



INNOVATION / TECHNOLOGY DEPLOYMENT SUMMARY

Safer by Design - Safety Scoring Tools, Procedures, and Training

CHALLENGE

More than 87,000 lives have been tragically lost since Nov. 7, 2000, the last deathless day on Texas roads. TxDOT's #EndTheStreakTX campaign raises public awareness, reminding Texans to help end the streak of roadway deaths. Another focal point in this effort to save lives is prioritizing continuous improvements to engineering and roadway design. Traditional approaches focused on meeting standards, with no tools for evaluating safety during project development. Using this **nominal safety** approach, construction and maintenance projects took only historical crash data into consideration to identify potential safety issues. TxDOT recognized a critical need for additional tools to help evaluate potential safety enhancements during project development and design.

SOLUTION

TxDOT's Design Division worked with experts in several districts and divisions to form the Council on System Safety. In partnership with the Texas A&M Transportation Institute (TTI), the council developed the **Safer by Design** suite of safety scoring tools, a simple but effective way to incorporate safety analyses into the roadway design process. Based on the AASHTO Highway Safety Manual (HSM), National Cooperative Highway Research Program (NCHRP) research, and FHWA Crash Modification Factors (CMF) Clearinghouse data, these safety scoring tools were developed to evaluate the effects of geometrics, traffic control, and roadside design elements on safety (see Fig. 3). During the initial phase, spreadsheet-based tools were created for rural highways and urban intersections. In phase two, the project team developed the web-based Urban Segment Safer by Design (SBD) tool, released in February 2024 (see Fig. 4). Research conducted over the past decade shows optimal safety performance may not be achieved by simply meeting minimum design standards. To enhance safety performance, current HSM guidance incorporates quantitative safety analysis into the highway transportation project planning and development processes. This **substantive safety** approach quantifies the safety impacts of design by anticipating crashes to estimate safety performance.

PROACTIVE APPROACH

TxDOT has been using a segment safety scoring tool to assess two-lane rural roadways and multi-lane rural roadways, and an intersection safety scoring tool for urban and suburban roadways. Beginning in September 2024, the new web-based tool will be used for urban (segment + intersection)

TxDOT GOALS



Deliver the right projects



Focus on the customer



Foster stewardship



Optimize system performance



Preserve our assets



Promote safety



Value our employees



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projects. Safer by Design goes further by categorizing design elements, defining standard and optimal values and calculating a score for each component, then combining scores from each category to determine the total score. This approach provides insight into the safety impact of each design element, facilitating decision-making during the project design process to optimize safety, and improving awareness as plans are made for future development. Instead of reacting to severe crashes, districts can use this systemic approach — and an **“every project is a safety project”** mindset — to substantially reduce the risk of crashes.

BENEFITS

Safer by Design safety scoring tools help TxDOT engineers make proactive, safety-driven decisions during the project development phase. The approach:

- Facilitates integration of safety analyses into project design.
- Increases awareness of how design changes affect safety.
- Offers the ability to compare Standard and Optimal design alternatives by defining a maximum practical value for each design parameter and providing an optimal safety score (see Fig. 3).
- Delivers valuable safety insights that can inform future project planning.

KEY TASKS

- Require all applicable projects use safety scoring tools to evaluate safety and report safety score.
- Implement tools to help engineers make safety-driven decisions.
- Provide training and resources on safety scoring tool use and interpretation.
- Promote a proactive approach to safety through design and encourage future improvement planning.

DATA SOURCES

Several design elements are taken into consideration and the impacts of changes can be visualized as a vortex plot (see Fig. 2). This clearly shows which increase safety (shown in green) and which need to be upgraded to achieve an optimal design (shown in orange). Safety impacts of various design elements are researched, quantified, and documented as safety performance functions (SPFs) and crash modification factors (CMFs). Safer by Design tools incorporate HSM and NCHRP guidance, information from the CMF Clearinghouse database, and TxDOT research.

Resources

[Design Division](https://www.txdot.gov/design-division)
([txdot.gov](https://www.txdot.gov))

[Safer by Design](https://www.txdot.gov/safer-by-design)
([txdot.gov](https://www.txdot.gov))

[Highway Safety Manual](#)
(HSM)

[Crash Modification](#)
[Clearinghouse \(CFM\)](#)

[#EndTheStreakTX](#)
([txdot.gov](https://www.txdot.gov))

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Figure 1. Scoring tool approach.

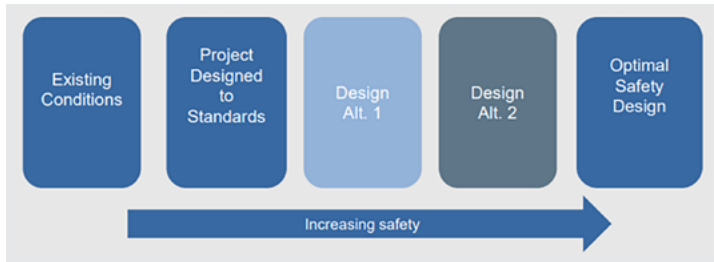


Figure 2. Powerful vortex plot.

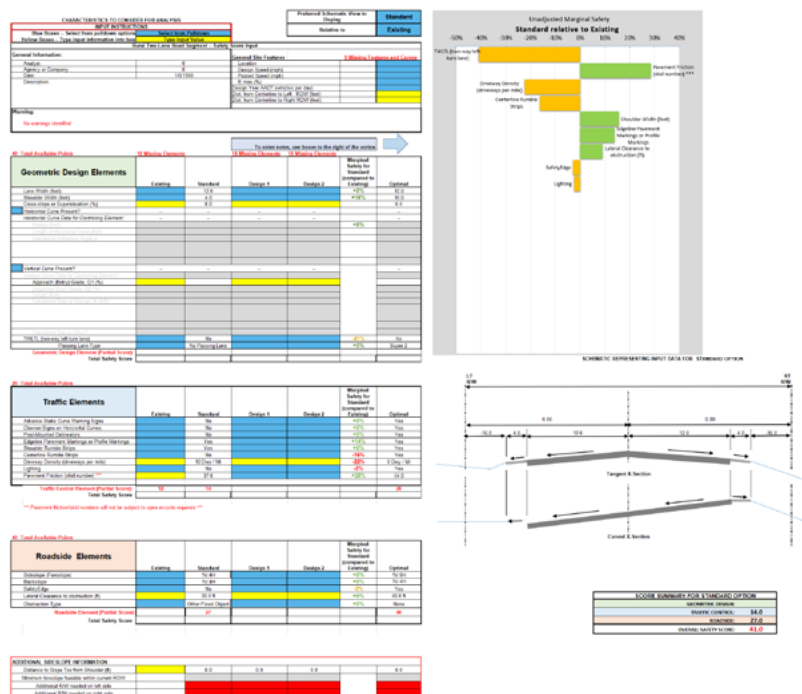
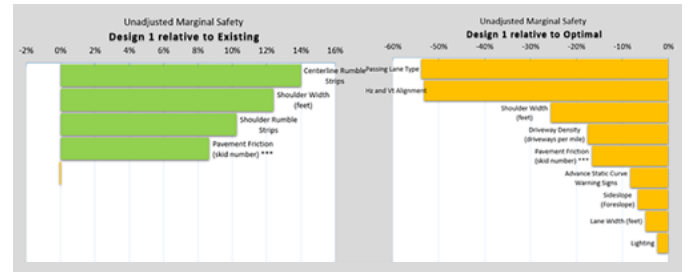
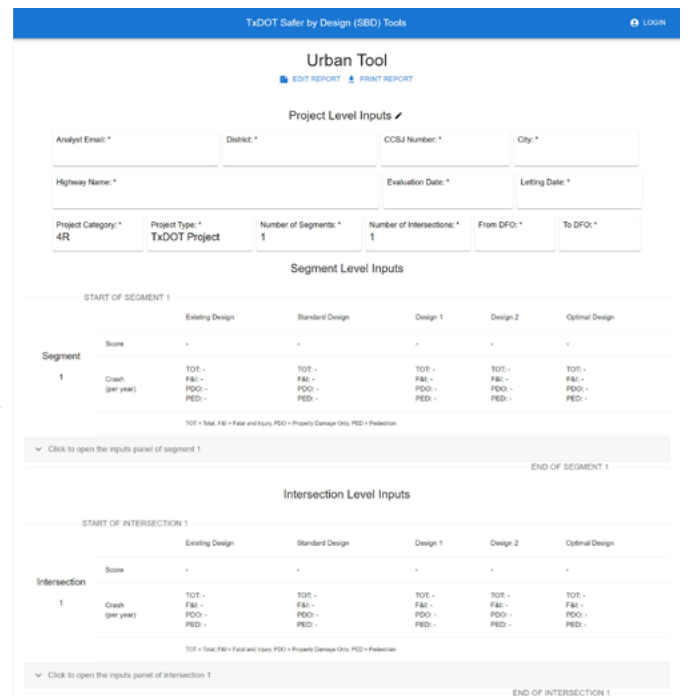


Figure 3. Phase one Excel-based safety scoring tool.

Figure 4. Current [web-based](#) Safer by Design (SBD) Urban Tool.