

7 Future Conditions Safety

In accordance with the approved MLOU, a safety analysis was conducted for future conditions utilizing the predictive methods set forth in the HSM Parts C and D. HSM Part C provides an outline for applying Safety Performance Functions (SPFs) to predict crash frequency and severity according to roadway geometry, intersection geometry, and traffic conditions. HSM Part D provides an outline for applying Crash Modification Factors (CMFs) to the forecasted crash frequencies and severities to account for deviations from the base conditions of the Part C predictions.

Consistent with the existing conditions safety analysis, the AOI includes the I-75 mainline between US 27 and SR 326 (broken into two segments to account for the new interchange at NW 49th Street), the I-75 interchanges at US 27 and at SR 326, as well as the following adjacent segments and intersections:

- Intersection of US 27 and NW 44th Avenue
- Intersection of US 27 and NW 35th Avenue Road
- Segment of US 27 from NW 44th Avenue to I-75 southbound ramps
- Segment of US 27 from I-75 northbound ramps to NW 35th Avenue Road
- Segment of SR 326 one-half mile west of I-75 southbound off-ramp
- Segment of SR 326 one-half mile east of I-75 northbound ramps
- Segment of NW 44th Avenue from US 27 to SR 326
- Intersection of NW 49th Street and NW 44th Avenue

For the five Build alternatives (Diamond, SPUI, Parclo-SE, Parclo-NE and DDI), the Build scenario analyses include the following segments and intersections due to the addition of the NW 49th Street Interchange:

- I-75 interchange with NW 49th Street (varies by Build scenario)
- Intersection of NW 49th Street and NW 44th Avenue
- Segment of NW 49th Street from NW 44th Avenue to I-75 southbound ramps
- Segment of NW 49th Street one-half mile east of I-75 northbound ramps

The following sections illustrate some of the factors that contributed to forecasted crash rates and severities in different portions of the future roadway network and the resulting predictions. The HSM Worksheets used to calculate the anticipated future crash rates are provided in **Appendix K**.

7.1 Predicted Crashes

7.1.1 I-75 Mainline

The I-75 mainline within this project’s AOI remains the same in the future conditions analysis as the existing conditions analysis, aside from the addition of on- and off-ramps at the proposed NW 49th Street interchange for the Build scenarios. The traffic volumes summarized in **Table 7-1** were utilized for the crash predictions for the I-75 mainline.

Table 7-1: I-75 Mainline 2045 AADT

From	To	2045 AADT	
		No Build	Build
N of SR 326 Interchange	SR 326 Interchange	94,200	93,800
SR 326 Interchange	Proposed Interchange	107,100	109,300
Proposed Interchange	US 27 Interchange	107,100	118,900
US 27 Interchange	S of US 27 Interchange	131,300	137,300

The HSM worksheets were utilized to predict the number of annual crashes expected in year 2045. The HSM prediction method is based on the projected 2045 AADT volumes and geometric properties of the I-75 mainline (horizontal curves, lane widths, shoulder widths, presence of median barriers, and presence of rumble strips). **Figure 7-1** provides the segmentation for the HSM analysis.

The predicted number of annual crashes ranges from approximately 132 crashes per year for the Parclo-SE scenario to approximately 143 crashes per year for the No Build scenario. **Table 7-2** summarizes the predicted number of annual crashes on the I-75 mainline for the No Build and Build scenarios.

Table 7-2: Predicted 2045 Annual Crashes I-75 Mainline (S of US 27 to N of SR 326)

Alternative	Fatal/Injury	PDO*	Total
No Build	40.3	102.8	143.1
Build Diamond	38.7	99.4	138.1
Build SPUI	39.1	100.9	140.0
Build Parclo SE	36.9	95.2	132.1
Build Parclo NE	37.9	97.8	135.7
Build DDI	38.7	99.4	138.1

*Property Damage Only

Figure 7-1: I-75 HSM Segmentation

No Build															
I-75 Southbound	Length (mi)		0.15	0.60	0.12	3.39					0.20	0.28	0.34	0.05	
	Length (ft)	4,429	800	3,168	616	17,881					1,073	380	1,500	1,815	268
	Segment Type	Basic	Merge	Basic	Diverge	Basic	Basic				Merge	Basic	Merge	Basic	Diverge
I-75 Northbound	Length (mi)					19,650	3.72								
	Length (ft)	4,300	671	3,029	847	18,132					671	2,809	941		
	Segment Type	Basic	Diverge	Basic	Merge	Basic	Basic				Diverge	Basic	Merge	Basic	

Components of proposed NW 49 Street Interchange Location

Diamond & DDI															
I-75 Southbound	Length (mi)		0.15	0.60	0.12	0.96	0.19	1.43	0.11	0.69	0.20	0.07	0.28	0.34	0.05
	Length (ft)	4,429	800	3,168	616	5,050	1,010	7,530	580	3,654	1,073	380	1,500	1,815	268
	Segment Type	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Diverge
I-75 Northbound	Length (mi)					19,658	3.72								
	Length (ft)	4,300	671	3,029	847	3,247	491	10,173	1,057	3,172	671	2,809	941		
	Segment Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	

Components of proposed NW 49 Street Interchange Location; Variation in cumulative length due to Concept Plan estimations

SPUI															
I-75 Southbound	Length (mi)		0.15	0.60	0.12	1.14	0.13	1.19	0.17	0.76	0.20	0.07	0.28	0.34	0.05
	Length (ft)	4,429	800	3,168	616	6,000	660	6,274	881	4,000	1,073	380	1,500	1,815	268
	Segment Type	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Diverge
I-75 Northbound	Length (mi)					19,694	3.73								
	Length (ft)	4,300	671	3,029	847	5,196	715	6,717	956	4,592	671	2,809	941		
	Segment Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	

Components of proposed NW 49 Street Interchange Location; Variation in cumulative length due to Concept Plan estimations

Parclo SE															
I-75 Southbound	Length (mi)		0.15	0.60	0.12	0.96	0.19	1.40	0.13	0.67	0.20	0.07	0.28	0.34	0.05
	Length (ft)	4,429	800	3,168	616	5,050	1,010	7,403	702	3,534	1,073	380	1,500	1,815	268
	Segment Type	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Diverge
I-75 Northbound	Length (mi)					19,676	3.73								
	Length (ft)	4,300	671	3,029	847	5,082	649	3,544	1,677	1,610	1,213	4,383	941		
	Segment Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Merge	Basic	

Components of proposed NW 49 Street Interchange Location; Variation in cumulative length due to Concept Plan estimations

Parclo NE															
I-75 Southbound	Length (mi)		0.15	0.60	0.12	0.96	0.19	1.40	0.13	0.67	0.20	0.07	0.28	0.34	0.05
	Length (ft)	4,429	800	3,168	616	5,050	1,010	7,400	702	3,535	1,073	380	1,500	1,815	268
	Segment Type	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	Diverge
I-75 Northbound	Length (mi)					19,638	3.72								
	Length (ft)	4,300	671	3,029	847	5,060	667	3,260	915	2,781	1,275	4,162	941		
	Segment Type	Basic	Diverge	Basic	Merge	Basic	Diverge	Basic	Diverge	Basic	Merge	Basic	Merge	Basic	

Components of proposed NW 49 Street Interchange Location; Variation in cumulative length due to Concept Plan estimations

7.1.2 Interchanges

I-75 and US 27 Interchange and I-75 and SR 326 Interchange

No improvements are planned to the two interchanges adjacent to the proposed NW 49th Street interchange in conjunction with the proposed interchange construction. The introduction of the NW 49th Street interchange will alter travel patterns at the adjacent interchanges in the Build scenario. As a result, the number of annual crashes expected at the US 27 and SR 326 interchanges vary between the No Build scenario and the Build scenarios. The future traffic volumes at the adjacent interchanges are consistent between the five Build scenarios. Therefore, the projected number of crashes does not differ between the Build scenarios and a single value is reported.

The number of predicted crashes calculated for the interchanges includes the merge areas, diverge areas, ramp segments, and ramp terminals. A summary of the predicted number of annual crashes at the adjacent interchanges is provided in **Table 7-3** for the No Build and Build scenarios.

Table 7-3: Predicted 2045 Annual Crashes I-75 Interchanges (US 27 and SR 326)

I-75 and US 27 Interchange			
Alternative	Fatal/Injury	PDO	Total
No Build	28.2	39.9	68.1
Build Diamond/SPUI/Parclos/DDI	27.1	38.4	65.5
I-75 and SR 326 Interchange			
Alternative	Fatal/Injury	PDO	Total
No Build	41.2	76.6	117.8
Build Diamond/SPUI/Parclos/DDI	40.2	77.4	117.6

I-75 and NW 49th Street Interchange

The primary difference in predicted number of annual crashes between the No Build and Build scenarios is the differing geometry for the five NW 49th Street interchange Build alternatives. There is no difference in projected traffic volume for the five Build scenarios and the difference in predicted number of crashes is directly related to the geometric characteristics. The number of predicted crashes reported for the interchange includes the merge areas, diverge areas, ramp segments, and ramp terminal intersections. The HSM does not provide CMFs for a DDI. However, there are sources that provide CMFs for the conversion of a Diamond Interchange to DDI; reference information provided in **Appendix K**. The average of two applicable “diamond to

DDI conversion” CMFs (average of CMF ID 8278 and CMF ID 8258) was used to determine the DDI ramp terminals predicted crashes. In addition, there are also methodology limitations for the analysis of the SPUI. CMF results for a Diamond Conversion to SPUI were not consistent; decreases and increases in crashes were both concluded. Therefore, a conversion factor was not applied and the SPUI ramp terminal intersection was evaluated as a four-leg intersection. Diamond Conversion to SPUI reference information is provided in **Appendix K**.

A summary of the predicted number of annual crashes at the proposed interchange is provided in **Table 7-4** for the five Build alternatives. The No Build scenario does not include an interchange at I-75 at NW 49th Street, so it is excluded from the table.

Table 7-4: Predicted 2045 Annual Crashes I-75 at NW 49th Street Interchange

Alternative	Fatal/Injury	PDO	Total
Build Diamond	11.9	25.3	37.2
Build SPUI	8.0	22.2	30.2
Build Parclo-SE	12.9	26.6	39.5
Build Parclo-NE	10.2	19.2	29.4
Build DDI	8.0	17.5	25.5

Based on the proposed geometry and traffic controls of the respective alternatives, the DDI interchange configuration results in the fewest predicted annual crashes, followed by the ParClo-NE, SPUI, Parclo-SE, and Diamond build alternatives.

Treatment and volume of left turn movements are a defining factor between interchange types. The Diamond, ParClo-SE, and ParClo-NE alternatives treat the southbound ramp movements similarly through the provision of a signalized intersections. The SPUI combines movements with the northbound ramps and the DDI crossover intersections allow for the treatment of left turn movements similarly to a typical right turn movement, therefore reducing conflict points. In addition, the Diamond alternative provides for left turns at two separate intersections; introducing a second intersection increases the potential of additional crashes. Both Parclo alternatives also have a second signalized intersection. The loop ramps reduce the left turn volumes at the second intersection, with the Parclo-NE loop serving the highest of all four left-turn movements; reducing the potential of left turn crashes at the ramp terminus.

7.1.3 Arterial Segments

No improvements are planned for the US 27 and SR 326 arterials with the proposed NW 49th Street interchange construction. Therefore, the geometric CMF’s are consistent between the No Build and Build scenarios. For the HSM Analysis for the arterial segments and intersections, the

segmentation of US 27, NW 49th Street (No Build) and SR 326 are provided on **Figure 7-2**; and provided on **Figure 7-3** for NW 49th Street under Build scenarios. There is a minor variation in projected AADT volumes between the No Build and Build scenarios that results in different projected numbers of annual crashes. For example, traffic growth on NW 44th Avenue is projected to be greater in the No Build scenario than in the Build scenarios, leading to a higher predicted number of crashes in the No Build scenario.

In the No Build scenario, NW 49th Street would be constructed across I-75 via an overpass without an interchange with I-75. The traffic volume on NW 49th Street east and west of the proposed interchange is projected to be less in the No Build scenario than in the Build scenarios, resulting in fewer predicted crashes. A summary of the predicted number of annual crashes on the arterial segments is provided in **Table 7-5** for the No Build and Build scenarios.

Table 7-5: Predicted 2045 Annual Crashes Arterial Segments

Roadway From	To	Scenario	Fatal/Injury	PDO	Total
US 27 NW 44 th Avenue	NW 35 th Avenue Road	No Build	6.6	17.0	23.6
		Build	6.4	16.3	22.7
SR 326 ½-mile west of NW 44 th Avenue	½-mile E of I-75 NB ramps	No Build	4.7	12.0	16.7
		Build	4.6	11.8	16.4
NW 44th Avenue US 27	SR 326	No Build	3.0	8.0	11.0
		Build	2.0	5.4	7.4
NW 49th Street NW 44 th Avenue	½-mile E of I-75 NB ramps	No Build	0.2	0.7	0.9
		Build	0.3	0.7	1.0

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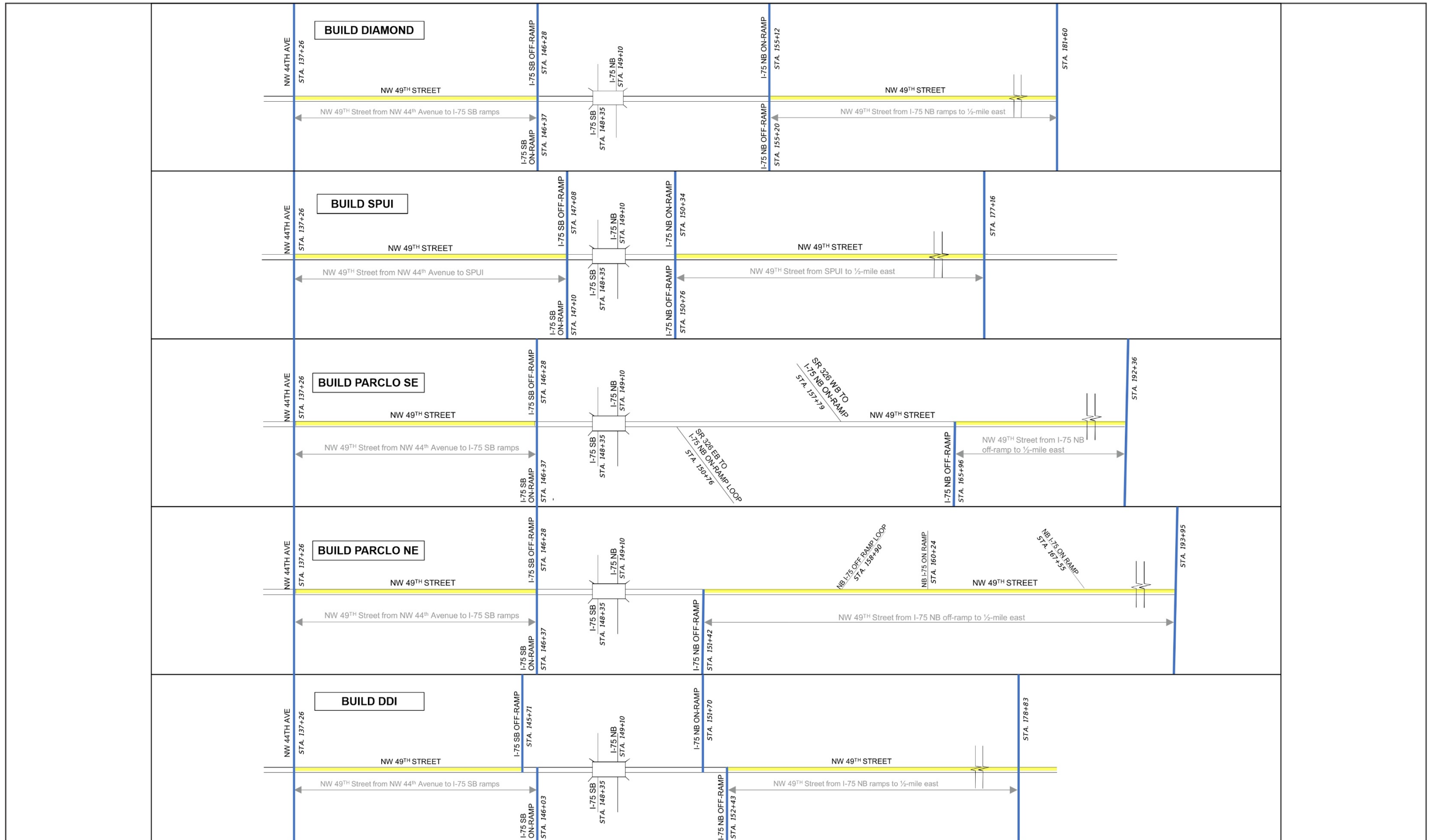


Figure 7-3: NW 49th Street Build Conditions HSM Segmentation

7.1.4 Intersections

In addition to the ramp terminal intersections evaluated as part of the interchanges, three other intersections within the AOI were evaluated to predict year 2045 annual crashes: US 27 at NW 44th Avenue, US 27 at NW 35th Avenue Road, and NW 44th Avenue at NW 49th Street. A summary of the predicted number of annual crashes at the adjacent intersections is provided in **Table 7-6** for the No Build and Build scenarios.

Table 7-6: Predicted 2045 Annual Crashes Intersections

Intersection	Scenario	Fatal/ Injury	PDO	Total
US 27 at NW 44 th Avenue	No Build	3.0	5.1	8.1
	Build Diamond/SPUI/Parclos/DDI	2.8	4.6	7.4
US 27 at NW 35 th Avenue Road	No Build	3.8	6.3	10.1
	Build Diamond/SPUI/Parclo/DDI	3.6	6.0	9.6
NW 49 th Street at NW 44 th Avenue	No Build	0.8	1.6	2.4
	Build Diamond/SPUI/Parclos/DDI	0.7	1.3	2.0

7.2 Future Predicted Safety Evaluation Summary

The cumulative results of the HSM predictive crash analyses for year 2045 are summarized in **Tables 7-7** and **7-8**.

Table 7-7: AOI Cumulative Predicted 2045 Annual Crash Summary

Location	NO BUILD			BUILD		
	FI	PDO	BUILD	FI	PDO	BUILD
I-75 (S of US 27-N Ramps & S Ramps-N of SR 326)	18.5	48.1	66.6	19.4	51.0	70.3
I-75 & US 27 Interchange ¹	28.2	39.9	68.0	27.1	38.4	65.5
I-75 & SR 326 Interchange ¹	41.2	76.6	117.7	40.2	77.4	117.7
US 27 (Arterial & Intersections)	13.5	28.4	41.8	12.8	27.0	39.8
SR 326 (Arterial & Intersections)	4.7	12.0	16.7	4.6	11.8	16.4
NW 44 th Avenue AOI (N & S of NW 49 th St)	3.0	8.0	11.0	2.0	5.4	7.4
TOTALS	109.0	212.9	321.9	106.1	211.0	317.2

¹Merge/Diverge/Ramps/Ramp Termini

Table 7-8: Project Site Predicted 2045 Annual Crashes

Location	DIAMOND			SPUI			ParClo SE			ParClo NE			DDI		
	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total	FI	PDO	Total
I-75 (N of US 27 to NW 49 th Street to S of SR 326)	19.4	48.5	67.8	19.8	49.9	69.7	17.6	44.3	61.8	18.5	46.8	65.3	19.4	48.5	67.8
I-75 & NW 49 th Street Interchange ¹	11.9	25.3	37.2	8.0	22.2	30.1	12.9	26.6	39.5	10.2	19.2	29.4	8.0	17.5	25.5
NW 49 th Street, NW 44 th Avenue to I-75	0.1	0.2	0.3	0.1	0.3	0.4	0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.2	0.3
NW 49 th Street, East of I-75	0.2	0.5	0.7	0.2	0.5	0.7	0.2	0.5	0.7	0.2	0.5	0.7	0.2	0.5	0.7
NW 44 th Avenue at NW 49 th Street	0.7	1.3	2.0	0.7	1.3	2.0	0.7	1.3	2.0	0.6	1.3	1.9	0.7	1.3	2.0
TOTALS	32.2	75.8	108.0	28.7	74.2	102.9	31.4	72.9	104.3	29.6	68.1	97.7	28.3	68.0	96.3

¹Merge/Diverge/Ramps/Ramp Termini

Based on the predicted number of crashes, the project AOI shows a reduction in total crashes from 321.9 crashes under No Build to 317.2 crashes under Build conditions. A comparison of the number of predicted crashes under the five Build alternatives for the project site shows that the DDI alternative results in the lowest number of predicted crashes (96.3 crashes). The ParClo-NE alternative is the second-best performing alternative with a total of 97.7 predicted crashes. The Diamond alternative results in the highest number of predicted crashes (108.0 crashes).

The Build condition is expected to decrease the number of predicted crashes. However, there are several locations with existing safety concerns; they are reflected on the district high crash locations list and/or have average crash rates higher than the statewide average. These safety deficiencies may still be present and require additional improvements. One such location is US 27 at NW 44th Avenue; under Build conditions, crashes are predicted to decrease. However, the predicted reduction in crashes may not be sufficient to offset existing safety conditions. The actual crash rate is higher than the statewide average crash rate; and it is a districtwide high crash location. Future operational analysis show significant delays eastbound during AM and westbound in PM. Since both volumes and delays decrease to/from NW 44th Avenue, it reflects a capacity issue with US 27. Based on the operational analysis, congested conditions contribute to these safety issues. Capacity improvements, reduction of conflict points and other major improvements are likely required.