



DRAFT TECHNICAL MEMORANDUM

July 8, 2025

Project #: 29061.0

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From: Mark Heisinger, PE and Nick Foster, ACIP, RSP₁

CC: Project Management Team

RE: Safe System Assessment Guidance

COMPASS adopted its first Regional Safety Action Plan (RSAP) in February 2025. The RSAP was developed through the lens of the Safe System Approach and includes a commitment from the COMPASS Board of Directors to a goal of zero roadway fatalities and serious injuries. This is an aggressive goal, and a key challenge identified by COMPASS member agencies in meeting this goal was limited safety expertise and capacity within agencies (i.e., agency staff, elected officials, and members of the public don't always understand safety needs and how to effectively address them). In addition, the COMPASS Safety Working Group identified improving safety in capital projects as a high priority for further discussion and implementation.

The Federal Highway Administration (FHWA) developed the Safe System Alignment Framework tool¹ (herein referred to as "SSA Tool"), which allows users to assess the alignment of project alternatives with the Safe System Approach using both quantitative and qualitative evaluations of a site and project treatments. This tool may be useful for COMPASS member agencies in assessing how effective capital projects are at reducing fatal and serious injury crashes. Application of the SSA Tool is most helpful during the evaluation of a project concept compared to existing conditions or project alternatives, but can be used in multiple stages of the project development process. Exhibit 1 shows where the SSA Tool may be most useful in a safety project development process.

¹ Federal Highway Administration. *Safe System Project-Based Alignment Framework*. 2024.
<https://highways.dot.gov/safety/zero-deaths/safe-system-project-based-alignment-framework>

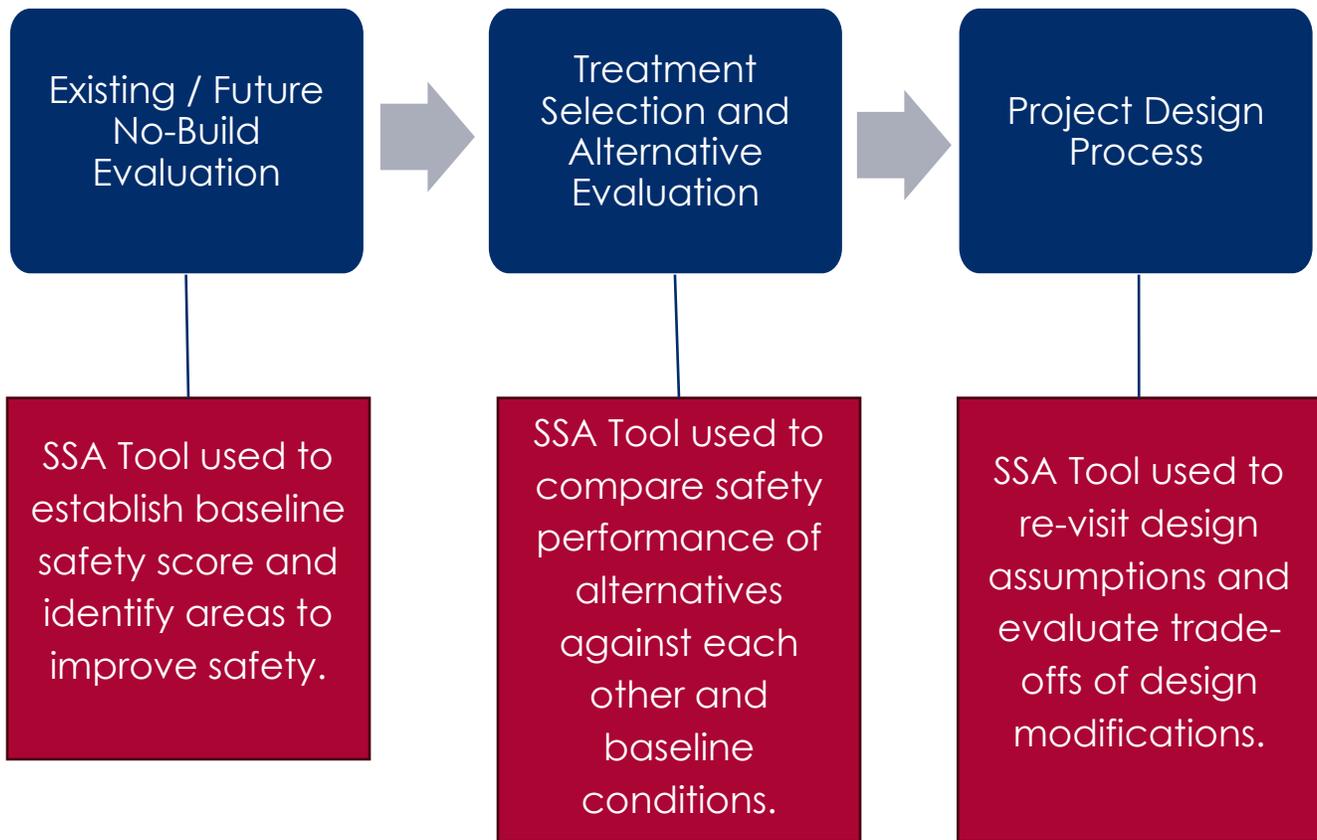


Exhibit 1 Potential Applications of SSA Tool during Project Development Process

This memorandum provides a background on the Safe System Approach, an overview of the SSA Tool, and an example of the SSA Tool on a typical capital project in the Treasure Valley. The purpose of this memorandum is to provide guidance on how the SSA Tool can be used to improve the effectiveness of capital projects in reducing fatal and serious injury crashes.

SAFE SYSTEM APPROACH BACKGROUND

SAFE SYSTEM APPROACH



The Safe System Approach is a comprehensive and proactive approach that, when applied, is designed to eliminate deaths and serious injuries on roadways by acknowledging human limitations and vulnerabilities. It emphasizes that transportation systems should have redundant safety measures, so that even if one safety measure fails, people are still protected. Under the Safe System Approach, safety actions should be implemented comprehensively to create safer roads, safer people, safer vehicles, safer speeds, and improved post-crash care.

The SSA Tool uses quantitative inputs (e.g., roadway elements or traffic patterns that contribute to crash likelihood, severity, and exposure) to evaluate an existing site or project alternative’s alignment with the safer speeds and safer roads elements. It uses qualitative inputs (e.g., what types of users use the roadway facilities? What are the levels of enforcement?) to evaluate alignment with safer people, safer vehicles, and post-crash care elements.

ROADWAY DESIGN HIERARCHY

The Safe System Roadway Design Hierarchy guide is a tool meant for transportation professionals to make informed decisions about which safety treatments are most effective at reducing fatal and serious injuries. It organizes these treatments into four tiers, with Tier 1 offering the greatest potential for reducing severe outcomes, emphasizing physical design changes that separate people from vehicle traffic or remove potential conflict points between vehicles. Tier 1 examples include converting intersections to roundabouts, installing protected bike lanes, and adding raised medians. Tier 2 focuses on reducing vehicle speeds emphasizing lowering speeds through traffic calming design elements, such as, speed humps, bulb outs,

Safe System Roadway Design Hierarchy

Tiers 1 through 3 are usually the most effective.

Tier
1

Remove Severe Conflicts

Removes exposure to conflicts and reduces crash likelihood.

Examples: Roundabouts, sidewalks, medians

Tier
2

Reduce Vehicle Speeds

Reduces the severity of potential crashes.

Examples: Raised crosswalk, speed humps

Tier
3

Manage Conflicts in Time

Reduces crash likelihood and exposure.

Examples: Protected left-turn phasing, leading pedestrian intervals

Tier
4

Increase Attentiveness & Awareness

Reduces crash likelihood.

Examples: Enhanced crossings, warning signs

narrowed lanes, chicanes. Tier 3 manages potential conflicts in time by using traffic signals or control devices, including protected left-turn phases and pedestrian hybrid beacons. Tier 4 aims to increase attentiveness and awareness of hazards by implementing design measures that alert road users, such as enhanced pavement markings and dynamic feedback signs.

The SSA Tool uses the principles of this hierarchy when evaluating crash exposure, risk factors, and severity of sites or project alternatives.

SAFE SYSTEM ALIGNMENT FRAMEWORK

FHWA developed the SSA Tool to assess roadway locations and potential improvements through a Safe System Approach (SSA) lens. The tool was created to provide practitioners with a tool to contrast and compare project alternatives relative to one another using scores for crash exposure, crash likelihood, and crash severity. This approach was developed with the SSA Principles in mind, and to be consistent with the Safe System Roadway Design Hierarchy.

The SSA Tool is provided in an Excel-based format. The user provides quantitative and qualitative inputs about the site or project alternative and the tool provides scores related to crash exposure, likelihood, and severity. To begin the process, the user must first provide inputs for existing conditions at a site. Once a score is derived for existing conditions, the user can complete the spreadsheet tool for each project alternative. The scores can be used to compare project alternatives to each other and to existing conditions, with scores being relative and lower scores indicating better alignment with the Safe System Approach.

PROJECT-BASED FRAMEWORK FACTORS

The SSA Tool aims to answer the following questions to evaluate a roadway's alignment with the Safe System Approach:

- What is the **level of exposure** to potential conflicts?
- How **severe** would potential crashes be?
- Based on what known risk factors are present, what is the **likelihood** of a crash?

The SSA Tool provides answers to these questions via quantitative assessment of existing sites or proposed projects. This section further describes these factors and the inputs required in the SSA Tool for the quantitative assessment

Crash Exposure

The crash exposure of a roadway facility is generally defined by the following:

- **Number of Conflict Points:** More potential paths crossing amongst users can increase exposure to crashes. Examples of conflicts could include permitted left-turns and through-traffic at traffic signals, or crosswalks that cross multiple lanes of travel.
- **Number of Users Present:** The more users traveling on a potential path of conflict will also increase exposure to crashes. This can be measured by metrics such as daily traffic volumes on a roadway or the number of people walking or biking on a crosswalk.
- **Roadway Width:** The width of a roadway and the resulting amount of time that a user is present in a conflict point also increases exposure (e.g., a wider lane may result in a longer crossing, thus increasing the amount of exposure between a driver and crosswalk user).

Crash Exposure Example - Crosswalks

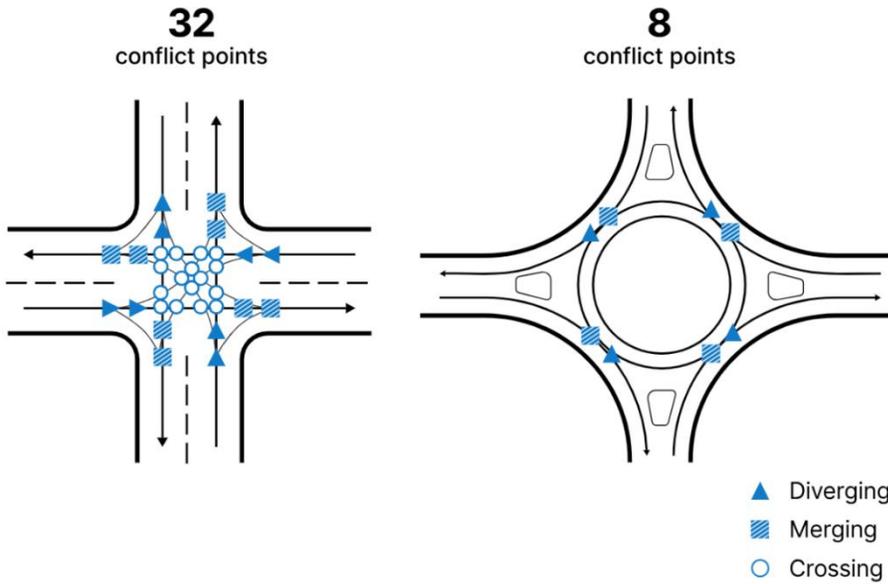


Example #1: This crosswalk, located at a traffic signal on a 5-lane arterial roadway, is 115 feet in length and crosses 5-lanes (5 total conflict points). There is limited median width to provide protection to people using the crosswalk. Source: Google Maps



Example #2: This crosswalk, also located on a 5-lane arterial, is 65 feet in length and crosses 4-lanes (4 total conflict points). A median provides physical protection to crosswalk users for 10 feet of the crossing. This crossing has less exposure compared to Example #1 since it has less conflict points and a shorter unprotected crossing length. Source: Google Maps

Crash Exposure Example – Number of Intersection Conflict Points



As shown in the diagram above, a traditional traffic signal with has 32 potential conflict points between through, left-turning, and right-turning vehicles. Single-lane roundabouts have only 8 total conflict points between vehicles, limiting the amount of exposure to crashes in comparison to a similar signalized intersection. Image Source: Texas DOT

Crash Exposure Data Inputs

Within the SSA Tool, the following inputs are required to calculate a score for crash exposure:

- Vulnerable Users Present (users per day):** The expected number of pedestrian and bicyclists walking along the corridor or crossing on a corridor or intersection.
- Crossing Distance (Max Number of Lanes):** The maximum number of lanes a pedestrian or bicyclist may cross along a corridor or intersection in a single crossing movement or stage.
- Motor Vehicles Volumes (Average Annual Daily Traffic):** Volumes of vehicles along the corridor or entering the intersection.
- Roadway Width (feet):** The width on the roadway along the corridor or the maximum roadway width from edgeline to edgeline at an intersection on the widest leg (not including median).

Motor Vehicles

Factor: Motor Vehicle Volumes (AADT)	
Thresholds	Values
Less than 1,000	1
1,001 - 5,000	4
5,001 - 10,000	6
10,001 - 15,000	8
Greater 15,000	10
User Input AADT	12,000
Score	8
Factor: Roadway Width (feet)	
Thresholds	Values
Less than 30	1
31 - 35	4
36 - 41	6
42 - 47	8
48 or more	10
User Input Width	40
Score	6
Exposure Score: Motor Vehicles Subtotal	14

Exhibit 2 Example Inputs and Score for Crash Exposure (Exposure Scoring Sheet tab of SSA Tool)

These inputs provide a resulting score, with higher scores indicating roadways with higher crash exposure. Exhibit 2 shows example scoring threshold values, user inputs (shown in the grey cells), and scores (shown in the yellow cells) for crash exposure.

Crash Likelihood

Crash likelihood on a roadway is measured in the SSA Tool by the presence of risk factors, which impact the probability of a crash taking place by influencing the opportunity for conflict and/or user error rates. Exhibit 3 and Exhibit 4 show risk factors that are considered within the SSA Tool for motor vehicles and vulnerable users.

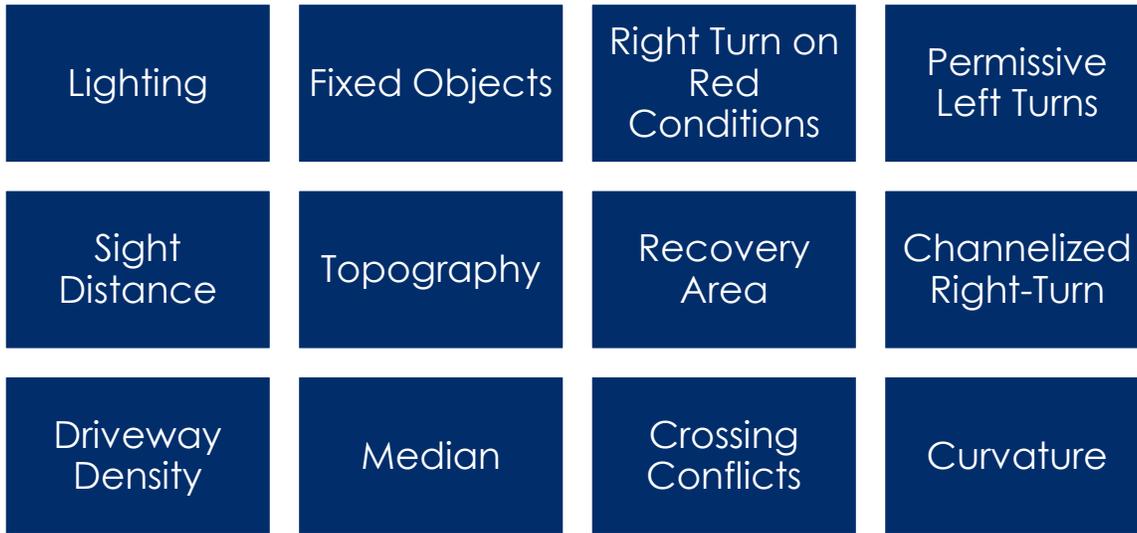


Exhibit 3 Motor Vehicle Risk Factors

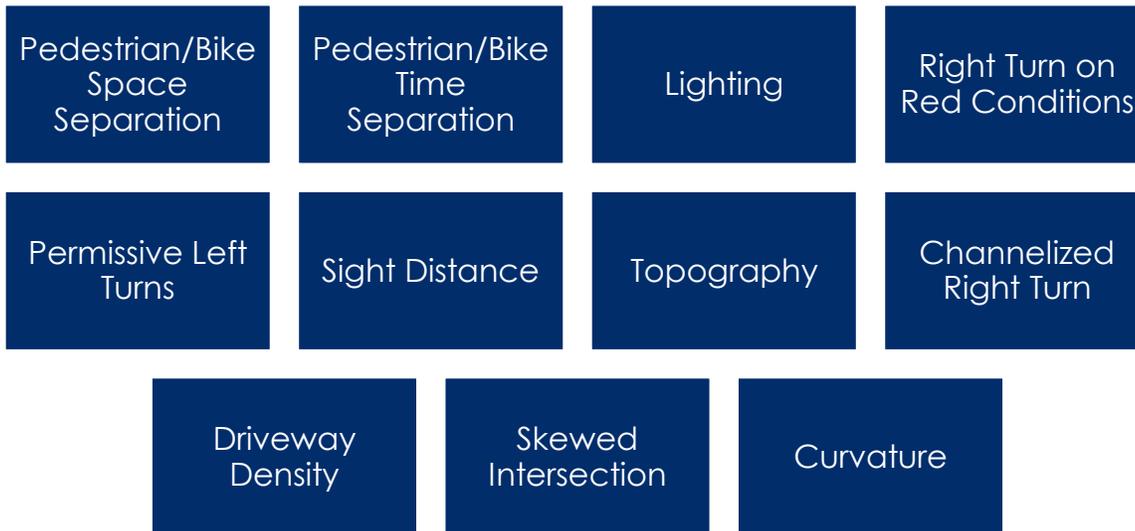


Exhibit 4 Vulnerable Road User Risk Factors

Risk Factor Example – Separation of Opposing Vehicular Direction of Travel



Increased Likelihood



Decreased Likelihood

Providing a buffer and/or physical separation between opposing vehicular directions of travel is a proven countermeasure for reducing fatal and serious injury crashes. The three images above display different median configurations. The image on the left provides buffer space that is limited to a centerline (less than 1 feet wide) and is the least effective at separating opposing directions of travel. The image on the right provides a buffer with a raised median. This vertical element eliminates potential conflicts between opposing directions of travel. The center image provides a center turn lane that is 13 feet wide. This treatment is less effective than the raised median as it does not remove conflicts, but it does provide more buffer space than the image on the left. Source: Google Maps

Additional Risk Factors

These lists of risk factors are not comprehensive and the user of the SSA Tool may choose to add additional risk factors if they are present under existing conditions or included or addressed in project alternatives. If additional risk factors are being considered, their effectiveness at reducing crash likelihood should be evaluated based on their relationship to the Safe System Roadway Design Hierarchy or the availability of crash modification factors, if available.

Crash Likelihood Data Inputs

The SSA Tool evaluates and provides a separate crash likelihood score for motor vehicles and vulnerable road users. The SSA Tool provides descriptions relating to risk factors and the user must choose a description that most accurately represents the conditions of the site under evaluation.

The tool then provides a score based on the description chosen, with a higher score indicating a higher likelihood of crash occurrence.

These inputs provide a resulting score, with higher scores indicating roadways with the increased presence of risk factors and higher crash likelihood. Exhibit 5 shows example scoring threshold values (i.e. scaling conditions), user inputs (options for user input are shown in grey cells, the selected cell has an “X”), and scores (shown by the bottom yellow cell) for the presence a risk factor that increases crash likelihood.

Risk Factor: Separation of Opposing Vehicular Direction of Travel

Roadway Segments

Along Segment (Place "X" for condition that most closely applies)	Scaling Conditions for the Risk Factors	Scaling Conditions for the Risk Factors Description
	0.00	Roadway with Median Barrier
X	0.75	Roadway with Raised Median
	1.50	Roadway with TWLTL or Painted Buffer 10 feet or greater
	2.25	Roadway with Centerline Buffer with Rumble Strip
	3.00	Undivided Roadway
0.75	N/A	N/A

Exhibit 5 Example Inputs and Score for Crash Likelihood Risk Factors (Risk Factors (Motor Vehicle) tab of SSA Tool)

Crash Severity

Crash severity is measured in the SSA Tool by factors that impact the probability of an injury or fatality in the event of a crash. The speed of vehicles upon impact is the most influential factor in determining crash severity². The crash type and type of user are also primary factors in influencing crash severity (e.g., people outside motor vehicles are more likely to be hurt at lower speeds). This concept is illustrated in Exhibit 6, which shows the crash fatality risk for different crash types based on impact speed. For crashes involving an automobile and pedestrian, the fatality risk is less than 25 percent when the impact speed is less than 20 miles per hour (mph). With an impact speed of 30 mph, the fatality risk increases to over 90 percent.

² *Self-Enforcing Roadways: A Guidance Report*. Federal Highway Administration. January 2018. <https://www.fhwa.dot.gov/publications/research/safety/17098/003.cfm>

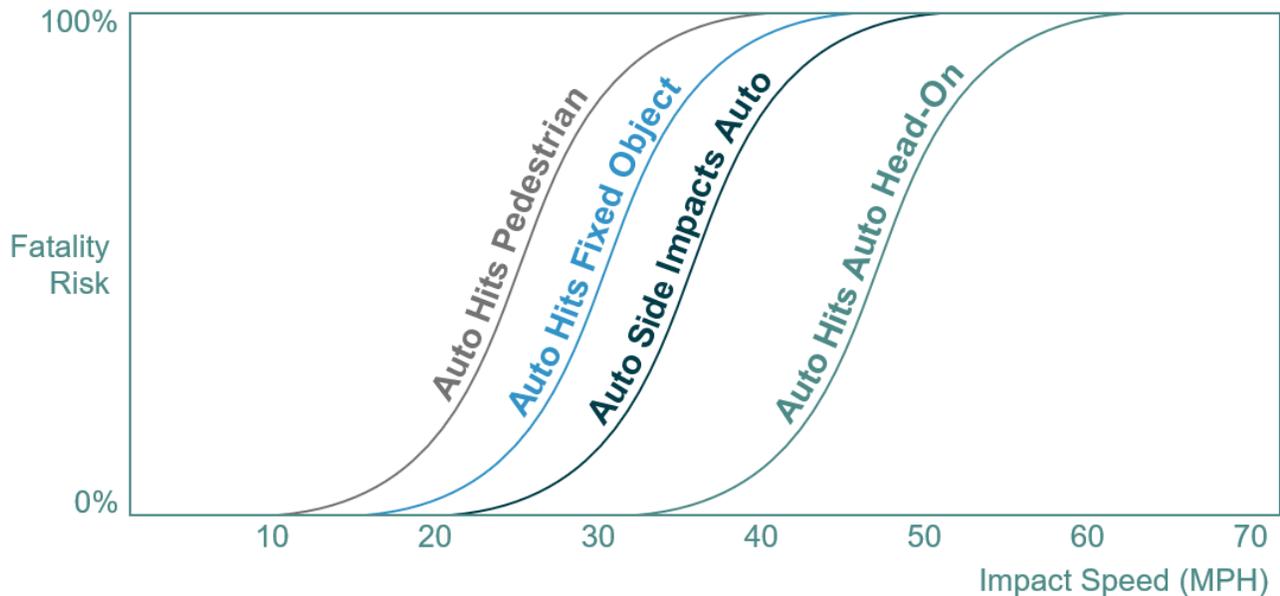


Exhibit 6 Crash Fatality Risk vs. Impact Speed (Source: United States Department of Transportation, Safe System Approach)

The scores calculated within the SSA Tool calculate crash likelihood (based on the likelihood of certain crashes occurring) and crash severity separately. Users should consider the relationship between crash types, crash users, and crash severity when assessing the score of a site or project.

Crash Severity Data Inputs

Within the SSA Tool, the following inputs are required to calculate a score for crash severity:

- Operating Speed (miles per hour):** Vehicle operating speed should be input for existing or no-build conditions. Operating speed should be based on measured 85th percentile speeds, if available. If not available, FHWA advises the operating speed should be assumed as the posted speed limit plus seven additional miles per hour.
- Proposed Conditions:** The user must indicate if the proposed conditions address factors that would decrease operating speeds via a “yes” or “no” answer. Factors that may decrease speed include physical factors (e.g., horizontal deflection, vertical deflection, reduced curb radii) or non-physical factors (e.g., advisory signs, enforcement). Physical factors are typically more effective at reducing speeds than non-physical factors.

These inputs provide a resulting score, with higher scores indicating roadways with higher potential crash severity (i.e., increased chance of fatality or serious injury in event of a crash).

Exhibit 7 shows example scoring threshold values, user inputs (shown in the grey cells), and scores (shown in the yellow cells) for crash severity.

Motor Vehicles

Risk Factor: Operating Speed (mph) or Speed Limit +7 mph	
Thresholds	Values
0 - 25	1
26 - 30	3
31 - 35	6
36 - 40	9
41 - 45	12
46 - 50	15
51 - 55	18
Greater than 55	20
User Input Speed	35
Score	6
For proposed conditions only: Do proposed improvements address factors impacting speed	
Motor Vehicles Subtotal	6
Comments and Assumptions (Discuss these improvements. Be sure to consider if these changes create new potential for severe conflict or speeding.) (Optional)	

Exhibit 7 Example Inputs and Score for Crash Severity (Severity Scoring Sheet tab of SSA Tool)

OTHER SAFE SYSTEM PROMPTS

The SSA Tool also asks a series of prompts to gauge the alignment of the project with the safer people, safer vehicles, post-crash care, and equity elements of the Safe System Approach. Response to these prompts is optional and is not needed to produce a quantitative score. The intent of these prompts is to encourage the user to consider the impact of the project on Safe System Approach elements beyond safer roads and safer vehicles.

TOTAL SCORE

After providing inputs related to crash exposure, crash likelihood, and crash severity, the SSA Tool provides a total score for the existing site or project. A total score for both motor vehicles and vulnerable users is derived by multiplying the scores of each scoring category. The sum of these scores is the Total Score, which is a relative score and can be used to compare project alternatives, with the lowest score potentially indicating greater alignment with the Safe System Approach.

Project Example – Midland Blvd / Iowa Ave Roundabout



Baseline Conditions: Prior to project construction, the intersection is all-way stop-controlled with left-turn lanes on three out of four approaches. Crosswalks are present on two legs. Lighting is minimal. Source: Google Maps, 2022



Project Conditions: The project implemented a roundabout with single lanes on the eastbound/westbound approaches and two lanes per direction on the northbound/southbound approaches. Crosswalks with RRFB's are provided on each intersection leg. There is improved lighting at the intersection and on each approach. Source: Google Maps, 2025

Exhibit 9 Example Project for SSA Tool Assessment

SSA TOOL SCORING RESULTS

Inputs related to site and project design elements were provided into the SSA Tool for Baseline and Project Conditions. The resulting scores were calculated separately for vulnerable road users and motor vehicles and are shown in Table 1.

Table 1 Midland Blvd / Iowa Ave Roundabout SSA Tool Results

Score Category	Vulnerable Road Users Score			Motor Vehicles Score		
	Baseline	Project	% Change	Baseline	Project	% Change
Exposure Score:	14	10	-29%	18	18	0%
Likelihood Score:	18	12	-33%	12	1	-92%
Severity Score:	15	10	-33%	6	3	-50%
Mode Total¹:	3780	1200	-68%	1296	54	-96%

¹Mode totals are the product of the exposure, likelihood, and severity scores

The SSA Tool calculates the Project Condition scores as 72 percent and 96 percent less than Baseline Condition scores for Vulnerable Road Users and Motor Vehicles, respectively. This reduction in scores indicates that Project Conditions are in greater alignment with the Safe System Approach than Baseline Conditions.

Table 2 indicates the specific factors and inputs within the SSA Tool that contributed to an improved score (i.e., greater alignment with the Safe System Approach). A review of these factors may help the user identify specific design elements that are most effective in reducing fatal and serious injury crashes. The improved score can also be related back to the Safe System Roadway Design Hierarchy. The primary driver of the improved score is the reduction in conflicts and motor vehicle speeds due to converting the intersection to a roundabout, which is a Tier 1 (remove severe conflicts) and Tier 2 (reduce vehicle speeds) treatment.

Table 2 Factors Contributing to Improved Score in SSA Tool

Scoring Category	Vulnerable Road Users	Motor Vehicles
Crash Exposure	<ul style="list-style-type: none"> • Reduced crossing distance 	Score is unchanged
Crash Likelihood	<ul style="list-style-type: none"> • Crosswalks and RRFB's on each leg of intersection • Removal of left-turn conflicts • Improved lighting • Sight distance improvements 	<ul style="list-style-type: none"> • Improved lighting • Removal of crossing conflicts (i.e., left-turn and through movements) • Sight distance improvements • Raised median on approaches
Crash Severity	<ul style="list-style-type: none"> • Roundabout (anticipated decrease in vehicle speeds) 	<ul style="list-style-type: none"> • Roundabout (anticipated decrease in vehicle speeds)

The user may also use the SSA Tool to further evaluate how changes in the design may affect the score. This could involve modifying design elements identified or introducing additional design elements to improve the score of certain subcategories. For example, the Crash Likelihood score for Vulnerable Road Users decreased by approximately 33% with the Project Conditions. To further improve/decrease that score, the SSA Tool indicates that the project could add dedicated bike facilities on each approach, provide greater separation between pedestrian facilities and motor vehicle traffic, and remove or consolidate driveways near the intersection.

NEXT STEPS

COMPASS member and partner agencies are encouraged to use the SSA Tool at different parts of the project development process to assess its usefulness in evaluating the safety performance of capital projects. COMPASS will continue to work with its member and partner agencies to explore potential applications of the SSA Tool and other tools for improving safety in capital projects.