SPEEDY SAFETY SOLUTIONS

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ABSTRACT

A challenge faced by many road controlling authorities is the lack of resources dedicated to building effective road safety programmes. One of the barriers to developing effective programmes is that identifying high-risk locations and evaluating possible intervention(s) specific to each situation is a very laborious task. This paper presents an innovative and interactive application that has been developed for the Northland Transportation Alliance to streamline this process.

The application summarises the risk metrics, crash history and proactive safety measures for a user defined road segment or intersection. The application then populates a list of safety interventions that will potentially be effective for the location based on the treatment philosophy (based on risk profile), One Network Road Classification (ONRC), crash history and the characteristics of the road.

This paper describes how the new application operates, how users formulate and prioritise programmes of work based on different metrics (e.g. Death and Serious Injuries (DSi's) per dollar spent or DSi's per kilometre). The presentation that accompanies this paper will also show how the built-in DSi's reduction and BCR calculators assist RCA's to collate the necessary information required to gain funding approval.

This paper will be of interest to road controlling authorities and road safety practitioners.

INTRODUCTION

Safer Journeys, New Zealand's Road Safety Strategy 2010-20 has a vision to provide a safe road system increasingly free of death and serious injury (Ministry of Transport, 2010). The strategy adopts the safe system approach to road safety focused on creating safe roads, safe speeds, safe vehicles and safe road use. These four safe system pillars need to come together if the New Zealand Government's vision for road safety is to be achieved.

In order to achieve a road network which is increasingly free of death and serious injury, road controlling authorities need to develop effective road safety programmes. In New Zealand, 88% of the road network, some 80,000km, is made up of "local roads" which are administered by city and district councils (NZTA, n.d.). However, these local authorities are often constrained by limited resources which affects their ability to develop effective road safety programmes. Smaller councils often do not have specialist road safety engineering expertise and these responsibilities fall to staff who are often responsible for a number of other components of the transport network.

To assist in the development of road safety programmes, the New Zealand Transport Agency (NZTA) has developed an online portal which identifies existing and potential areas of high crash risk. Once a high-risk corridor or intersection has been identified however, the RCA must also:

- review the crash records
- identify potential countermeasures
- compare the relative cost and return on investment for each intervention
- apply for funding

To streamline this, the Northland Transport Alliance (NTA) commissioned Abley to develop an automated process for identifying potential interventions for intersections and corridors that are both appropriate for the context and that are likely to address the crash risk.

METHODOLOGY

The first step in developing the tool was a review of national guidance to identify potential countermeasures. Countermeasures were identified through the NZTA's *High Risk Intersections Guide* and the *High Risk Rural Roads Guide*. Key inputs included which crash types each intervention addresses and the associated crash reduction factors. The guidance often included a range of crash reduction values recorded from different studies and thus an appropriate crash reduction range was incorporated into the database with engineering judgment applied to identify a "default" crash reduction factor. The crash type groupings used for corridors and intersections are shown in Table 1.

Table 1. Crash types assessed for applicability with each intervention

Corridors	Intersections
Head on	Loss of control
Loss of control	Right turn against
Out of context curves	Crossing
Turning vs. Same direction	Roundabout entry
Intersection	Turning vs. Same direction
Dark	Dark
Wet	Wet
Active Road User (Pedestrian/Cyclist)	Cyclist
	Pedestrian

The next step in the process was to identify the applicability of each intervention based on crash history and context. This was to ensure the tool only displayed interventions that were likely to be appropriate and address the crash risk. The factors which were used to assess the context of a corridor were: ONRC, AADT, lane width, shoulder width, road stereotype[1] and alignment[1]. For intersections, the form and control were considered. For both intersections and corridors, consideration was also given to whether the location had an urban or rural speed environment and, and whether the existing speed aligned with the safe and appropriate speed[2]. This process relied on engineering judgment to determine the applicability for each intervention.

Where applicability was not clear, the intervention was deemed to be appropriate thus enabling the user to consider the appropriateness for the site-specific situation.

Considering context in addition to the crash record was an important step in filtering potential interventions to ensure those that pre-populated were relevant. This ensured that an “activated advance stop sign” would only populate for a priority-controlled intersection in a rural speed-environment with a prevalence of crossing crashes and conversely a “continuous roadside (edge) barrier” would not populate for a low volume, low ONRC road with no history of loss of control crashes, or for a road in an urban residential area with a high density of property access points.

Both the *High Risk Intersections Guide* and the *High Risk Rural Roads Guide* outline a process for aligning risk assessments with a treatment strategy. For example, an intersection with **High** Collective and Personal risk warrants “*Safe System Transformation Works*” works i.e. high expenditure. The purpose of treatment strategies is to ensures that there is an appropriate level of investment for the corresponding crash risk. Thus, the final stage was to identify which treatment philosophy (or philosophies) the interventions aligned with. As an example, “median barriers” were identified as a “*Safe System Transform Works”* intervention and “edge marker posts” were identified as both a *Safety Management* and a *Safety Maintenance* intervention.

APPLICATION

Once the database was completed, a GIS web tool was developed. The web tool allows users to either select pre-defined corridors or intersections (based on the Urban KiwiRAP process) or select custom lengths of corridors.

Once the selection has been made, the tool recalculates the personal and collective risk profiles and displays other key attributes. **Figure 1** shows the key attributes and crash profile populated for an intersection and **Figure 2** shows the key attributes and crash profile populated for custom length corridor.

[1] Road stereotype refers to the type of road e.g. two-lane undivided. Road stereotype and alignment were classified in accordance with the Infrastructure Risk Rating Manual (BRODIE C., et al, 2016)
[2] As described in the Speed Management Guide (NZTA, 2016)

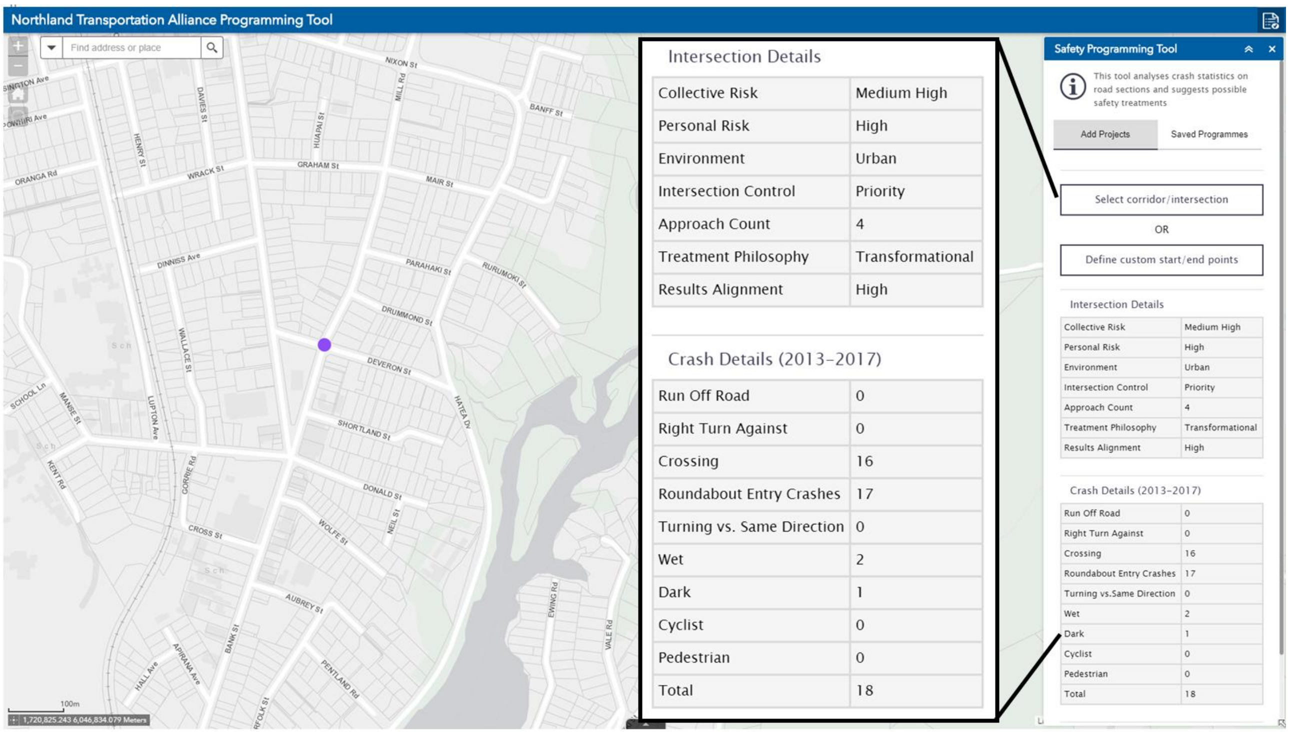

Figure 1. Populated crash details and key attributes for an intersection in the tool

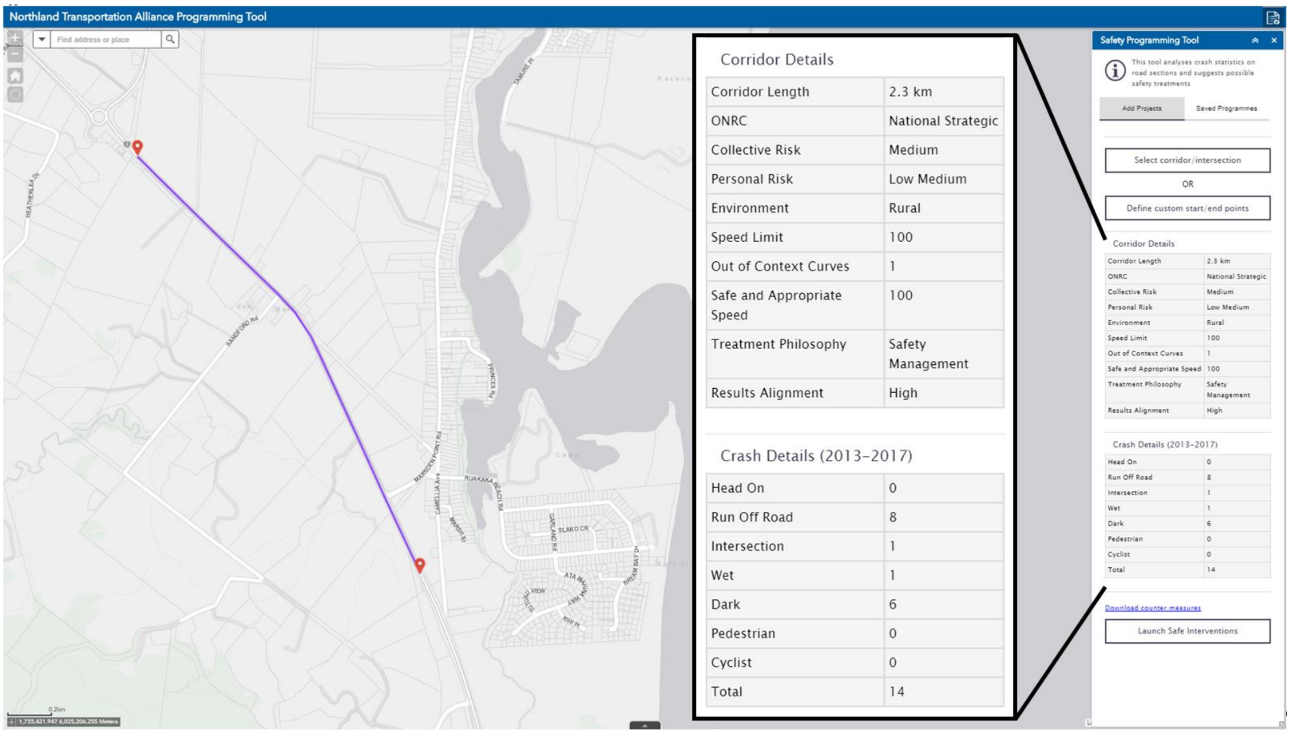

Figure 2. Populated crash details and key attributes for a custom corridor in the tool

The tool then processes the crash and physical attributes of the selection and uses the database to determine which interventions should be pre-populated for consideration. As shown in **Figure 3**, the tool calculates the anticipated number of death and serious injuries (DSi's) that may be prevented annually for each intervention. This is calculated by applying a crash reduction factor to the historical crash data for the selected corridor/intersection. The default crash reduction was informed by a review of available crash reduction studies (listed in the afore mentioned guidance) for each intervention. A user is also able to use professional judgment to amend the crash reduction percentage within the range of crash reduction potential listed in guidance.

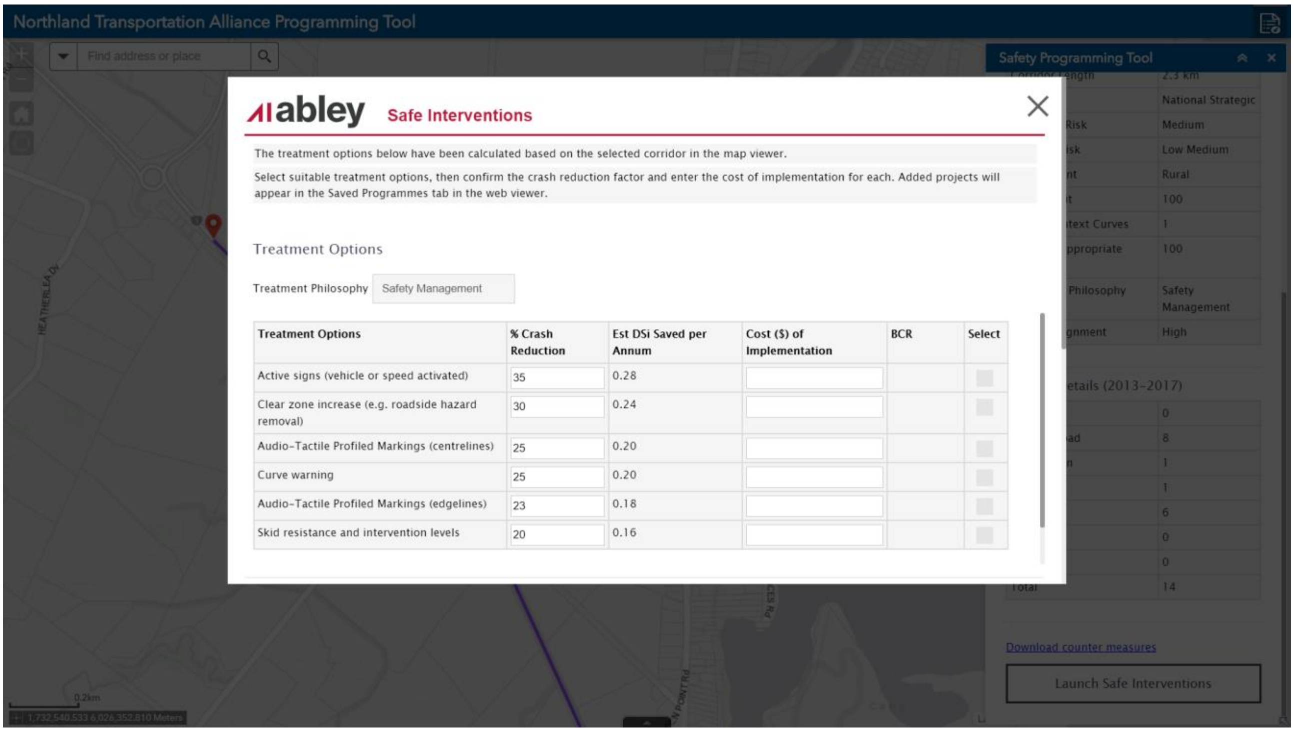

Figure 3. Pre-populated interventions

Users are also able to obtain an indicative BCR for the project by entering in a cost estimate for each intervention. The tool is also able to calculate the cumulative crash reduction potential and corresponding BCR if multiple interventions are selected e.g. if a user wanted to consider implementing audio tactile profile paving and a wide centreline.

Finally, the user can choose to save the interventions to an existing or new road safety programme. The tool then allows the programmes to be compared by various metrics including:

- DSi's saved per year per dollar spent
- DSi's saved per year per km

Limitations

A limitation of the tool is that it is informed by the interventions and corresponding crash reductions listed in the *High Risk Rural Roads Guide* and *High Risk Intersections Guide* which were published in 2011 and 2013 respectively. Thus, innovative treatment approaches developed in recent years e.g. raised intersections are not currently included in the tool. Furthermore, it is likely that there are more recent studies into the crash reduction potential of interventions which have not been included.

To address this, the tool allows the user to manually enter an intervention or to modify the crash reduction value applied to existing interventions. However, this does rely on the user conducting the required research to determine the appropriate crash reduction.

CONCLUSIONS AND NEXT STEPS

The automated process provides an innovative approach to translating identified crash risk to interventions for consideration. The tool reduces the time taken to develop effective road safety programmes by pre-populating interventions that are likely to be suitable for the context and effective in addressing the crash risk for user defined corridors and intersections.

The next steps for the project include developing an export function which will streamline the funding application process.

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