

# Executive Summary

The Florida Department of Transportation (FDOT) District Seven prepared an Interchange Operational Analysis Report (IOAR) to document the highway safety benefits, operational, and geometric improvements to mitigate the existing operational deficiencies for the I-275 (SR 93) and Hillsborough Avenue (US 92) interchange in Hillsborough County, Florida (WPI Seg No.: 436732-2). The study Area of Influence can be found in **Figure E1**.

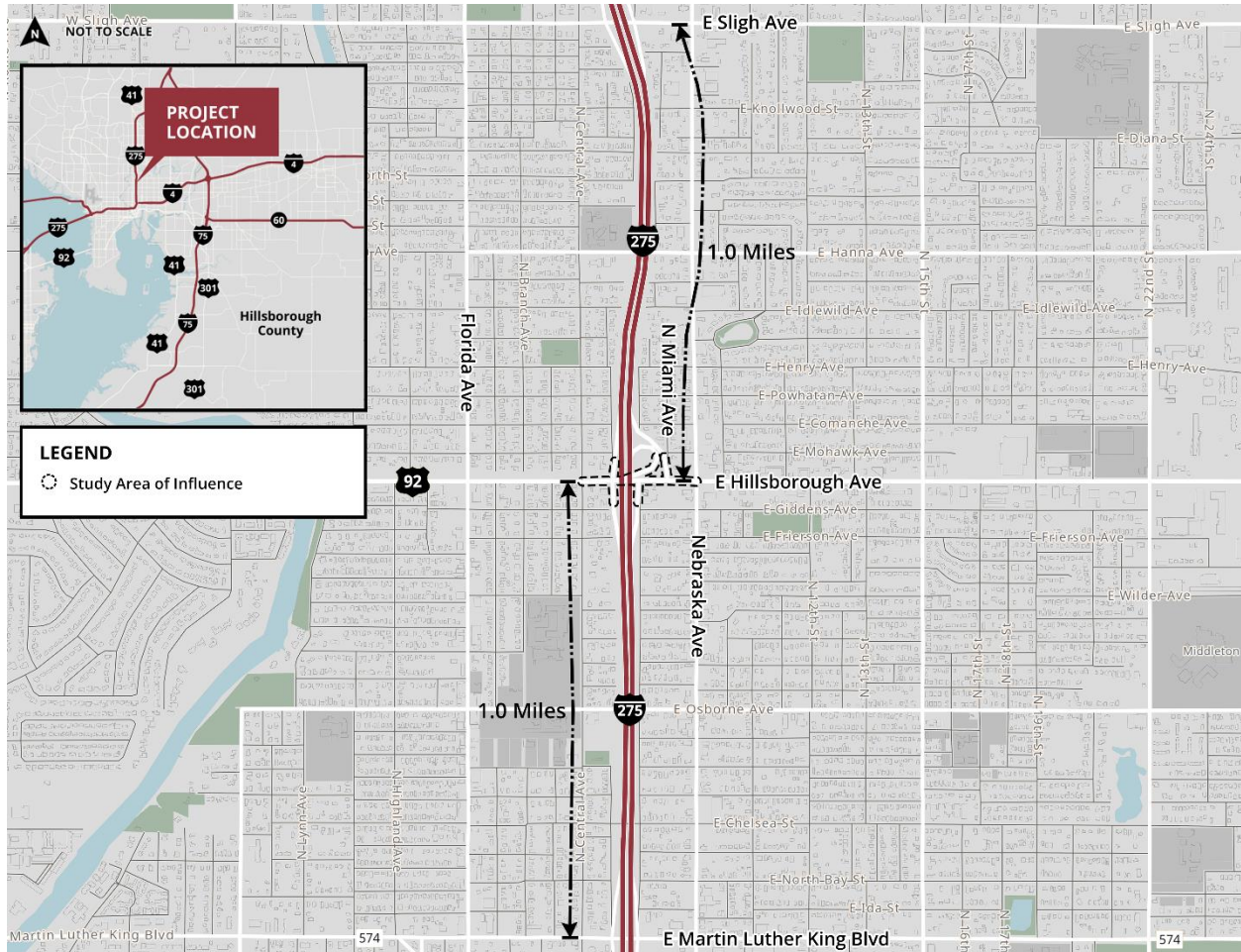


Figure E1: Project Location Map

This IOAR builds off previous efforts conducted under both the FDOT District Seven Interchange Needs Evaluation on I-275 (SR 93) from SR 574 (Dr. Martin Luther King Jr. Boulevard) to south of I-275/I-75 (SR 93A) dated December 2016 and the I-275 (SR 93) Project Development and Environment (PD&E) Study from north of SR 574 (Dr. Martin Luther King Jr. Boulevard) to north of Bearss Avenue (SR 678/CR 582) (WPI Segment No.: 431821-1), dated October 2019. Based on the results of these studies, District Seven has identified the need for additional improvements that will be included in this IOAR under the Build conditions, as follows:

- Installation of left-turn lane from eastbound Hillsborough Avenue to northbound I-275. The inclusion of the additional eastbound left-turn lane will require the installation of a signal to control the previously uncontrolled movement necessitating the evaluation of the interchange operations.
- Modify the northbound I-275 loop ramp to westbound Hillsborough Avenue movement from free flow to signal control, with the addition of a second right turn lane.

This IOAR included those improvements in the Build Alternative and explored additional solutions to solve the challenges present at the I-275 and Hillsborough Avenue interchange to alleviate existing traffic congestion, improve safety, and provide capacity where possible to ensure the interchange can support future growth and economic development. The following sections summarize the evaluation of the existing and future traffic operations both with and without the proposed Build Alternative improvements.

### Existing Traffic Conditions

In both the AM and PM peak hours, the I-275 and Hillsborough Avenue interchange experiences significant congestion, leading to safety and operational issues in the eastbound and westbound directions. In the eastbound direction, the unsignalized eastbound left turn at the northbound I-275 ramp terminal experiences queue spillback that impacts the ability for eastbound Hillsborough Avenue to process traffic and creates an unsafe speed differential between the inside and outside lanes through the Central Avenue intersection. This speed differential also heavily impacts the ability for westbound left turn movements at the southbound I-275 ramp terminal to safely cross traffic under the movement's permitted phase, which leads to a significant number of collisions. The southbound I-275 ramp terminal intersection had a reported crash rate roughly 4.1 times higher than the statewide crash rate average for similar locations with the most common crash type at this location being left-turn collisions occurring under the permitted phase operation.

In the westbound direction, Hillsborough Avenue also experienced operational bottlenecks as the northbound I-275 to westbound Hillsborough Avenue free flow loop ramp attempts to merge into westbound Hillsborough Avenue through traffic as it approached the westbound right turn lane drop at the Central Avenue intersection. This merge condition results in slowdown in the outside lanes of westbound Hillsborough as either westbound drivers slow to allow vehicles to merge as they approach the drop lane, merging drivers stop entirely in the drop lane waiting for a safe gap to merge, or merging drivers force their way into traffic. Each of these scenarios results in abrupt starting and stopping of westbound Hillsborough Avenue which can limit the ability of westbound traffic to process through the interchange.

Additionally, queuing is also present along the southbound approach of the I-275 southbound ramp terminal in both the AM and PM peak hours. This is due to current timing at the signals within the interchange area favoring (roughly 77 percent of green time) east-west flow as well as having challenges dissipating queue due to the cycle length. This results in queuing that impacts I-275 southbound mainline operations in both the AM and PM peak hours due to lack of protected green time for the heavy southbound right turn movement.

## Future Traffic Conditions

The following summarizes the results of the intersection and queue analyses conducted to evaluate the future operations of the I-275 and Hillsborough Avenue interchange with and without the proposed improvements under the opening year (2025) and design year (2035) traffic conditions.

### No-Build Alternative

The No-Build Alternative assumes the existing traffic control and geometrics of the I-275 and Hillsborough Avenue interchange are maintained in the opening year (2025) and design year (2035) analysis. While the net benefit of this alternative would be to save on construction cost of the proposed improvements, all existing operational and safety challenges identified under the existing year (2021) operations would be maintained or worsen as traffic volumes continue to increase, which would not meet the intent of this study. The following challenges will be present under the No-Build Alternative analysis:

- The yield-controlled operation of the eastbound left-turn at the northbound I-275 ramp terminal will continue to result in queue spillback onto eastbound Hillsborough Avenue, leading to speed differential between the inside and outside lanes that continue past the Central Avenue intersection and limiting the ability for Hillsborough Avenue to effectively process vehicles in the eastbound direction in the AM and PM peak hours. Additionally, this condition also presents sight distance challenges for the westbound left turn at the southbound I-275 ramp terminal as drivers attempt to see past vehicles stopped or slowed in the inside lane as they try to identify safe gapping across eastbound Hillsborough Avenue;
- The westbound left turn at the southbound I-275 ramp terminal will continue to see a high level of collisions due to the previously mentioned speed differential and sight distances issues caused by the eastbound left turn at the northbound I-275 ramp terminal. This conflict is currently a major reason the southbound I-275 ramp terminal crash rate is roughly 4.1 times higher than the statewide average and will only worsen if the conditions are not improved;
- Westbound Hillsborough Avenue will continue to experience outside lane slowdowns as the northbound I-275 to westbound Hillsborough Avenue free flow loop ramp approaches the westbound right turn drop lane at Central Avenue and attempts to merge with westbound Hillsborough Avenue through traffic; and
- Poor operation at the southbound approach to the I-275 southbound ramp terminal in the AM and PM peak hours leads to southbound approach queue spillback that impact I-275 southbound mainline operations.

## Build Alternative

To alleviate the challenges under the No-Build alternative, the Build Alternative consists of the following improvements:

- Hillsborough Avenue within the Area of Influence (AOI) would require six lanes of capacity to handle the amount of through traffic present under the forecast conditions. Due to the capacity constraints to the west of the AOI between N Ola Avenue and Central Avenue limiting the typical section to 4 lanes of capacity, the transition between the six lane and four lane typical section at Central Avenue under the No-Build Alternative is causing significant congestion and queuing issues within the AOI. To alleviate this, at least within the AOI that would impact mainline operations, the transition from the six lane to four lane typical will be shifted to the Nebraska Avenue intersection. This would shift the congestion rather than eliminating it, but additional signage and pavement marking can be placed along Nebraska Avenue to better help vehicles preposition before entering the AOI. Additionally, the reduction in typical section from six lanes to four lanes will enhance pedestrian safety by reducing crossing distances within the AOI.
- To eliminate the drop lane merge condition of the northbound I-275 to westbound Hillsborough Avenue loop ramp, which operates as a free flow movement that drops into the westbound right turn lane at Central Avenue, the loop ramp will be brought under signal control and dual right turn lanes will be provided.
- To address queue spillback caused by the eastbound Hillsborough Avenue to northbound I-275 left turn movement, the existing single left turn lane yield controlled movement will be converted to a dual left turn lane protected only signal-controlled condition. The additional eastbound left turn lane will be accommodated by shifting the transition of eastbound Hillsborough Avenue from two to three eastbound lanes from west of the Central Avenue intersection to east of the northbound I-275 terminal.
- The eastbound Hillsborough Avenue to southbound I-275 right turn movement will be converted into a dedicated right turn lane dropping at the southbound ramp terminal instead of carrying through the interchange.
- The existing northbound I-275 to eastbound Hillsborough Avenue stop controlled dual right turn lanes will also be brought under signal control to better manage clearing of the ramp and provide a protected phase for pedestrians using the crosswalk present on the approach.
- The current safety concerns at the southbound I-275 ramp terminal will be addressed by converting the existing permitted-protected single left turn lane operation of the westbound Hillsborough Avenue to southbound I-275 movement to a dual left turn protected only control condition. This additional left turn lane will develop along the east side of the interchange with the inside through lane of westbound Hillsborough Avenue dropping into the new left turn bay.
- To accommodate westbound Hillsborough Avenue through traffic, the existing right turn drop lane at the northbound I-275 on-ramp/Miami Avenue intersection will be converted to a shared through/right turn lane.
- To mitigate queuing on the southbound I-275 off-ramp, the southbound approach of the southbound I-275 ramp terminal intersection will add an additional left turn bay to the inside of the approach and restripe the lanes to provide two right turn lanes, a shared through-left turn lane, and a dedicated left turn lane.

The results of the Build alternative traffic analysis include the following:

- The queue spillback of the eastbound left turn at the northbound I-275 ramp terminal into the eastbound Hillsborough Avenue through lanes is expected to be eliminated. This will also remove speed differential between the inside and outside lanes along eastbound Hillsborough Avenue which will in turn enhance safety;
- The removal of the permitted operation of the westbound left turn movement at the southbound I-275 ramp terminal will reduce the amount of left turn collisions at the intersection and enhance safety; and
- Queuing along the southbound approach to the southbound I-275 ramp terminal will no longer extend past the gore and will have no impact on I-275 southbound mainline operations.

## Alternatives Comparison

To compare the operational benefits of the implementation of the proposed improvements under the Build Alternative, network-wide Measures of Effectiveness (MOEs) from the CORSIM microsimulation analysis are summarized in **Table E1** for both the No-Build Alternative and Build Alternative in the opening year (2025) and design year (2035). The results indicate that under the Build Alternative, vehicle miles traveled, total travel time, speed average, total travel delay and latent demand will all improve in both the AM and PM peak hours for both analysis periods indicating operational net benefit to the Build Alternative.

Qualitative safety analysis using HSM procedures showed that implementing the suggested improvements under the Build Alternative will reduce 41.78 crashes per year, equating to an annual cost savings of \$5,156,272.90. Comparing the annual cost of the project to the safety benefits shows a benefit-to-cost ratio of 9.31, indicating that the build alternative is justifiable.

This analysis would indicate that the proposed improvements to the I-275 at Hillsborough Avenue interchange adhere to both FWHA policy points by enhancing both operations and safety aspects of the interchange while also adhering to current design standards. Based on this analysis, the Build Alternative would provide a greater level of mobility and safety than the No-Build Alternative for all users of the I-275 and Hillsborough Avenue interchange.

**Table E1: Network-Wide CORSIM MOEs for Opening Year (2025) and Design Year (2035)**

Network-Wide MOE	Analysis Time Period	Opening Year (2025)			Design Year (2035)		
		No-Build Alternative	Build Alternative	% Difference	No-Build Alternative	Build Alternative	% Difference
Vehicle Miles Traveled (veh-miles)	AM	16,162	17,161	6%	16,039	17,426	9%
	PM	17,830	20,546	15%	17,845	21,084	18%
Total Travel Time (Hours)	AM	2,167	1,875	-13%	2,488	2,112	-15%
	PM	2,478	1,828	-26%	2,750	2,279	-17%
Speed Average (mph)	AM	7.5	9.2	22%	6.4	8.3	28%
	PM	7.2	11.3	56%	6.5	9.3	43%
Total Travel Delay (hours)	AM	1,709	1,388	-19%	2,033	1,616	-21%
	PM	1,961	1,245	-37%	2,232	1,681	-25%
Latent Demand (veh)	AM	4,450	2,436	-45%	6,045	4,186	-28%
	PM	4,332	1,539	-64%	5,839	2,664	-54%

# FHWA Policy Points

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## Policy Point 1: Proposal does not adversely impact operations or safety of the existing facility.

- 1 An operational and safety analysis has concluded that the proposed change in access does not have an adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).

### Satisfaction of Policy Point 1

The proposed modifications to the I-275 and Hillsborough Avenue interchange documented in this IOAR will enhance safety and traffic operations within the AOI. A significant safety concern exists at the southbound I-275 ramp terminal due to the permitted/protected operations of the westbound left turn movement. Due to queue spillback in the eastbound direction from the eastbound left turn movement at the northbound I-275 ramp terminal, the inside lane along eastbound Hillsborough Avenue becomes blocked through Central Avenue. This blocking creates an unsafe speed differential between the vehicles caught in the inside lane and those in the more rapidly moving outside lane. In addition to inducing speed differential, vehicles stopped in the inside lane can also pose a sight distance challenge for vehicles attempting to make the permitted left turn onto the interstate, which leads to a significant number of left turn collisions at this location. The Build Alternative not only eliminates the permitted left turn movement through the inclusion of signalized dual left turns for the westbound left turners at the southbound I-275 ramp terminal, but the adjustment of the eastbound left turn at the northbound I-275 ramp terminal from a permitted only single left turn to a signalized protected only dual left turn movement eliminates the eastbound queue spillback of this movement and eliminating speed differential between lanes.

Along I-275, queue spillback is currently present on the southbound I-275 off-ramp in AM and PM peak hours. If nothing is done, this will lead to vehicles spilling back onto the I-275 southbound mainline which will create an unsafe speed differential between through movements and vehicles waiting to exit the interstate which is a major safety concern. Through the improvements under the Build Alternative, I-275 southbound mainline impacts are not expected by the design year (2035) under the Build Alternative.

Along westbound Hillsborough Avenue, if no improvements are conducted to improve the current condition, vehicles will continue to enter westbound flow from the loop ramp at a higher rate of speed

to those being metered by the signals along Hillsborough Avenue. This leads to an unsafe merge condition in the westbound right turn drop lane where vehicles either can find a safe gap to merge, force their way into traffic or come to a stop with their blinker on while waiting to merge while vehicles continue to enter from the loop ramp at free flow. The Build Alternative completely removes this conflict by bringing the movement under a signal controlled dual right turn movement.

The operational results of the comparison between the No Build and Build Alternatives indicate benefit under the Build Alternative. In the AM peak hour, VMT increased by 9 percent, total travel time dropped by 15 percent, average speed increased by 28 percent, total travel delay reduced by 21 percent, and latent demand (vehicles unable to enter the system during microsimulation due to poor operations) dropped by 28 percent. In the PM peak hour, VMT increased by 18 percent, total travel time dropped by 17 percent, average speed increased by 43 percent, total travel delay reduced by 25 percent, and latent demand dropped by 54 percent.

If the Build Alternative is not implemented, the existing operational and safety challenges within the AOI will only continue to exacerbate as demand at the interchange grows along with the growth forecasted within Hillsborough County. The implementation of the Build Alternative is estimated to reduce up to 41.78 crashes per year, equating to an annual cost savings of \$5,156,272.90. Comparing the annual cost of the project to the safety benefits shows a benefit-to-cost ratio of 9.31, indicating that the Build Alternative is justifiable.

**Policy Point 2: A full interchange that meets or exceeds current design standards is provided.**

- 2 The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on-ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.

**Satisfaction of Policy Point 2**

The proposed Build Alternative will provide full access to all the traffic movement on Hillsborough Avenue to and from I-275. The design will meet current standards, where able, for the projects on the interstate system and comply with the American Association of State Highway and Transportation Officials (AASHTO) and FDOT design standards. Design variations are anticipated for bike lane width, maximum grade break, and turn lane length. A Design Exception is anticipated for ramp shoulder width. Should any additional discrepancies be identified during the development of this project, design exceptions and variations will be processed per FDOT and FHWA Guidelines during the design phase of the project.