2045 Network-Wide Performance

Table 7-18 summarizes the network-wide performance results for the No-Build and Build Alternatives during the 2045 AM and PM peak periods. Comparison of the alternatives shows that the Build consistently exhibited better performance than the No-Build Alternative in terms of delay, average speed, number of stops and latent demand.

In terms of average speed, the Build Alternative shows better performance than the No-Build during both peak periods with speed increases of 50% (AM) and 24% (PM). Network delay time reductions for the Build Alternative were 70% (AM) and 42% (PM). Significant improvements were realized for the total travel time, latent delay/demand, and total stops. This upholds the results observed in the previous sections, in which the Build Alternative alleviated the majority of the congestion present in the No-Build simulations.

Table 7-18 2045 Network-Wide Performance

AM PEAK	No Build	Build	
Average Speed (mph)	32	48	50%
Total Delay (hr)	26,667	7,914	-70%
Latent Delay (hr)	16,076	2,446	-85%
Latent Demand	6,613	135	-98%
Total Travel Time (hr)	57,736	40,614	-30%
Total Stops	2,291,768	458,002	-80%
Vehicles Arrived	321,773	335,595	4%
PM PEAK	**No Build**	**Build**	
Average Speed (mph)	34	42	24%
Total Delay (hr)	24,075	13,989	-42%
Latent Delay (hr)	34,478	23,279	-32%
Latent Demand	9,692	6,343	-35%
Total Travel Time (hr)	58,343	49,242	-16%
Total Stops	1,777,773	801,317	-55%
Vehicles Arrived	388,964	394,966	2%

Note: Percentages indicate comparisons to the No-Build Alternative.

7.5 Benefit-Cost Analysis

A benefit/cost (B/C) ratio was estimated for the Build Alternative based on a 20-year design life. The benefits were calculated by assigning monetary values to the reduction in automobile and truck travel time while the costs include the total project cost, which include estimates for construction, ROW, and engineering/inspection). **Table 7-19** lists the various parameters and their values used in equations for benefit calculations.

Table 7-19 B/C Parameters and Values

Parameter	Value
Interest rate	4.0%
Value of automobile travel ($/hour)	17.67
Value of truck travel ($/hour)	94.04
Percent trucks	5%
No. of working days in a year	260

Annualized total travel time, which included the travel time within the network and latent delay time, for the No-Build and Build alternatives were used in the B/C equations to estimate the anticipated annual benefits for the opening year and the design year. The benefits considered the simulation results for eight hours per day (four for the AM and PM peak periods) and 260 working days per year. The project benefits are provided in **Table 7-20**.

Table 7-20 Project Benefit Calculations

Analysis Year	Annual Total Travel Time (hr)		Annual Benefits in Dollars
	No-Build	Build	
Opening Year 2025	23,641,193	19,071,203	$98,202,219
Design Year 2045	43,324,726	30,051,131	$285,229,648

The annual increase in benefit (gradient) between the 2025 and 2045 horizon was based on a linear calculation, which equates to a $9,351,371 per year benefit. The total benefit for the 20-year project life is $1,806,951,445 (2018 Dollars). As shown in **Table 7-21**, the Build Alternative provide a B/C ratio of 2.28 for a 20-year design life when considering the operational improvements.

Table 7-21 Project Benefit/Cost Ratio

Design Life	Benefits (2018 Dollars)	Cost (2018 Dollars)	Project B/C
20 Years	$1,806,951,445	$793,000,000	**2.28**

7.6 Future Conditions Safety Analysis

The AASHTO Highway Safety Manual (HSM) methodology was used to compare the predicted crashes of the No Build Alternative to the Preferred Build Alternative. The segments analyzed were the freeway mainline segments between on-ramp and adjacent off-ramp (between interchanges). Eight freeway segments were analyzed from I-295 to Atlantic Boulevard. The segment from Old St. Augustine Road to I-295 has the same geometry between No Build and Build Alternatives; therefore, no safety comparison analysis was completed.

It should be noted that there is no overlap between the southbound exception segment near Atlantic Boulevard (discussed in Section 7.3) and the No Build and Build safety analysis segments.

The Safety Performance Functions (SPFs) for freeways were referenced from the 2014 HSM Supplement. The SPF for Multiple-Vehicle Crashes is represented by HSM Equation 18-15 and the SPF for Single-Vehicle Crashes is represented by HSM Equation 18-18. The SPFs were also specified by crash severity, Fatal and Injury (FI) and Property Damage Only (PDO), and area type, Urban, using coefficients from HSM Tables 18-5 and 18-7 for Single-Vehicle and Multiple-Vehicle Crashes, respectively. The base conditions for the SPFs used are the following:

- Lane width of 12 feet
- Inside shoulder width of 6 feet
- Median width of 60 feet
- No presence of median barrier
- Outside shoulder width of 10 feet
- Clear zone of 30 feet
- No presence of outside barrier

Crash Modification Factors (CMFs) are applied to SPFs in order to estimate the Predicted Crashes for scenarios where the geometry does not match the base conditions of the SPF. The following CMFs were applied to the SPFs for FI crashes and PDO crashes during the HSM analysis:

- Lane Width
- Inside Shoulder Width
- Median Width
- Median Barrier
- Outside Shoulder Width
- Outside Clearance
- Outside Barrier

Limitations exist in regard to the available base conditions for SPFs. For this analysis the number of through lanes available for analysis was limited to 10 lanes total for both directions of travel. Four segments in the study area exceeded 10 through lanes of travel in the Build Alternative. These Build segments were analyzed as a 10 lane segment and any potential benefit of additional through lanes beyond the maximum of 10 may not be realized. An additional assumption for the Build Alternative analysis is that express lanes were included in the total count of through lanes.

The 2045 AADTs were utilized in the No Build and Build Alternatives safety analysis. **Table 7-22** contains the total annual predicted crashes for the No Build and Build Alternatives as well as the percent difference between the two alternatives. While three of the segments saw an increase in crashes in the Build Alternative, the Build alternative provides an overall 6.2% decrease in annual predicted crashes, which equates to 20.9 crashes, when compared to the No-Build. The areas with higher predicted crashes for the Build Alternative were primarily caused by reducing the median width (distance from edge of shoulder to barrier face in the HSM formulas) by adding the additional travel lanes. It is important to note that three of the Build segments had cross sections that exceeded 10 through lanes; therefore, not all of the benefit of the Build Alternative could be realized by the HSM analysis due to the limitations of the methodology as previously discussed. **Appendix E** contains the detailed SPF and CMF calculations.

Table 7-22 Total Predicted Crashes (per year)

Segment	No Build	Build	Percent Difference
I-295 to US 1	15.33	13.55	-11.6%
US 1 to Southside Blvd	20.90	24.79	18.6%
Southside Blvd to Baymeadows Rd	46.52	49.11	5.6%
Baymeadows Rd to Butler Blvd*	53.01	55.67 (12 lanes)	5.0%
Butler Blvd to Bowden Rd*	46.76	45.40 (16 lanes)	-2.9%
Bowden Rd to University Blvd	21.92	19.21	-12.3%
University Blvd to Emerson St	87.83	72.87	-17.0%
Emerson St to Atlantic Blvd*	43.88	34.64 (11 lanes)	-21.1%
Total	**336.15**	**315.25**	**-6.2%**

*Build analysis number of lanes exceeded HSM's maximum of 10 lane segment for SPF. Build segment analyzed with 10 lanes.
(X lanes) – Number of through lanes in Build Alternative Design

The crash data evaluated in Section 3.2.2 showed that there are several high crash locations within the study area – defined as locations in which the segment actual crash rate exceeds the statewide average crash rate for similar facilities. These include the I-95 segment from Old St. Augustine Road to Butler Boulevard, as well as the segment from Butler Boulevard to Atlantic Boulevard, which accounts for the entire I-95 study area. Along I-95 from Old St. Augustine Road to Butler Boulevard, rear end crashes were the most common type of crash accounting for 44.2% of total crashes. These primarily occur due to unexpected or sudden stops on the freeway, which occur more frequently in areas with recurring congestion. The portion of I-95 from Butler Boulevard to Atlantic Boulevard also had rear end crashes as the most common type of crash accounting for 60.4% of total crashes, followed by fixed object crashes accounting for 13.7% of total crashes.

The operational analysis in Section 7.4 shows that under No-Build conditions, this recurring congestion is expected to increase considerably by the Opening Year 2025 and even more so by the Design Year 2045. In addition to causing travel time delay due to slower speeds, this is also expected to increase the number of stops on the freeway. This trend is likely to also increase the number of rear end crashes throughout the study area.

The Build Alternative alleviated or significantly reduced all areas of congestion during the 2025 and 2045 analysis, and therefore is expected to lower crash rates in the study area by reducing the number of stops on the freeway facility. In addition to reducing crashes from frequent stops, the Build Alternative also incorporates several enhancements that effectively reduce the number of lane changes and weaving on the facility. This is also expected to improve safety, in terms of sideswipe and angled collisions, since these are largely caused by driver error during lane-changing maneuvers. Please note that, while the Build Alternative is expected to improve safety overall, two areas of congestion are noted in the 2045 operational analysis, both of which occur in the general purpose lanes. During the AM peak period, congestion and speeds approaching 20 mph are observed between Bowden Road and University Boulevard during the peak hour. During the PM peak period, speeds as low as 20 mph are observed in the southbound direction between Emerson Street and University Boulevard during the peak hour, with speeds approaching 30 mph observed during both off-peak hours. In both of these cases, the use of variable message signs (VMS) located upstream will inform drivers of the upcoming congestion and reduce the number of incidents due to changes in travel speed. For these reasons, the Build Alternative is expected to provide safety enhancements over the No-Build during both the Opening Year and Design Year, which is upheld by the results of the HSM-based safety analysis discussed above.

7.7 Recommended Alternative

The No-Build Alternative is not in conformance with the most recent long range transportation plan for the region and will not be able to accommodate the travel demand within the study area. The analysis presented in this study shows that the Build Alternative provides acceptable operations within the study area through the Design Year 2045. This report supports the conclusion that the proposed roadway enhancements within the area of influence for the Build Alternative will benefit both the interstate and regional transportation systems.

The Design Year 2045 operational analysis results show that the I-95 facility performs significantly better under the Build Alternative. The No-Build Alternative operates under severe congestion during both peak periods which impacts both directions of I-95 and I-295 throughout the analysis period. During the AM peak period, the Build Alternative provided substantial operational improvements along I-95 in both directions with free-flow operations observed along the majority of the facility in both the general purpose lanes and the express lanes. Similar to the 2045 AM peak period, the Build Alternative provided significant operational improvements along I-95 in both directions during the 2045 PM peak period. Free-flow operations were observed along the majority of the facility in both the general purpose lanes and the express lanes. The benefit-cost analysis that was based on the operational benefits and project cots showed a B/C of 2.28. In terms of safety, the HSM-based analysis shows that the Build Alternative is expected to reduce mainline crashes by 6.2% (20.9 crashes per year).

Based on the safety and traffic operations benefits of the Build Alternative, it is considered the preferred alternative for this SIMR. **Appendix H** provides the conceptual signing plan for the Build Alternative and the proposed typical sections for the Build Alternatives are provided in **Appendix I**.