## NEW ZEALAND: SAFE SYSTEM ASSESSMENT FRAMEWORK

### THE PROBLEM

Investment in road infrastructure projects is often not contingent on achieving Safe System outcomes. Furthermore, simple compliance with road design standards does not necessarily guarantee Safe System outcomes. There is therefore a need for road agencies to methodically consider Safe System objectives in road infrastructure projects and, ideally, to link these objectives to investment outcomes.

Road agencies in Australia and New Zealand have adopted the Safe System approach and have been working to implement programmes consistent with achieving Safe System outcomes for more than a decade. Infrastructure needs to be planned, implemented and maintained to assist in meeting these objectives. This includes the need to assess whether infrastructure (whether planned or existing) is likely to meet Safe System objectives.

In addition, there is increased awareness under the Safe System approach that infrastructure managers need to assess their projects with regards to all of the Safe System pillars. Even though there is typically less control over the non- infrastructure pillars, it is still possible to influence safety in a broader sense, including through improved stakeholder engagement. To date there have been no methods available to make this type of Safe System assessment for infrastructure projects.

### THE SOLUTION

New Zealand has developed Safe System audit guidelines for transport projects incorporating key elements of the Austroads Safe System Assessment Framework. The Safe System Assessment Framework is designed to help road agencies methodically consider Safe System objectives in road infrastructure projects and provides a structured way to identify elements of road design and operation that need to be modified to achieve closer alignment with Safe System outcomes.

A Safe System Assessment Framework was developed that provides a qualitative rating indicating how infrastructure projects are meeting Safe System objectives. The framework also prompts users to consider all the pillars of the Safe System. The framework breaks the assessment of risk down into key components, using terminology that is familiar to infrastructure managers. The Austroads Safe System Assessment Framework also outlines a treatment hierarchy to help identify the most effective treatments that might be used to minimise death and serious injury.

The Safe System Assessment Framework is based on a matrix that identifies each of the key crash types that result in fatal and serious injuries. These are run-off-road, head-on, intersection, 'other' (which typically includes rear-end and maneuvering crashes), pedestrians, cyclists and motorcyclists. For each of these crash types, risk is assessed based on crash exposure, likelihood and severity. These are the core components of risk, and elimination of any one of these risks for any crash type will eliminate the chance of a serious injury crash occurring.

The matrix is based on a score from 0 to 4 for each crash element as shown in the Table 1 below. A score of 0 indicates very low risk of death and serious injury, while a score of 4 indicates a very high risk. The overall score is out of a possible 448 and the closer the score is to zero, the more the project in question is in alignment with Safe System principles.

**Table 1: Safe System Assessment Framework matrix**

| | Run-off-road | Head- on | Intersection | Other | Pedestrian | Cyclist | Motorcyclist | |
|---|---|---|---|---|---|---|---|---|
| Exposure | /4 | /4 | /4 | /4 | /4 | /4 | /4 | |
| Likelihood | /4 | /4 | /4 | /4 | /4 | /4 | /4 | |
| Severity | /4 | /4 | /4 | /4 | /4 | /4 | /4 | |
| Product | / 64 | / 64 | / 64 | / 64 | / 64 | / 64 | / 64 | / 448 |

The scores show the risk for each crash type, and an assessment can be made of how close the design is likely to be in delivering Safe System objectives. Prompts are also provided for the assessment of other Safe System pillars. In this way, consideration is given to other ways that the users of the framework can influence Safe System outcomes beyond the traditional infrastructure solutions.

Following is an example of how the Safe System Assessment Framework has been used in New Zealand for a project on State Highway 1 in an area known as Dome Valley. The project targeted a 15-kilometre-long section of highway that provides an important link between Northland and Auckland for commuters, freight and tourists but has a poor crash history and contains unexpected curves, poor visibility and steep slopes.

Between 2006 and 2015 there were 17 fatalities and 45 serious injuries on this road section. A project was developed to reduce the risk and potential severity of future crashes, particularly relating to head-on, run-off-road and intersections crashes.

Figure 1 shows a typical road layout on Dome Valley prior to safety improvements, highlighting the winding and hilly nature of the road with no physical central median separation and only partial treatment of roadside hazards. The second image in the figure shows some of the safety improvements being applied as part of the project including a median barrier to separate opposing traffic flows and roadside safety improvements.

**Figure 1. State Highway 1 Dome Valley before and during safety improvements**

Source: Waka Kotahi New Zealand Transport Agency

The project design included a range of options both with and without median barriers, roadside barriers, shoulder widening and wide centerlines. A Safe System Assessment was undertaken for each option. The primary focus of the assessment was to evaluate the relative safety afforded by each option through the provision of varying lengths of different safety interventions.

The assessment highlighted the critical importance of Primary Safe System infrastructure interventions such as median and roadside barriers. The Safe System Assessment favoured the option that provided the highest level of protection from serious trauma, noting that: “To obtain the highest alignment with Safe System principles in the high-speed midblock sections of this road, consider implementing continuous roadside and median flexible barriers.”

Following is another example where the Safe System Assessment Framework was used to evaluate safety improvement options for an intersection with safety deficiencies and a record of 39 crashes reported over a five-year period, the majority of which involved crossing or turning vehicles. Two options were considered for upgrading the intersection: (a) traffic signals with pedestrian crossing facilities on all approaches; and (b) a single-lane roundabout with traffic calming and zebra crossings on all approaches.

The roundabout was confirmed as a Primary Safe System treatment that provided the highest Safe System alignment and greatest protection against exposure to large forces in the event of a crash. Based on this assessment, the roundabout option was progressed and has since been constructed. Before and after images of the intersection are shown in Figure 2.

**Figure 2. Church Street/Victoria Street intersection before and after safety improvements**

Source: Waka Kotahi New Zealand Transport Agency

**THE OUTCOME**

The Austroads Safe System Assessment Framework was released early in 2016 and is now widely applied throughout Australia and New Zealand. It has now been made compulsory for use for all infrastructure projects in some states. The framework has been used as a practical tool for assessing and improving infrastructure. However, there has been additional value from the tool as a training aid.

In New Zealand, road safety audits must be undertaken for projects to receive funding under the National Land Transport Fund (NLTP). A new guide - Safe System audit guidelines for transport projects - has been developed which embeds the Austroads Safe System Assessment Framework methodology as part of the wider road safety auditing process, effectively mandating the requirement for Safe System Assessments to be undertaken as part of project development.

Breaking the crash types and risks down into core elements has proven to be a powerful mechanism to explain Safe System concepts in very practical terms. It has generated new, informed conversations about safety and how Safe System concepts can be embedded within the design, construction, operation, maintenance and use of road infrastructure.

**FURTHER INFORMATION**

Further details can be found in the following references:

- Turner et al. (2016) Austroads Research Report AP-R509-16: Safe System Assessment Framework
- Austroads Safe System Assessment Framework - webinar
- NZ Transport Agency (2022) Safe System audit guidelines for transport projects