

Chapter 3. ALTERNATIVE ANALYSIS

The results of the network analysis for the Build conditions, including the proposed Acadian interchange modifications and an additional lane on I-10 are presented in this chapter. The following subsections contain summaries of the Tier I and Tier II/III analyses and an overview of the study area network. The overview includes a general description of the network and the proposed changes within the study area to address issues identified in **Chapter 2**.

Summary of Tier I Analysis

A high-level interchange analysis (Tier I) was completed during the Stage 0 Study to determine feasible interchange alternatives. As a result, the only alternative moving forward for further analysis for the Perkins interchange is the removal of the ramps. This eliminates the inadequate spacing between interchanges. The alternatives for the Acadian interchange moving forward from the Tier 1 analysis were a diamond interchange, a single-point urban interchange (SPUI), and a diverging diamond interchange (DDI). Details of the Tier I analysis are in **DCR Appendix A**.

Summary of Tier II/III Analysis

The purpose of the Tier II/III analysis was to further refine the alternatives selected in Tier I. This included the critical geometry, alternative analysis, striping, and conflict point comparison. The geometric layout was refined through an iterative process between the geometric design team and the traffic analysis team to determine the lane configurations based on the environmental constraints and operations. The diamond interchange configuration was analyzed first to confirm it would meet the purpose and need of increasing the interchange spacing and improving the geometry of the entrance ramps. The SPUI or DDI would have increased environmental impacts and were only to be analyzed if needed.

Proposed Diamond Interchange Build Layout

The proposed Build diamond interchange included the following features:

- An additional lane on mainline I-10 (in each direction), this creates a weave on I-10 westbound between College and Acadian (the current configuration is a merge from College and a lane drop at Acadian)
- Lengthened acceleration and deceleration lanes east of Acadian (I-10 westbound on-ramp and I-10 eastbound off-ramp)
- Acadian northbound at I-10 interchange
 - An additional northbound left turn lane onto the I-10 westbound on-ramp. The taper for the dual lefts starts just north of Acadian Centre
 - Two additional northbound right turn lanes onto the I-10 eastbound on-ramp starting just south of Acadian Centre
 - An additional northbound through lane between Perkins and Acadian Centre which becomes the inside right turn lane to I-10 eastbound on-ramp
 - The signal phases for the dual left and dual right turn lanes are protected only
- Acadian southbound at I-10 interchange

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- An additional southbound left turn lane onto the I-10 eastbound on-ramp. The dual left turn lanes start north of the westbound off-ramp.
- Additional storage for the southbound right turn lane onto the I-10 westbound on-ramp.
- I-10 eastbound off-ramp at Acadian - An additional right turn lane onto Acadian southbound creating dual right turn lanes.
- I-10 westbound off-ramp at Acadian - An additional right turn lane onto Acadian northbound creating dual turn lanes.
- Acadian/Stanford at Perkins
 - The northbound right turn lane converted to a shared through-right turn lane which becomes the inside right turn lane to the I-10 eastbound on-ramp.
 - The southbound right turn only lane eliminated and the outside through lane converted to include a shared through-right turn lane.

Figure 3.1 presents the proposed lane configuration. The proposed Line and Grade geometry is in **Appendix D**.

LEGEND:

- ← Lane Configuration
- Signalized Intersection

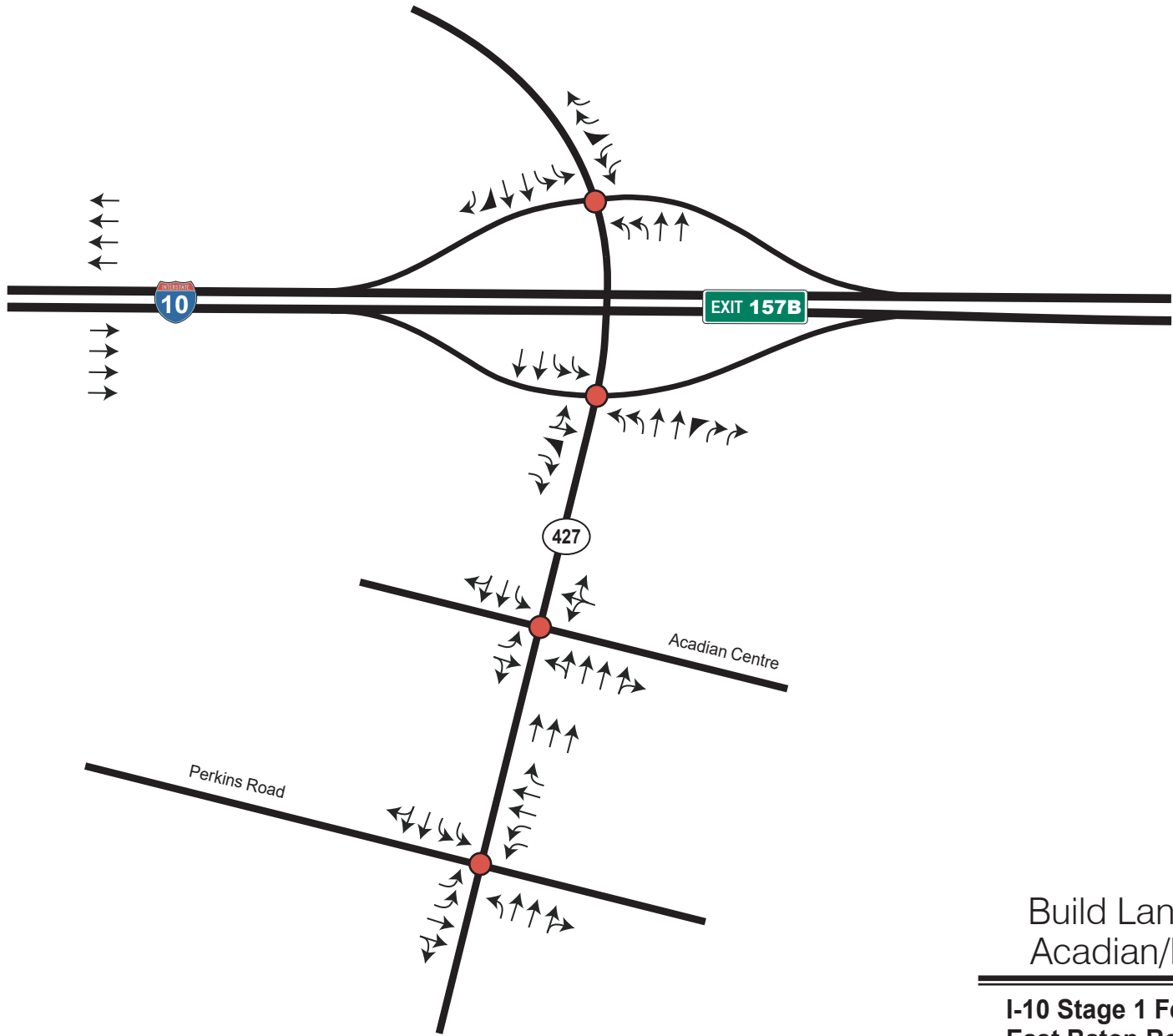
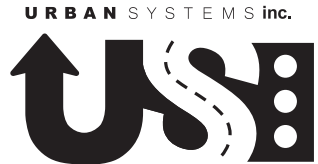


Figure 3.1
Build Lane Geometry
Acadian/Perkins IMR

I-10 Stage 1 Feasibility Study
East Baton Rouge Parish, LA

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Critical Geometry

The proposed geometric modifications to I-10, and the intersections of Acadian at the I-10 interchange and Acadian Centre were designed, with exceptions, to meet the LADOTD Minimum Design Guidelines and are in accordance with “A Policy on Geometric Design of Highways and Streets 2018”. The LADOTD Road Design Manuals and applicable memoranda were also utilized.

The Line and Grade geometry, proposed critical geometry criteria and design exceptions are presented in **Appendix D**.

Alternative Analysis

Analysis was conducted for the AM and PM peaks for the 2040 Build conditions and compared to the No Build analysis summarized in **Chapter 2**. The input parameters and analysis reports for the Build analysis are included in **Appendix D**. The 2040 Build volumes are presented in **Appendix C**.

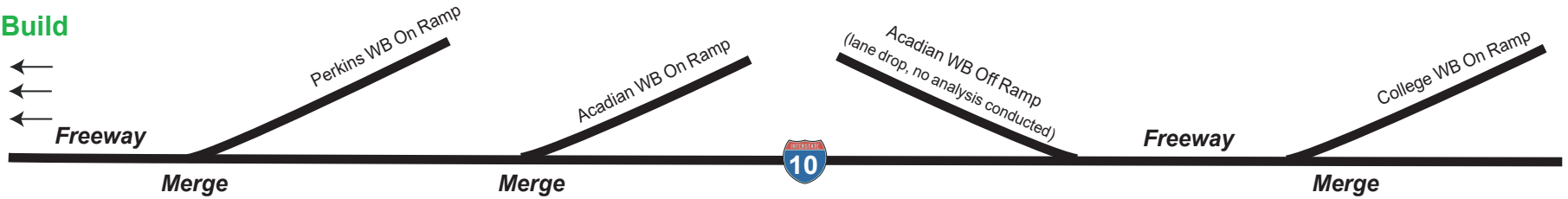
Freeway/Merge/Diverge/Weave

HCS version 7.5 was used for freeway, merge, diverge and weave analyses. Due to the geometry changes in the Build condition, analysis types differed between the No Build and Build by location. **Figure 3.2** was prepared to illustrate the differences and present the analysis type performed for each location.

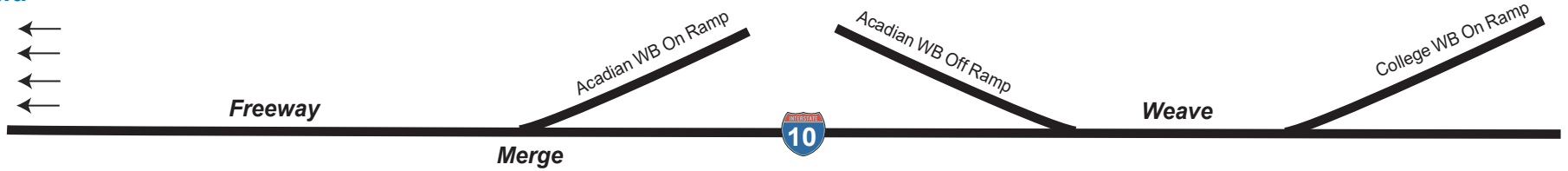
The measure of effectiveness was density, which is the number of vehicles occupying a given length of a lane or roadway at an instant, in passenger cars per lane per mile (pc/mi/l_n). A limitation of the HCS software is that density is not reported when thresholds are exceeded, such as volume to capacity ratio greater than one.

I-10 Westbound

No Build

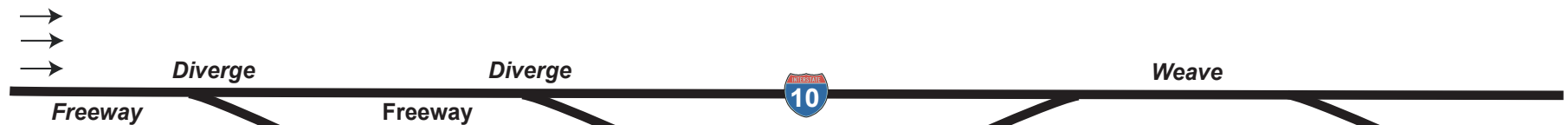


Build



I-10 Eastbound

No Build



Build

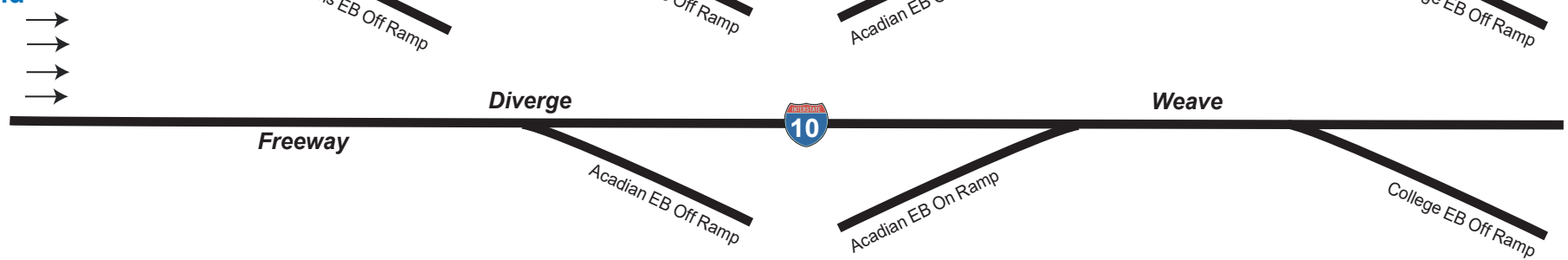


Figure 3.2
I-10 Analysis Types
IMR Data Collection
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The analysis reports are in **Appendix D**.

I-10 Eastbound

The weave analysis included a sensitivity analysis for I-10 eastbound between Acadian and College, similar to the existing and No Build analysis detailed in **Chapter 2**. **Figure 3.3** presents the I-10 eastbound AM and PM peak analysis results. The analysis reports are in **Appendix D**.

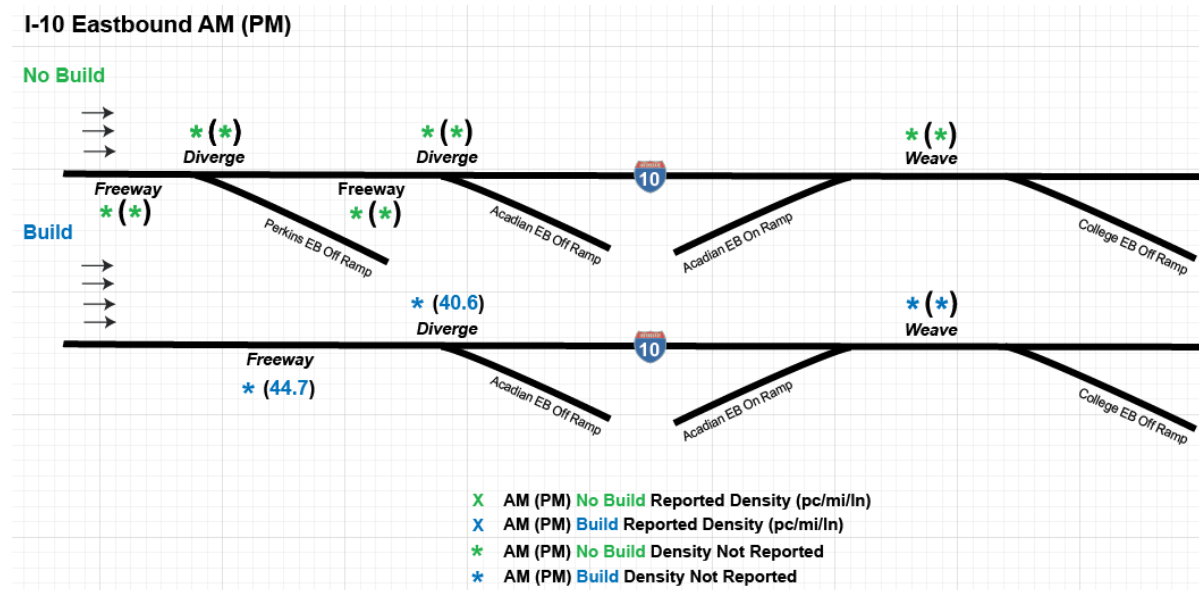


Figure 3.3 I-10 Eastbound AM and PM Results

The analysis results for I-10 eastbound indicated that in the AM peak the proposed improvements may not impact operations in the study area on the I-10 mainline. The PM peak analysis results indicate the widening and the removal of the Perkins ramps should improve the I-10 eastbound mainline operation west of Acadian. Therefore, the weave section between Acadian and College may become the bottleneck in the PM peak and inhibit traffic throughput along the remaining system.

I-10 Westbound

A sensitivity analysis was conducted for Build condition weave on I-10 westbound between College and Acadian with the following three (3) volume scenarios:

- Volume Scenario 1: 100% of vehicles entering from College exit at Acadian
- Volume Scenario 2: No vehicles entering from College exit at Acadian, 100% are from I-10 westbound

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- Volume Scenario 3: 50% of entering from College exit at Acadian

The details of the weave volumes are in **Appendix D**. **Figure 3.4** presents the I-10 westbound AM and PM peak analysis results.

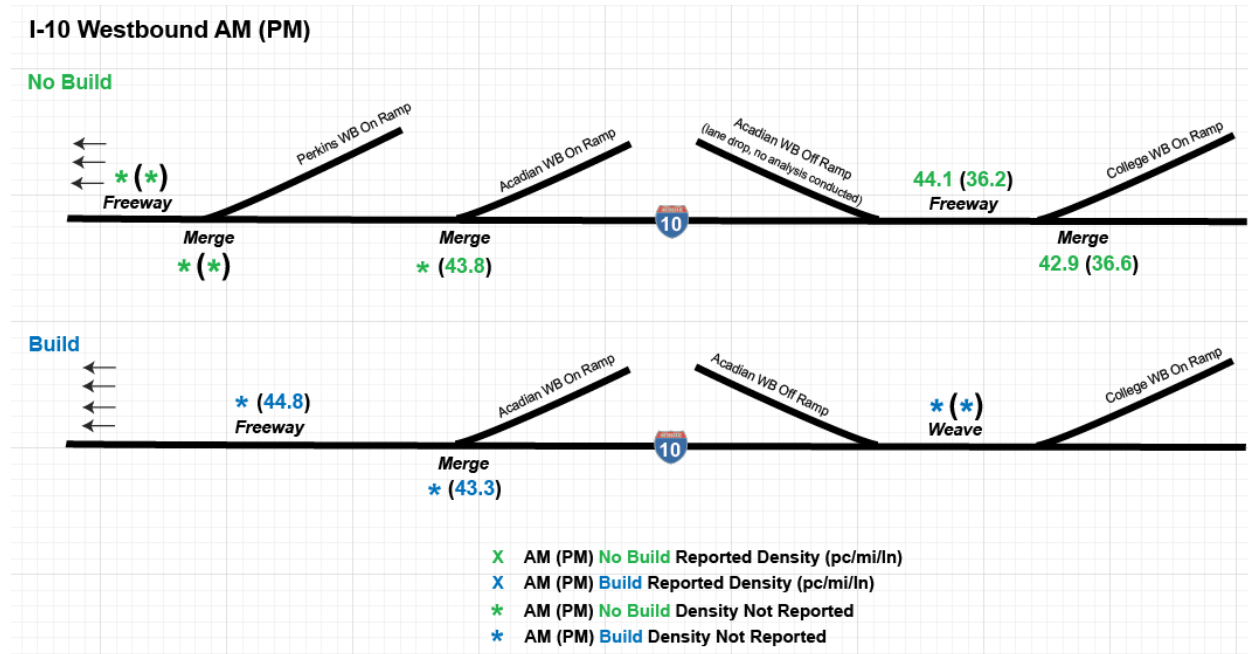


Figure 3.4 I-10 Westbound AM and PM Results

The analysis results for I-10 westbound indicated that in both the AM and PM peaks, the weave section between College and Acadian may become the bottleneck and inhibit traffic throughput along the remaining system. The results also indicate that in the PM peak, mainline traffic operations west of the Acadian off-ramp should improve with the proposed widening and interchange modifications.

Another limitation of HCS software is that downstream queues and bottlenecks are not fully evaluated. Therefore, analyses were conducted for the Build freeway segments by reducing the vehicular demand until the volume to capacity ratio reached one to estimate the maximum throughput. The results were 7,620 vph on I-10 eastbound and 7,975 vph on I-10 westbound. A comparison to the eastbound and westbound Build volumes at these locations of 7,843 vph and 8,162 vph respectively indicates that the demand in both cases may exceed the maximum throughput potentially resulting in bottlenecks.

A bottleneck on I-10 eastbound prior to the Acadian ramps may meter the throughput volume and then the weave operation between Acadian and College may not be the bottleneck point. A

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bottleneck on I-10 westbound west of Acadian may not occur if the weave between College and Acadian meters the westbound throughput volume.

Surface Street Intersections

Trafficware Synchro 8 was used to analyze the signalized intersections at the ramp terminal intersections on Acadian with the proposed Build condition geometry.

Signal timing parameters in the Build conditions analysis were developed to accommodate concurrent vehicle and pedestrian movements for proposed crosswalks, as presented in the Line and Grade in **Appendix D**. The signal phases accommodating concurrent pedestrian crossings were set to 'minimum recall' and the minimum green time plus the yellow time was adjusted to accommodate the calculated clearances.

The minimum pedestrian times were calculated as:

$$\textit{Minimum Pedestrian Times (sec)} = \textit{Walk Distance (ft)} \times 3.5 \textit{ ft/sec} + 7 \textit{ sec walk}$$

The crosswalk measurements and pedestrian timing calculations are presented in **Appendix D**. The pedestrian accommodations at the intersections on Acadian should be re-visited during design as pedestrian signals with actuation may be considered and/or the timing parameters should be re-calculated when exact sidewalk and crosswalk locations are confirmed.

Tables 3.1 and **3.2** presents the results of the Build analysis for the signalized intersections. The highest v/c ratio and 95th percentile queue for each approach were reported. The queue results were reported in number of vehicles but then converted to feet by multiplying 25 feet/vehicle.

Table 3.1
AM Scenario Comparison
Signalized Intersection Synchro Analysis

| Location | AM | | | | | | | | |
|--|-------------|-----------|--------------------|-------------|-----------|--------------------|--|-----------|--------------------|
| | Existing | | | No Build | | | Build | | |
| | Delay (sec) | V/C Ratio | 95th % Queues (ft) | Delay (sec) | V/C Ratio | 95th % Queues (ft) | Delay (sec) | V/C Ratio | 95th % Queues (ft) |
| Acadian Thruway at I-10 Westbound Ramps | 21.3 | | | 21.8 | | | 28.4 | | |
| <i>Acadian Thruway Northbound</i> | 11.5 | 0.74 | 138 | 11.8 | 0.75 | 143 | 24.6 | 0.72 | 213 |
| <i>Acadian Thruway Southbound</i> | 14.3 | 0.54 | 370 | 15.2 | 0.57 | 393 | 27.0 | 0.54 | 273 |
| <i>I-10 Off-ramp Westbound</i> | 42.0 | 0.82 | 350 | 42.1 | 0.83 | 363 | 31.8 | 0.77 | 383 |
| Acadian Thruway at I-10 Eastbound Ramps | 16.7 | | | 17.2 | | | 27.6 | | |
| <i>Acadian Thruway Northbound</i> | 50.1 | 0.82 | 300 | 51.9 | 0.83 | 315 | 35.5 | 0.86 | 415 |
| <i>Acadian Thruway Southbound</i> | 5.7 | 0.54 | 368 | 6.0 | 0.57 | 390 | 14.9 | 0.59 | 323 |
| <i>I-10 Off-ramp Eastbound</i> | 61.8 | 0.73 | 95 | 61.2 | 0.73 | 98 | 52.9 | 0.88 | 290 |
| Acadian Thruway at Acadian Centre | 8.5 | | | 8.8 | | | 9.4 | | |
| <i>Acadian Thruway Northbound</i> | 8.4 | 0.50 | 320 | 8.9 | 0.53 | 343 | 7.1 | 0.32 | 208 |
| <i>Acadian Thruway Southbound</i> | 5.1 | 0.42 | 253 | 5.4 | 0.44 | 265 | 7.1 | 0.60 | 408 |
| <i>Richland Plantation Eastbound</i> | 84.4 | 0.41 | 5 | 84.4 | 0.41 | 5 | 84.4 | 0.41 | 5 |
| <i>Acadian Centre Westbound</i> | 46.0 | 0.59 | 140 | 46.1 | 0.60 | 145 | 69.8 | 0.82 | 188 |
| Acadian Thruway at Perkins Road | 44.0 | | | 47.5 | | | 53.9 | | |
| <i>Stanford Avenue Northbound</i> | 44.2 | 0.90 | 375 | 44.6 | 0.91 | 390 | 54.5 | 0.92 | 460 |
| <i>Acadian Thruway Southbound</i> | 47.9 | 0.80 | 425 | 48.7 | 0.81 | 448 | 67.8 | 0.92 | 558 |
| <i>Perkins Road Eastbound</i> | 42.3 | 0.80 | 363 | 45.2 | 0.82 | 410 | 47.6 | 0.82 | 205 |
| <i>Perkins Road Westbound</i> | 42.0 | 0.81 | 530 | 50.2 | 0.93 | 643 | 42.4 | 0.90 | 830 |
| Perkins Rd at I-10 Ramps | 18.0 | | | 18.9 | | | Intersection does not exist this scenario | | |
| <i>I-10 Eastbound off-ramp Southbound</i> | 54.5 | 0.91 | 398 | 53.2 | 0.91 | 435 | | | |
| <i>Perkins Road Eastbound</i> | 6.1 | 0.24 | 158 | 7.1 | 0.27 | 193 | | | |
| <i>Perkins Road Westbound</i> | 11.5 | 0.41 | 318 | 13.5 | 0.47 | 375 | | | |

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Table 3.2
PM Scenario Comparison
Signalized Intersection Synchro Analysis

| Location | PM | | | | | | | | |
|--|-------------|-----------|--------------------|-------------|-----------|--------------------|--|-----------|--------------------|
| | Existing | | | No Build | | | Build | | |
| | Delay (sec) | V/C Ratio | 95th % Queues (ft) | Delay (sec) | V/C Ratio | 95th % Queues (ft) | Delay (sec) | V/C Ratio | 95th % Queues (ft) |
| Acadian Thruway at I-10 Westbound Ramps | 20.3 | | | 20.8 | | | 26.6 | | |
| <i>Acadian Thruway Northbound</i> | 11.9 | 0.78 | 123 | 12.1 | 0.78 | 130 | 19.1 | 0.50 | 183 |
| <i>Acadian Thruway Southbound</i> | 14.2 | 0.59 | 418 | 15.2 | 0.62 | 448 | 24.2 | 0.51 | 275 |
| <i>I-10 Off-ramp Westbound</i> | 42.4 | 0.81 | 313 | 42.4 | 0.81 | 325 | 33.6 | 0.76 | 358 |
| Acadian Thruway at I-10 Eastbound Ramps | 15.1 | | | 15.4 | | | 31.9 | | |
| <i>Acadian Thruway Northbound</i> | 38.9 | 0.67 | 303 | 38.5 | 0.68 | 313 | 39.8 | 0.85 | 385 |
| <i>Acadian Thruway Southbound</i> | 6.6 | 0.60 | 418 | 7.1 | 0.63 | 450 | 17.6 | 0.63 | 333 |
| <i>I-10 Off-ramp Eastbound</i> | 65.8 | 0.64 | 50 | 66.0 | 0.65 | 53 | 52.9 | 0.91 | 365 |
| Acadian Thruway at Acadian Centre | 8.4 | | | 8.6 | | | 8.8 | | |
| <i>Acadian Thruway Northbound</i> | 8.7 | 0.54 | 373 | 9.1 | 0.57 | 393 | 7.4 | 0.39 | 243 |
| <i>Acadian Thruway Southbound</i> | 4.7 | 0.42 | 240 | 4.9 | 0.43 | 255 | 7.2 | 0.61 | 418 |
| <i>Richland Plantation Eastbound</i> | 51.8 | 0.29 | 18 | 51.8 | 0.29 | 18 | 51.8 | 0.29 | 18 |
| <i>Acadian Centre Westbound</i> | 47.7 | 0.51 | 78 | 47.5 | 0.52 | 80 | 59.5 | 0.79 | 120 |
| Acadian Thruway at Perkins Road | 53.2 | | | 55.7 | | | 58.5 | | |
| <i>Stanford Avenue Northbound</i> | 65.0 | 0.89 | 598 | 67.3 | 0.91 | 630 | 83.1 | 0.93 | 540 |
| <i>Acadian Thruway Southbound</i> | 62.5 | 0.90 | 348 | 63.0 | 0.90 | 363 | 54.1 | 0.94 | 745 |
| <i>Perkins Road Eastbound</i> | 47.4 | 0.85 | 575 | 51.4 | 0.87 | 668 | 60.6 | 0.87 | 305 |
| <i>Perkins Road Westbound</i> | 42.0 | 0.77 | 550 | 45.7 | 0.78 | 638 | 43.1 | 0.80 | 773 |
| Perkins Rd at I-10 Ramps | 9.5 | | | 10.1 | | | Intersection does not exist this scenario | | |
| <i>I-10 Eastbound off-ramp Southbound</i> | 55.2 | 0.66 | 213 | 56.5 | 0.73 | 233 | | | |
| <i>Perkins Road Eastbound</i> | 4.2 | 0.38 | 233 | 4.5 | 0.42 | 265 | | | |
| <i>Perkins Road Westbound</i> | 8.7 | 0.49 | 390 | 9.5 | 0.55 | 448 | | | |

At Acadian Centre, the minimum green for the side streets were initially extended from the existing to accommodate pedestrians crossing Acadian concurrently with the vehicle phase. The longer side street phases resulted in shorter signal splits for the Acadian northbound and southbound phases, and southbound queues were reported exceeding 700'. An additional analysis was conducted to represent actuation at the Acadian crossing. With shorter side street splits and no minimum recall, the southbound queues were reported at approximately 400'. These results are presented in **Table 3.1** and **3.2**, and both sets of analysis reports are in **Appendix D**.

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The results in **Tables 3.1** and **3.2** indicated both increases and decreases in the delay, v/c ratio and queues compared to the No Build conditions.

The reported 95% queues on the I-10 eastbound and westbound off-ramps were compared to the proposed storage lengths in the Line and Grade. The comparison indicated that the queues would not extend onto the mainline.

Both the Acadian eastbound and westbound on-ramps are proposed to include two (2) lanes at the intersection to receive dual turning movements from either direction. The two (2) lanes would merge to one (1) prior to joining the mainline. The Highway Capacity Manual does not include a methodology to analyze the merge on the ramp from two (2) lanes to one (1). Should this merge on either ramp become a bottleneck point, traffic could back up into the intersection and block traffic on Acadian. This would not, however, affect operations on the mainline of I-10.

Safety Analysis

The number and type of conflict points were determined for the Build condition and compared to those for the existing conditions. The conflict point diagrams for the proposed configuration are presented in **Appendix D**. **Table 3.3** presents the comparison of existing vs Build conflict points.

**Table 3.3
Existing vs Build w/Improvements
Conflict Point Comparison**

| Conflict Type | Existing | Build |
|--|-----------------|--------------|
| Interstate Mainline | | |
| Diverging Conflict | 3 | 2 |
| Merging Conflict | 3 | 2 |
| Crossing Conflict | 0 | 0 |
| TOTAL Mainline | 6 | 4 |
| Acadian at the I-10 Interchange (Intersection) | | |
| Diverging Conflict | 9 | 12 |
| Merging Conflict | 9 | 14 |
| Crossing Conflict | 18 | 45 |
| Acadian at Acadian Centre (Intersection) | | |
| Diverging Conflict | 6 | 8 |
| Merging Conflict | 8 | 8 |
| Crossing Conflict | 20 | 26 |
| Perkins at the I-10 Interchange* (Intersection) | | |
| Diverging Conflict | 3 | 0 |
| Merging Conflict | 3 | 0 |
| Crossing Conflict | 3 | 0 |
| TOTAL Intersection | 79 | 113 |

*Interchange removed in Build conditions

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A review of **Table 3.3** indicated the number of conflict points on the mainline was reduced due to the removal of the Perkins Road ramps. The number of conflicts increases in the Build conditions for the intersections due to additional lanes on Acadian.

Striping and Signage layouts

The purpose of developing conceptual striping and signage layouts as part of an IMR is to ensure the alternative design could be adequately signed and striped with the proposed modifications. Striping and signing layouts are presented in **Appendix D**.

Study Area Network Overview

The main safety concern in the study area noted in **Chapter 2** was the inadequate spacing between the Perkins and Acadian interchanges. The proposed removal of the Perkins interchange eliminates this issue.

The signalized intersection analyses of the Acadian interchange for the diamond interchange alternative indicated the v/c ratios were less than one for all movements. Results also indicate queues on the off-ramps should not exceed available storage or back-up onto the mainline.

Analysis indicated the diamond interchange alternative would meet the purpose and need of increasing the interchange spacing and improving the geometry of the entrance ramps while servicing design year traffic. Other interchange improvements, such as the DDI and SPUI, are not needed due to the severe congestion on the interstate which may still cause Acadian Thruway I-10 on-ramps vehicles to queue.

Additional Considerations

In the No Build, vehicles entering from College must make two (2) lane changes to stay on I-10 westbound. With the proposed improvements, only one (1) lane change is required for this maneuver.

The I-10 westbound on-ramp from Acadian would include additional storage for queued vehicles in the Build condition and the longer merge length would be an improvement from the existing and No Build conditions.

If the weave section on I-10 eastbound between Acadian and College is still or becomes a bottleneck, queues would extend onto the on-ramp from Acadian. The proposed interchange modifications would provide additional storage for queued vehicles on the ramp and on Acadian compared to existing and No Build conditions.

The added lane would provide additional capacity of approximately 2,250 passenger cars per lane per hour on the interstate system. This may decrease the duration of congestion during the AM and PM periods and also provide benefits during the off-peak.

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