To test the safety of the proposed alternatives the Enhanced Interchange Safety Analysis Tool (ISATe) was used. The ISATe was developed using the Highway Safety Manual (HSM). ISATe provides crash predictions for highway interchanges based on their geometric alignment, various design components such as the presence of a barrier, or lane widths and shoulder widths to estimate future crashes. It then scales the number of predicted crashes by the input AADT for that specific area so that it can calculate the expected crashes. PennDOT is currently integrating the use of the HSM into the design process, therefore the ISATe was the tool chosen to do the analysis. It is used to compare the no-build condition to the proposed alternatives to aide in understanding of the safety of each alternative and help in the recommendation of choosing an alternative.

The difference in crashes for opening day (2025), and the design year (2045) is directly proportional to the AADT of each area. The AADTs for these years were found by taking the 2013 AADT, and scaling it up using compounding growth rate of 2% per year.

The ISATe analysis tool gave an output summary detailing expected number of crashes per year, and to what severity. As expected, the number of crashes per year for the no-build alternative is higher than the proposed alternatives, due to its alignments, and inadequate ramp lengths. While all the alternatives came up very close in safety rating, the safest alternative is 2A, with 211.5 predicted crashes in the design year, next is 2D with 212.4 crashes, and lastly 2B with 216.3 crashes. It is important to take note of where the crashes are happening. Alternative 2B was found to be the safest on the mainline, but the least safe on the ramps, due to the fact that all of the exits are grouped together, so there are fewer exits from the mainline. 2A was found to be the safest on the ramps due to the fact that it has fewer ramps than the other alternatives.

Alternatives and predicted crashes.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ALTERNATIVE** | **TOTAL CRASHES** | | **MAINLINE** | | **RAMPS** | | **TERIMINI** | |
| **2025** | **2045** | **2025** | **2045** | **2025** | **2045** | **2025** | **2045** |
| I80 | 203.7 | 378.0 | 183.3 | 340.1 | 11.4 | 21.1 | 9.0 | 16.7 |
| 2A | 119.6 | 211.5 | 102.8 | 182.0 | 7.0 | 12.4 | 9.7 | 17.1 |
| 2B | 124.4 | 216.3 | 102.2 | 177.8 | 13.5 | 23.4 | 8.7 | 15.1 |
| 2D | 122.4 | 212.4 | 103.7 | 179.9 | 10.0 | 17.4 | 8.7 | 15.0 |

APPENDIX NOTES:

1. When looking at the full report summary, pay most attention to KABC, not PDO
2. In ISATe files:
   1. 2013 = 2025
   2. 2014 = 2045
      1. AADTs were calculated for correct years and put in as 2013 and 2014 due to program limits
3. The ISATe spreadsheet is not calibrated to our location
4. To account for ramps not currently existing, an AADT of 1000 (in 2013) was assumed, and 10000 was used for connector ramps.

To analyze the ramp terminals, another spreadsheet developed by PennDOT using the HSM was used. The PennDOT HSM Tool uses information about the intersection, such as lane configurations, pedestrians, school, and alcohol sales establishments nearby, as well as existing crash data to calculate the predicted number of crashes and type at a particular intersection. This analysis was used for all of the ramp terminal intersections in the project limits. For this project the Urban and Suburban Arterials part of the tool was used. Like the ISATe, AADTs are needed to run this program, and therefore, the AADTs were extrapolated from the 2013 AADTs using a compounding growth rate again. These results are for the design year (2045)

From the analysis it is found that the existing condition is once again the least safe, with 10.14 crashes per year, and alternative 2D has the safest ramp terminals, with a predicted 6.64 crashes/year. Close, but not as safe is 2B with 1.15 crashes per year. The least safe of the proposed alternatives is 2A with 8.47 crashes per year.

Alternative 2D also has the least number of crashes per intersection. 2A was found to have the least safe intersections.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of Crashes/year | | |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  | **NO BUILD** |  | **2A** |  | **2B** |  | **2D** |  |
| N9TH | 4.48 | 2 | 1.59 | 1 | 1.67 | 1 | 1.46 | 1 |
| PARK | 1.26 | 1 | 1.16 | 1 | 0.64 | 1 | 0.59 | 1 |
| BROAD | 1.40 | 1 | 2.43 | 2 | 1.24 | 1 | 1.24 | 1 |
| MAIN | 2.29 | 2 | 2.59 | 1 | 3.36 | 3 | 3.35 | 3 |
| DREHER | 0.71 | 2 | 0.70 | 1 |  |  |  |  |
| total | 10.14 | 8.00 | 8.47 | 6.00 | 6.91 | 6.00 | 6.64 | 6.00 |
| CRASH/INTERSECTION |  | 1.27 |  | 1.41 |  | 1.15 |  | 1.11 |
|  |  |  |  |  |  |  |  |  |
|  | = number of intersections | | |  |  |  |  |  |