	9:00 AM-4:00 PM	10.2%	12.0%	21.8%	22.6%	55.0%	42.4%
PM Peak	4:00 PM-7:00 PM	2.8%	26.4%	10.6%	11.7%	24.9%	24.2%
Overnight	7:00 PM-6:00 AM	6.4%	10.4%	7.0%	14.4%	15.6%	19.2%
	Totals	**50.0%**	**50.0%**	**50.0%**	**50.0%**	**100.0%**	**100.0%**

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T6-2) Diurnal Table time period

6.3.4 External Zone Traffic Volumes

External trips travel to or from external zones. Both ends of E-E trips travel to/from external zones, and the external end of I-E/E-I trips travel to/from external zones. Unlike internal links (in which the traffic volume is determined through the traffic assignment process), the number of trips on external zone links are specified directly from traffic counts. For this study, CDM Smith obtained 2014 AADT counts at each external station from ALDOT's traffic counts website.[23] Table 6-3 contains a list of all 23 external zones in the I-10 MRB&B model. The first column of the tables has the external zone numbers. The second column indicates the roadway (including a north, east or west descriptor for roads that cross the model boundary twice). The third column notes the county (Mobile or Baldwin). Finally, the fourth column shows the 2014 AADT at each external zone. Since these are two-direction counts, it is assumed that there will be an equal number of trip origins and destinations at each external zone. For example, Zone 464 has a count of 4,410. It is assumed Zone 464 will have 2,205 daily trip origins and 2,205 daily trip destinations. These volumes indicate the

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[22] Transportation Research Board, National Cooperative Highway Research Program, Report 365, Travel Estimation Techniques for Urban Planning, pp.87-91
[23] https://aldotgis.dot.state.al.us/atd/default.aspx

total number of trips to and from each external zone. However, they don't indicate the travel pattern of these trips to internal zones or other external zones. This topic is covered in the next section.

Table 6-3 –External Zone: 2014 AADT Volumes

TAZ Number	External TAZ Roadway	County	2014 ALDOT AADT
464	Dauphin Island Pkwy	Mobile	4,410
465	SR-188	Mobile	2,210
466	US 90 (West)	Mobile	6,010
467	I-10 (West)	Mobile	44,730
468	Old Pascagoula Rd	Mobile	1,130
469	Grand Bay-Wilmer Rd	Mobile	7,510
470	Dawes Rd	Mobile	1,620
471	Jeff Hamilton Rd	Mobile	1,780
472	Airport Road	Mobile	5,220
473	Tanner-Williams Rd	Mobile	4,990
474	US 98 (West)	Mobile	9,300
475	Lott Rd	Mobile	2,680
476	US 45 (North)	Mobile	8,340
477	Celeste Rd	Mobile	4,650
478	US 43 (North)	Mobile	19,450
479	SR-59 (North)	Baldwin	840
480	I-65 (North)	Baldwin	23,240
481	US-31 (East)	Baldwin	4,410
482	CR-112 (Old Pensacola Rd)	Baldwin	710
483	I-10 (East)	Baldwin	31,460
484	US-90 (East)	Baldwin	5,310
485	US-98 (East)	Baldwin	10,080
486	SR-182 (Perdido Beach Blvd)	Baldwin	16,740

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / T6-3) 2014 External Counts

6.3.5 External Trip Model Adjustments

The AirSage and StreetLight Data travel pattern data were used to adjust the external portions of the travel demand model's trip table (E-E and I-E/E-I trips), as well as internal trips that cross Mobile Bay.

The following summarizes the trip table adjustments and the sequence in which they were executed. This sequence of adjustments was done separately for each of the model's four time-of-day trip tables.

1. **Mobile Bay Crossing Trips:** The StreetLight Data travel pattern was used to adjust the portions of the trip table for all trips that cross Mobile Bay via I-65, I-10 or US-98 (including E-E trips). These adjustments were made to both the PC and CV trip tables (using the corresponding PC and CV StreetLight Data).

2. **E-E Trips:** The travel patterns of E-E trips were adjusted differently for PCs versus CVs. For PCs, AirSage data was used to determine the proportion of trips at each external zone that were E-E trips (as opposed to I-E/E-I Trips). The absolute number of E-E trips at each external zone was then adjusted to match the AirSage proportions (using the external zone traffic counts described in Section 6.3.4). The travel patterns of these E-E trips were also adjusted to reflect the AirSage travel pattern, except in the case of E-E trips that cross Mobile Bay. In those cases, the StreetLight Data travel patterns were retained. For CV E-E trips that cross Mobile Bay, the StreetLight Data pattern described in the previous step was retained. However, for CV E-E trips that do not cross Mobile Bay, CDM Smith retained the MATS/BCHD travel pattern.

3. **E-I/I-E Trips:** Several steps were required to implement adjustments to the E-I and I-E trips.

    a. **Calculate Number of E-I/I-E Trips:** As noted in the prior step, the number of E-E trips at each external zone were estimated from the StreetLight Data. The remaining trips at each external zone are, by definition, E-I trips. The number of E-I trips at each external zone in the trip table were adjusted to match the proportion estimated by StreetLight Data. A similar procedure was used to determine the number of reciprocal I-E trips coming from internal zones, such that there was an equal number of E-I and I-E trips.

    b. **I-E/E-I Trip Distribution:** The final step was to distribute the E-I/I-E trips between the internal and external zones. Trip length frequency distributions were created for different trip types and time periods from the AirSage observed travel pattern data. The E-I/I-E portions of the trip distribution models were then made to match these trip length frequency distributions by adjusting (calibrating) the friction factors in each time period. This friction factor was then used to distribute the E-I/I-E trips between the external and internal zones.

6.3.6 Origin-Destination Matrix Estimation (ODME)

After the 2015 PC trip table was adjusted using the AirSage and StreetLight Data travel pattern information, the overall PC trip table was adjusted to match the PC traffic counts using a process called ODME. ODME essentially executes a series of select link analyses at the traffic count locations, and makes selective adjustments to the trip table, until the traffic assignment volumes in the model match the traffic counts. For the PC trip table calibration, the ODME attempted to match the traffic assignment to the 2015/2016 PC traffic counts at the 83 bi-directional traffic count locations coded in the model. The PC ODME used PC traffic counts only. The truck trip table was calibrated separately using truck traffic counts.

6.4 Truck Model Development

This section describes the development of the truck model (as opposed to the PC model described in the previous section). Traditional trip generation is primarily designed to estimate passenger car vehicle trips and is generally not well-suited for estimating truck/CV trips. To create the CV trip table for the I-10 MRB&B model, CDM Smith used trip rates published in the NCHRP Report 716, "Travel Demand Forecasting: Parameters and Techniques (Table 4.22) and are shown in Table 6-4. The employment categories and trip rates were developed by the Puget Sound Regional Council (PSRC)

Table 6-4 – Truck Trip Generation Rates

Category	Productions	Attraction
Households	0.0163	0.0283
PSRC Employment Categories		
Agriculture	0.0404	0.2081
Mining	0.0404	10.8831
Construction	0.0453	0.0644
Retail	0.0744	0.009
Education/Government	0.0135	0.0118
Finance, Insurance, Real Estate	0.0197	0.0276
Manufacturing Products	0.0390	0.0396
Equipment	0.039	0.0396
Transportation/Utility	0.0944	0.0733
Wholesale	0.1159	0.0258

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T6-4) Truck Trip Rates

This trip generation method calculates truck trips from the number of households, and the number of employees for various employment categories. To calculate the "Households" category of trip productions and attractions, CDM Smith used the Fishkind socioeconomic forecasts. To calculate the "Employment" categories of trip productions and attractions, CDM Smith utilized employment data from the Alabama Bureau of Industrial Relations (ABIR). ABIR provided 2014 employment data by North American Industry Classification System (NAICS) employment category by census block group for Mobile and Baldwin Counties.[24] There are some differences in the NAICS and PSRC employment categories shown in Table 6-4. Therefore, CDM Smith made some assumptions about which NAICS category best aligns with each PSRC category. Truck trip productions and attractions were then calculated by census block group according to the PSRC trip rates. The Alabama employment data was provided by census block group, not the TAZ boundaries used in the I-10 MRB&B model. Therefore, CDM Smith "spatially joined" the centroids of the census block groups to the model TAZs to create an equivalency table between the two sets of boundaries. This, in turn, allowed CDM Smith to match truck productions-attractions from a given census block group to an I-10 MRB&B model TAZ.

To run the trip distribution step, CDM Smith used the Truck Friction Factors from Florida Department of Transportation (FDOT) Statewide travel demand model. CDM Smith then split the daily truck production-attraction matrix into time-of-day trip tables using the same factors as were used for the passenger car NHB trip purpose (see Table 6-2). The AirSage and StreetLight Data travel pattern adjustments were then applied to the time-of-day truck trip tables, using the method described in Section 6.3.5. Finally, ODME was performed on the time-of-day truck trip tables, to match them to the traffic counts and the FDOT truck trip length frequency distribution.

6.5 2015 No-Build Model Calibration Statistics

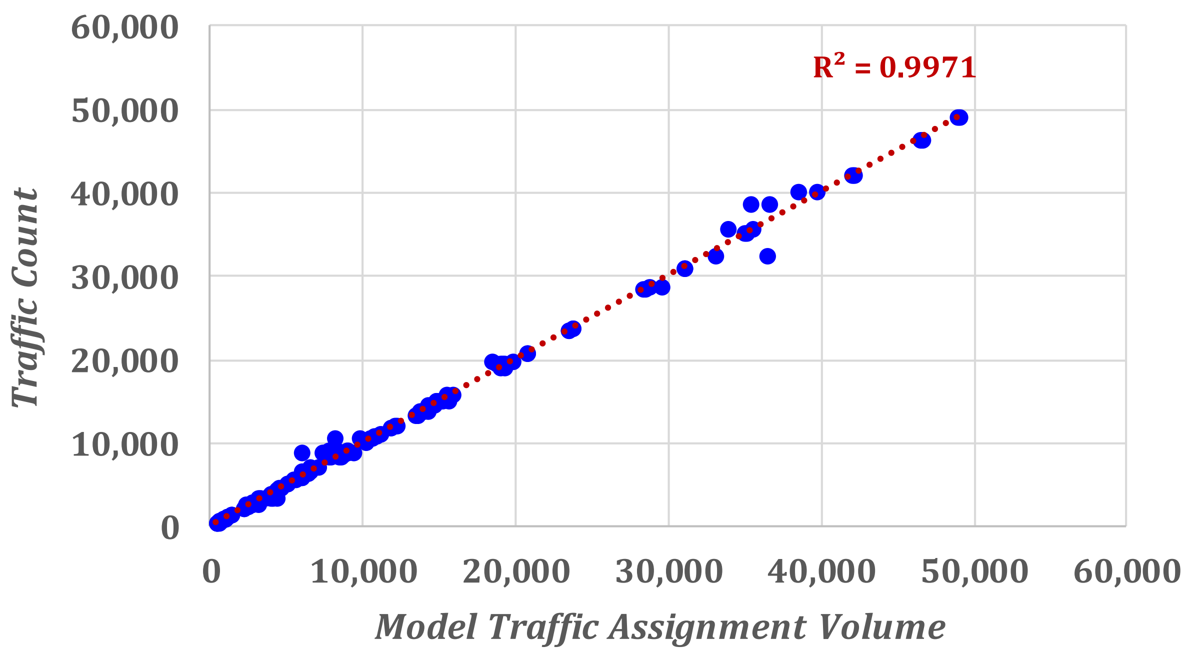
This section provides model calibration statistics to illustrate how well the 2015 base-year I-10 MRB&B travel demand model replicates 2015 traffic conditions. The statistics are presented for PC and CV trips combined, except where noted.

6.5.1 Volume/Count Comparison

Figure 6-5 is a scatterplot which compares the 2015 daily total volumes from the model traffic assignment against the actual 2015/2016 traffic count volumes at the same location. The diagonal dotted line indicates where there would be a perfect match between assignment and count volumes. The proximity of the markers (blue dots) to the diagonal line indicate the goodness of fit. As the scatterplot shows, there is a very close volume match at all of the traffic count locations. The R-squared correlation value is a very high 0.9971.

[24] Fishkind employment estimates were not used as they did not produce employment estimates by NAICS categories.

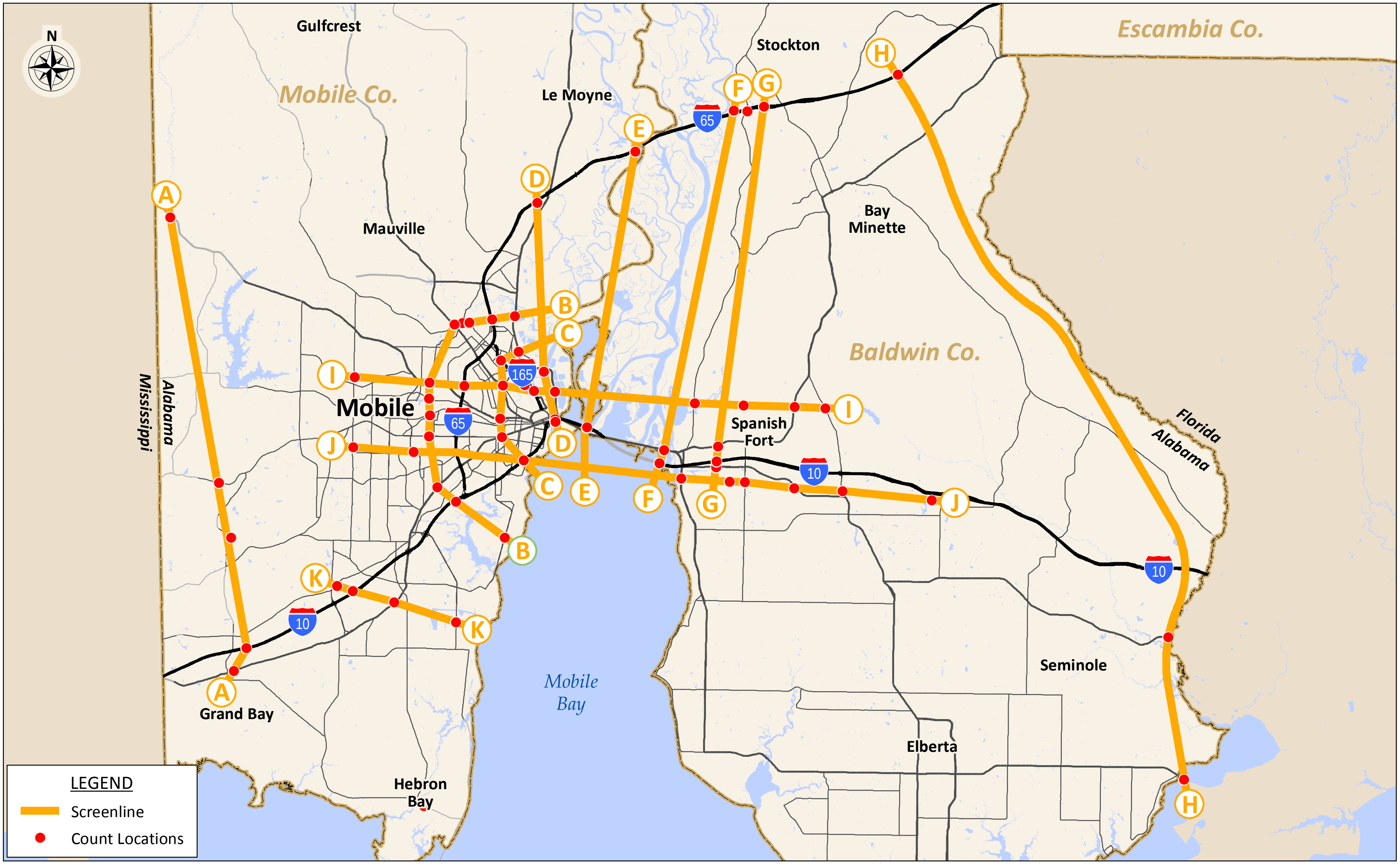
Figure 6-5 – Daily Traffic Assignment Volume versus Count Volume



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F6-5) Volume-Count Scatter

6.5.2 Screenline Volume/Count Comparison by Time Period

As described in Section 2.6, CDM Smith identified ten volume screenlines for the I-10 MRB&B model (Lettered A through K). The map in Figure 6-6 shows the location of the ten screenlines with the red dots indicating where routes used in the model calibration cross the screenline. For each screenline and each model time period, the total traffic assignment volume was compared against the total traffic count as part of the model validation process. Table 6-5 shows the assignment/count comparisons for each screenline and for each time period (including the daily totals). As the table shows, the assignment volumes are within three percent of the count volumes for nearly all of the screenlines and time periods.



X:\TFT Group\Projects\AL 112768 I-10 Mobile River Bridge Comprehensive T&R Study\ArcMap\Model Calibration Traffic Volume Screenlines.mxd \ 3-17-17

CDM Smith

MODEL CALIBRATION TRAFFIC VOLUME SCREENLINES

FIGURE 6-6

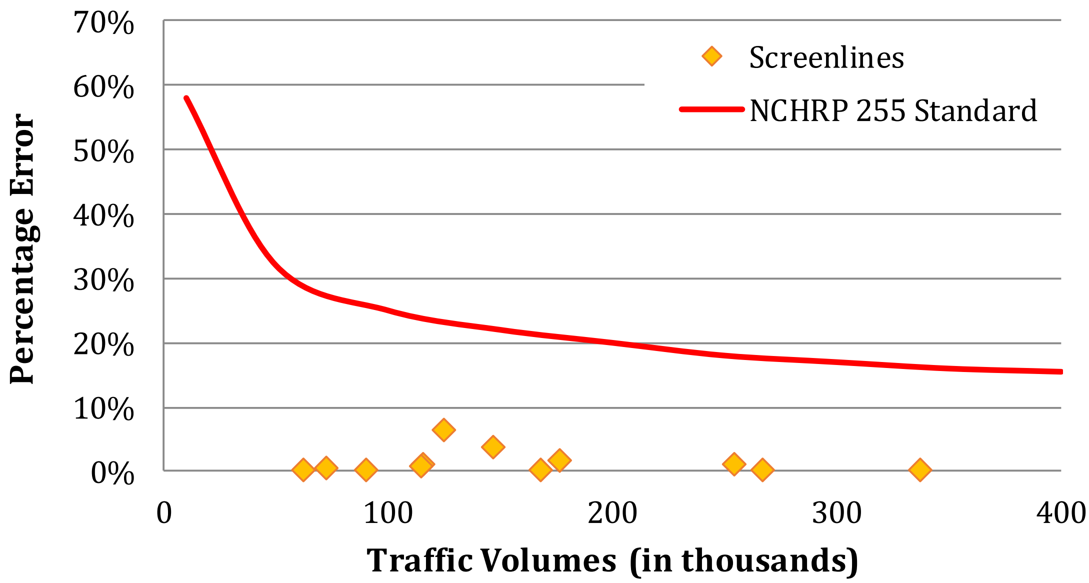
May 30, 2018

		Screenlines										
Time Period	**Volume/Count**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
AM	Model Volume	8,980	58,990	32,980	27,120	21,670	22,170	17,360	10,110	45,960	47,080	13,800
	Traffic Count	8,960	59,030	33,340	27,450	22,610	20,790	17,320	10,080	46,130	46,880	13,790
	% Difference	**0.20%**	**-0.10%**	**-1.10%**	**-1.20%**	**-4.20%**	**6.60%**	**0.20%**	**0.30%**	**-0.40%**	**0.40%**	**0.10%**
Midday	Model Volume	27,620	143,730	73,180	57,640	49,030	48,550	50,750	33,790	105,720	114,300	40,140
	Traffic Count	27,620	143,520	74,300	60,030	52,580	48,810	51,240	33,680	107,820	114,810	40,060
	% Difference	**0.00%**	**0.10%**	**-1.50%**	**-4.00%**	**-6.80%**	**-0.50%**	**-1.00%**	**0.30%**	**-1.90%**	**-0.40%**	**0.20%**
PM	Model Volume	12,230	71,3q30	35,740	28,870	23,640	23,830	24,110	14,360	53,500	59,200	18,250
	Traffic Count	12,240	71,600	36,380	29,910	25,480	24,300	24,270	14,280	53,310	58,770	18,250
	% Difference	**-0.10%**	**-0.40%**	**-1.80%**	**-3.50%**	**-7.20%**	**-1.90%**	**-0.70%**	**0.60%**	**0.40%**	**0.70%**	**0.00%**
Overnight	Model Volume	13,670	63,070	32,250	28,480	22,950	22,920	22,460	14,790	46,640	46,560	18,880
	Traffic Count	13,670	63,340	33,050	29,900	24,460	22,470	22,530	14,790	47,120	46,660	18,910
	% Difference	**0.00%**	**-0.40%**	**-2.40%**	**-4.70%**	**-6.20%**	**2.00%**	**-0.30%**	**0.00%**	**-1.00%**	**-0.20%**	**-0.20%**
DAILY	Model Volume	62,490	337,130	174,130	142,110	117,280	117,470	114,690	73,060	251,810	267,140	91,070
	Traffic Count	62,490	337,500	177,070	147,300	125,130	116,370	115,350	72,830	254,380	267,120	91,000
	% Difference	**0.00%**	**-0.10%**	**-1.70%**	**-3.50%**	**-6.30%**	**0.90%**	**-0.60%**	**0.30%**	**-1.00%**	**0.00%**	**0.10%**

6.5.3 Percentage Error by Volume Group

Another way to measure model calibration is a percentage traffic volume error threshold by volume level. A commonly used error threshold was published in NCHRP Report 255.[25] It provides a recommended allowable percentage volume error along screenlines according to the total volume on the screenline. The higher the total volume, the lower the percentage error allowable. The red line in Figure 6-7 shows the standard "maximum allowable deviation" from NCHRP 255, while the yellow diamonds show the percentage daily volume error on each model screenline. As the figure shows, all of the I-10 MRB&B model screenline errors are well below the red "maximum allowable deviation" line, indicating that the model is well calibrated against the traffic counts.

Figure 6-7 – Daily Screenline Volumes versus Maximum Allowable Deviation



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F6-7) Screenline Vol Deviation

[25] Figure A-9 from National Cooperative Highway Research Project (NCHRP), Report 255, "Highway Traffic Data For Urbanized Area Project Planning And Design"

6.5.4 GEH Error

GEH is an error formula that allows a comparison of traffic volume errors regardless of the volumes on the individual links.[26] The GEH formula is shown in Figure 6-8. A GEH error of 5 or less is considered a good match between the actual count and the model's traffic assignment volume. According to most industry standards, 85 percent of the calibrated links in the travel demand model should have a GEH error of 5 or less.[27]

There were 164 links used in the I-10 MRB&B model calibration. Table 6-6 shows the number of links according to four GEH error ranges, both before and after model calibration. Prior to calibration, three-quarters of the links had a GEH of more than 10. However, after model calibration, a majority of the links had a GEH of less than 1, and 85 percent had a GEH error of less than 5.

Figure 6-8 – GEH Formula

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}}$$

Table 6-6 – Daily Volume GEH Error: Before/After Calibration

	Before Calibration		After Calibration	
GEH Error	Number of Links	Percent of Links	Number of Links	Percent of Links
Less Than 1	17	10%	90	55%
1 to Less Than 5	9	5%	50	30%
5 to Less Than 10	14	9%	13	8%
Greater Than 10	124	76%	11	7%
Total	**164**	**100%**	**164**	**100%**

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T6-6) GEH

[26] The GEH formula is an acronym of inventor's name: Geoffrey E. Havers.
[27] For example, the Wisconsin Department of Transportation Microsimulation Guidelines: http://www.wisdot.info/microsimulation/index.php?title=Model_Calibration#The_GEH_Formula

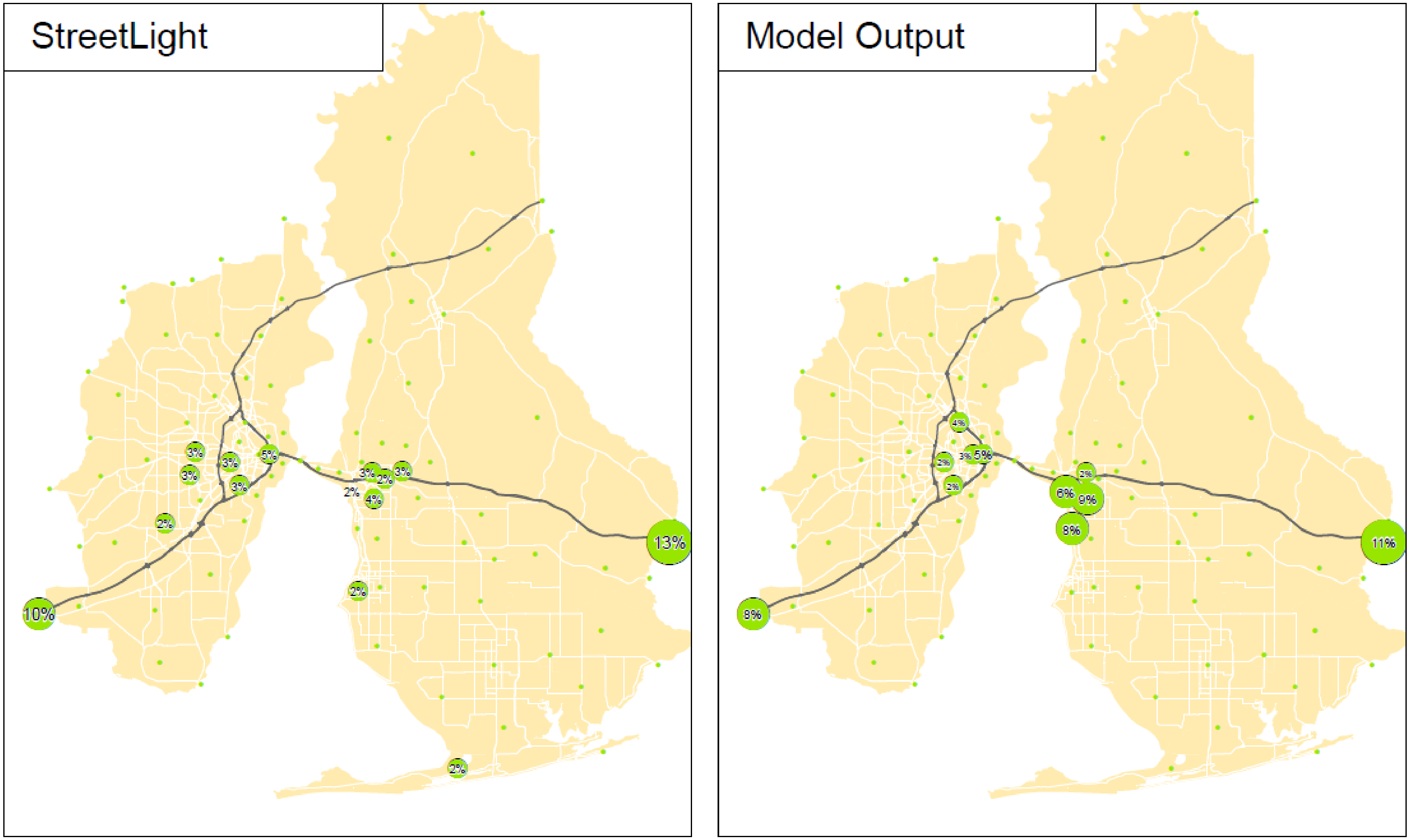
6.5.5 Select Link Analysis Comparisons

During the model validation, CDM Smith conducted several comparisons between the observed travel patterns (provided by AirSage and StreetLight Data) and the model travel patterns. Figure 6-9 illustrates one such comparison. It shows two select link analyses of passenger cars that travel across the I-10 Bayway: the map on the left shows the StreetLight Data pattern, and the map on the right shows the base model's traffic assignment travel pattern. The travel pattern maps have some subtle variations, but overall they show very similar patterns of travel between the two counties. In Mobile County, a majority of the trips are clustered in and around the I-10/I-65/I-165 triangle. In Baldwin County, a majority of the trips are clustered in the Eastern Shores area. Additionally, a significant portion of the trips origins/destinations are located on the I-10 external zones at the Mississippi and Florida State lines: StreetLight Data shows 10 and 13 percent (at the Mississippi and Florida State lines respectively), whereas the model assignment shows 8 and 11 percent. The similarities between these two travel pattern maps shows that the model reliably reflects existing travel patterns.

May 30, 2018

StreetLight vs Model Output: I-10 Select Link

Personal Vehicles



Share of Total Trip Ends

- Less than 2%
- 2% to 5%
- 5% to 10%
- More than 10%

Data displayed are 24-hour weekday averages.

Percentages indicate the share of intercounty trips originating from and terminating in each study area TAZ.

CDM Smith

Select Link Analysis Comparison: Model vs. StreetLight Data

FIGURE 6-9

6.5.6 Travel Times

As part of model validation, CDM Smith also compared the estimated travel times from the I-10 MRB&B model to observed travel times. StreetLight Data metrics provided the average travel time (in seconds) between all zone (TAZ) pairs that cross Mobile Bay. Observed travel times are presented separately for three day-of-week groupings: weekly average (all 7 days of the week), weekdays only and weekends only. The travel times are also provided by the four time periods that match the I-10 MRB&B model time periods (as shown in Table 6-2), as well as the daily average travel times. After model calibration, CDM Smith extracted from the model the travel times (for weekdays by time period) for 24 zone-pairs of trips that cross Mobile Bay. These were then compared against the StreetLight Data travel times. Table 6-7 provides an example of one of these travel time comparisons. In this example, the origin zone is TAZ 366 which is located along I-10 in Baldwin County at the AL-181 interchange, and the destination zone is TAZ 79 which is located along Airport Road (west of downtown Mobile and just east of I-65). The table shows travel times for westbound trips only.

Table 6-7 shows that during the AM peak, the model estimates a travel time that is higher than the travel time reported by StreetLight Data; it is 20 percent higher on I-10 and 7 percent higher on US-98. During the Midday, the model estimates travel times that are 11 percent lower than StreetLight Data across either route. While some variability between these two sources (StreetLight Data and the I-10 MRB&B model) is expected, the example below shows that the two sets of travel times are relatively close, and that the travel demand model is not significantly favoring one route over the other. In other words, the travel time differences (between StreetLight Data and the I-10 MRB&B model) move in tandem.

Table 6-7 – StreetLight Data versus Model-Estimated Travel Times (TAZ 366 to 79)

Route:	**I-10**			**US-98**		
Time Period	*StreetLight Data Travel Times*	*I-10 MRB&B Model Travel Times*	*Percent Difference*	*StreetLight Data Travel Times*	*I-10 MRB&B Model Travel Times*	*Percent Difference*
AM Peak	27	33	20%	31	33	7%
Midday	26	24	-11%	28	25	-11%
PM Peak	26	23	-13%	26	25	-4%

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T6-7 Travel Time Compare

6.6 Base-Year Traffic Assignment

After completing base-year model development and calibration, CDM Smith ran traffic assignment on the 2015 base ("No Build") model. Table 6-8 provides daily traffic volumes at three locations that the I-10 MRB&B project will cross:

- Mobile River (4 routes)
- Western Mobile Bay (3 routes)
- Eastern Mobile Bay (3 routes)

The table compares the model-estimated traffic volumes against the actual 2015/2016 traffic counts (along with the percentage difference). The table shows that the daily model volumes are close to the actual traffic counts on I-65 and I-10. Due in part to the "closed network" nature of the routes within Mobile River and Mobile Bay, the model struggled to match the traffic volumes on the Cochrane Bridge and US-98.

Table 6-8 – No-Build Model Traffic Assignment Volumes vs. Traffic Counts

Location	Roadway	2015/2016 Traffic Counts	2015 Traffic Assignment	Percent Difference
Mobile River Crossings	I-65	30,100	29,900	-0.66%
	Cochrane Bridge	17,500	15,400	-12.00%
	Bankhead Tunnel (US-98)	16,700	15,600	-6.59%
	Wallace Tunnel (I-10)	71,500	69,500	-2.80%
	Total	**135,800**	**130,400**	**-3.98%**
West Mobile Bay between Wallace Tunnel and Mid-Bay Interchange	I-65	30,100	29,900	-0.66%
	I-10	77,100	72,000	-6.61%
	US-98	17,900	15,800	-11.73%
	Total	**125,100**	**117,700**	**-5.92%**
East Mobile Bay between Mid-Bay Interchange and Baldwin County	I-65	30,100	29,900	-0.66%
	US-98	21,400	17,800	-16.82%
	I-10	64,900	69,500	7.09%
	Total	**116,400**	**117,200**	**0.69%**

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T6-8) 2015 NB Model

6.7 Future Year Model Development

This section describes how the future-year “No-Build” models were developed for the years: 2020, 2030 and 2040. And provides summary traffic volume estimates across the Mobile River.

6.7.1 Future-Year Roadway Networks

MATS and BCHD assumed different future years for their models. BCHD assumed 2020, while MATS assumed 2040.[28] However, all of the future year projects shown in the 2040 MATS network will be completed by 2020. Therefore, CDM Smith used the same roadway network for all three future-year models (2020, 2030 and 2040). CDM Smith created the future-year roadway network by combining the MATS and BCHD future-year networks (similar to what was done to create the 2015 base-year model roadway network). To this future year network, CDM Smith added five recently-identified planned capacity improvement projects in central Mobile County, which are:

1. **Schillinger Road:** from US-98 to Lott Road
2. **Zeigler Boulevard:** from Athey Road to Forest Hill Road
3. **Zeigler Boulevard:** from Schillinger Road to Cody Road
4. **Zeigler Boulevard:** from Tanner Williams Road to Schillinger Road
5. **Tanner Williams Road:** from Zeigler Road to Schillinger Road

6.7.2 Future-Year Uncalibrated Trip Tables

The same trip generation process, that was used to develop the 2015 base model, was also used to develop the 2020, 2030 and 2040 models (See Sections 6.3 and 6.4). The difference was that corresponding 2020, 2030 and 2040 socioeconomic data were used as inputs to the trip generation calculations. The resulting future-year P-A tables were then carried through the same trip distribution and time-of-day splitting procedures to obtain the uncalibrated future-year time-of-day trip tables.

[28] Although MATS’s future year model was 20 years farther into the future, MATS did not have any intermediary year networks/models (e.g. 2020 or 2030).

6.7.3 External Station Traffic Volume Forecasts

As noted earlier in this Chapter, the I-10 MRB&B model contains 23 external stations, the location of which are shown in Figure 6-3. For the base-year I-10 MRB&B model, the external station traffic volumes are known directly from traffic counts collected at each external station. The future-year traffic volumes at the external TAZs are estimated by first forecasting traffic volume growth rates at each external TAZ. The growth rates are expressed as a Compound Average Annual Growth Rate (CAAGR). Then the base-year traffic counts at each external TAZ are multiplied by the corresponding CAAGR forecast.

To forecast CAAGRs, CDM Smith utilized ALDOT historical traffic count data. ALDOT's traffic counts website[29], from which CDM Smith obtained the 2014 external TAZ traffic counts, also provides up to ten years of AADT counts at each location (Years 2005 through 2014). Table 6-9 shows the actual and adjusted 2005-2014 CAAGR for each external TAZ.

At 15 of the 23 external stations, there was negative traffic volume growth in the 2005-2014 period. Over the preceding decade traffic volume growth has slowed throughout the U.S. The 2007-2009 economic recession (so-called "Great Recession"), along with the 2008 spike in oil/gas prices, caused a dramatic decline in traffic volumes throughout the U.S. between 2005 and 2009. Since 2009 traffic volumes have begun to slowly increase again, but in many cases, they remain below the 2005 levels. Understanding that these economic events impacted the traffic volumes, in cases where the 2005-2014 traffic volume growth is negative, CDM Smith assumed that future traffic volume growth (between 2014 and 2040) would resume a modestly positive growth trajectory of 0.2% per year. At the remaining external stations (that had positive growth rates), CDM Smith assumed this growth rate would remain constant through the 2014-2040 period; except at two external stations (466 and 486), where the actual growth rates were reduced slightly.

These adjusted growth rates (based on the 2005-2014 traffic volume growth during the economic recession and 2008 oil/gas prices spike) are shown in the fifth column of the table, in conjunction with the 2014 AADT volumes, were used to calculate the 2020, 2030 and 2040 external TAZs volumes. The 2020 and 2040 traffic volume forecasts are shown in the latter two columns of Table 6-9. To illustrate how traffic volumes on some of the external TAZs are expected to increase over the next 25 years, the graph in Figure 6-10 shows the historical and forecast traffic volumes at three key external stations for the I-10 MRB&B model (all located on Interstate routes). All three lines show positive, but not rapid growth.

- I-10 West (at the Mississippi State Line)
- I-10 East (at the Florida State Line)
- I-65 North (at the Baldwin County/Escambia County line)

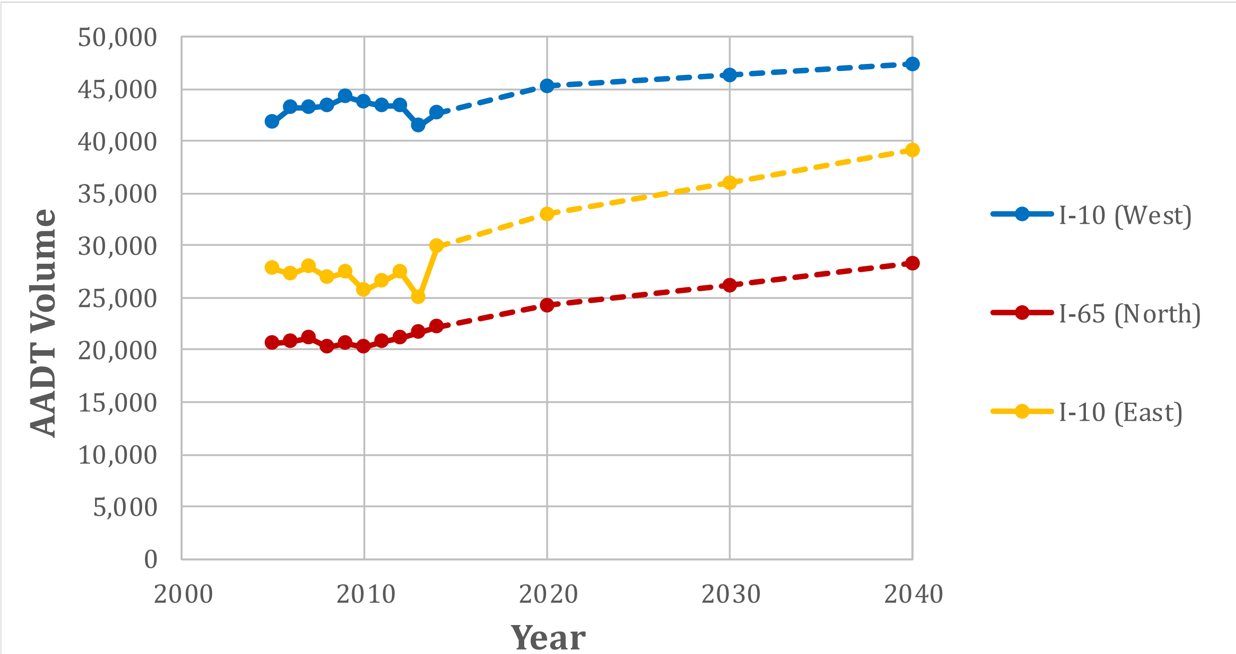
[29] https://aldotgis.dot.state.al.us/atd/default.aspx

Table 6-9 – 2020, 2030 & 2040 Forecast AADT at External Zones

TAZ Number	External TAZ Roadway	Actual 2005-2014 Growth Rate based on ALDOT AADT	Adjusted Growth Rates for 2015-2040 Traffic Forecast	2014 Actual AADT	2020 Forecast AADT	2030 Forecast AADT	2040 Forecast AADT
464	Dauphin Island Pkwy	1.4%	1.4%	4,410	4,810	5,550	6,410
465	SR-188	1.2%	1.2%	2,210	2,370	2,670	3,020
466	US 90 (West)	8.6%	0.2%	6,010	6,080	6,200	6,330
467	I-10 (West)	0.2%	0.2%	44,730	45,310	46,300	47,310
468	Old Pascagoula Rd	-48.7%	0.2%	1,130	1,150	1,170	1,190
469	Grand Bay-Wilmer Rd	-18.7%	0.2%	7,510	7,600	7,750	7,910
470	Dawes Rd	-20.1%	0.2%	1,620	1,640	1,670	1,700
471	Jeff Hamilton Rd	-1.7%	0.2%	1,780	1,800	1,830	1,870
472	Airport Road	0.7%	0.2%	5,220	5,280	5,390	5,500
473	Tanner-Williams Rd	-0.6%	0.2%	4,990	5,050	5,150	5,250
474	US 98 (West)	-0.1%	0.2%	9,300	9,420	9,610	9,800
475	Lott Rd	-4.0%	0.2%	2,680	2,710	2,760	2,820
476	US 45 (North)	-0.2%	0.2%	8,340	8,440	8,610	8,780
477	Celeste Rd	-0.3%	0.2%	4,650	4,710	4,800	4,900
478	US 43 (North)	-2.2%	0.2%	19,450	19,680	20,080	20,480
479	SR-59 (North)	-2.0%	0.2%	840	850	870	880
480	I-65 (North)	0.8%	0.8%	23,240	24,300	26,190	28,220
481	US-31 (East)	-1.8%	0.2%	4,410	4,460	4,550	4,650
482	CR-112 (Old Pensacola Rd)	-1.1%	0.2%	710	720	740	750
483	I-10 (East)	0.8%	0.8%	31,460	33,080	35,960	39,090
484	US-90 (East)	-1.1%	0.2%	5,310	5,380	5,490	5,600
485	US-98 (East)	-2.5%	0.2%	10,080	10,200	10,410	10,620
486	SR-182 (Perdido Beach Blvd)	2.5%	2.0%	16,740	18,850	22,980	28,010

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T6-9) External Traffic Counts

Figure 6-10 – Actual/Forecast AADTs on Interstate Highway External TAZs



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F6-10) External Forecast Graph

6.7.4 Future-Year Trip Table Calibration

The final step toward producing the future-year trip tables was to apply the base-year "calibration effect" trip table. This "calibration effect" trip table is the absolute difference between the uncalibrated and calibrated 2015 base-year trip tables. It reflects all of the trip table adjustments that were made to ensure that the traffic assignment traffic volumes, travel patterns and trip length frequency distributions were calibrated to existing conditions (see Sections 6.3.5 and 6.3.6).

6.8 Future Year No-Build Traffic Volumes

Table 6-10 and Figure 6-11 show the traffic volumes across the Mobile River via four routes:

- I-65
- Cochrane Bridge
- Bankhead Tunnel (US-98)
- Wallace Tunnel (I-10)

The traffic volumes are shown in six years: 2000, 2010, 2015, 2020, 2030 and 2040. Actual traffic counts are shown for the first three years (2000, 2010 and 2015), and model-estimated forecasts are shown for the latter three years (2020, 2030 and 2040).

The table and graph show that traffic volumes across the Mobile River are expected to roughly double in the 40-year period between 2000 and 2040, from 110,800 to 200,800. Over this period the CAAGR is 1.5 percent. The period with the highest CAAGR in traffic volume is expected to occur between 2015 and 2020 (3.4 percent). After that period, the CAAGR is expected to taper-off to 1.4 percent in the 2020-2030 period, and finally to 0.8 percent in the 2030-2040 period. Traffic volume growth in is expected to be lower the latter time periods, due to the gradual slowing of population (household) and employment growth in the Mobile-Baldwin County region (see Chapter 4 for additional details on the socioeconomic forecasts).

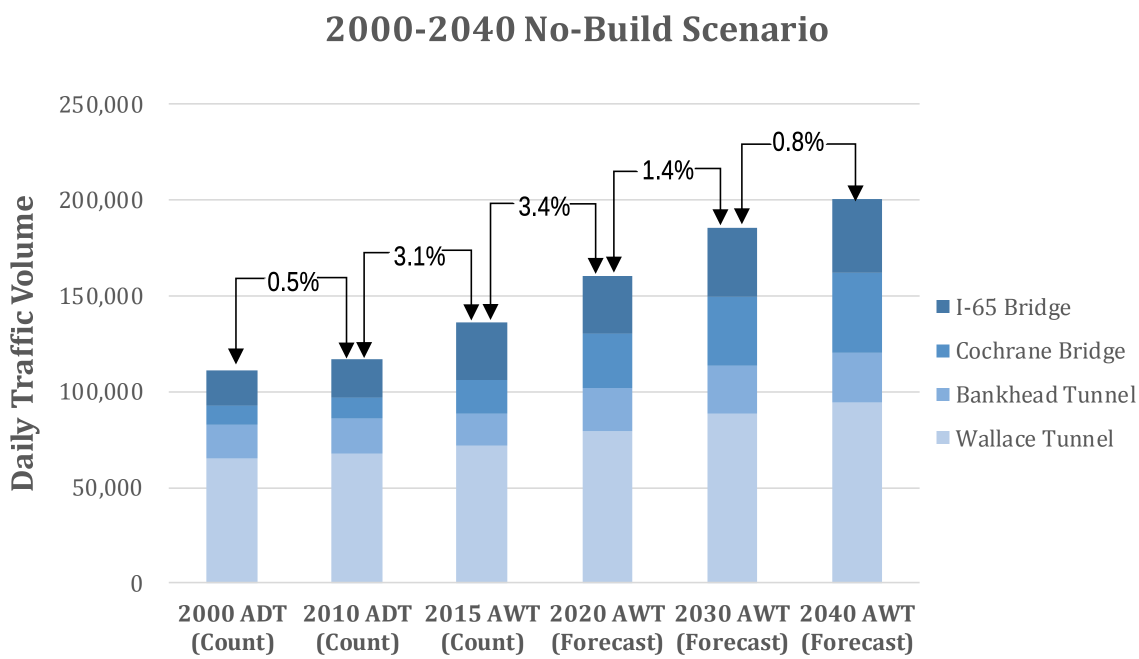
Future growth across the Mobile River is constrained by the Wallace and Bankhead Tunnels, which currently operate at capacity for much of the day. The growth in the Wallace and Bankhead Tunnels will be lower compared to the other two routes because these two crossings are already capacity constrained. Over the 2000-2040 period, the forecasted CAAGR is just below 1.0 percent on both Tunnels. Traffic growth is highest on the Cochrane Bridge, as it currently has the most available capacity. The traffic volumes on the Cochrane Bridge are expected to increase four-fold in the 40-year 2000-2040 period from 10,100 to 41,700 vehicles, which is a CAAGR of 3.6 percent.

Table 6-10 – 2000 to 2040 Mobile River Traffic Volumes

	Average Daily Traffic				
	I-65 Bridge	**Cochrane Bridge**	**Bankhead Tunnel**	**Wallace Tunnel**	**Screenline Total**
2000 AADT (Count)	18,000	10,100	17,500	65,200	110,800
2010 AADT (Count)	19,600	11,300	18,500	67,300	116,700
2015 AWT (Count)	30,100	17,500	16,700	71,500	135,800
2020 AWT (Forecast)	30,500	27,900	22,500	79,700	160,600
2030 AWT (Forecast)	35,800	36,300	24,300	88,900	185,300
2040 AWT (Forecast)	39,100	41,700	25,700	94,300	200,800
	Growth Rates (CAAGR)				
2000 to 2010	0.9%	1.1%	0.6%	0.3%	0.5%
2010 to 2015	9.0%	9.1%	-2.0%	1.2%	3.1%
2015 to 2020	0.3%	9.8%	6.1%	2.2%	3.4%
2020 to 2030	1.6%	2.7%	0.8%	1.1%	1.4%
2030 to 2040	0.9%	1.4%	0.6%	0.6%	0.8%

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T6-10) No-Build Screenline

Figure 6-11 – 2000 to 2040 Mobile River Traffic Volumes



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F6-11) No-Build Graphs

Chapter 7 – Design Alternatives

In addition to constructing the I-10 Bridge itself and reconstructing/widening the I-10 Bayway, this project will also involve reconfiguring all seven of the interchanges along I-10 within the project area, which are located (from west to east) at:

- Broad Street
- Virginia Street
- Texas Street
- Canal Street/Water Street
- "East Tunnel" (I-10/US-98)
- Mid-Bay and
- Daphne

Figure 7-1 contains an illustration that identifies the locations of five of these seven interchanges. The Broad and Texas Street interchanges are not included on the map. The modification at Broad Street will consist mainly of adding a "Texas U-turn" from the westbound exit ramp to the eastbound entrance ramp (for vehicles that wish to access the I-10 Bridge). The Texas Street interchange will be removed entirely; the existing interchange consists of ramps to/from the east (facing toward Wallace Tunnel). The changes at the Broad and Texas Street interchanges have been reflected in the travel demand models developed for this T&R study.

Over the course of completing the T&R study, CDM Smith coded and modeled scores of interchange configurations at the remaining five locations. Following this period of testing, ALDOT identified a single, preferred interchange configuration at each interchange. This chapter contains a description of these five proposed interchange configurations along I-10 and concludes with the average weekday traffic volume estimates for No-Build and Build alternatives from the 2020, 2030 and 2040 models.

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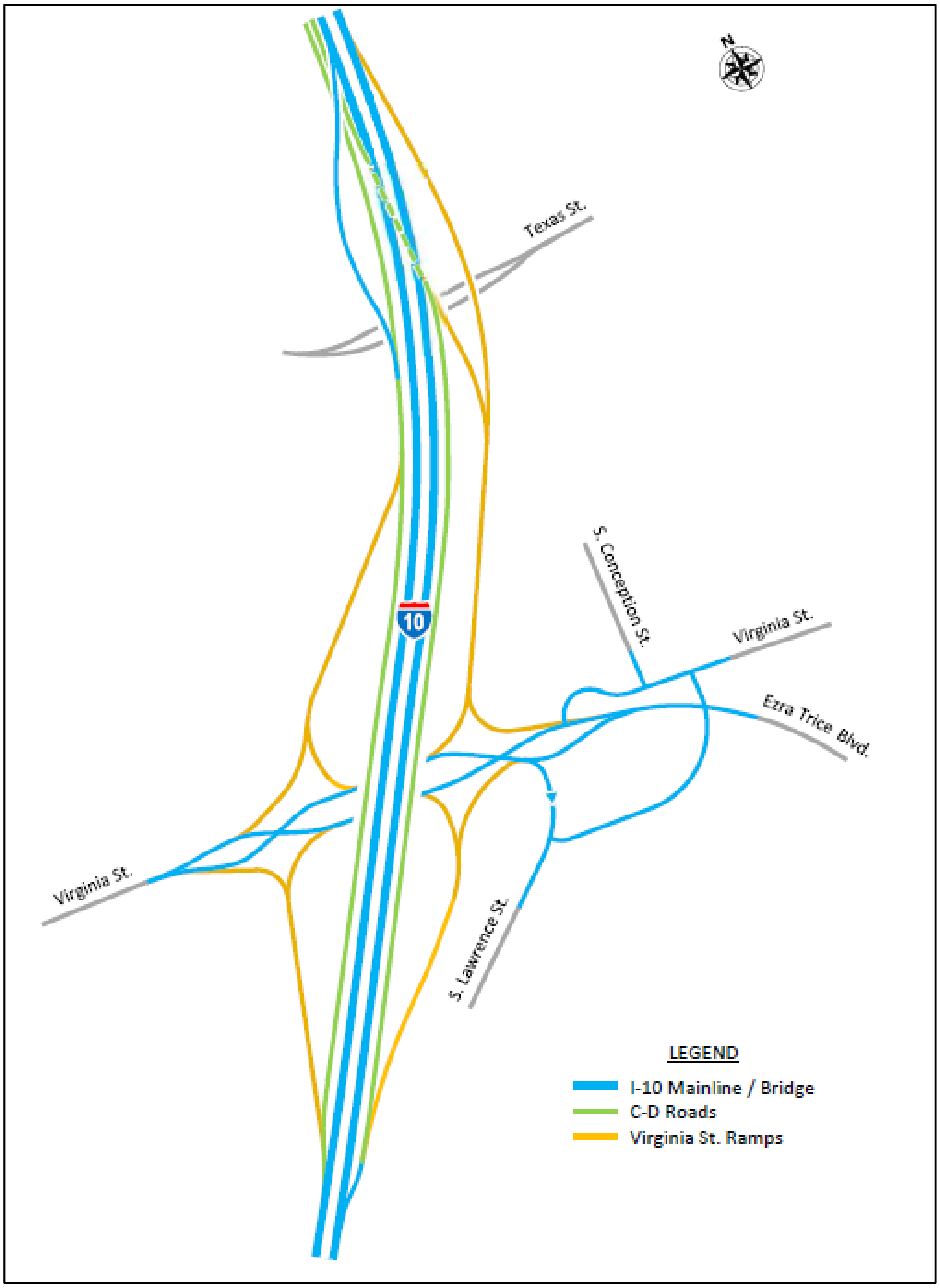
LOCATIONS WITH INTERCHANGE ALTERNATIVES

FIGURE 7-1

7.1 Location A – Virginia Street Interchange

Figure 7-2 shows the proposed configuration of the I-10 interchange at Virginia Street. The existing interchange is a Conventional Diamond Interchange (CDI), except for the entrance ramp from Virginia Street to eastbound I-10, which is a loop ramp. There is also currently a pair of north-facing ramps at Texas Street (eastbound I-10 entrance ramp, and westbound I-10 exit ramp), located just one-quarter mile north of the Virginia Street interchange. In the proposed Virginia Street interchange, the ramps at Texas Street would be eliminated, the Virginia Street interchange would be converted to a Diverging Diamond Interchange (DDI). Access from the western leg of I-10 to downtown Mobile and the Wallace Tunnel would be provided via Collector-Distributor (C-D) Roads that would be signed for Canal/Water Street.

Figure 7-2 – Location A: Proposed I-10 Virginia Street Interchange

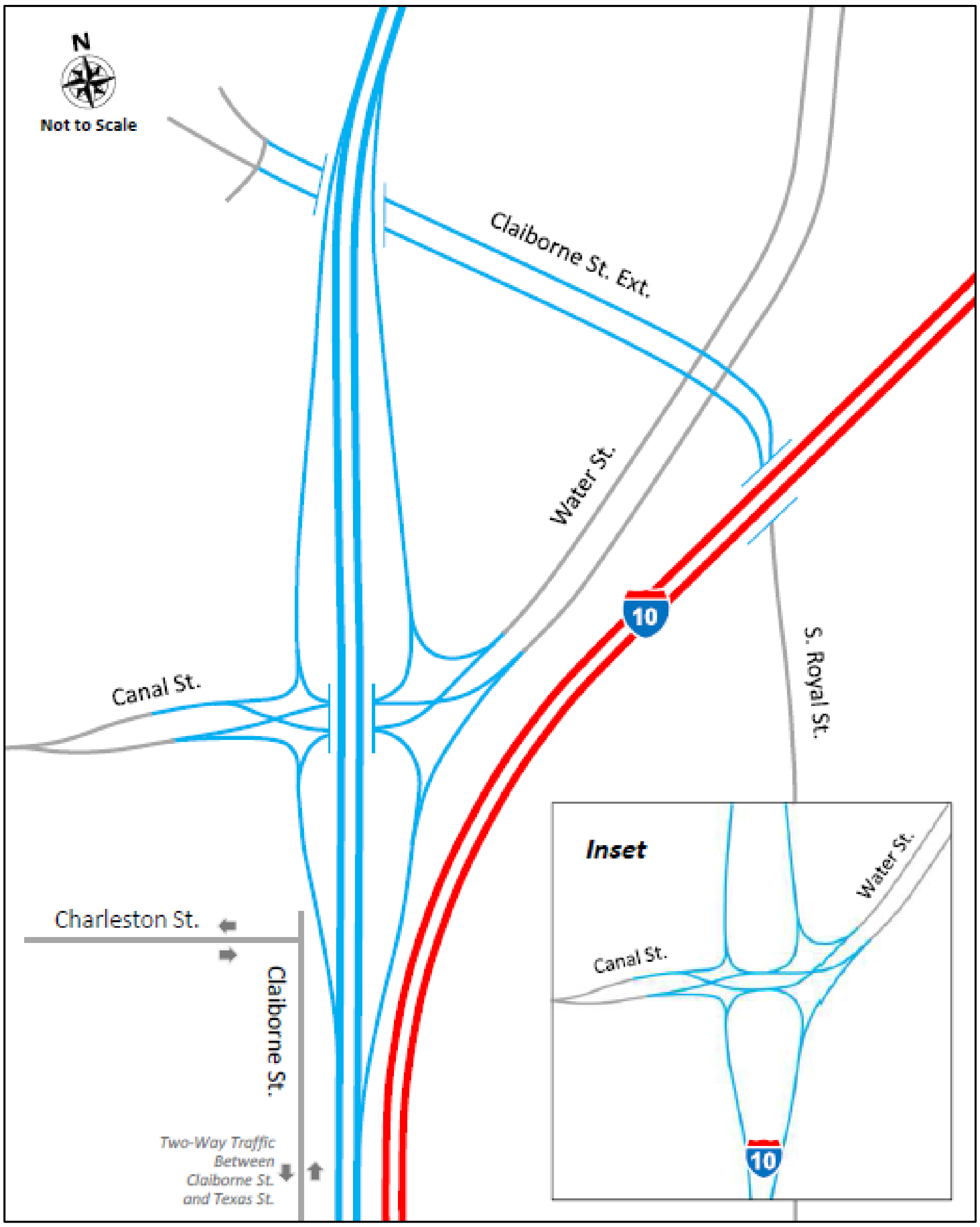


F7-2 Virginia Interchange.png

7.2 Location B – Canal Street/Water Street Interchange

Location B consists of the current I-10 at Canal/Water Street interchange and is located at the western end of the Wallace Tunnel. The existing interchange would be replaced with a DDI at Canal/Water Street, and the roadways between I-10 and the Wallace Tunnel would travel on an overpass over the Canal/Water Street DDI. This "DDI with Overpass" interchange configuration is illustrated in Figure 7-3.

Figure 7-3 – Location B: Proposed Canal/Water Street Interchange

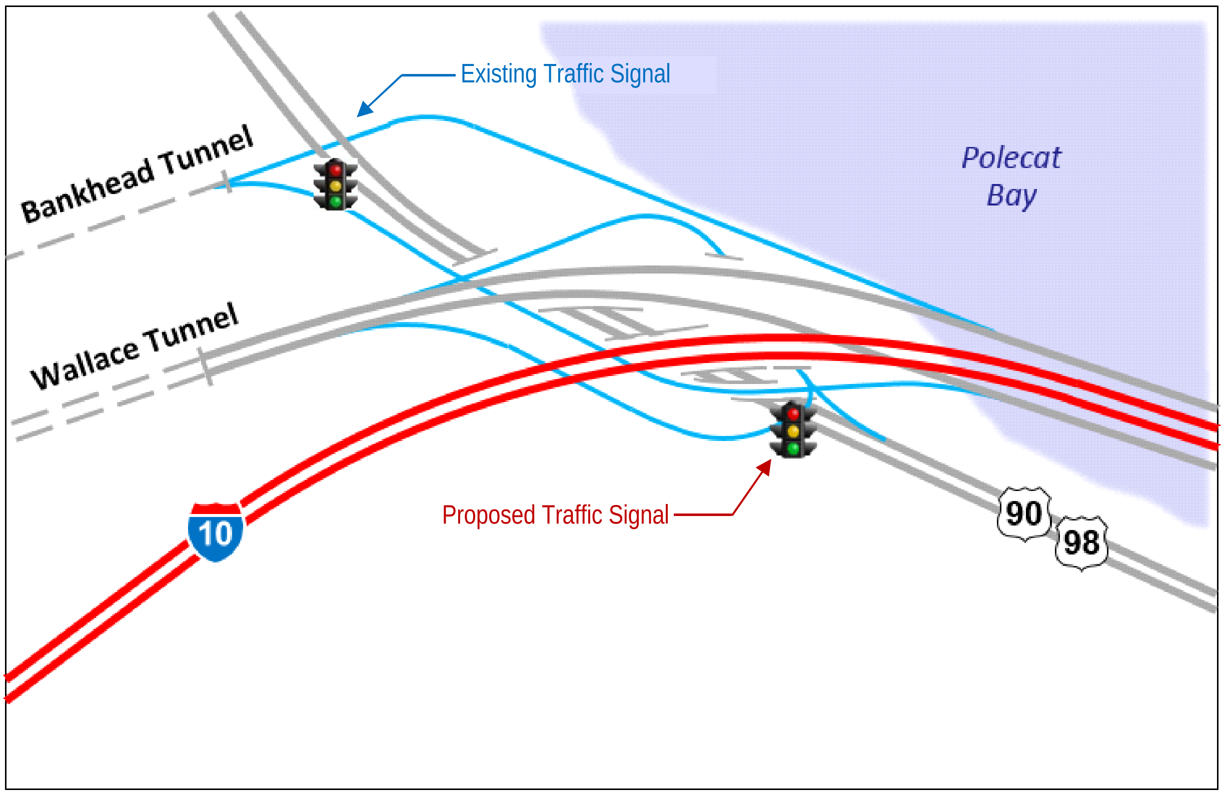


F7-3 Canal-Water Street (Location B).png

7.3 Location C – East Tunnel Interchange (US-90/98)

Location C is located at the eastern end of the Wallace Tunnel. Currently, the interchange is where I-10 and Battleship Parkway (US-90/98) cross. Figure 7-4 shows the proposed interchange configuration. This interchange configuration would retain a direct high-speed connection between the Wallace Tunnel and the I-10 Bayway. Access ramps would remain between the Wallace Tunnel and Battleship Parkway (US-90/98). A proposed traffic signal would be installed on US-98 where the ramps to/from the Wallace Tunnel intersection US-98. The configuration would also retain the exit ramp from the westbound I-10 Bayway to Battleship Parkway (US-90/98), which terminates at an existing traffic signal. Finally, the ramp from the Bankhead Tunnel (US-90/98) to the eastbound I-10 Bayway would be retained.

Figure 7-4 – Location C: Proposed East Tunnel Interchange Configuration

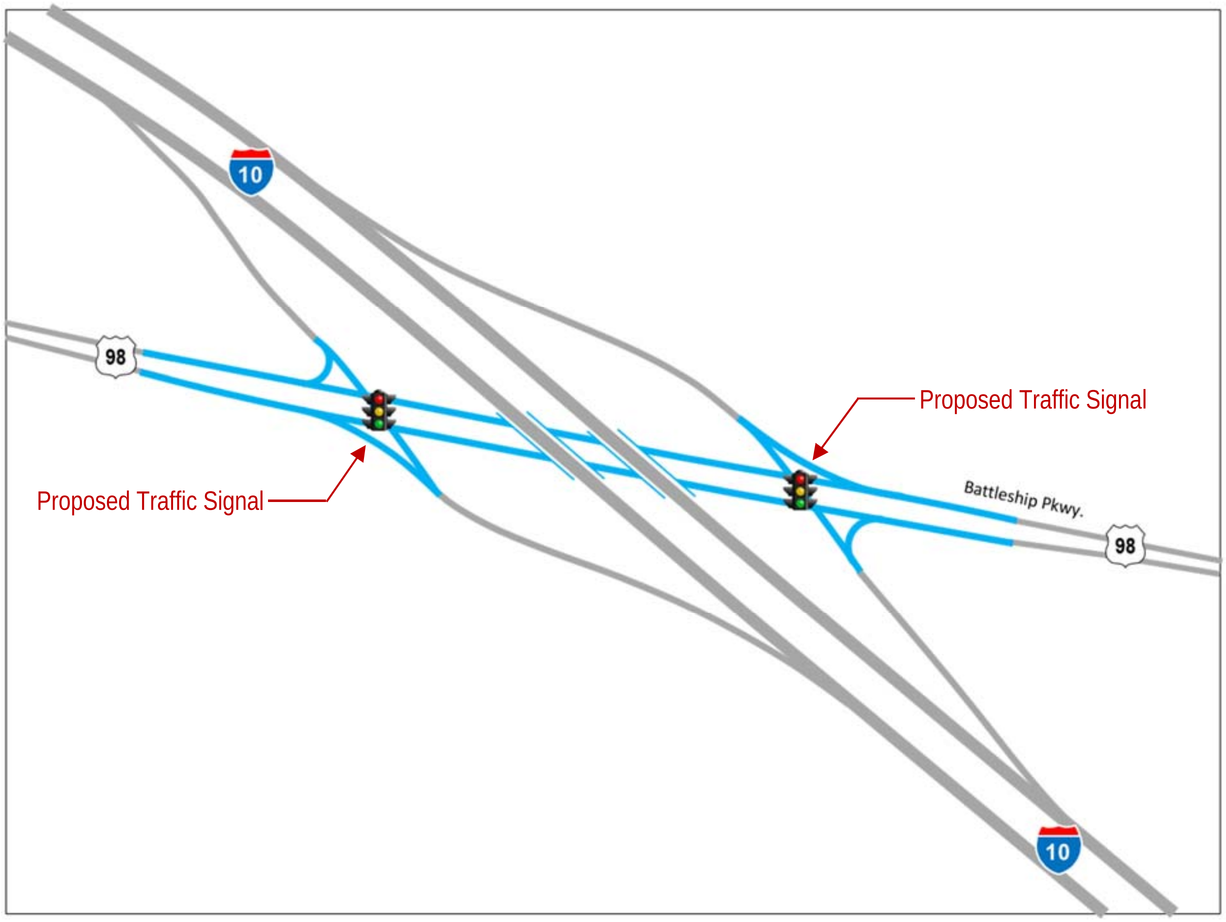


F7-4 (New) East Tunnel.png

7.4 Location D – Mid-Bay Interchange

Location D is known as the Mid-Bay Interchange. At this location, the I-10 Bayway crosses over the US-98 Causeway. The existing interchange is a CDI on a skewed angle, and the exit ramp terminals (from I-10 to US-98) are stop-sign controlled. In the proposed project, the existing configuration would be retained, except traffic signals would be added at each pair of ramp terminals to improve traffic control and safety. The proposed interchange configuration and traffic signals at Location D are shown in Figure 7-5.

Figure 7-5 – Location D: Proposed Mid-Bay Interchange Configuration

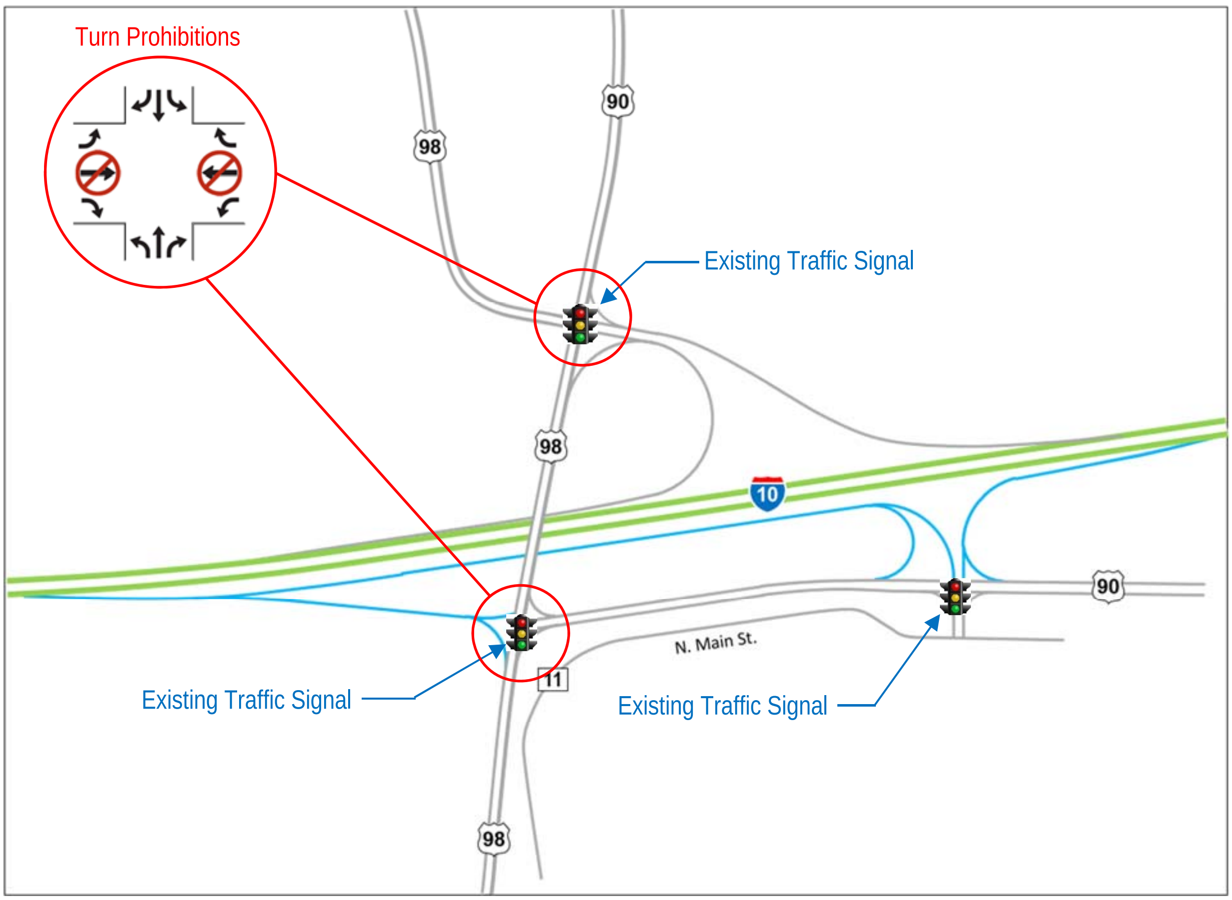


F7-5 Mid-Bay Interchange (Traffic Signals).png

7.5 Location E – Daphne Interchange

Location E is called the Daphne Interchange. It is the first I-10 interchange east of Mobile Bay. The existing configuration of this interchange will largely be left intact. The existing/future interchange design is illustrated in Figure 7-6. However, certain existing through movements will be prohibited in the future configuration. At the intersection where the US-98 slip-ramp, the north-south segment of US-90 and the westbound I-10 ramps converge, the east-west through movements will be prohibited. In the westbound direction, this will prohibit drivers on the westbound I-10 exit ramp from traveling directly to US-98 via the US-98 slip-ramp. In the eastbound direction, this will prohibit drivers from traveling directly from the US-98 slip-ramp to the eastbound I-10 entrance ramp. At the at-grade Y-intersection in the south east quadrant of the Daphne interchange, there will also be through movement prohibitions between the eastbound I-10 ramps at the shopping mall driveway located south of US-90, across the street from the I-10 ramps.

Figure 7-6 – Location E: Proposed Daphne Interchange Configuration

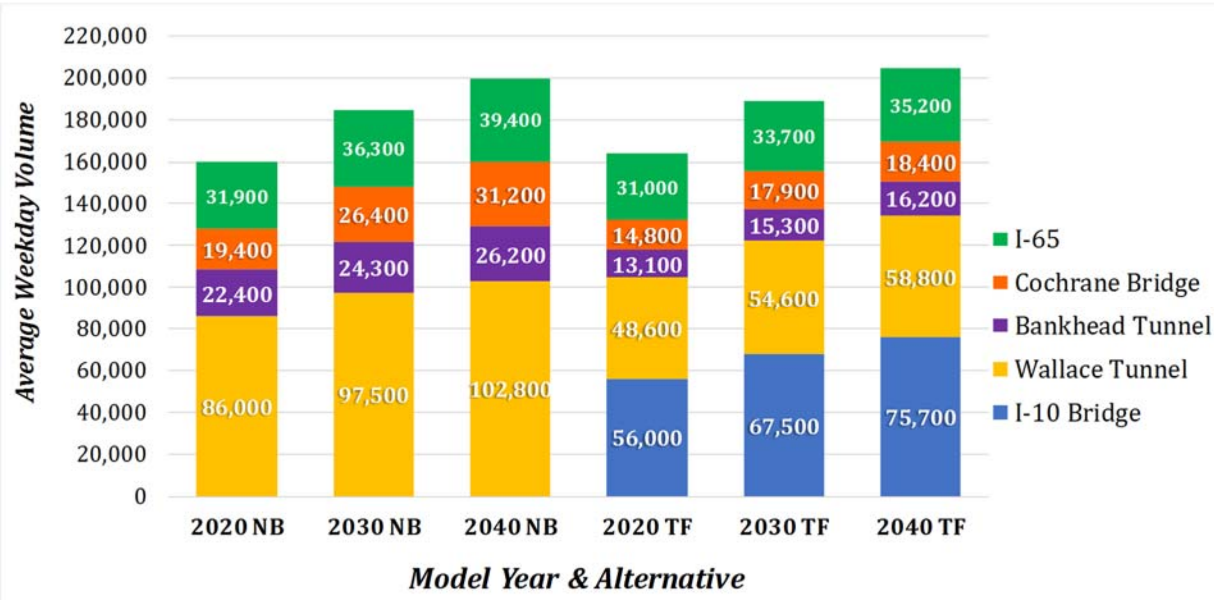


F7-8 (New) Daphne.png

7.6 Toll-Free Traffic Volumes: Build vs. No-Build

Figure 7-7 shows the estimated average weekday traffic volumes on the bridges/tunnels that will cross the Mobile River within the study area. The first three columns of the graph show the 2020, 2030 and 2040 No-Build ("NB") scenarios, which assume the I-10 Bridge is not constructed (and all of the interchanges described above remain in their existing configurations).[30] The latter three columns in the graph show the 2020, 2030 and 2040 "Build Toll-Free" scenarios with the interchange configurations described above.

Figure 7-7 – Mobile River Daily Traffic Volumes: No-Build and Build Toll-Free



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F7-7) 2020-30-40 NB & TF

The graph shows that under the "No-Build" scenario, the total weekday volume across the Mobile River screenline will be 159,700 in 2020, increasing to 184,500 in 2030 and finally 199,600 in 2040. The CAAGR is 1.5 percent between 2020 and 2030, which declines to 0.8 percent between 2030 and 2040. As also noted in Section 6.8, the traffic volume growth rate in the latter 2030-2040 period is lower than the 2020-2030 period, due to the lower growth rate forecasted for the underlying socioeconomic measures (households, employment and schools). Under the "Build Toll-Free" scenario, the total screenline volume is 2.4 percent higher in all three model years, compared to the "No Build" scenario (approximately 3,800 to 4,700 vehicles higher in absolute terms). This increased traffic demand is due to the increased capacity and speeds across Mobile

[30] The same "No-Build" volumes are shown in Table 6-10 and Figure 6-11 in the previous chapter.

River provided by the I-10 Bridge. However, within the respective scenarios ("No-Build" and the "Build Toll-Free"), the overall traffic volume growth rates are the same.

The graph also shows the "market share" of each Mobile River crossing under each scenario and year. Under the "No-Build" (NB) configuration, the existing Wallace Tunnel would handle just over half of the traffic crossing the Mobile River all three model years. The Bankhead Tunnel would maintain a market share of approximately 13 percent in all three model years. The Cochrane Bridge, on the other hand, is expected to have a market share that increases from 12 percent in 2020 to 16 percent in 2040 (the traffic volumes would increase from 19,400 to 31,200). The reason for this market share increase (and large traffic volume increase) is that the Cochrane Bridge currently operates well below its capacity, whereas the Wallace and Bankhead Tunnels are already operating at-capacity for much of the day. Therefore, since the Cochrane Bridge is the only crossing that has available capacity, future traffic demand will attempt to fill this available capacity.

Under the "Build" configurations (where the I-10 Bridge is added), the market shares change significantly. As would be expected, a significant portion of the traffic would shift away from the four existing crossings toward the I-10 Bridge. Table 7-1 shows the change in volume (in both absolute and percentage terms) by river crossing and by year, when comparing the "No-Build" scenario against the "Build Toll-Free" scenario. The table shows that the absolute (and percentage) volume in the Wallace Tunnel would decline if the I-10 Bridge were constructed and operated without tolls. The volumes decline by 37 to 44 thousand, or approximately 43 percent in all three model years. The volumes in the Bankhead Tunnel decline by 9 to 10 thousand, or approximately 40 percent. The Cochrane Bridge volumes decline by 4,600 (or 24 percent) in 2020; this decline widens to 12,800 (or 41 percent in 2040). Under the "No-Build" scenario, the Cochrane Bridge volume had increased rapidly, since it was the only crossing with available capacity. Under the "Build Toll-Free" scenario, all of the routes have available capacity, and therefore traffic volumes on the Cochrane Bridge would grow more slowly over time. Finally, the I-65 volumes are lower in the "Build" scenario by 900 (3 percent) in 2020, by 2,600 (7 percent) in 2030 and by 4,200 (11 percent) in 2040.

Table 7-1 – Toll-Free versus No-Build Scenario Traffic Volumes

	Absolute Difference			Percent Difference		
Mobile River Crossing	**2020**	**2030**	**2040**	**2020**	**2030**	**2040**
I-65	-900	-2,600	-4,200	*-3%*	*-7%*	*-11%*
Cochrane Bridge	-4,600	-8,500	-12,800	*-24%*	*-32%*	*-41%*
Bankhead Tunnel	-9,300	-9,000	-10,000	*-42%*	*-37%*	*-38%*
Wallace Tunnel	-37,400	-42,900	-44,000	*-43%*	*-44%*	*-43%*

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T7-1 TF vs NB Traffic

DRAFT

Chapter 8 – Toll Plan and Toll Sensitivity Testing

This chapter introduces the tolling component of the I-10 MRB&B project. The first section of this chapter contains a description of the tolling plan. The succeeding sections of this chapter describe the toll diversion method used to estimate the toll revenues on the I-10 MRB&B project, including the toll suppression and traffic signal delay used in the model. The latter sections of the chapter contain the toll rate sensitivity tests and market share analyses at various toll rates.

8.1 Toll Plan Description

A large variety of tolling scenarios and toll rates for the I-10 MRB&B project were tested. ALDOT intends to charge tolls for vehicles using the I-10 Bridge, Wallace Tunnel and any portion of the I-10 Bayway. ALDOT also intends to charge toll rates based on the driver's entry and exit points. The toll concessionaire will determine the location and configuration of toll gantries. Consequently, no specific toll gantry locations are shown in this report. Figure 8-1 shows the extent of the roadways/bridge on which drivers will be charged tolls. Table 8-1 and Figure 8-2 show the toll rate ratios comprising the toll plan.[31] The eastbound entry-exit points are shown in purple typeface (in the lower-left-corner of the table), and the westbound entry-exit points are shown in purple typeface (in the upper-right-corner of the table). There are two possible "full-length" trips in each direction. They are:

- Between Canal Street and the Daphne Interchange (via Wallace Tunnel), a distance of 9.35-miles, and
- Between Virginia Street and Daphne Interchange (via the I-10 Bridge), a distance of 8.65-miles.

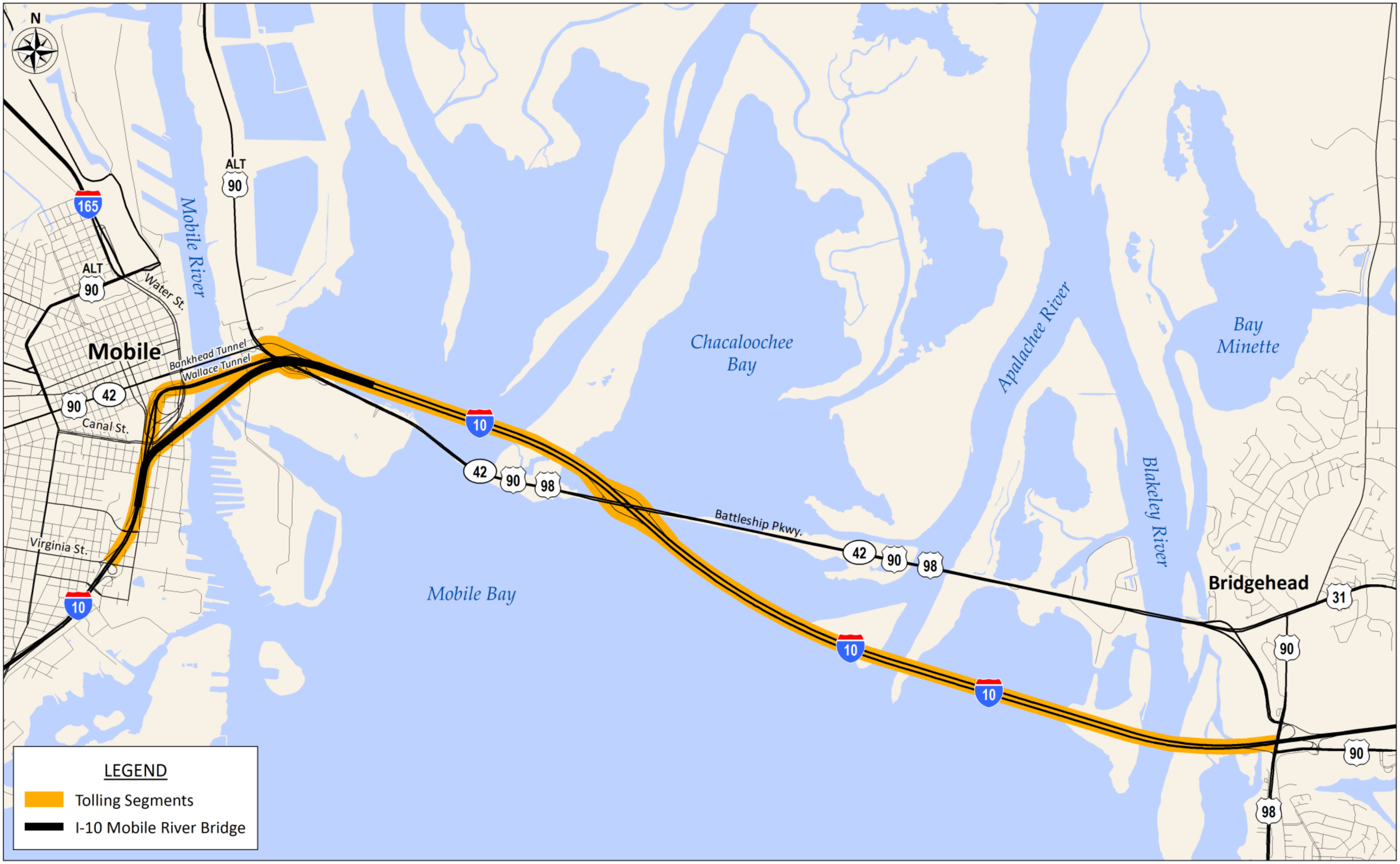
For these trips, vehicles will be charged 100% of the project toll rate. For lesser distance trips, drivers will be charged between 30% and 70% of the "full-project" toll rate. Figure 8-2 shows the passenger car toll rates (in 2020 dollars) for all eight entry-exit points in each direction of the I-10 MRB&B project.

Table 8-1 – Toll Rate Ratios

		Exit Interchange				
		Daphne	Mid-Bay	East Tunnel	Canal St.	Virginia St.
Entry Interchange	Daphne	-	40%	70%	100%	100%
	Mid-Bay	40%	-	30%	60%	60%
	East Tunnel	70%	30%	-	50%	-
	Canal/Water St.	100%	60%	50%	-	-
	Virginia St.	100%	60%	-	-	-

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T8-1 2020 Toll Rate Table

[31] In discussions with ALDOT, this toll plan has been referred to as Toll Scenario 5f



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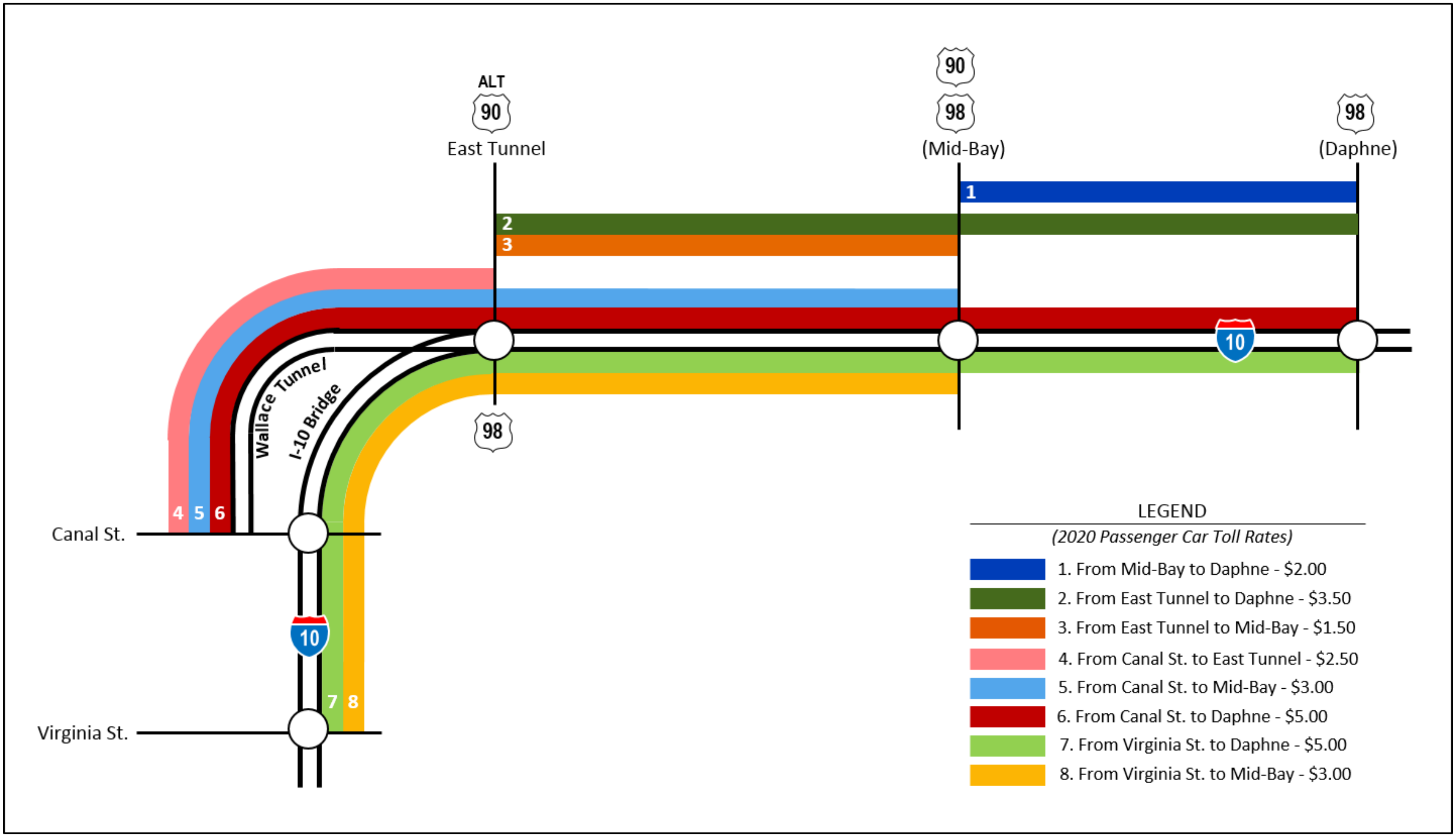
Tolled Roadway Segments

FIGURE 8-1



Toll Entry-Exit Interchange Combinations

FIGURE 8-2

8.2 Toll Diversion Methodology

For the present study, CDM Smith used the "Cost Ratio" toll diversion method. The first step in the toll modeling process was to compute travel time and travel costs between each origin-destination zone pair for paths with the lowest travel time on tolled and on toll-free routes. Travel time and cost matrices were developed using a path-building process in the model. Using the time, distance, and toll cost (called skims), a ratio of generalized cost for each path is calculated as follows:

$$CR = \frac{Toll\ Path\ Cost}{Free\ Path\ Cost}$$

$$CR = \frac{VOT * Tt + VOC * Dt + Toll}{VOT * Tf + VOC * Df}$$

where,

CR	=	Cost Ratio
VOT	=	Value of Time
Tt	=	Travel Time on Toll Path
VOC	=	Vehicle Operating Cost
Dt	=	Distance Traveled on Toll Path
Toll	=	Toll Cost
Tf	=	Travel Time on Free Path
Df	=	Distance Traveled on Free Path

The cost ratio calculated for each movement is then used to split the original trip tables into "toll" and "non-toll" components. The model used for this purpose resembles an S-curve that assumes that if the costs are the same, the trip maker would be indifferent as to which route to use, and trips would split evenly between toll and toll-free paths. As the toll path cost increases, the share of tolled trips decreases, and more trips are assigned to the toll-free path. However, the resulting congestion on the toll-free path would cause some trips to shift back to the toll path. In each model iteration, the toll trips are assigned to the toll path and toll-free trips to the toll-free path. This process is repeated until a user equilibrium criterion is satisfied, i.e., no further rerouting is possible without user cost degradation. This traffic assignment methodology is referred to as a User Equilibrium Assignment and is generally applied in travel demand models. This methodology inherently takes into account vehicle operating costs for both toll-free and toll paths, including potentially higher vehicle operating costs for using a longer toll-free path. Information obtained from the assignment process included the number of vehicles using the highway system on the toll-free and toll paths, as well as other performance measures, such as degree of congestion, vehicle miles traveled, and travel time. The number of vehicles assigned to the toll facility was used to determine the revenue and toll sensitivity of the project. The toll sensitivity analysis was conducted by time-of-day for the AM peak, midday, PM peak and overnight periods. In the Cost Ratio equation shown above, the time cost parameter is known as the value of time (VOT), and the distance cost parameter is known as the vehicle operating cost (VOC). The next two subsections contain further details on VOT and VOC.

8.2.1 Value of Time

VOT converts the travel time to a monetary value; VOT is expressed in dollars per hour. As described in Chapter 5, RSG conducted an SP survey for this study to estimate the VOT for likely users of the I-10 MRB&B in the Mobile-Baldwin County region. RSG estimated VOT for PCs and CVs separately.

As shown in Table 5-1 (in Chapter 5), RSG estimated PC VOTs by time period and by median household income. The average PC VOT estimated from the survey (in 2016 dollars) was **$8.79** per hour. In the future year models (Years 2020, 2030 and 2040), the 2016 VOT estimates were escalated by 2.0 percent per year (the assumed inflation rate). Thus, the average VOT increased to $9.51 in 2020 (an 8.2% increase compared to 2016), and to $14.13 in 2040 (a 60.8% increase compared to 2016).

Within the travel demand models, CDM Smith did not use these average PC VOT values. Instead, CDM Smith calculated PC VOT separately for every O-D pair in the model trip table (and for each of the four model time periods). CDM Smith used the Fishkind TAZ-level 2015 median household income estimates, to determine the income-dependent VOT for both the trip origin TAZ and the trip destination TAZ. CDM Smith then used a weighted average of the two VOTs to calculate the VOT for that particular O-D pair (and in that particular time period). The average of the two VOTs were weighted according to the total number of trips produced by the origin versus the total number of trips attracted to the destination.

RSG conducted a separate SP survey for commercial vehicles (CVs). RSG estimated a single VOT of **$27.60** per hour in 2016 dollars (for all CV classes and time periods). This CV VOT was escalated by 2.0 percent per year. Thus, the CV VOT values used in the travel demand models were $29.88 in 2020 dollars, and $44.39 in 2040 dollars.

8.2.2 Vehicle Operating Cost

VOC is the cost of operating a vehicle for one mile. Motor fuel is the primary (and most variable) component of VOC. The overall VOC also includes the amortized cost of purchasing the vehicle, vehicle maintenance, insurance and licensing fees. The PC VOC used for 2015 was based on an average gasoline cost of $2.12 per gallon and an average fuel economy of 19 miles per gallon. The PC VOC is assumed to increase at a rate of 2.0 percent per year (in line with inflation). The PC VOC parameters used in the model are 22-cents per mile in 2020, 27-cents per mile in 2030, and 33-cents per mile in 2040. The CV VOC was calculated using a similar method, and was also assumed to increase at a rate of 2.0 percent per year. The CV VOC parameters used in the model are 66-cents per mile in 2020, 81-cents per mile in 2030, and 99-cents per mile in 2040.

8.3 Toll Suppression

Higher toll rates on the I-10 MRB&B project will result in a lower number of vehicles crossing Mobile River/Bay. This reduction occurs due to a variety of factors, such as some travelers opting not to make the trip or resorting to transit or ride-share options to make the same trip. To reflect the decreased traffic demand across the Mobile River/Bay, CDM Smith incorporated a portion of the toll cost into the trip distribution step of the travel demand model. Toll Suppression, as it is known, reduced the total traffic volume crossing Mobile River/Bay as the toll rates increased.

8.4 Traffic Signals

The US-98 Causeway is the primary competing route across the Bayway portion of the I-10 MRB&B toll route, and the Bankhead Tunnel and Cochrane Bridge are both competing routes across the Mobile River. The US-98 Causeway closely parallels the I-10 Bayway, and has a speed limit of 55 mph. However, this route has numerous traffic signals which impede flow along the route. Bay Bridge Road (which lies to the west of the Cochrane Bridge) also has numerous traffic signals which impede traffic flow on that route as well. The list below identifies all existing and proposed signalized intersections in the project corridor which would be affected by opening of the I I-10 MRB&B project.

Traditional travel demand models reflect traffic congestion on roadway links using volume-delay functions. However, these functions do not specifically reflect intersection traffic signal delay. To better reflect the potential delays on US-98 (particularly since traffic volumes on this competing route will increase in response to tolls being imposed on the I-10 MRB&B project), CDM Smith incorporated traffic signal information onto some of the nodes at existing or proposed intersections with traffic signals. These features were included in the forecast years only (2020, 2030 and 2040). The traffic signal information included the number of through and turning lanes on each approach, and the green/yellow/red interval times at each approach. The nine existing and proposed intersections, for which traffic signal timing information was included in the travel demand model, are shown in the list below in **bold** text (traffic signals were not added to the intersection nodes listed in grey text). These locations are also identified in Figure 8-3.

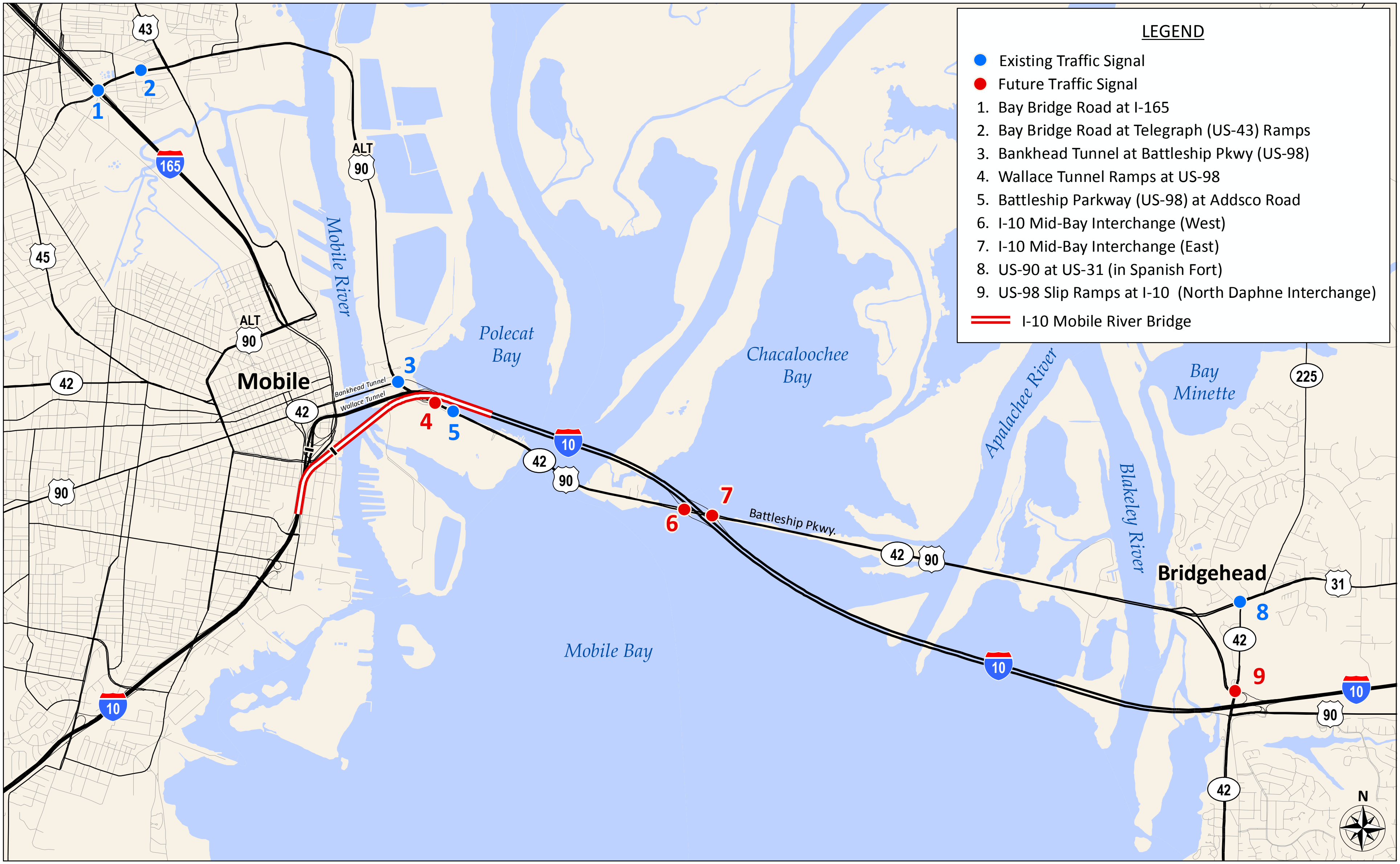
<u>**Existing Signalized Intersections**</u>

- **Bay Bridge Road at I-165**
- *Bay Bridge Road at Grover Ave/Butts St*
- **Bay Bridge Road at Ramps to/from Telegraph Rd (US-43)**
- *Bay Bridge Road at Tin Top Ln/Magazine Rd*
- **Bankhead Tunnel at Battleship Pkwy (US-98)**
- **Battleship Pkwy (US-98) at Addsco Rd**
- **US-90 at US-31 (in Spanish Fort)**
- *US-90 at Spanish Main St*
- *US-90 at Town Centre Ave*
- *US-90 at Bass Pro Drive*
- **US-98 at US-90 (North Daphne I-10 Interchange)**
- *US-98 at US-90 (South Daphne I-10 Interchange)*

<u>**Proposed Signalized Intersections**</u>

- **Wallace Tunnel Ramps at US-98 (East Tunnel Interchange)**
- **I-10 Mid-Bay Interchange (West Intersection)**
- **I-10 Mid-Bay Interchange (East Intersection)**

DRAFT



CDM Smith

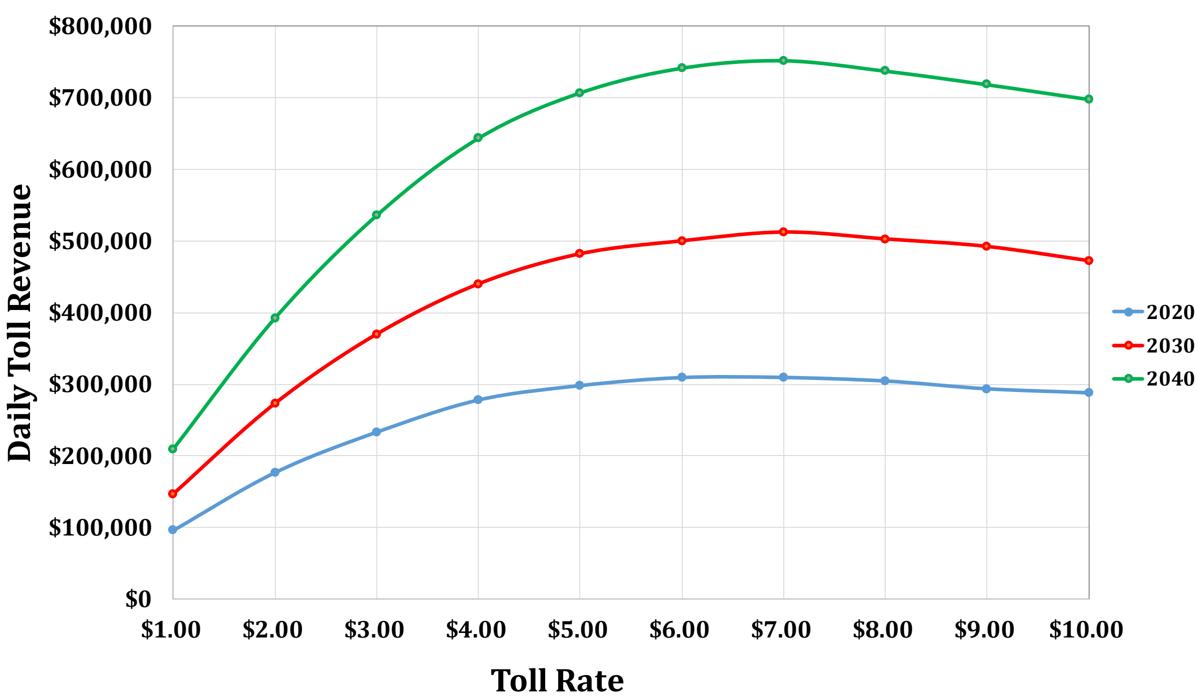
TRAFFIC SIGNAL LOCATIONS

FIGURE 8-3

8.5 Toll Rate Sensitivity Testing

For convenient identification, the toll rate levels described in this report are named according to the passenger car toll rate in 2020 dollars to travel the full-length of the I-10 MRB&B project. The actual toll rates will vary depending the entry and exit points, year and vehicle class. The toll plan described in Section 8.1 was tested with a range of passenger car toll rates (to travel the full length of the project) ranging from $1.00 to $10.00 (in 2020 dollars). These toll sensitivity tests were used to select the toll rates for the project. Figure 8-4 shows the daily project toll revenues that could be generated at each toll rate in model years 2020, 2030 and 2040. As the graph illustrates, the revenue maximizing toll rate (in 2020 constant dollars) is $7.00 in all three model years. At the revenue maximizing toll rates, the estimated daily weekday revenues (in nominal year dollars) are $309,500 in 2020, $512,200 in 2030 and $751,800 in 2040. Although $7.00 is the estimated revenue maximizing toll rate, ALDOT has selected a base toll rate of $5.00. This toll rate level delivers approximately 90 percent of the revenue compared to the revenue maximizing toll rate. Not all customers will pay the base toll rate. As is described in Chapter 10, frequent-users will be offered discounted toll rates, and video customers will pay a toll surcharge to offset the higher cost of collecting video tolls.

Figure 8-4 – Toll Rate Sensitivity Curves



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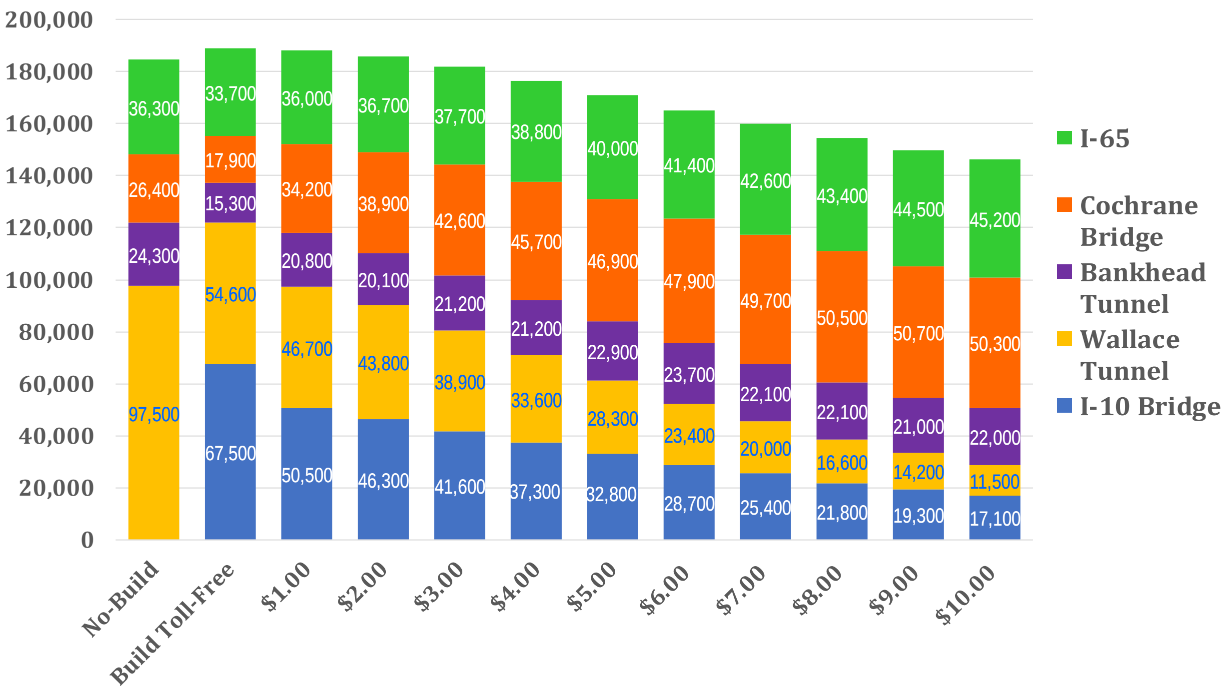
8.6 Market Share Analysis

Figure 8-5 contains a market share analysis under the toll plan described in Section 8.1. The amounts shown are estimated 2030 weekday traffic volumes. For comparison purposes, the first bar shows the "No-Build" configuration volumes, the second bar shows the "Build Toll-Free" volumes, while the latter ten bars show the traffic volumes across the Mobile River at each toll rate ($1.00 to $10.00.) The decline in the total height of each bar in the graph illustrates the effect of the toll suppression. As the toll rate increases, the total demand on traffic crossing Mobile Bay is expected to decrease, as more people opt-out of making trips which cross Mobile Bay. The higher toll rate increases the total cost for both toll and non-toll traffic alike. For drivers who choose the toll route, the direct toll cost is higher; and for drivers who choose the toll-free route, the travel time cost is higher, as more drivers divert away from the toll route, further congesting the toll-free route.

Under the "Build Toll-Free" case the total screenline volume would be 189,000. However, as the toll rates increase the total volume decreases to 170,500 at a $5.00 toll (a 10 percent decrease compared to the toll-free case). At a $10.00 toll rate the total volume further decreases to 146,100 (a 23 percent decrease).

The graph also shows that the traffic volumes on the two tolled routes (the I-10 Bridge and the Wallace Tunnel) steadily decrease as toll rates increase. Under the toll-free scenario, the combined traffic volume on the I-10 Bridge and in the Wallace Tunnel is 122,100 (which is a 65 percent market share). At a $5.00 toll rate, this combined toll route volume decreases to 61,100 (which is a 36 percent market share). Finally, at a $10.00 toll rate, the combined toll route volume decreases to 28,600 (a 20 percent market share). The traffic that diverts away from these two toll routes (and that is not lost to toll trip suppression), moves to the Bankhead Tunnel, the Cochrane Bridge or I-65. The Bankhead Tunnel is estimated to have a weekday volume of 15,300 under the toll-free scenario. This volume increases 36 percent to 20,800 at the $1.00 toll rate, and steadily increases to approximately 22,000 at the highest toll rates. The traffic volumes on the Cochrane Bridge increase even more sharply: from 17,900 under the "Build Toll-Free" case to 34,200 at a $1.00 toll (a 91 percent increase). The volumes on the Cochrane Bridge continue to increase as toll rates rise; the volumes cap-out just above 50,000 vehicles at toll rates higher than $7.00. Finally, the traffic volumes on I-65 increase as toll rates rise, but the increase is not as sharp (compared to rises on Bankhead and Cochrane). The estimated 2030 weekday traffic volume on I-65 is 33,700 under the "Build Toll-Free" scenario, which gradually increases to 45,200 at a $10.00 toll rate (a 34 percent). Based on a select-link analysis, most of the traffic that diverts to I-65 from the I-10/US-98 Corridor (in order to avoid the tolled routes) has an origin or destination within northern Baldwin County.

Figure 8-5 – 2030 Market Share by Mobile River Crossing



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Chapter 9 – Expected Toll Revenue Estimates

As noted at the end of the prior chapter, a base toll rate of $5.00 for passenger cars (Class 1 vehicles) in 2020 dollars has been selected for the I-10 MRB&B project. This chapter first describes the toll rate structure for the I-10 MRB&B project in more detail, followed by the general assumptions underpinning the toll revenue estimates. The chapter concludes with estimated annual transactions and expected toll revenues for the I-10 MRB&B project. Annual revenue estimates were developed for a 50-year period from the assumed project opening date of January 1, 2025 through December 31, 2074. These toll revenue estimates amounts are prior to including the toll rate discounts, surcharges or fees, and prior to deducting the costs of toll collection operations and maintenance costs

9.1 Toll Rate Structure

The I-10 MRB&B project is assumed to have a four vehicle-class toll rate structure, as follows:

- **Class 1 – Two-Axle Vehicles:** This vehicle class includes all two-axle vehicles: whether they have two, four or six tires; and whether they are passenger cars, motorcycles, sport utility vehicles (SUVs), passenger/service vans, passenger buses or single unit trucks.
- **Class 2 — Three-Axle Trucks:** This vehicle class will be charged a toll rate two-times that of Class 1 vehicles.
- **Class 3 — Four-Axle Trucks:** This vehicle class will be charged a toll rate three-times that of Class 1 vehicles.
- **Class 4 — Five or More Axle Trucks:** Five-axle trucks will be charged a toll rate four-times that of Class 1 vehicles. The toll rate schedule specifies that each additional axle of a vehicle (greater than five axles) will be charged an additional toll equivalent to the Class 1 rate. For example, if the Class 1 rate is $5.00, and the Class 4 rate is $20.00, then a six-axle truck will be charged a toll rate of $25.00. However, based on vehicle classification counts collected for this study, vehicles with greater than five-axles constitutes less than one percent of traffic on I-10. Therefore, to produce more conservative forecasts, CDM Smith has assumed that any vehicles with greater than five-axles will be charged the Class 4 (five-axle) toll rate.

The CDM Smith travel demand model contains two separate trip tables for passenger cars and trucks; it does not contain separate trip tables for each of the classes of trucks listed in the above toll rate structure. The proportions of truck transactions falling into Toll Rate Classes 2, 3 and 4 were estimated from vehicle classification counts collected on I-10.[32] The following is the assumed distribution of trucks by toll rate class for all years:

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[32] ALDOT collected FHWA 13-class vehicle classification counts in March 2016 on the I-10 Bayway at the Blakley River (CDM Smith Traffic Count Location #173). CDM Smith also analyzed vehicle classification counts collected by ALDOT in

- **Class 2:** Three Axle Trucks 7%
- **Class 3:** Four Axle Trucks 23%
- **Class 4:** Five or more Axle Trucks 70%

Based on this proportional distribution of truck by toll rate class and based on the toll rate multipliers in each class (relative to the Class 1 toll rates), CDM Smith determined that trucks on I-10 would have an average toll rate of **3.63**-times that of Class 1 vehicles. In the travel demand model, truck transactions were charged the passenger car (Class 1) toll rate multiplied by 3.63; for example, a $5.00 Class 1 toll rate equaled a truck toll rate of $18.15.

9.2 Toll Rates by Gantry, Vehicle Type and Year

Figure 9-1 illustrates how to interpret toll rate tables Table 9-1 through Table 9-4. The purple toll rates shown in the bottom-left side of the table are for movements in the eastbound direction, while the blue toll rates in the upper-right side of the table are for movements in the westbound direction. Table 9-1 through Table 9-4 show the I-10 Bridge and Bayway toll rates for the project opening year (2025) by toll rate class. The four tables correspond to toll rate Classes 1 through 4 respectively. Each table shows the toll rates for all 16 possible movements (eight entry-exit combinations per direction).

Figure 9-1 – Example of Table of Toll Rates by Direction

Westbound Toll Rates

		Exit Interchange				
		Daphne	Mid-Bay	East Tunnel	Canal St.	Virginia St.
Entry Interchange	Daphne	-	$2.26	$3.96	$5.66	$5.66
	Mid-Bay	$2.26	-	$1.70	$3.39	$3.39
	East Tunnel	$3.96	$1.70	-	$2.83	-
	Canal St.	$5.66	$3.39	$2.83	-	-
	Virginia St.	$5.66	$3.39	-	-	-

Eastbound Toll Rates

March 2016 in the I-10 Wallace Tunnel (CDM Smith Traffic Count Location #168); these counts revealed a nearly identical distribution of trucks by vehicle class.

Table 9-1 – 2025 Posted Toll Rates by Entry-Exit Points, Two-Axle Vehicles

		Exit Interchange				
		Daphne	Mid-Bay	East Tunnel	Canal St.	Virginia St.
Entry Interchange	Daphne	-	$2.26	$3.96	$5.66	$5.66
	Mid-Bay	$2.26	-	$1.70	$3.39	$3.39
	East Tunnel	$3.96	$1.70	-	$2.83	-
	Canal St.	$5.66	$3.39	$2.83	-	-
	Virginia St.	$5.66	$3.39	-	-	-

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-1 to T9-4) 2025 Toll Rates

Table 9-2 – 2025 Posted Toll Rates by Entry-Exit Points, Three-Axle Vehicles

		Exit Interchange				
		Daphne	Mid-Bay	East Tunnel	Canal St.	Virginia St.
Entry Interchange	Daphne	-	$4.53	$7.92	$11.31	$11.31
	Mid-Bay	$4.53	-	$3.39	$6.79	$6.79
	East Tunnel	$7.92	$3.39	-	$5.66	-
	Canal St.	$11.31	$6.79	$5.66	-	-
	Virginia St.	$11.31	$6.79	-	-	-

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-1 to T9-4) 2025 Toll Rates

Table 9-3 – 2025 Posted Toll Rates by Entry-Exit Points, Four-Axle Vehicles

		Exit Interchange				
		Daphne	Mid-Bay	East Tunnel	Canal St.	Virginia St.
Entry Interchange	Daphne	-	$6.79	$11.88	$16.97	$16.97
	Mid-Bay	$6.79	-	$5.09	$10.18	$10.18
	East Tunnel	$11.88	$5.09	-	$8.49	-
	Canal St.	$16.97	$10.18	$8.49	-	-
	Virginia St.	$16.97	$10.18	-	-	-

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-1 to T9-4) 2025 Toll Rates

Table 9-4 – 2025 Posted Toll Rates by Entry-Exit Points, Five-Axle Vehicles

		Exit Interchange				
		Daphne	Mid-Bay	East Tunnel	Canal St.	Virginia St.
Entry Interchange	Daphne	-	$9.05	$15.84	$22.63	$22.63
	Mid-Bay	$9.05	-	$6.79	$13.58	$13.58
	East Tunnel	$15.84	$6.79	-	$11.31	-
	Canal St.	$22.63	$13.58	$11.31	-	-
	Virginia St.	$22.63	$13.58	-	-	-

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-1 to T9-4) 2025 Toll Rates

Table 9-5 shows the full-length toll by vehicle class for years 2025 through 2074 (to fit the table on a single page, some of the latter year toll rates have been omitted). Toll rates are assumed to be identical for all days-of-week and all times-of-day (i.e., no congestion pricing). All toll rates in these tables are shown in nominal dollars (i.e., inflation-adjusted dollars). Toll rates (initially expressed in 2020 dollars) have been inflated by 2.5 percent per year to obtain the future-year toll rates. The toll rates shown in these tables, and used in the revenue calculations, have not employed rounding. In practice, toll rates on toll facilities are often rounded to the nearest one-cent, five cents or 25-cents in some cases. Furthermore, toll rates on some facilities are not escalated annually, but instead are escalated every three years, every five years, or at the discretion of the toll agency. Please note that the toll rate escalation factor (2.5 percent) is higher than the assumed inflation rate (of 2.0 percent) used for the VOT and VOC. Therefore, the cost of the toll rate is expected to increase in real terms over time (i.e., increase faster than inflation).

Table 9-5 – Full-Length Toll Rates by Vehicle Class by Year

Year	Class 1	Class 2	Class 3	Class 4
2025	$5.66	$11.31	$16.97	$22.63
2026	$5.80	$11.60	$17.40	$23.19
2027	$5.94	$11.89	$17.83	$23.77
2028	$6.09	$12.18	$18.28	$24.37
2029	$6.24	$12.49	$18.73	$24.98
2030	$6.40	$12.80	$19.20	$25.60
2031	$6.56	$13.12	$19.68	$26.24
2032	$6.72	$13.45	$20.17	$26.90
2033	$6.89	$13.79	$20.68	$27.57
2034	$7.06	$14.13	$21.19	$28.26
2035	$7.24	$14.48	$21.72	$28.97
2036	$7.42	$14.85	$22.27	$29.69
2037	$7.61	$15.22	$22.82	$30.43
2038	$7.80	$15.60	$23.39	$31.19
2039	$7.99	$15.99	$23.98	$31.97
2040	$8.19	$16.39	$24.58	$32.77
2041	$8.40	$16.80	$25.19	$33.59
2042	$8.61	$17.22	$25.82	$34.43
2043	$8.82	$17.65	$26.47	$35.29
2044	$9.04	$18.09	$27.13	$36.17
2045	$9.27	$18.54	$27.81	$37.08
2046	$9.50	$19.00	$28.50	$38.01
2047	$9.74	$19.48	$29.22	$38.96
2048	$9.98	$19.96	$29.95	$39.93
2049	$10.23	$20.46	$30.70	$40.93
2050	$10.49	$20.98	$31.46	$41.95
2060	$13.43	$26.85	$40.28	$53.70
2070	$17.19	$34.37	$51.56	$68.74
2074	$18.97	$37.94	$56.91	$75.88

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-5) Max Toll Rates by Year

9.3 Basic Assumptions

As described elsewhere in the report, the traffic and revenue estimates are based on the basic assumptions summarized in the list below:

- Actual inflation in the 2025 to 2074 period will be consistent with the 2.0 percent per year assumed in this report. The VOT and VOC parameters have both been escalated by 2.0 percent per year in the travel demand model.
- Toll rates are increased by 2.5 percent annually between 2025 and 2074. Toll rates will increase 0.5 percent per year faster than the assumed inflation rate. In other words, the toll rates will increase in real terms (above and beyond the assumed inflation rate).
- PC VOTs vary by time-of-day and by the median household income of the trip's origin and destination TAZs. The average PC VOT is $0.16 per minute ($9.51 per hour) in 2020 dollars and $0.24 per minute ($14.13 per hour) in 2040 dollars.
- CV VOT will be $0.50 per minute ($29.77 per hour) in 2020 dollars and $0.74 ($44.23 per hour) in 2040 dollars. PC and CV VOT were estimated via an SP survey conducted by RSG for the I-10 MRB&B project (See Chapter 5 for more details).
- The PC VOC will be 22-cents per mile in 2020, rising 2 percent annually to 27-cents in 2030 and to 33-cents in 2040.
- The CV VOC will be 66-cents per mile in 2020, rising 2 percent annually to 81-cents in 2030 and to 99-cents in 2040.
- The annualization factor (or the number of revenue days per year) is 330.
- The I-10 MRB&B would open to traffic by January 1, 2025.
- All roadway improvement projects included in the current Mobile MPO and Baldwin County Long Range Transportation Plans will be implemented within the specified timeframe.
- No other competing facilities or additional capacity improvements would be constructed during the 2025-2074 period, other than those listed in the current Long Range Transportation Plans.
- Toll rates are set at the amounts shown in this report.
- Economic growth in the project study area will be generally consistent with what was assumed in the socioeconomic forecasts produced by Fishkind & Associates.
- The I-10 MRB&B will be properly signed and effectively promoted to encourage maximum usage.
- Motor fuel will remain in adequate supply and no national or regional emergency shall arise that would abnormally restrict the use of motor vehicles.
- No major construction activities, natural disasters or acts of terrorism would affect access and circulation on the I-10 MRB&B facility.
- Toll rates and the revenue estimates shown within this chapter assume that all vehicles will be charged the same toll rates regardless of whether the transaction occurs through transponder or video tolling. The revenue impacts of toll rate discounts, toll rate surcharges and invoice fees are evaluated in Chapter 10.

These general assumptions are consistent with what is typically assumed in a T&R study. Any significant departure from these basic assumptions would likely affect traffic levels and generated revenues on the I-10 MRB&B project.

9.4 Ramp-Up Period

The annualized traffic and revenue estimates were adjusted to reflect the effect of a "ramp-up" period. Ramp-up is typically applied to forecasts for new facilities that may require a few years to reach the full forecast level, as drivers become familiar with the new facility. Because the I-10 MRB&B project would supplement an existing facility, the ramp-up factors used for the I-10 MRB&B project in this study were less restrictive than those typically used for other "green field" facilities. A three-year ramp-up factor was used. Collected revenues are estimated to be 85 percent of the model-estimated revenues in the 2025 opening year, increasing to 90 percent in the second year (2026), 95 percent in the third year (2027), and 100 percent in 2028 and all the subsequent years.

9.5 Annual Transactions and Gross Revenue Tables

The estimated annual transactions are provided in Table 9-6, and the estimated gross toll revenues are provided in Table 9-7. T&R estimates are provided for the years 2025 through 2074. To allow the tables to fit onto one page each, some years have been omitted. In the latter 25 forecast years, only the decennial and final years are shown (2050, 2060, 2070 and 2074). In each table, there are separate columns for transactions/revenue by vehicle class (plus a total column).

The annual transactions and revenues reflect the annualization factor, ramp-up factor, the annual inflation-adjustment of toll rates, and the other basic assumptions listed above. The revenues do not reflect deductions for operations and maintenance costs. Additionally, the impact of revenue leakage is not considered in these estimates (see Chapter 11 for revenue leakage estimates). The revenues shown are termed expected revenues, the revenues collected if each vehicle paid the full and correct toll.

Table 9-6 shows that in the 2025 opening year there are 15.0 million Class 1 transactions and 1.7 million transactions in Classes 2 through 4 (i.e., approximately 10.0 percent truck transactions). By 2028, when the ramp-up period ends, the total annual transactions increase by approximately one-quarter from 16.7 to 21.0 million. Between 2025 and the final estimate year, 2074, the total number of annual transactions are estimated to increase by approximately 60 percent in all rate classes: from a total of 16.7 to 26.8 million.

Table 9-7 shows that in the 2025 opening year the project generates expected revenues of $76.3 million in Class 1 and expected revenues of $30.0 million in Classes 2 through 4 (i.e., approximately

28.0 percent truck revenue). By 2028, when the ramp-up period ends, the total annual revenue increases by approximately one-third from $106.3 to $144.4 million. Between 2025 and the final estimate year, 2074, the total revenue increases more than five-fold from $106.3 to $580.9. Toll revenue increases somewhat faster among the three truck classes. Class 1 revenues increase from $76.3 to $410.0 million (a multiple of 5.4), while the Class 2 through 4 revenues increase from $30.0 to $170.8 million (a multiple of 5.7). The share of revenue from trucks (Classes 2 through 4) increases slightly from 28.2 percent to 29.4 percent between 2025 and 2074.

Figure 9-2 and Figure 9-3 respectively contain stacked-graphs of the annual transactions and revenue by toll rate Class between 2025 and 2074. The first graph illustrates that the increase in number of transactions "rolls off" after year 2040, while the second graph illustrates that annual revenues continue to climb, due to the 2.5 percent per year increase in toll rates.

Table 9-6 – Expected Annual Toll Transactions by Vehicle Class (in thousands)

Year	Class 1	Class 2	Class 3	Class 4	Total
2025	14,952	117	380	1,161	16,610
2026	16,229	126	410	1,251	18,016
2027	17,563	135	440	1,344	19,482
2028	18,956	144	471	1,439	21,010
2029	19,438	147	480	1,465	21,530
2030	19,934	150	488	1,491	22,063
2031	20,173	152	496	1,514	22,335
2032	20,416	154	504	1,538	22,612
2033	20,664	157	512	1,562	22,895
2034	20,916	159	520	1,587	23,182
2035	21,174	162	528	1,612	23,476
2036	21,436	164	536	1,638	23,774
2037	21,703	167	545	1,664	24,079
2038	21,976	170	554	1,692	24,392
2039	22,254	173	563	1,719	24,709
2040	22,537	175	572	1,748	25,032
2041	22,637	176	576	1,758	25,147
2042	22,738	177	579	1,768	25,262
2043	22,839	178	582	1,778	25,377
2044	22,941	179	586	1,788	25,494
2045	23,044	180	589	1,799	25,612
2046	23,148	182	592	1,809	25,731
2047	23,252	183	596	1,820	25,851
2048	23,357	184	599	1,830	25,970
2049	23,463	185	603	1,841	26,092
2050	23,569	186	606	1,852	26,213
2051	23,607	186	608	1,855	26,256
2052	23,644	187	609	1,859	26,299
2053	23,681	187	610	1,863	26,341
2054	23,719	187	611	1,867	26,384
2064	23,945	190	619	1,890	26,644
2074	24,096	191	624	1,905	26,816

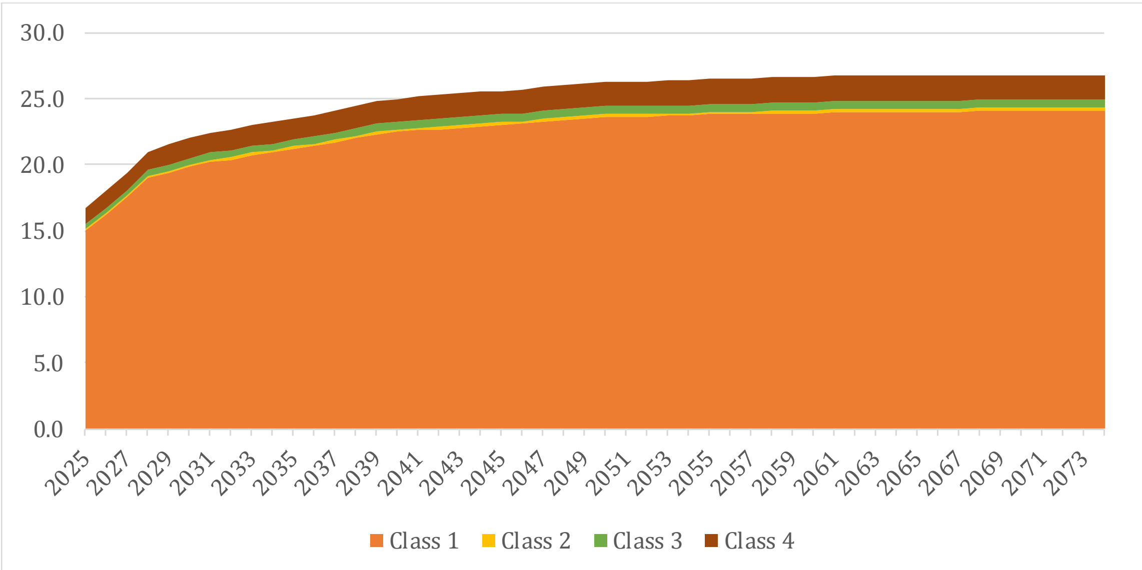
Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-6 Annual Trxn by Rate Class

Table 9-7 – Expected Annual Toll Revenue by Vehicle Class (in $ millions)

Year	Class 1 Vehicle Revenue	Class 2 Vehicle Revenue	Class 3 Vehicle Revenue	Class 4 Vehicle Revenue	Total Toll Revenue WITHOUT Discounts/ Surcharges/ Invoices
2025	$76.3	$1.2	$5.7	$23.1	$106.3
2026	84.9	1.3	6.3	25.6	118.1
2027	94.2	1.4	6.9	28.2	130.7
2028	104.2	1.6	7.6	31.0	144.4
2029	109.5	1.6	8.0	32.5	151.6
2030	115.1	1.7	8.3	33.9	159.0
2031	119.4	1.8	8.7	35.4	165.3
2032	123.8	1.9	9.1	36.9	171.7
2033	128.4	1.9	9.5	38.5	178.3
2034	133.2	2.0	9.9	40.2	185.3
2035	138.2	2.1	10.3	41.9	192.5
2036	143.4	2.2	10.7	43.7	200.0
2037	148.7	2.3	11.2	45.6	207.8
2038	154.3	2.4	11.7	47.6	216.0
2039	160.1	2.5	12.2	49.7	224.5
2040	166.1	2.6	12.7	51.8	233.2
2041	171.0	2.7	13.1	53.5	240.3
2042	176.0	2.8	13.5	55.1	247.4
2043	181.2	2.9	14.0	56.9	255.0
2044	186.5	2.9	14.4	58.7	262.5
2045	192.0	3.0	14.9	60.5	270.4
2046	197.7	3.1	15.3	62.4	278.5
2047	203.5	3.2	15.8	64.4	286.9
2048	209.5	3.3	16.3	66.4	295.5
2049	215.7	3.4	16.8	68.5	304.4
2050	222.0	3.5	17.4	70.7	313.6
2051	227.9	3.6	17.8	72.6	321.9
2052	233.9	3.7	18.3	74.6	330.5
2053	240.2	3.8	18.8	76.6	339.4
2054	246.5	3.9	19.3	78.7	348.4
2064	319.1	5.1	25.2	102.4	451.8
2074	410.1	6.6	32.4	131.8	580.9

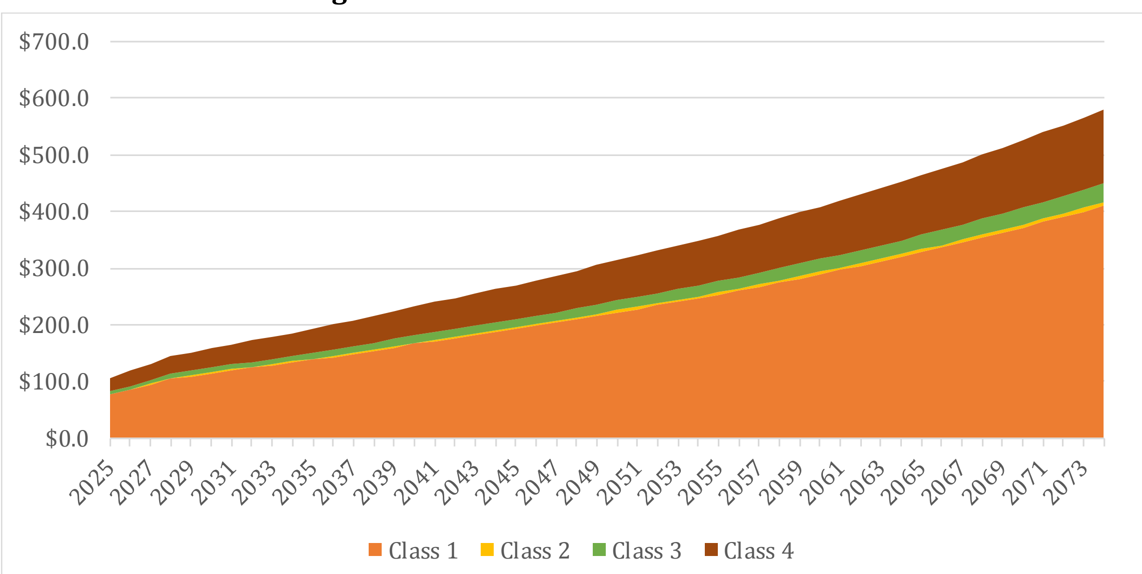
Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-7 Annual Rev by Rate Class

Figure 9-2 – Annual Toll Transactions



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-6 Annual Trxn by Rate Class

Figure 9-3 – Annual Gross Toll Revenues



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T9-7 Annual Rev by Rate Class

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Chapter 10 – Gross Toll Revenues with Discounts, Surcharges and Fees

The I-10 MRB&B project will have two separate, but related toll policies, which reward frequent-users with a discounted toll and recover the cost of video tolling with a surcharge and monthly fee which also encourages early use of transponders. ALDOT intends to establish a transponder system for the I-10 MRB&B project under the name "*algo-pass*." The Concessionaire will establish the detailed toll policies in compliance with ALDOT's contractual requirements. This chapter describes the general toll discount plan being offered to frequent-user customers, as well as the general toll surcharges and invoicing fees that will be charged to video customers (who are most likely to be infrequent-use customers). The chapter then contains a description of the key inputs to the analysis and the methodology used to estimate the revenue impacts of these discounts/surcharges/fees. The chapter concludes with estimated gross annual toll revenues inclusive of the toll discounts/surcharges/fees.

10.1 Toll Discount, Surcharge and Fee Plans

ALDOT researched the ways other toll facilities have offered toll discounts and recovered the incremental cost of video tolling. ALDOT analyzed a variety of potential toll discounts as well as surcharge/invoice-fee options in order to determine the proposed toll plan. The following three sections describe the proposed plan:

10.1.1 Toll Discount Plan

Toll discounts will be given to Class 1 (two-axle vehicle) frequent-use customers as follows:

- **15%** discount to customers who have between **20 to 39** transactions per calendar month
- **30%** discount to customers who have **40** or more transactions per calendar month

The number-of-transaction thresholds (20 or 40) within each discount category must be met within a given calendar month. On the first day of the month, the transaction-count for each customer will be reset to zero. The discount will only be provided to customers with an *algo-pass* transponder, and who maintain a positive balance on their *algo-pass* account. The transaction-count and discounts will apply only to a single transponder device and will not be applied across multiple transponders registered to a single account. The discount will be applied as a credit to the account after the month end to all qualifying transactions during the prior month. The discount program applies to Class 1 vehicles only, and is not offered to vehicles in Toll Rate Classes 2, 3 or 4. Finally, the discount applies only to customers with an *algo-pass* transponder, and will not be offered to customers with other types of transponders that may be interoperable (e.g., SunPass).

10.1.2 Toll Surcharge Plan

Any vehicle that does not possess a valid *algo-pass* transponder (or other interoperable transponder) will be deemed a video customer. Tolls will be collected from video customers by taking a video image of the vehicle's license-plate via roadside cameras. The license plate number is then sent to the Department of Motor Vehicles (DMV) in the relevant state to obtain the vehicle owner's registered name and address. All video transactions will be assessed a 40 percent surcharge above the base toll rate to cover the extra cost of processing these transactions. The surcharge will apply to transactions in all vehicle classes (Classes 1, 2, 3 and 4).

10.1.3 Invoice Fee Plan

All customers with one or more video transactions in a calendar month will also be assessed a $5.00 invoice fee for the month in which the video transactions occur. Multiple video transactions occurring within the same calendar month will be combined together onto a single invoice for that month. Thus, customers will only be subject to one $5.00 invoice fee per calendar month (and a maximum of 12 invoice fees per calendar year). The $5.00 invoice fee will be charged to video tolling customers in all vehicle classes in addition to the 40 percent toll rate surcharge on video toll transactions.

10.2 Inputs to Toll Discount/Surcharge/Fee Revenue Analysis

CDM Smith was asked to analyze revenue impacts of providing toll discounts, and of imposing surcharges/invoice fees on video customers. The analytical method that CDM Smith developed, relied upon three key inputs, which are discussed in the following three subsections.

10.2.1 StreetLight Data Frequency Metrics

The discounts and surcharge/invoice fees described above are based in part on the customers' frequency of use each month. To estimate how these discounts and surcharge/invoice fees may affect toll revenues on the I-10 MRB&B, CDM Smith obtained "frequency metrics" from StreetLight Data, Inc.

The frequency metrics were derived from data that StreetLight Data obtains through Location-Based Service (LBS) applications on smart phones. These applications—such as those for mapping, weather, retail shopping, or dating apps—tailor the information and services based on the user's location.[33]

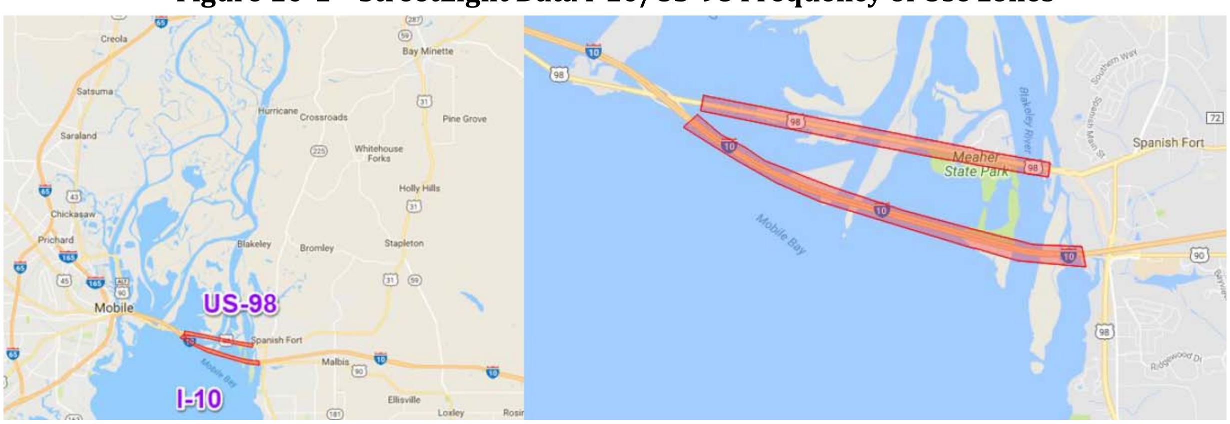
I-10 across Mobile River/Bay is the primary route of interest for obtaining frequency of use data. However, US-98 parallels I-10 across Mobile Bay and is a strong competitor to I-10. Local drivers

[33] For more information about StreetLight Data Location Based Services, please see:
https://www.streetlightdata.com/new-location-based-services-data-update
https://www.streetlightdata.com/evaluating-location-based-services-data-for-transportation-representative

frequently switch between the routes depending on current traffic conditions, or their particular trip origin and destination that day. Therefore, CDM Smith obtained frequency of use data for both US-98 and I-10 separately and in combination where they cross Mobile Bay.

Figure 10-1 illustrates the cordon-zones drawn on I-10 and US-98 for this frequency analysis. To be included in the frequency metrics analysis, devices had to pass through one of these two zones drawn around the eastern portions of the I-10 Bayway and US-98 Causeway. Each one-way trip through either of the cordon zones is counted as a trip in StreetLight Data's frequency analysis. As mobile devices use LBS applications, the device is frequently providing location coordinates. StreetLight Data strings these location data points together to create discrete trips.[34] For this analysis, only devices that were active somewhere in the U.S. every day of the month were included in the sample. This filtered dataset yielded an average sample-size of more than 8,500 devices per month. StreetLight Data was also able to present the data according to Residents (of Mobile or Baldwin County, Alabama) versus Non-Residents. The mobile device frequency distributions were provided separately for 12 calendar months (November 2016 through October 2017), since the toll discounts and invoice fees are calculated on a calendar month basis. The monthly frequency distributions were provided in single-value-bins (1 trip per month, 2 trips per month, 3 trips per month, etc.). The observed monthly device frequencies ranged from 1 to 171 trips per month. However, there were only a handful of observations that exceeded 100 trips per month. CDM Smith capped the device frequency at 100 trips per month.

Figure 10-1 – StreetLight Data I-10/US-98 Frequency of Use zones



Source: StreetLight Data presentation file, December 13, 2017

[34] Any device that stays the same location for less than 60 minutes, the separate data points are considered part of the same trip; if the device stays in a zone for longer than 60 minutes, they are deemed separate trips.

Figure 10-2 is a graph showing several frequency (probability) distributions. The yellow line describes the observed frequency distribution provided by StreetLight Data for mobile devices traveling across Mobile Bay (via I-10 or US-98) during the month of July 2017. The graph is limited to frequencies between 1 and 40.

The “raw” or observed frequency distribution contained missing data at certain frequencies, and graphs of the data revealed some oscillations in the shape of the frequency distribution. To fill the missing data points and smooth the shape of the frequency distribution, CDM Smith fitted each observed monthly frequency distribution to a Pareto-function frequency distribution. The cumulative Pareto distribution is stated as:

$$Percent\ of\ Traffic\ at\ DF(x) = 1 - \frac{1}{DF(x)}^{\alpha}$$

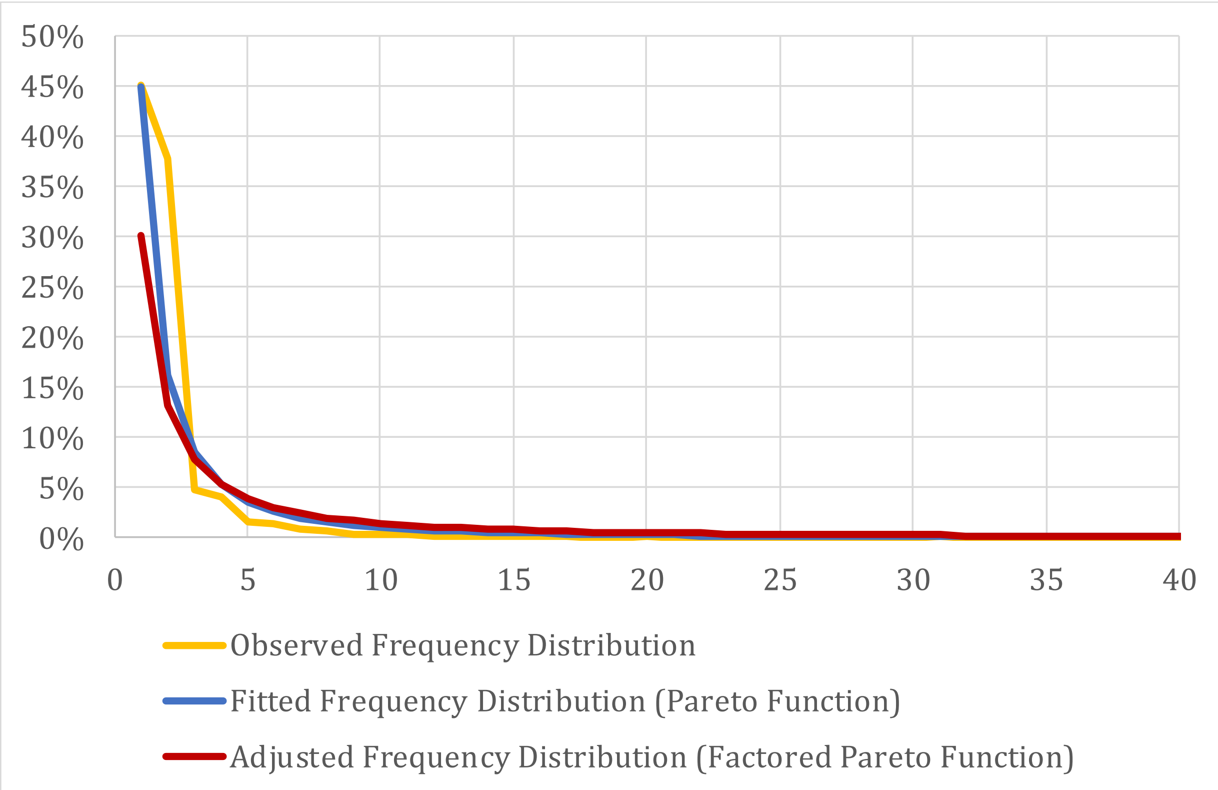
where,

DF(x)	=	Device Frequency at “x” times per month (for frequencies 1 to 100)
α	=	Alpha coefficient (shape parameter)

The alpha factors of the fitted frequency distributions ranged from 0.78 to 1.26. The blue line in Figure 10-2 shows the fitted frequency distribution based on the observed July 2017 device frequencies (alpha = 0.86).

CDM Smith then made adjustments to the fitted frequency distribution in order to reduce the number of very infrequent trips and to shift the distribution curve toward the higher frequencies. This was accomplished by reducing the alpha factors in the Pareto-functions. The red line in Figure 10-2 shows the adjusted frequency distribution with the adjusted alpha coefficient (alpha = 0.52).

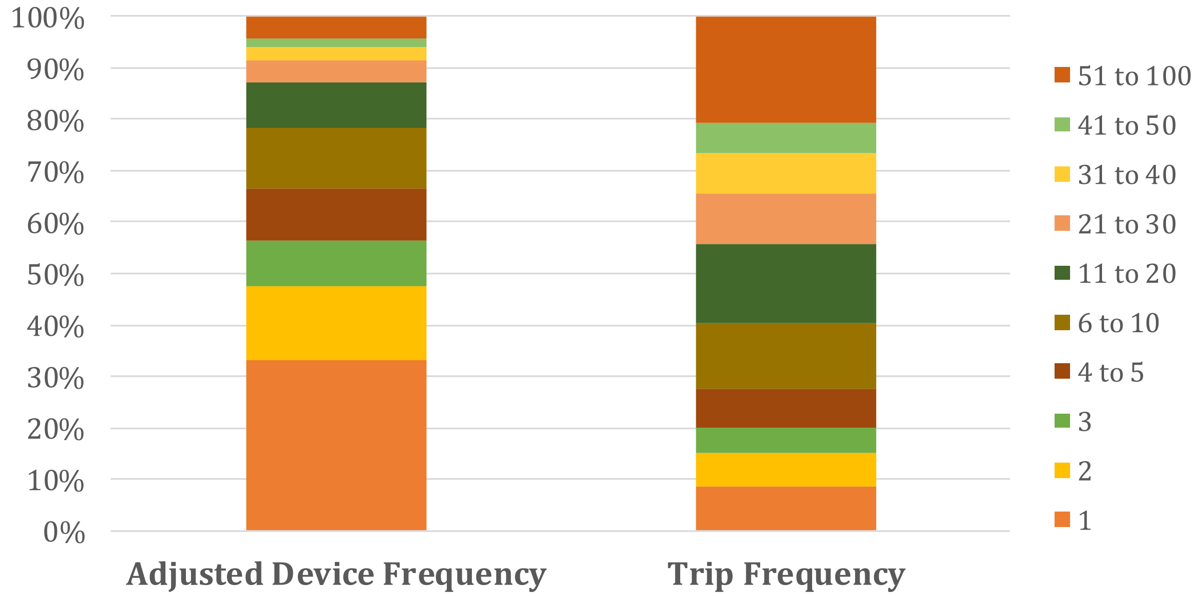
Figure 10-2 – Device Frequency Distributions – July 2017



I-10 MRB T&R by Freq & Disc--2-Tier-2025 v8.2 CORRECT ELAST.xlsx / 8.7) JUL 2017 Devices Pareto

The adjusted frequency distribution shown in Figure 10-2 represents the proportion of mobile devices (or potential toll customers) that travel a given number of times per month. When this distribution of devices/customers is expressed in terms of numbers of trips, the distribution appears quite different. Figure 10-3 shows both of these distributions side-by-side: the device/customer distribution is shown on the left (identical to the red line in Figure 10-2) and the and trip distribution is shown on the right. The higher device/trip frequencies are grouped into categories to allow for easier comparisons. The extremes highlight the differences. The lowest device frequency (one trip per month) represents 33.1 percent of the devices in the July 2017 sample. However, these devices represent only 8.7 percent of all the vehicle trips crossing Mobile Bay via I-10/US-98. Conversely, the devices that make between 51 and 100 trips per month represent only 4.3 percent of all devices. However, due to the large numbers of trips this relatively small population of devices make, this category of devices comprises 20.6 percent of all the vehicle trips crossing Mobile Bay via I-10/US-98. The trip frequency distributions (not the device distributions) were used to separate the monthly transactions into transactions by monthly trip frequency (see Section 10.3.3).

Figure 10-3 – Adjusted Device and Trip Frequency Distributions – July 2017



I-10 MRB T&R by Freq & Disc--2-Tier-2025 v8.2 CORRECT ELAST.xlsx / 8.7) JUL 2017 Devices Pareto

10.2.2 Percent Video Transactions

In order to complete these calculations, CDM Smith prepared estimates of the percentage of transactions that will be video transactions (as opposed to transponder transactions) for each year by trip frequency of use per month.

Based on other recently-opened All Electronic Tolling (AET) projects (even on projects that have toll rate surcharges for video tolling), the percentage of video transactions in the first year of operation is approximately 30 percent. Therefore, CDM Smith assumed that the video percentage on the I-10 MRB&B in the 2025 opening year will be 30 percent. However, in the later years, it is anticipated that the video percentages will quickly decrease. This assumption is based on many factors, including:

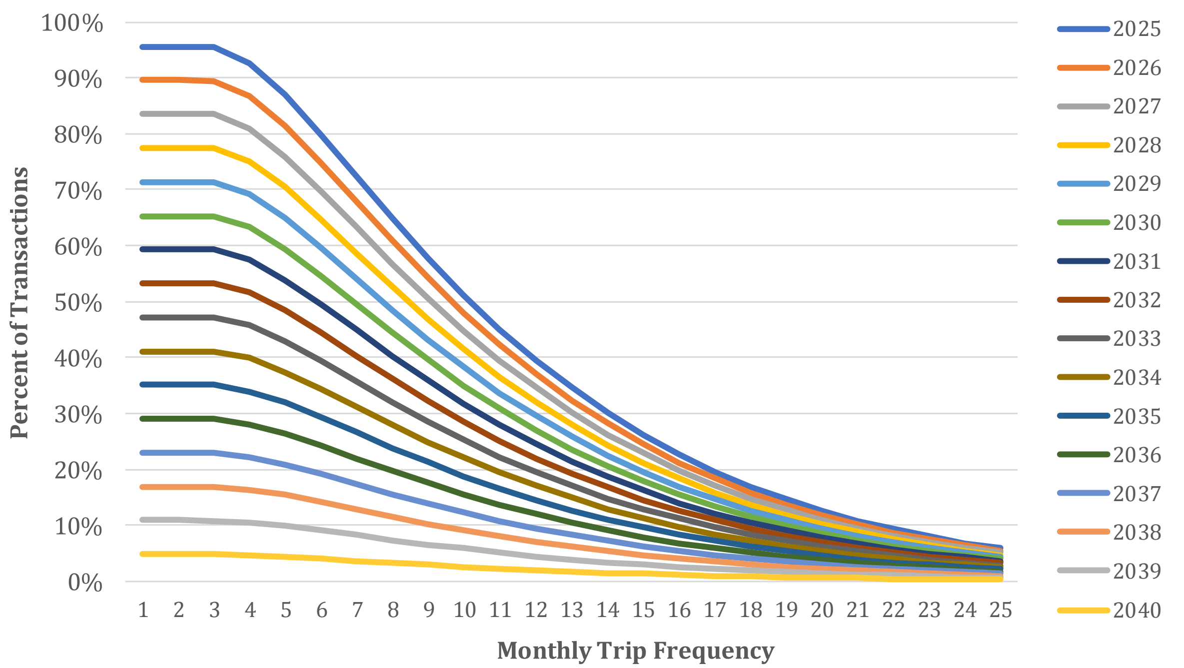
- Existing toll transponder systems are becoming increasing more interoperable among multiple toll road, bridge and tunnel facilities.
- Many of the new roads, bridges and tunnels constructed in the U.S., open as toll facilities, which in turn, has led to more drivers purchasing toll transponders.
- There has been discussion of universal toll transponders being pre-installed in new vehicles (possibly rendering video tolling unnecessary).

- Many toll roads and bridges currently impose surcharges and billing fees on customers without a transponder, providing an incentive for video customers to obtain a transponder.

Based on the likely increased penetration of transponders, CDM Smith has assumed that the percentage of video transactions will fall to 1 percent by the Year 2040. Between the Year 2025 (with 30 percent video tolling) and the Year 2040 (with 1 percent video tolling), CDM Smith assumes the annual video percentages will decrease at a roughly linear rate.

Within each year, CDM Smith needed to further estimate the video percentage for each trip frequency between 1 and 100 trips per month. It can generally be assumed that the video percentages will be relatively high among low trip frequencies, and lower among high trip frequencies. CDM Smith used a Chi-Squared probability distribution to estimate the video percentage in a particular frequency bin, while still meeting the overall "target" video percentage for that year. Figure 10-4 shows the video percentages by year by trip frequencies (for frequencies between 1 and 25). For example, in the Year 2030, 65 percent of vehicles with a frequency of one trip per month are estimated to pay via video tolling; while only 35 percent of vehicles with a frequency of ten trips per month are estimated to pay via video tolling.

Figure 10-4 – Video Percentage by Year by Trip Frequency



I-10 MRB T&R by Freq & Disc--2-Tier-2025 v8.2 CORRECT ELAST.xlsx / 9) Percent Video Trxn--STANDARD

10.2.3 Toll Price Elasticity

In economics, the price elasticity of demand shows the percentage change in quantity demanded in response to a one percent change in price. In this analysis, CDM Smith estimated separately the percentage change in demand due to the frequent-user toll discounts and due to the video tolling surcharge. The toll price elasticity factors were estimated by running the travel demand model using the lower (toll discount) or higher (video surcharge) toll rates. Table 10-1 shows the toll elasticities used for the year 2030 for passenger cars (Class 1) and for trucks (Classes 2, 3 and 4). CDM Smith has assumed that drivers may not be as price sensitive to toll discounts and surcharges. Therefore, 50 percent of the actual model toll elasticities were used in the analysis (and are shown in Table 10-1).

Since toll discounts are not offered to trucks, only the toll surcharge elasticity factor is shown in the table, while both discount and surcharge elasticities are shown for passenger cars. Separate toll price elasticities were estimated for Years 2020, 2030 and 2040. CDM Smith interpolated and extrapolated the toll price elasticity factors among these three model years (2020, 2030 and 2040), to estimate factors for all years between 2025 and 2074. In the calculation procedure described below, these factors were used to increase the number of toll discount transactions, or to decrease the number of video tolling transactions.

Table 10-1 – 2030 Toll Elasticity Estimates

Vehicle Type	Toll Rate Type	Toll Elasticity	Toll Rate Change	Transaction Change
Passenger Car	15% Discount	-0.417	-15%	6%
Passenger Car	30% Discount	-0.417	-30%	13%
Passenger Car	40% Surcharge	-0.333	40%	-13%
Truck	40% Surcharge	-0.261	40%	-10%

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T10-1)Elasticities Report Table

10.3 Revenue by Frequency-of-Use

This section contains a description of the specific steps required to calculate the revenue estimates with toll discounts, video tolling surcharges and invoice fees.

10.3.1 Daily Transactions by Vehicle Type by Gantry by Year

The starting point of the toll discount/surcharge/invoice analysis is the weekday model transaction estimates by year (2025-2074) by vehicle class.

10.3.2 Convert Daily Transactions to 12 sets of Monthly Transactions

Since the toll discounts and invoice fees are calculated on a calendar month basis, the weekday transaction estimates were converted from weekday to monthly estimates. The number of transactions in a month are expected to vary based on the number of days in the month, and by the traffic demand in that month. CDM Smith estimated the weekdays, weekend days and holiday traffic demand on the I-10 MRB&B by month, using permanent traffic counters located along I-10 in the project vicinity. Table 10-2 shows the factors that were used to convert the number of average annual weekday transactions (as estimated by the travel demand model) to calendar month transactions. The same factors were used for both vehicle types (PC and CV); and these factors were used in all forecast years. Note the sum of these factors is 330 days (with rounding).

Table 10-2 –Weekday to Monthly Conversion Factors

Month	Weekday to Monthly Conversion Factors
January	25.5
February	26.3
March	28.6
April	27.3
May	29.1
June	29.0
July	30.0
August	28.1
September	26.4
October	27.1
November	25.7
December	27.0

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx
Tab: T10-2)Monthly Conversion Factor

10.3.3 Split Transactions by Frequency Bins

The transactions (that were separated by vehicle type by month in the prior steps) were then separated into one-hundred separate vehicle frequency bins from 1 trip per month to 100 trips per month. The monthly adjusted Pareto-function frequency distributions (as described in Section 10.2.1) were used to split the monthly transactions into the separate frequency bins. The same set of 12 monthly frequency distributions were used for all forecast years.

10.3.4 Split Transactions by Transponder versus Video

The transactions were then further split into transaction type: transponder transactions versus video transactions. As described in Section 10.2.2, CDM Smith developed video transaction percentages by trip frequency by year. The video percentages were multiplied by the transactions (for the corresponding year and trip frequency) to obtain the number of video transactions, with the remaining proportion being the number of transponder transactions. The video percentages assume that both vehicle types would have same video percentages, and that the video percentage (for a given trip frequency) will remain constant across all 12 months within a forecast year.

10.3.5 Split Transponder Transactions into Frequency Bins

At this point in the calculation, the monthly transactions have been separated by vehicle type (passenger cars versus truck), by month, by trip frequency and by transaction type (video versus transponder). The transponder transactions were then further split into the following three toll rate categories:

- **Standard Toll Rate:** ETC transactions made by customers with trip frequency of 1 to 19 trips per month.
- **Low Discount (15%) Toll Rate:** ETC transactions made by customers with trip frequency of 20 to 39 trips per month.
- **High Discount (30%) Toll Rate:** ETC transactions made by customers with trip frequency of 40 to 100 trips per month.

10.3.6 Transaction Adjustments Based on Toll Price Elasticity

Section 10.2.3 contained a summary of the way toll elasticity factors were calculated for the toll discounts and toll surcharges. In this step, the number of transactions was adjusted up or down by toll rate category as follows:

<u>**Video Transactions**</u>

- **Surcharge Video Toll Rate:** Transactions in this toll rate category will be charged a surcharge of 40 percent of the base toll rate. Due to the 40 percent toll rate increase, PC transactions were decreased by approximately 13 percent, and CV transactions by approximately 10 percent.

Transponder Transactions

- **Standard Toll Rate:** ETC transactions in this category had monthly trip frequencies of 1 to 19 trips per month. Customers in this category pay the standard toll rate, and do not receive any toll discounts. The transactions in this category were not adjusted because there was no change in the toll rates.

- **Low Discount (15%) Toll Rate:** ETC transactions in this category had monthly trip frequencies of 20 to 39 trips per month. PC customers in this category will receive a 15 percent discount on the standard toll rate. Due to the 15 percent toll rate decrease, PC transactions were increased by approximately six percent.

- **High Discount (30%) Toll Rate:** ETC transactions in this category had monthly trip frequencies of 40 or more trips per month. PC customers in this category will receive a 30 percent discount on the standard toll rate. Due to the 30 percent toll rate decrease, PC transactions were increased by approximately 13 percent.

The transaction adjustments for PC and CV were calculated separately, using the toll elasticities for each vehicle type. The outputs of this step were the elasticity-adjusted transactions by vehicle type (passenger cars versus truck), by month, by trip frequency, by toll rate category.

10.3.7 Calculate Revenues with Toll Rate Discounts/Surcharges

To obtain the estimated toll revenue inclusive of the toll discounts and surcharges, the elasticity-adjusted monthly transactions were multiplied by the relevant toll rate type (standard, low discount, high discount or surcharge rates) for the corresponding vehicle class (PC or CV), forecast year and entry-exit points.

10.3.8 Calculate Monthly Invoice Fees

The number of invoices sent per month is a function of the number of video transactions in a frequency bin, divided by the number of monthly trips corresponding to that bin. For example, if there are 20,000 video transactions in the 8 transactions per month bin, then 2,500 invoices would be mailed to drivers in this category (20,000 ÷ 8 = 2,500). These 2,500 invoices would result in expected invoice fee revenue of $12,500 (2,500 × $5.00 = $12,500). The estimated number of monthly invoices generated per month is calculated for each frequency bin. The total number of invoices generated per month are then summed across all 12 months to estimate the annual number of invoices.

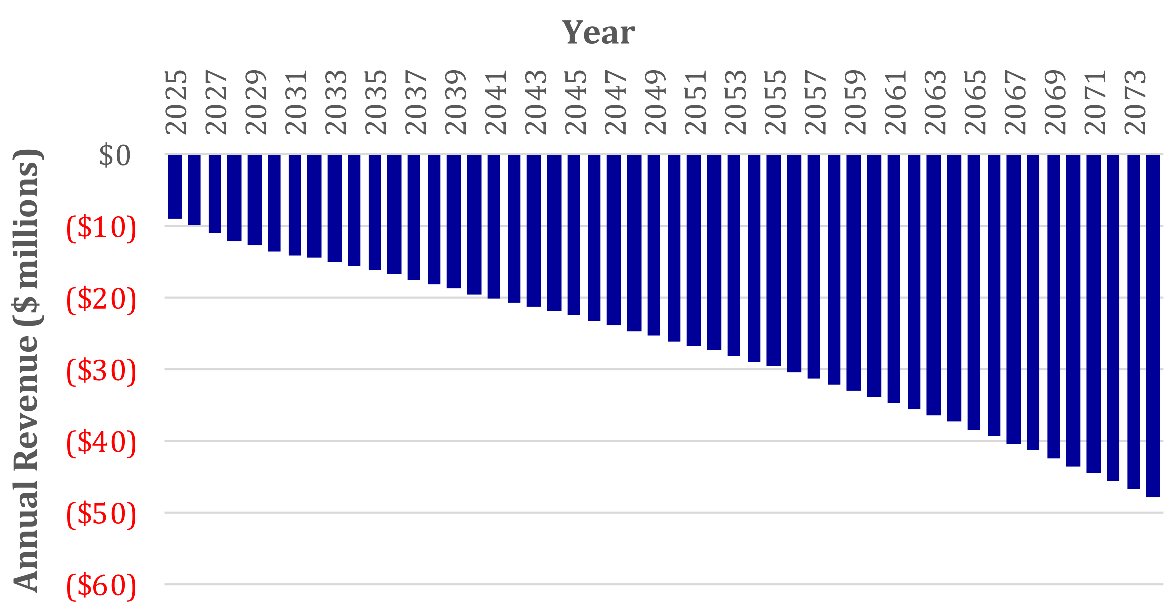
10.4 Toll Revenues with Discounts and Surcharges/Fees

Figure 10-5, Figure 10-6 and Figure 10-7 illustrate the annual revenue impacts due to the toll discounts, toll surcharge and invoice fees respectively. Similarly, Table 10-3 summarizes the toll revenue impacts and provides the total expected revenues before and after the discounts, surcharges and invoice fees are applied.

The first column in Table 10-3 contains the annual gross toll revenues (as were shown in Table 9-7 at the end of Chapter 9).

The second column in Table 10-3 has the negative toll revenue impact of providing the two-tiered discounts to passenger cars (this is the undiscounted minus the discounted transponder transaction revenue). Figure 10-5 illustrates the annual cost of the toll discounts and shows that the absolute revenue impact steadily increases over time from approximately $10 million in the opening year (2025) to nearly $48 million in the final forecast year (2074).

Figure 10-5 – Toll Discount Revenue Reduction



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F10-4 to F10-6) Revenue Impacts

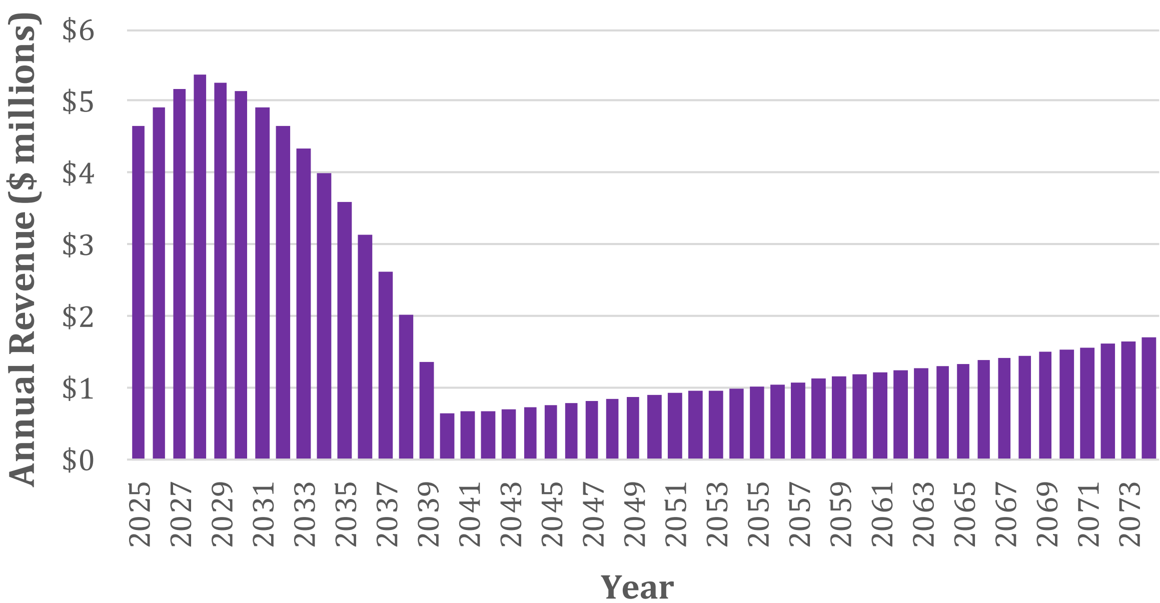
Table 10-3 – Annual Revenue Estimates with Discounts/Surcharges/Invoice Fees

Year	Gross Toll Revenues WITHOUT Discounts/ Surcharges/ Invoices	Toll Discount Revenue Reduction	Video Tolling WITH Surcharge Revenue Increase	Monthly Invoice Fee Revenue	Overall Revenue Impact	Gross Toll Revenues WITH Discounts/ Surcharges/ Invoices
2025	$106.3	($8.0)	$5.8	$5.9	$3.7	$110.0
2026	$118.1	($8.9)	$6.1	$6.0	$3.2	$121.3
2027	$130.7	($10.0)	$6.3	$6.1	$2.4	$133.1
2028	$144.4	($11.1)	$6.5	$6.1	$1.5	$145.9
2029	$151.6	($11.7)	$6.3	$5.8	$0.4	$152.0
2030	$159.0	($12.4)	$6.1	$5.4	($0.9)	$158.1
2031	$165.3	($12.9)	$5.8	$5.0	($2.1)	$163.2
2032	$171.7	($13.4)	$5.4	$4.5	($3.5)	$168.2
2033	$178.3	($13.9)	$5.0	$4.0	($4.9)	$173.4
2034	$185.3	($14.4)	$4.5	$3.6	($6.3)	$179.0
2035	$192.5	($15.0)	$4.0	$3.1	($7.9)	$184.6
2036	$200.0	($15.6)	$3.4	$2.6	($9.6)	$190.4
2037	$207.8	($16.2)	$2.8	$2.1	($11.3)	$196.5
2038	$216.0	($16.8)	$2.2	$1.5	($13.1)	$202.9
2039	$224.5	($17.5)	$1.4	$1.0	($15.1)	$209.4
2040	$233.2	($18.2)	$0.7	$0.5	($17.0)	$216.2
2041	$240.3	($18.7)	$0.7	$0.5	($17.5)	$222.8
2042	$247.4	($19.3)	$0.7	$0.5	($18.1)	$229.3
2043	$255.0	($19.9)	$0.7	$0.5	($18.7)	$236.3
2044	$262.5	($20.5)	$0.8	$0.5	($19.2)	$243.3
2045	$270.4	($21.1)	$0.8	$0.5	($19.8)	$250.6
2046	$278.5	($21.7)	$0.8	$0.5	($20.4)	$258.1
2047	$286.9	($22.3)	$0.8	$0.5	($21.0)	$265.9
2048	$295.5	($23.0)	$0.8	$0.5	($21.7)	$273.8
2049	$304.4	($23.7)	$0.9	$0.5	($22.3)	$282.1
2050	$313.6	($24.4)	$0.9	$0.5	($23.0)	$290.6
2051	$321.9	($25.1)	$0.9	$0.5	($23.7)	$298.2
2052	$330.5	($25.7)	$0.9	$0.5	($24.3)	$306.2
2053	$339.4	($26.4)	$1.0	$0.5	($24.9)	$314.5
2054	$348.4	($27.1)	$1.0	$0.5	($25.6)	$322.8
2064	$451.8	($35.1)	$1.3	$0.5	($33.3)	$418.5
2074	$580.9	($45.2)	$1.7	$0.5	($43.0)	$537.9

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: T10-3) Disc Revenue Impacts

The third column in Table 10-3 contains the toll revenue increase resulting from the video tolling surcharge. Figure 10-6 illustrates the annual revenue increase due to the toll surcharge. The graph shows that in the first six years of operation, the video tolling surcharge would increase revenues by approximately $5 million annually. However, after Year 2031, the surcharge revenue quickly drops, as the percentage of video transactions decreases toward one percent. By 2040, the toll surcharge decreases to less than $1 million. Due to toll rate increases, the surcharge revenue slowly increases again, and is approximately $1.7 million in the final forecast year (2074), partly due to the toll rate increase.

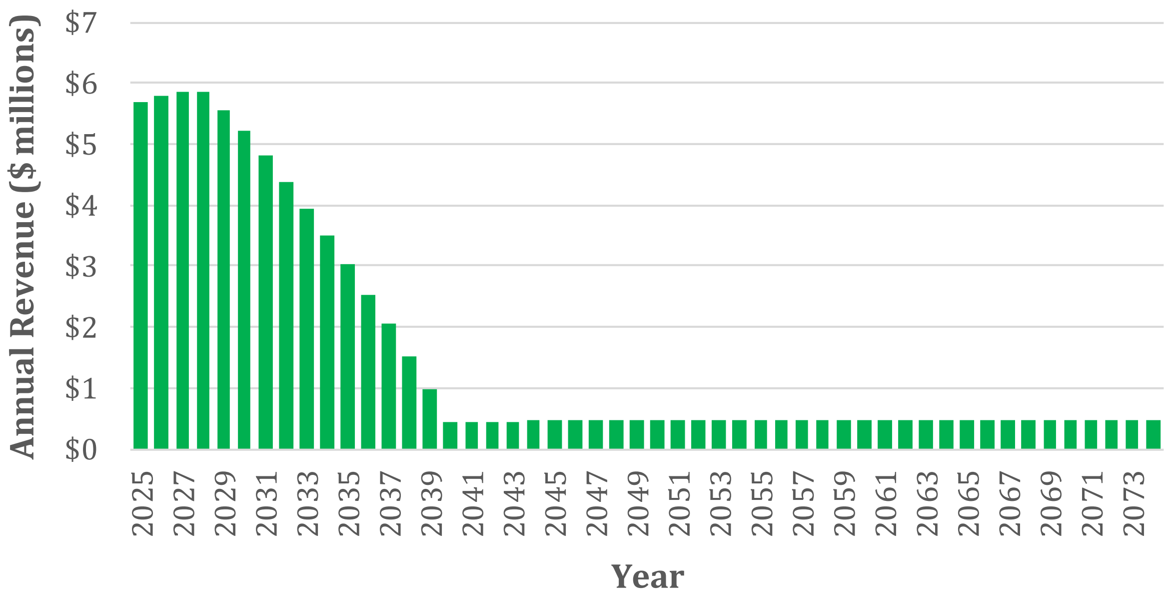
Figure 10-6 – Video Tolling Surcharge Revenue



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F10-4 to F10-6) Revenue Impacts

The fourth column in Table 10-3, contains the toll revenue increase resulting from the $5.00 monthly invoice fee (for video tolling customers). Figure 10-7 illustrates the estimated annual invoice fee revenue. Like the video surcharge revenues, the invoice fee revenue quickly decreases after first few years of operation. However, because the $5.00 invoice fee cannot be increased, the invoice fee revenue remains essentially flat after the year 2040. Between 2040 and 2074, the invoice fee revenue is estimated at approximately one-half million dollars annually.

Figure 10-7 – Invoice Fee Revenue



Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / Tab: F10-4 to F10-6) Revenue Impacts

The final column in Table 10-3 shows the annual gross toll revenue inclusive of the discounts, surcharges and invoice fees. The overall revenue impact of the toll discounts, surcharges and invoice fees is slightly positive in the first three years (2025-2027). The higher percentage of video transactions (with a 40 percent surcharge) in these years increases the overall revenue, relative to the reduction in revenue from the toll discounts. However, by the fourth year (2028), the cost of the toll discounts outweighs the revenue gain from the toll surcharges. The annual discount/surcharge/invoice revenues are progressively lower relatively to the non-discounted revenues. By 2040 and all years thereafter, the annual discount/surcharge/invoice revenues are approximately eight percent lower than the non-discounted revenues.

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Chapter 11 – Net Toll Revenue Estimates

This chapter provides estimates of toll collection costs on the I-10 MRB&B, both capital costs and annual operations and maintenance (O&M) costs. The toll collection O&M costs and roadway O&M costs are used to calculate "net" annual toll revenues for the I-10 MRB&B project. The prior chapter (Chapter 10) provided the estimated gross toll revenues with frequent-user discounts and video customer surcharges/invoice fees. The net toll revenues, are the revenues remaining after deducting the O&M costs. The net toll revenues are available to make interest and principal payments, and for other financial purposes.

These toll collection cost estimates assume that the I-10 MRB&B will be operated as an all-electronic toll (AET) collection system. On an AET facility, there are gantries (like roadway sign structures) located over the roadway at each toll collection point, which are mounted with transponder readers and cameras. Drivers do not stop at the toll collection points. Regular drivers will establish a toll account and use a windshield-mounted transponder to make toll payments. As noted in Chapter 10, ALDOT intends to establish a transponder system for the I-10 MRB&B project to be named "*algo-pass*." For drivers without a toll account, they may pay via video-tolling. Cameras mounted on the toll gantries will capture an image of their license plate. The license plate number is then sent to the Department of Motor Vehicles (DMV) in the relevant state to obtain the vehicle owner's registered name and address. An invoice will then be mailed to drivers, and they may pay online or mail a check or money-order.

The toll collection capital and O&M cost estimates assume that the I-10 MRB&B concessionaire will outsource the toll collections equipment maintenance and toll transaction processing functions (including license plate image review and the mailing of video toll invoices) to a vendor (for a fixed fee per transaction). The concessionaire will still need to cover the costs of staffing and operating two Customer Service Centers (CSCs): one on the Mobile County end of the project, and one on the Baldwin County end of the project.[35]

[35] Two CSCs are required, per the Concessionaire Agreement

11.1. Capital Costs

This section provides capital cost estimates for both: the initial design and construction costs, as well as the ongoing renewal & replacement (R&R) costs. The concessionaire of the I-10 MRB&B project will be at liberty to determine the type of toll collections equipment used and the exact toll gantry locations. The capital costs of the toll collection system contained herein are based on one possible toll plan that would include toll gantries on 8 ramps and at one mainline location (one mainline gantry per direction). This configuration includes 10 total gantry structures, that cover 16 mainline lanes and 18 shoulder lanes (34 lanes total).

11.1.2 Construction Capital Costs

Table 11-1 has a summary of the estimated capital costs to install an AET collection system on the I-10 MRB&B for "Outsourced" toll operations. Outsourced, in this context, means that the toll transaction processing activities will be handled by an outside vendor, hired by the concessionaire. These estimates assume that the concessionaire will pay the vendor a fixed-fee per transaction for the processing services. Therefore, the concessionaire will not need to purchase equipment and hire staff dedicated to toll processing functions. The table shows the initial cost to design and construct the toll collection system for the assumed 2025 opening year. The detailed capital cost estimates are provided in Appendix D.

Table 11-1 – 2025 Capital Costs Estimate

Capital Cost Category	Cost in 2025 Dollars
Toll Zone Lane Equipment	$3,649,350
CSC Equipment	$168,550
Common Equipment	$187,470
Communications System	$146,450
System Software	$1,130,640
Spare Equipment	$161,350
Civil Engineering Costs	$1,717,960
Services	$1,919,410
Contingency (10%)	$908,120
GRAND TOTAL	$9,989,300

Source File: ALDOT I-10 Mobile --Toll Collection CAPITAL+R&R COSTS, Scenario 5f 04-24-2018 v1.2.xlsx

11.1.3 Renewal & Replacement Capital Costs

Once the toll facility has been constructed and is operational, the toll collection equipment must be routinely repaired, replaced and upgraded. These ongoing toll collection capital costs are referred to as renewal and replacement (R&R) costs, or alternatively as lifecycle costs. Table 11-2 contains the annual toll operation R&R cost estimates for the years 2025 through 2074.

For these R&R cost estimates, CDM Smith assumed that the entire toll collection system will need to be replaced every 10 years, due to system "wear and tear" and the availability of technologically-superior equipment. Within these estimates, the decennial "system refresh" costs occur in Years 2035, 2045, 2055 and 2065. The "system refresh" costs consist of the initial 2025 construction costs, escalated to nominal year dollars. However, they only include 30 percent of the initial 2025 civil engineering costs; it is assumed that items under this cost category, such as the concrete toll gantry foundations, fiber optic conduit and other infrastructure elements will not need replacement in the succeeding years. Between these decennial "system refresh" years, the R&R costs consist solely of "spare parts." For example, in 2035, the system refresh is estimated at $9.6 million. However, in the following year, 2036, which consists solely of spare parts, the R&R cost is only $200 thousand. All of these R&R cost estimates assume that the I-10 MRB&B project (and the configuration of its toll collection system) remain the same, and that there are no physical or tolling expansions of the I-10 MRB&B project described herein.

Table 11-2 – Renewal & Replacement Cost Estimates (in nominal year dollars)

YEAR	Lane Equipment	CSC Equipment	Common Equipment	Communications System	System Software	Spare Equipment	Civil Costs	Services	ANNUAL TOTAL
2025	$3,649,350	$168,550	$187,470	$146,450	$1,130,640	$161,350	$1,717,960	$1,919,410	$9,081,180
2026						$164,580			$164,580
2027						$167,870			$167,870
2028						$171,230			$171,230
2029						$174,650			$174,650
2030						$178,140			$178,140
2031						$181,700			$181,700
2032						$185,330			$185,330
2033						$189,040			$189,040
2034						$192,820			$192,820
2035	$4,449,000	$205,000	$229,000	$179,000	$1,378,000	$196,680	$628,200	$2,340,000	$9,604,880
2036						$200,610			$200,610
2037						$204,620			$204,620
2038						$208,710			$208,710
2039						$212,880			$212,880
2040						$217,140			$217,140
2041						$221,480			$221,480
2042						$225,910			$225,910
2043						$230,430			$230,430
2044						$235,040			$235,040
2045	$5,423,000	$250,000	$279,000	$218,000	$1,680,000	$239,740	$765,900	$2,852,000	$11,707,640
2055	$6,610,000	$305,000	$340,000	$265,000	$2,048,000	$292,240	$933,600	$3,477,000	$14,270,840
2065	$8,058,000	$372,000	$414,000	$323,000	$2,496,000	$356,220	$1,137,900	$4,238,000	$17,395,120
2074						$425,710			$425,710

Source File: ALDOT I-10 Mobile --Toll Collection CAPITAL+R&R COSTS, Scenario 5f 04-24-2018 v1.2.xlsx

11.2. Toll Collection O&M Cost Inputs & Assumptions

Calculating the toll collection O&M costs is a multi-step process. This section outlines the input data required and the cost assumptions. The next section contains a summary of the calculation procedure with a detailed example for one forecast year (2030). Year 2030 has been selected as an example year because it is shortly after the toll "ramp up" will expire, and it is one of the years for which a travel demand model was developed.

11.2.1 Transactions and Revenue Inputs

These toll collection cost estimates require that the annual transactions and revenue estimates are provided separately for transponder and video transactions. Video transactions have higher processing costs. Within the same transaction type (transponder or video), all vehicles will cost the same to process, regardless of whether the vehicle is a passenger car or truck.

11.2.2 Number of Video Tolling Images

The number of video tolling images (i.e., license plate images) to process will arise from two sources:

1. **Video transactions:** These are vehicles without a *algo-pass* or other interoperable transponder. The license plates of these vehicles must be identified through video tolling images in order to be billed. The annual number of video tolling images in this category is equal to the annual number of video transactions (as estimated in Chapter 10), which CDM Smith assumes will vary between approximately 30 percent and 1 percent of all transactions.

2. **Transponder transaction failures:** A small proportion of transponder transactions will fail due to the inability of the readers mounted on the toll gantries to capture the in-vehicle transponder's radio-frequency identification (RFID) tag information. The annual number of video tolling images in this category is 0.1 percent of all transponder transactions.

The sum of these two categories becomes the total number of video images to process. All video images are initially processed through optical character recognition (OCR) software. These estimates assume that 85 percent of all license plate numbers will be successfully read by the OCR software. However, the remaining 15 percent must be manually reviewed by a person, and the license plate number keyed into a computer. These estimates assume that 98 percent of the license plate numbers will be successfully captured through manual review, but that 2 percent of the 15 percent of manually-reviewed transactions (or 0.3 percent of all video images) will be blank or unreadable. Tolls cannot be collected from these so-called "bad images," and thus constitute one source of revenue leakage.

11.2.3 Cost Categories and Assumptions

Once the gross T&R are estimated, and the transponder/video split has been calculated, the toll collection O&M costs can be calculated. CDM Smith has identified seven toll collection O&M cost categories:

1. Transaction processing
2. License Plate Registration Information Retrieval
3. Invoice Printing and Mailing
4. Credit Card Processing Fees
5. Transponders
6. Customer Service Center
7. Revenue Leakage

Table 11-3 lists each cost category and the specific assumptions within those categories. Some assumptions are percentages, while others are specific dollar amounts. The percentage assumptions are fixed in all years (2025 through 2074). The dollar amount costs were initially estimated in 2017 dollars, and then the costs were inflated by 2.0 percent per year (half a percent lower than the toll escalation rate, see Chapter 9). Section 11.3 discusses each cost category, and the assumptions within each, in greater detail.

Table 11-3 – Assumptions Summary

Category	Cost Category Description	Assumption Amount (2017 Dollars)	Assumption Units
1	**Transaction processing costs**	-	
1A	*Transponder transactions*	*$0.055*	*per transaction*
1B	*Video transactions*	*$0.400*	*per transaction*
2	**License Plate Registration Information Retrieval costs**	-	
2A	*In-State (Alabama) Vehicles*	*$1.00*	*per unique vehicle per month*
2B	*Out-of-State Vehicles*	*$1.00*	*per unique vehicle per month*
3	***Invoice Printing and Mailing costs***	*$0.80*	*per unique video customer per month*
4	**Credit Card Processing Fees**	-	
4A	*Proportion of Toll Revenue Paid via credit card*	*70.0%*	*of total toll revenue*
4B	*Credit Card Processing Fee*	*2.2%*	*of toll revenue paid via credit cards*
5	**Transponder Sales Revenue and Costs**	-	
5A	*Wholesale cost of transponder*	*$3.00*	*cost per transponder*
5B	*Amount charged to customers to purchase transponder*	*$5.00*	*cost per transponder*
6	**Customer Service Center costs**	-	
6A	*Staffing Costs*	*$1,177,600*	*per year (in 2017 dollars)*
6B	*Office lease, office equipment, etc.*	*$468,000*	*per year (in 2017 dollars)*
7	**Revenue Leakage**	-	
7A	*ETC Toll Non-Payment Proportion*	*1.0%*	*of transponder transaction revenue*
7B	*Transponder reading failure*	*0.003%*	*of transponder transaction revenue*
7C	*Video Toll Non-Payment Proportion*	*30.0%*	*of video transaction revenue*
7D	*Invalid license plate registration information*	*5.0%*	*of video transaction revenue*
7E	*Unreadable video tolling images*	*0.3%*	*of video transaction revenue*

Source File: I-10 Mobile--NET Toll Revenue-Scenario 5f--Two-Tier Discounts, PC only v6.0 REPORT.xlsx

11.2.3 Toll Collection O&M Cost Estimate

This section provides more details on each cost category: the assumptions used and how it was calculated. To illustrate these calculations, the Year 2030 O&M estimates are used as an example. Table 11-4 shows the 2030 O&M toll collection costs by category.

Table 11-4 – 2030 Toll Collection Costs

Category	Cost Category Description	Assumption Amount (2030 Dollars)	Assumption Units	2030 Transactions or Amount	2030 Total Cost
1	**Transaction processing costs**	-		-	-
1A	*Transponder transactions*	*$0.071*	*per transaction*	*19,568,000*	*$1,392,000*
1B	*Video transactions*	*$0.517*	*per transaction*	*3,286,000*	*$1,700,000*
2	**License Plate Registration Information Retrieval costs**	-		-	-
2A	*In-State (Alabama) Vehicles*	*$1.29*	*per unique vehicle per month*	*668,000*	*$863,000*
2B	*Out-of-State Vehicles*	*$1.29*	*per unique vehicle per month*	*413,000*	*$534,000*
3	***Invoice Printing and Mailing costs***	*$1.04*	*per unique video customer per month*	*1,081,000*	*$1,119,000*
4	**Credit Card Processing Fees**	*1.5%*	*of total toll revenue paid via credit cards*	-	-
4A	*Proportion of Toll Revenue Paid via credit card*	*70.0%*	*of total toll revenue*	*13,697,000*	*$110,760,000*
4B	*Credit Card Processing Fee*	*2.2%*	*of toll revenue paid via credit cards*	-	*$2,437,000*
5	**Transponder Sales Revenue and Costs**	-		-	-
5A	*Wholesale cost of transponder*	*$3.88*	*cost per transponder*	*8,000*	*$33,000*
5B	*Amount charged to customers to purchase transponder*	*$5.52*	*cost per transponder*	*8,000*	*-$46,000*
6	**Customer Service Center costs**	-		-	-
6A	*Staffing Costs*	*$1,177,600*	*per year (in 2017 dollars)*	*n/a*	*$1,523,000*
6B	*Office lease, office equipment, etc.*	*$468,000*	*per year (in 2017 dollars)*	*n/a*	*$605,000*
7	**Revenue Leakage**	-		-	-
7A	*ETC Toll Non-Payment Proportion*	*1.0%*	*of transponder transaction revenue*	*196,000*	*$1,195,000*
7B	*Video Toll Non-Payment Proportion*	*30.0%*	*of video transaction revenue*	*986,000*	*$11,633,000*
7C	*Invalid license plate registration information*	*5.0%*	*of video transaction revenue*	*164,000*	*$1,939,000*
7D	*Unreadable video tolling images*	*0.3%*	*of video transaction revenue*	*10,000*	*$116,000*
7E	*Transponder reading failure*	*0.003%*	*of transponder transaction revenue*	*1,000*	*$200*
		2030 Total Toll Collection O&M Costs			**$25,043,200**

Source File: I-10 Mobile--NET Toll Revenue-Scenario 5f--Two-Tier Discounts, PC only v6.0 REPORT.xlsx / Tab: 8) 2030 Cost Summary

11.3.1 Transaction Processing Costs

It is assumed that the I-10 MRB&B concessionaire will outsource toll transaction processing to an outside vendor, and the vendor contract will charge a fixed processing fee per transaction. The assumed costs per transaction (in 2017 dollars) are as follows:

- Transponder transactions: $0.055 (5.5¢) per transaction
- Video transactions: $0.40 per transaction

The processing costs within each transaction type are the same regardless of vehicle type. The transponder and video transaction processing costs include the labor cost of inspecting and maintaining the roadside toll collection equipment. These per transaction costs are assumed to increase in cost by 2 percent per year. The higher cost for video transactions is due, in large part, to the need for manual review of a portion of the license plate images. In 2030, these processing costs will rise to 7.1-cents and 51.7-cents respectively. The 2030 total annual toll processing costs are estimated at $3,062,000 ($1,374,000 and $1,688,000 respectively).

11.3.2 License Plate Registration Information Retrieval Costs

For all video transactions, the owner's name and mailing address must be obtained through the DMV from the state corresponding to the license plate. CDM Smith has assumed that the cost to obtain ("look up") the registration information of any vehicle, whether registered with Alabama or out-of-state license plates, will be $1.00 per vehicle (in Year 2017 dollars). In 2030, the cost per out-of-state license plate look-up is assumed to rise to $1.29. There will be an estimated 1.2 million "look-ups" for the I-10 MRB&B project in 2030, resulting in a cost of 534 thousand dollars.[36]

11.3.3 Invoice Printing and Mailing Costs

As noted in Chapter 10, invoices will be mailed to video customers on a monthly calendar basis (for all of the transactions accrued during the prior calendar month). For each year, CDM Smith estimated the number of unique video customers per month from the StreetLight Data frequency metrics. The twelve monthly estimates were then summed to derive the total number of unique monthly customers per year. CDM Smith assumed that the total cost of printing and mailing each invoice is $0.80 in 2017 dollars. To obtain the annual printing/mailing costs per year, CDM Smith multiplied the total number of unique monthly video customers by the printing/mailing unit cost (in nominal year dollars).

[36] In-state (Alabama) and out-of-stated license plates "look-up" costs are shown separately. Based on an analysis of StreetLight Data frequency metrics, CDM Smith estimated that 62 percent of video transaction vehicles will be Alabama residents, while the remaining 38 percent will be out-of-state residents.

In 2030, the per-piece mailing cost is assumed to increase from $0.80 (in 2017 dollars) to $1.04 (in 2030 dollars). CDM Smith estimates that just under 1.1 million invoices will be mailed in 2030, resulting in a total 2030 mailing cost of $1.1 million.

11.3.4 Credit Card Processing Fees

CDM Smith has assumed that 70 percent of all toll revenue will be paid via credit card, and that the credit card processing fee will be 2.2 percent of that revenue. Thus, 1.54 percent of the total toll revenue will be paid toward credit card fees. The remaining 30 percent of the toll revenue will be paid via check (through the mail) or check or cash at one of the two I-10 MRB&B Customer Service Centers.

In 2030, the total gross revenue is $108.6 million; 70 percent of this amount is $76.0 million. Thus, the 2030 credit card processing fees will be approximately $1.7 million (2.2 percent of $76.0 million).

11.3.5 Transponder Sales Revenue and Costs

The transponder category, unlike the other categories, has both cost and income components. Overall, the transponder category is expected to generate net income. CDM Smith has assumed that the vast majority of *algo-pass* transponders sold will be the 6C type of “sticker” tag, and that these transponders will have a wholesale cost of $3.00 each (in 2017 dollars). The I-10 MRB&B concessionaire may, by Alabama Code,[37] charge up to $20.00 per transponder (the fee is capped at $20.00 in nominal year dollars and may not be increased with inflation). However, due to the lower amounts charged for transponders by surrounding states (in particular Florida), CDM Smith has assumed that the concessionaire will charge $5.00 (in 2017 dollars, increased by 2 percent annually). Thus, generating net income of $2.00 per transponder (in 2017 dollars). Based on the StreetLight Data frequency metrics, CDM Smith has estimated that each transponder will, on average, be used for 70 transactions on the I-10 MRB&B per year. For estimation purposes, the total number of transponders purchased is a function of the total number of transponder transactions per year. Thus, in the opening year, the largest number of the transponders will be purchased. In each succeeding year, the number of transponders purchased depends on the net increase in the number of transactions (over the prior year). A new transponder is sold for every 70 additional transactions in the succeeding year.

In the 2025 opening year, an estimated 240 thousand I-10 MRB&B transponders will be sold. However, by 2030, the number sold will be only 8,500 (less than five percent the number that were sold in the opening year). In 2030, the wholesale cost is assumed to be $3.88, while the

[37] 2017 Code of Alabama, Title 23 (HIGHWAYS, ROADS, BRIDGES AND FERRIES), Chapter 2 (TOLL ROADS, BRIDGES AND FERRIES), Article 6 (Electronic Toll Collection Act). Passed as Act 2017-375, §1

amount charged to customers will be $5.52. This results in a net income of $1.64 per transponder, and 2030 overall transponder income of $14,000.

11.3.6 Customer Service Center

Under the concession agreement the I-10 MRB&B concessionaire shall operate two Customer Service Centers (CSCs). The CSC cost category consists of two cost subcategories: staffing and office. Table 11-5 shows the estimated staffing costs of operating the two CSCs; while Table 11-6 shows the estimated office costs. Both tables show the unit costs of each item in 2017 dollars, the number of each item required (staff persons, cell phones, etc.). To the right of the unit costs are the total costs in both 2017 dollars and 2030 dollars. CDM Smith assumes all of these costs will inflate two percent per year. In 2017 dollars, the estimated staffing costs are $1.2 million, and the office costs are $468 thousand; for a total cost of approximately $1.65 million. By 2030, it is assumed these costs will increase by 30 percent to $2.1 million ($1.5 million plus $600 thousand).

Table 11-5 – Customer Service Centers – Annual Staffing Costs

Staff Position	2017 Cost Per Staff Person (Salary plus Benefits)	Number of Full-Time Staff Required	2017 Total Staffing Costs	2030 Total Staffing Costs
General Manager	$176,000	1	$176,000	$228,000
Finance Manager	$144,000	1	$144,000	$186,000
Admin Assistant	$81,600	1	$81,600	$106,000
Systems Admin	$160,000	1	$160,000	$207,000
Supervisors	$109,600	2	$219,200	$284,000
AET CSRs	$56,000	4	$224,000	$290,000
Tag Inventory/Store Front Personnel	$43,200	4	$172,800	$224,000
Total Annual Staffing Costs			**$1,177,600**	**$1,525,000**

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / **Tab:** T11-5) CSC Staffing

Table 11-6 –Customer Service Centers – Annual Office Costs

Customer Service Center items	2017 Annual Cost	Number Required	2017 Total Office Costs	2030 Total Office Costs
Office Leases	$120,000	2	$240,000	$310,000
Cell Phones	$6,000	6	$36,000	$47,000
Office Equipment Lease	$30,000	2	$60,000	$78,000
Utilities & Facility Maintenance	$66,000	2	$132,000	$171,000
Total Annual CSC Office Costs			**$468,000**	**$606,000**

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / **Tab:** T11-6) CSC Office Costs

11.3.7 Revenue Leakage

Revenue Leakage is the toll revenue lost to technical malfunctions or toll evasion. CDM Smith has identified five potential sources of revenue leakage on the I-10 MRB&B:

1. **Transponder Toll Non-Payment:** This is the first subcategory of non-payment of tolls. In the case of transponders, customers may have purchased an *algo-pass* transponder, established an *algo-pass* toll account and added funds to the account. However, at some point, their account balance becomes negative as they continue to drive on the I-10 MRB&B, accrued transactions/tolls, but do not replenish their account with additional funds. (The same situation may arise with interoperable transponders as well.) CDM Smith has assumed that one percent of expected transponder-based revenue will be lost to this type of revenue leakage. In 2030, this will result in revenue leakage of approximately $1.2 million on the I-10 MRB&B. The concessionaire may be entitled to charge fines and/or turn the account over to a debt collection agency in order to recoup some of this revenue loss. However, CDM Smith has not assumed any of the recouped funds in its revenue leakage estimate.

2. **Video Toll Non-Payment:** This is the second subcategory of non-payment of tolls (including surcharges, fees, penalties and fines). Drivers that do not have a transponder are automatically deemed video customers. Of these video customers, CDM Smith estimates that 30 percent will not pay, despite fines and fees, and the potential suspension of their license. Since it is unlikely that Alabama will be able to suspend the licenses of out-of-state drivers, many of these non-paying video customers will be out-of-state drivers. In 2030, this source of revenue loss will amount to an estimated $11.6 million (30 percent of $38.7 million in expected video customer revenue). The concessionaire may be entitled to charge late-payment fines and/or turn the transactions over to a debt collection agency in order to recoup some of this revenue loss. However, CDM Smith has not assumed any of the recouped funds in its revenue leakage estimate (see Section 11.4.4).

3. **Invalid License Plate Registration Information:** For video customers, once a license plate state and number are obtained from the video tolling images, that license plate number must be submitted to the relevant DMV agency to obtain the vehicle owner's name and address. CDM Smith estimates that 5 percent of vehicle license plate registration information will be unavailable or invalid: either the DMV has no registration record for that license plate number, or the registration address is no longer valid (and the mailed invoice is returned). Consequently, I-10 MRB&B tolls cannot be collected from these video customers. In 2030, this source of revenue loss will amount to an estimated $1.9 million (5 percent of $38.8 million in expected video customer revenue).

4. **Unreadable Video Tolling License Plate Images:** An estimated 0.3 percent of video tolling images will be "bad images" from which the license plate number cannot be obtained. In 2030, this source of revenue loss will amount to an estimated $116 thousand (0.3 percent of $38.7 million in expected video customer revenue).

5. **Transponder Failure *plus* Unreadable License Plate Images:** The final source of revenue leakage is, by far, the smallest. As described in Section 11.2.2, a small portion of transponder reads will fail (0.1 percent). This will result in these failed-transponder transactions being treated as a video toll, until the license plate number can be matched against the license plate numbers in the transponder accounts database. However, as noted above, a small proportion of video images will fail as well. When both failures occur in succession, the I-10 MRB&B will be unable to collect a toll for this transaction. These are estimated to represent just three ten-thousandths (0.0003 percent) of all transponder transactions. In 2030, this source of revenue loss will amount to an estimated $200.

11.4 Costs Not Included in Estimates

CDM Smith sought to make the toll collection O&M costs as detailed and inclusive as possible. However, there are four costs which have been specifically excluded, and are being addressed by the Client elsewhere: Insurance, Contingency Costs, Oversight Staffing Costs, Toll Fines and Penalties.

11.4.1 Insurance

The Concessionaire will be required to purchase property, liability and other types of insurance. Insurance costs are not included in the estimates contained in this chapter.

11.4.2 Contingency

CDM Smith typically includes a contingency of 20 percent in its toll collection cost estimate. However, ALDOT's Financial Advisor for the I-10 MRB&B project has included similar contingency costs in its risk analysis. Therefore, no contingency costs are included in this cost estimate.

11.4.3 Oversight Staffing Costs

For Toll Roads/Bridges operated by a concessionaire, the project owner (ALDOT in this case) will have internal staff or consultants to oversee the toll operations. This is not a cost that the concessionaire shall be required to cover. Thus, it is not included in the toll collection O&M cost estimates. However, it is a cost that will be borne by a State of Alabama agency (if not ALDOT itself). Table 11-7 provides a detailed cost estimate for this oversight staff (in 2017 dollars).

Table 11-7 – 2017 Oversight Staffing and Miscellaneous Costs

	Staff Position/Item	Quantity	Type	2017 Cost (Staff Costs include benefits)
Staff	General Manager	1	full-time employee	$176,000
	Finance Manager	1	full-time employee	$144,000
	Administrative Assistant	1	full-time employee	$80,000
	Accountant	1	full-time employee	$104,000
Miscellaneous	Office Lease	1	per year	$30,000
	Cell Phones	2	per year	$3,000
	Office Equipment Lease	1	per year	$9,000
	Vehicle Leases & Insurances	1	per year	$13,200
	Utilities	1	per year	$9,600
Total				**$568,800**

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / **Tab:** T11-7) ALDOT Oversight Staff

11.4.4 Fines and Penalties

The I-10 MRB&B concessionaire may be permitted to charge additional fines and penalties to customers who do not pay video tolling invoices on-time, have negative transponder account balances, or other types of toll violations. The toll collection O&M cost estimates contained herein do not include any of these possible fines and penalties.

11.5 Net Toll Revenue Estimates

The annual net toll revenues on the I-10 MRB&B were determined by subtracting the Toll O&M Costs and Bridge/Roadway O&M Costs from the gross toll revenues. The net toll revenues do not include capital or R&R costs. The toll collection costs do not include any additional positive revenue that may be gained from charging customers violations fines, late payment fees and other fines/fees. Table 11-8 summarizes the net toll revenues.

Table 11-8 – Gross and Net Toll Revenues

Year	Gross Toll Revenue	Toll Collection Costs	Revenue Leakage	Net Toll Revenue
2025	$110.0	($7.5)	($14.3)	$88.2
2026	$121.3	($8.2)	($14.9)	$98.2
2027	$133.1	($8.7)	($15.4)	$109.0
2028	$145.9	($9.1)	($15.8)	$121.0
2029	$152.0	($9.2)	($15.4)	$127.4
2030	$158.1	($9.3)	($14.9)	$133.9
2031	$163.2	($9.3)	($14.1)	$139.8
2032	$168.2	($9.2)	($13.3)	$145.7
2033	$173.4	($9.2)	($12.4)	$151.8
2034	$179.0	($9.1)	($11.4)	$158.5
2035	$184.6	($9.1)	($10.3)	$165.2
2036	$190.4	($9.0)	($9.2)	$172.2
2037	$196.5	($8.9)	($7.9)	$179.7
2038	$202.9	($8.8)	($6.6)	$187.5
2039	$209.4	($8.7)	($5.1)	$195.6
2040	$216.2	($8.5)	($3.6)	$204.1
2041	$222.8	($8.7)	($3.7)	$210.4
2042	$229.3	($9.0)	($3.8)	$216.5
2043	$236.3	($9.2)	($3.9)	$223.2
2044	$243.3	($9.4)	($4.0)	$229.9
2045	$250.6	($9.7)	($4.1)	$236.8
2046	$258.1	($9.9)	($4.2)	$244.0
2047	$265.9	($10.2)	($4.4)	$251.3
2048	$273.8	($10.4)	($4.5)	$258.9
2049	$282.1	($10.7)	($4.6)	$266.8
2050	$290.6	($11.0)	($4.7)	$274.9
2051	$298.2	($11.2)	($4.9)	$282.1
2052	$306.2	($11.5)	($5.0)	$289.7
2053	$314.5	($11.7)	($5.1)	$297.7
2054	$322.8	($12.0)	($5.3)	$305.5
2064	$418.5	($15.1)	($6.8)	$396.6
2074	$537.9	($18.8)	($8.6)	$510.5

Source File: I-10 Mobile--NET Toll Revenue-Scenario 5f--Two-Tier Discounts, PC only v6.0 REPORT.xlsx / Tab: 9a) NET Toll Rev ROUNDED

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Chapter 12 – Sensitivity Tests

The toll transactions and revenue shown in Chapters 8 through 11 reflect CDM Smith's forecasts that rely upon "base-case" assumptions. There are uncertainties in every forecast that stem, in part, from uncertainties in the underlying assumptions. Additionally, not all of the underlying assumptions affect the forecasts equally. To account for the potential variability in the base-case forecasts, CDM Smith conducted a variety of sensitivity tests on some of the underlying model assumptions. These tests identified the revenue impact of each variable one at a time and identified the level of impact on toll revenue. CDM Smith conducted both "low-side" and "high-side" sensitivity tests. The first section describes each test. The second section describes the results of the tests, and provides a relative ranking, based on the revenue impact of each test.

12.1 Description of Sensitivity Tests

The following ten assumptions were adjusted in the sensitivity tests. For the first eight assumptions, CDM Smith conducted both low and high-side sensitivity tests; for the final two assumptions, CDM Smith conducted only a high-side sensitivity test. Thus, there were 18 sensitivity tests conducted in each model year.

1. **Value of Time(VOT):** VOT measures a drivers' willingness to pay tolls. The VOTs used in the 2020 model ranged from 11-cents per minute to 19-cents per minute, depending upon the incomes in the origin and destination zones. These input values were based on the SP survey described in Chapter 5. CDM Smith tested if actual VOTs were lower or higher than the values estimated by the RSG survey. In the "low-side" test, CDM Smith decreased the VOT for each origin-destination pair in the model by 25 percent. Conversely, in the "high-side" test, CDM Smith increased the VOT for each origin-destination pair in the model by 25 percent.
2. **Vehicle Operating Cost (VOC):** VOC is the cost of operating a vehicle for one mile. As noted in Chapter 8, the 2020 passenger car VOC assumed in the base model was 22-cents per mile. CDM Smith tested if actual VOCs were lower or higher than assumed in the base model. In the "low-side" test, CDM Smith decreased the VOC by 25 percent (to 17-cents per mile). Conversely, in the "high-side" test, CDM Smith increased the VOC by 25 percent (28-cents per mile).
3. **Socioeconomic Forecasts:** The "trip generation" step of travel demand model relies upon spatially-disaggregated socioeconomic forecasts. The estimated number of households, employment and other socioeconomic measures in each traffic analysis zone (TAZ) are converted into estimated numbers of trips produced by or attracted to each TAZ (using trip generation formulas). In addition to the "base" socioeconomic forecasts used to develop the base-case travel demand model, Fishkind & Associates also produced "low growth" and "high growth" socioeconomic forecasts for the I-10 MRB&B study area.

CDM Smith tested if socioeconomic growth was lower or higher than assumed in the base model. In the "low-side" test, CDM Smith created 2020, 2030 and 2040 travel demand models based on the "low growth" socioeconomic forecasts. Conversely, in the "high-side" test, CDM Smith created 2020, 2030 and 2040 travel demand models based on the "high growth" socioeconomic forecasts.

4. **Toll Suppression:** As described in Section 8.3, the toll traffic and revenue estimates include the impacts of toll suppression, which is a reduction in traffic demand across Mobile Bay due to the increased cost of travel (due to the imposition of tolls on I-10). The base-case toll suppression was based on adding 5 percent of toll cost into the trip distribution step of the travel demand model (on the toll routes). For these sensitivity tests, the base-case toll suppression factor was varied. Specifically, for the "low side" test, the toll suppression factor was increased by 50 percent (to 7.5 percent of the toll rate), and for the "high side" test, the toll suppression factor was reduced by 50 percent (to 2.5 percent of the toll rate).
5. **Frequency of Use Distribution:** The monthly trip frequency distributions (based on StreetLight Data frequency metrics) are one of the three variable inputs to the toll discount/surcharge revenue impact calculation. The frequency distributions indicate what proportion of traffic crosses Mobile Bay a certain number of times per month. For these sensitivity tests, the monthly frequency distribution input file was altered. For the "high side" sensitivity test, CDM Smith used the "unadjusted" fitted Pareto distribution. This unadjusted distribution is skewed toward lower frequency trips, and has an average trip frequency of 4.5 trips per month (whereas the adjusted distribution used in the base forecasts has an average trip frequency of 9.1 trips per month). For the "low side" sensitivity test, CDM Smith further adjusted the Pareto distribution toward the higher monthly frequencies. This "low side" frequency distribution has an average trip frequency of 12.5 trips per month (versus 9.1 trips per month in the base-case frequency distribution).
6. **Percentage of Video Transactions:** As described in Section 10.2.2, CDM Smith assumed that video transactions would comprise approximately 20 percent of all transactions in the project opening year (2025), and that this would decrease to approximately 1 percent of all transactions in 2040. CDM Smith then used a Chi-squared distribution to allocate the video transactions among the monthly trip frequencies (1 to 100 trips per month). In the "high" video percentage sensitivity test, CDM Smith assumed that the percentage of video transactions would still decline over time, but would remain higher for the duration of the forecast period. In the "high" sensitivity test, video transactions comprise approximately 21 percent of all transactions in the project opening year (2025), decreasing to approximately 9 percent by 2040 (and all years thereafter). In the "low" video percentage sensitivity test, CDM Smith assumed that video transactions would be approximately 8 percent of all transactions in the 2025 opening year, and decline to 1 percent of all transactions by 2040 (and all years thereafter).
7. **Toll Price Elasticity:** As described in Section 10.2.3, the toll price elasticity factors indicate the percentage change in transactions in response to a one percent change in

price. The toll price elasticities were estimated by varying the toll price in the travel demand model and calculating the relationship between toll price and the toll revenue generated. In the base toll discount/surcharge revenue impact analysis, CDM Smith used half (50 percent) of the actual toll price elasticity values. In the "high" toll elasticity sensitivity test, CDM Smith used the actual toll price elasticity values estimated by the travel demand models. In the "low" toll elasticity sensitivity test, CDM Smith used toll price elasticity values that were one-quarter (25 percent) of the actual values.

8. **Annualization Factor (Revenue Days):** Annualization Factor is the number used to convert the transactions and revenue from daily to annual estimates. In the base-case estimates, CDM Smith used an annualization factor of 330. This factor assumed that on each weekday of the year the project would generate 100 percent of the daily revenue estimated by the model (260 weekdays), while weekend days would generate two-thirds (or 66 percent) of the daily revenue estimated by the model (105 weekend days, multiplied by 2/3 = 70 revenue days). The 260 weekday revenue days, and the 70 weekend revenue days, sum to 330 revenue days per year. CDM Smith tested if daily-to-annual factor was lower or higher than assumed in the base model. In the "low-side" test, CDM Smith decreased the Annualization Factor from 330 to 300 (a nine percent reduction). Conversely, in the "high-side" test, CDM Smith increased the Annualization Factor from 330 to 345 (a 4.5 percent increase).
9. **External Zone Growth Rates:** Traffic volumes on all external links (links that cross the outer perimeter of the model) must be specified directly. The I-10 MRB&B model contains 23 external zones. In the base year, the traffic volumes were established from recent traffic counts. To forecast the future year traffic volumes at the external zones, CDM Smith analyzed traffic volume growth at the external zones between 2005 and 2014. This period showed negative growth on a majority of the external zones. As reported in Chapter 6, CDM Smith assumed minimal positive growth of 0.2 percent on a majority of the external zones. In this sensitivity test, CDM Smith tested if actual traffic volume growth at the external zones were twice the growth rate forecast in the base-case model. At external zones where the assumed base-case growth rates were 0.2 percent, the growth rates were increased to 0.4 percent, with a similar doubling of growth rates at all other external zones. The only exception was at the external station on I-10 at the Mississippi State line, where the growth rate was increased from 0.2 to 1.0 percent. CDM Smith did not conduct a "low-side" sensitivity test for this assumption.
10. **Truck Growth Rates:** The I-10 MRB model contained separate trip tables for passenger cars and trucks. The growth rate in the truck trip tables (between the model years 2020 to 2030, and 2030 to 2040) were primarily a function of the socioeconomic growth rates (since truck trip generation relied primarily upon employment forecasts). CDM Smith tested if truck traffic volumes increased more quickly than overall traffic volumes. Specifically, CDM Smith increased the growth rate of the truck trip tables by 50 percent between 2020-2030 and between 2030-2040. The trucks grew at a CAAGR of approximately 0.9 percent between 2020 and 2040. This CAAGR was increased to

approximately 1.3 percent. CDM Smith did not conduct a "low-side" sensitivity test for this model assumption.

12.2 Sensitivity Test Results

CDM Smith conducted 18 sensitivity tests (eight low-side and ten high-side tests). The sensitivity tests were conducted at the proposed toll rates (shown in Chapter 9), which will be $5.00 in 2020 dollars for a Class 1 vehicle (passenger car) to travel the full length of the project. Table 12-1 and Table 12-2 contain summary results of the 2030 and 2040 sensitivity tests respectively. The tables show the relative ranking of each sensitivity test, in terms of the magnitude of its revenue impact. Results from two years are shown (2030 and 2040) to illustrate how the revenue impact magnitude changes over time. The first column of the table shows the "ranking" of the sensitivity test, in terms of its negative or positive revenue impact (versus the "base case" revenues). The second column of the table describes the sensitivity test. The third column shows the estimated annual revenues of each sensitivity test, including the base-case.[38] Finally, the fourth column shows the percent change in the revenues compared to the base-case. The following bullet-points describe the percentage revenue changes for each sensitivity test.

1. **Value of Time (VOT):** The low VOT sensitivity test has the strongest downside effect on toll revenues in both 2030 and 2040. A 25 percent reduction in VOT results in a 12.1 percent reduction in revenues in 2030, and an 11.3 percent reduction in 2040. The low-side VOT test ranks **-8** out of the 8 downside sensitivity tests in both years. The high VOT test has a similarly strong upside effect on toll revenues. A 25 percent increase in VOT results in a 9.2 percent increase in revenues in 2030, and 8.6 percent in 2040; the high VOT tests rank **+9** and **+10** respectively.
2. **Vehicle Operating Costs (VOC):** In 2030, the high and low VOC tests are ranked **+3** and **-2** respectively. Due to the relatively high base toll rate on the I-10 MRB&B project, the VOC represents a small proportion of the total travel cost for toll trips. VOC and revenue are positively correlated. In 2030, increasing or decreasing the VOC by 25 percent, increases/decreases the toll revenues by approximately 2.0 percent. The magnitude of the revenue impact increases over time. Between 2030 and 2040, the revenue impact of the low-side VOC test (-25%) changes from 2.0 percent to 3.0 percent (and the ranking changes from **-2** to **-4**).
3. **Socioeconomic Forecasts:** The low and high socioeconomic forecasts have a fairly strong effect on toll revenues. The low socioeconomic test decreases toll revenues by 3.6 percent in 2030 (ranked **-4** out of 8 low-side tests), and 8.3 percent in 2040 (ranked **-5** out of 10 high-side tests). Over time, the low-side socioeconomic forecasts are progressively lower than the base socioeconomic forecasts. This, in turn, results in traffic demand (and toll

[38] The 2020 forecasts precede the currently projected opening year of 2025. Additionally, the forecasts in 2020 excludes any ramp-up effects.

revenues) being lower in the latter year (2040) compared to the earlier year (2030). Conversely, the high socioeconomic test increases toll revenues by 6.4 percent in 2030 (ranked **+7** out of 10 high-side tests), and 5.9 percent in 2040 (ranked **+9** out of 10 high-side tests). Unlike the low-side test, the high-side socioeconomic forecast test does not result in a higher percentage increase in the latter year (6.4 versus 5.9 percent increase). This partly due to a majority of the additional traffic demand being intra-county, rather than cross-county.

4. **Toll Suppression:** The toll suppression tests have a relatively large impact on toll revenues. Toll suppression and revenue are negatively correlated; lower suppression results in higher revenues. The low suppression sensitivity test increased revenues by 8.9 percent in 2030 (ranked **+8**), and by 5.5 percent in 2040 (again ranked **+8**). The high suppression sensitivity test decreased revenues by 6.7 percent in 2030 (ranked **-6**), and by 9.8 percent in 2040 (again ranked **-7**).
5. **Frequency of Use Distribution:** In 2030, the low frequency distribution has the strongest upside effect on toll revenues. It is ranked a **+10** and increases revenues by 11.1 percent. The low frequency distribution pushes a greater number of transactions into the video category, which generate more revenue because of the 40 percent surcharge, and it generates more revenue because fewer of the transponder customers would qualify for the frequent-user toll discounts. However, in 2040, the revenue impact of the low frequency distribution is diminished, largely because the percentage of video has decreased to a nominal amount (approximately 1 percent). Therefore, almost no additional video surcharge revenue is earned, but there is some revenue increase in 2040 as a low proportion of transponder customers qualify for the toll discount. The 2040 low-frequency test generates 3.9 percent more revenue in 2040, and is ranked **+6**. The high frequency distribution reduces revenues for the reverse reasons: fewer customers are in the video tolling category and more customers qualify for the frequent-user toll discounts. But again, the revenue impact diminishes over time, as the percentage of video transactions decreases. The high frequency distribution reduces revenues by 3.4 percent in 2030 (ranked **-3**) but by only 1.5 percent in 2040 (ranked **-2**).
6. **Percentage of Video Transactions:** The revenue impact of the video percentage sensitivity test changes significantly between 2030 and 2040. In the base-case, the percentage of video transactions are approximately 14 percent in 2030 and 1 percent in 2040. In the "high" video percentage test, percentage of video transactions are approximately 17 percent in 2030 and 9 percent in 2040. The revenues in the "high side" test are 1.4 percent higher in 2030 and 3.7 percent higher in 2040; the ranking rises from a **+3** to a **+5**. In the "low" video percentage test, percentage of video transactions are approximately 6 percent in 2030 and 1 percent in 2040. The revenues in the "low side" test are -4.3 percent lower in 2030 and no difference in 2040 as the video percentage is identical to the base-case; the negative ranking falls from a **-5** to a **-1**.
7. **Toll Price Elasticity:** The impacts of toll elasticity "flips" between 2030 and 2040. In the earlier year (2030), the low elasticity slightly increases revenues, while the high elasticity slightly decreases revenues. They are ranked **+1** and **-1** respectively in 2030, meaning

they have the lowest impact of all the tests. In 2030, the video percentage is relatively high. Decreasing or increasing the elasticity affects both the toll discounts and the toll surcharges simultaneously, and they almost evenly offset one another. However, in the latter year (2040), the percentage of video transaction is assumed to be minimal (only one percent of transactions). Therefore, the low elasticity results in the toll discount inducing fewer new discount transactions, resulting in lower revenues overall (1.6 percent lower). Conversely, the high elasticity (in 2040) test induces a significant number of discount transactions, resulting in a 3.3 percent revenue increase.

8. **Annualization Factor (Revenue Days):** This sensitivity test changes the multiplication formula used to convert the daily revenues to annual revenues. The low-side test of this variable reduces revenues by 9 percent, while the high-side test increases revenues by 5 percent. These low/high percentages are identical in all forecast years. In 2030, the low socioeconomic forecast is ranked a **-7** out of the 8 downside sensitivity tests, and the high socioeconomic forecast is ranked a **+5** among the 9 upside sensitivity tests.
9. **External Zone Growth Rates:** In 2030, this sensitivity test increases toll revenues by 4.0 percent, and is ranked **+4** among the 9 upside sensitivity tests. However, in 2040, this sensitivity test only increases toll revenues by 2.2 percent, and its ranking falls from **+4** to **+1**. This decreasing percentage impact indicates that internal (Mobile County and Baldwin County) traffic demand contributes a more to traffic growth on the I-10 MRB&B (in absolute terms) compared to the external zones (from Mississippi and Florida).
10. **Truck Growth Rates:** Trucks only represent approximately 10 percent of the total transactions on the I-10 MRB&B (in the base-case). However, increasing the truck trip table growth by 50 percent results in a notable increase in overall project toll revenues. This test increases toll revenues by 0.9 percent in 2030 (ranked **+2**), and by 2.9 percent in 2040 (ranked **+3**).

Each of these sensitivity tests were run in isolation, not together. Actual future conditions may include more than one of these upside or downside parameters acting in concert, resulting in revenues that are low or higher than the percentage changes indicated by the individual, isolated sensitivity tests.

Table 12-1 – 2030 Sensitivity Test Rankings

Ranking	Test Description	Annual Revenues (millions)	Percent Difference
-8	VOT -25%	$139.1	-12.1%
-7	Low Annualization Factor	$143.8	-9.1%
-6	High Suppression	$147.7	-6.7%
-5	Low Video Percentage	$151.4	-4.3%
-4	SE Low	$152.5	-3.6%
-3	High Trip Frequency	$152.8	-3.4%
-2	VOC -25%	$155.0	-2.0%
-1	High Price Elasticity	$158.0	-0.1%
-	BASE	$158.1	-
+1	Low Price Elasticity	$158.3	0.1%
+2	Trucks: High-Growth	$159.7	0.9%
+3	High Video Percentage	$160.4	1.4%
+4	VOC +25%	$161.2	1.9%
+5	Externals: High-Growth	$164.5	4.0%
+6	High Annualization Factor	$165.4	4.5%
+7	SE High	$168.4	6.4%
+8	Low Suppression	$172.3	8.9%
+9	VOT +25%	$172.9	9.2%
+10	Low Trip Frequency	$175.9	11.1%

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / **Tab:** T12-1) 2030 Sensitivity Test

Table 12-2 – 2040 Sensitivity Test Rankings

Ranking	Test Description	Annual Revenues (millions)	Percent Difference
-8	VOT -25%	$191.8	-11.3%
-7	High Suppression	$195.1	-9.8%
-6	Low Annualization Factor	$196.6	-9.1%
-5	SE Low	$198.4	-8.3%
-4	VOC -25%	$209.8	-3.0%
-3	Low Price Elasticity	$212.7	-1.6%
-2	High Trip Frequency	$213.0	-1.5%
-1	Low Video Percentage	$216.2	0.0%
-	BASE	$216.2	-
+1	Externals: High-Growth	$221.0	2.2%
+2	VOC +25%	$222.3	2.8%
+3	Trucks: High-Growth	$222.4	2.9%
+4	High Price Elasticity	$223.3	3.3%
+5	High Video Percentage	$224.1	3.7%
+6	Low Trip Frequency	$224.7	3.9%
+7	High Annualization Factor	$226.0	4.5%
+8	Low Suppression	$228.1	5.5%
+9	SE High	$229.0	5.9%
+10	VOT +25%	$234.8	8.6%

Source File: ALDOT I-10 MRB&B TIFIA--Report Tables v1.4.xlsx / **Tab:** T12-2) 2040 Sensitivity Test

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Disclaimer

CDM Smith used currently-accepted professional practices and procedures in the development of these traffic and revenue estimates. However, as with any forecast, it should be understood that differences between forecasted and actual results may occur, as caused by events and circumstances beyond the control of the forecasters. In formulating the estimates, CDM Smith reasonably relied upon the accuracy and completeness of information provided (both written and oral) by the Alabama Department of Transportation, our subconsultants and others. CDM Smith also relied upon the reasonable assurances of independent parties and is not aware of any material facts that would make such information misleading.

CDM Smith made qualitative judgments related to several key variables in the development and analysis of the traffic and revenue estimates that must be considered as a whole; therefore, selecting portions of any individual result without consideration of the intent of the whole may create a misleading or incomplete view of the results and the underlying methodologies used to obtain the results. CDM Smith gives no opinion as to the value or merit of partial information extracted from this report.

All estimates and projections reported herein are based on CDM Smith's experience and judgment and on a review of information obtained from multiple agencies, including the Alabama Department of Transportation. These estimates and projections may not be indicative of actual or future values, and are therefore subject to substantial uncertainty. Future developments cannot be predicted with certainty, and may affect the estimates or projections expressed in this report, such that CDM Smith does not specifically guarantee or warrant any estimate or projection contained within this report.

While CDM Smith believes that the projections or other forward-looking statements contained within the report are based on reasonable assumptions as of the date of the report, such forward-looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. Therefore, following the date of this report, CDM Smith will take no responsibility or assume any obligation to advise of changes that may affect its assumptions contained within the report, as they pertain to socioeconomic and demographic forecasts, proposed residential or commercial land use development projects and/or potential improvements to the regional transportation network.

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