ENHANCED IDENTIFICATION OF HIGH-RISK INTERSECTIONS

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1. ABSTRACT

The New Zealand Transport Agency’s High-Risk Intersections Guide introduces new assessment techniques for identifying the risk of someone dying or being seriously injured in the future. The assessment techniques have been developed using industry knowledge of the inter-relationships between speed environment, intersection form and control type and crash movements to estimate risk. The departure from a wholly reactive approach to road safety allows high-risk intersections to be identified before people are killed or seriously injured.

This paper presents the development of a geographical information systems based mechanism for calculating the risk profile of all intersections in a town, city or region in a cost-effective and time-efficient compared to the manual equivalent. Aside from enabling Road Controlling Authorities to make informed decisions about prioritising road safety countermeasure improvements, the process has helped unlock the true value of the transport related data that organisations often put great effort and expense into collecting. The paper goes on to demonstrate the robustness of the risk estimation process by comparing recent fatal and serious crashes at intersections against prior risk estimates of the occurrence of those high-severity crashes.

This paper will be of interest to everyone involved with the targeted identification, prioritisation and funding of road safety improvements, and those seeking to unlock the true value of transport data sets.

2. SAFER JOURNEYS, NEW ZEALAND’S ROAD SAFETY STRATEGY 2010-20

Safer Journeys, New Zealand’s Road Safety Strategy 2010-2020, has a vision to provide a safe road system increasingly free of death and serious injury. It adopts a Safe System approach to road safety focused on creating safe roads, safe speeds, safe vehicles and safe road use [1].

The Safe System philosophy is based on creating a forgiving road system that acknowledges that people make mistakes and have limited ability to withstand crash forces without being killed or seriously injured. Under the Safe System, all parts of the system - roads and roadsides, speeds, vehicles, and road use, all need to be improved and strengthened - so that if one part fails, other parts will still protect people involved in a crash.

Safer Journeys signifies a shift in focus, from reducing crashes to minimising the likelihood of high-severity crash outcomes. In order to give effect to this change in focus, new analytical approaches have been developed that prioritise intersections on the likelihood of future fatal and serious casualty occurrence and risk.
3. TRADITIONAL SAFETY APPROACHES

The traditional approach of identifying and addressing road safety issues at intersections in New Zealand has generally been targeted on the basis of historic crash performance; through crash reduction studies, and black-spot analyses and treatments. While these crash clustering approaches served New Zealand well in the past, it tended to place a strong emphasis on crashes with minor injuries.

Alternative approaches were introduced to overcome this, including the ranking of sites by the social cost of crashes. However, this had the opposite effect and ended up placing excessive focus on recent fatal crashes. As fatal crashes very rarely occur at the same location within a five-year period, the approach of prioritising sites for treatment based on social crash costs is fraught with the risk of reaching false conclusions about crash risk because of a low number of observations. Prioritising in this manner also drew criticism from the general public who were unaccepting of an approach of waiting for someone to die or be seriously injured before the funding of improvements could be justified.

The relative rarity of fatal and to a lesser extent serious crashes at the same site is evidenced from analysis of crash data in Auckland. Analysis of crash data at intersections in 2013 showed that 79% of fatal and serious crashes occurred at sites with no previous fatal or serious crashes in the previous 5 years and 64% occurred at sites with 2 or fewer injury crashes in the same period. This suggests that an approach of prioritising based on previous fatal and serious crashes in particular, is not a strong indicator of a high probability of future fatal and serious crashes.

4. THE HIGH-RISK INTERSECTIONS GUIDE [2]

The ‘High-Risk Intersections Guide’ was published by the New Zealand Transport Agency in 2013. It provides practitioners with best practice guidance to identify, target and address key road safety issues at high-risk intersections. The approach aligns with Safer Journeys focus on reducing deaths and serious injuries.

The High-Risk Intersections Guide introduces a new technique for identifying intersections that have a disproportionately higher than average risk of future deaths or serious injuries if recent crash trends continue. The new technique calculates an estimated number of Death and Serious injury (DSi) casualty equivalents based on relationships between speed environment, intersection form and control type and crash movement type factors. This approach is founded on knowledge that crash outcomes vary as a function of speed, intersection form and control type, and crash movement type. The DSi casualty equivalents method acknowledges that actual fatal and serious crash data alone is not a good indicator of the underlying risk of a high-severity crash at many intersections.

The High-Risk Intersections Guide provides DSi factors, referred to as ‘Severity Indices’, for all primary crash movement types for the following intersection types:

- Signalised crossroads
- Signalised T-intersections
- Roundabouts
- Priority (Give Way or Stop) controlled crossroads
- Priority (Give Way or Stop) controlled T-intersections

Different severity indices are provided for urban (≤70km/h) and rural (≥80km/h) speed environments. The severity indices in the *High-Risk Intersections Guide* are calculated based on nationwide crash statistics from 2008 to 2012 and represent the average number of deaths and serious injuries per reported injury crash for each primary crash movement type at a specific intersection form, control type and speed environment.

The *High-Risk Intersections Guide* defines two main types of risk metric: Collective Risk and Personal Risk.

- **Collective Risk** is measured as the total number of fatal and serious crashes or estimated deaths and serious injuries within 50 metres of an intersection in a crash period.
- **Personal Risk** is the risk of death or serious injuries per 100 million vehicle kilometres travelled within 50 metres of an intersection.

### 4.1 Collective Risk

Collective Risk is calculated by multiplying each reported injury crash at an intersection over the past five years by the corresponding severity index and summing the values. The Collective Risk of an intersection is then categorised into a five-tiered risk threshold classification.

The thresholds have been determined by analysing the safety performance of thousands of intersections in New Zealand, and set so that intersections with a ‘High’ or ‘Medium-High’ Collective Risk profile (i.e. high-risk) make up fewer than 5% of all intersections in New Zealand. The Collective Risk thresholds based on the estimated DSi casualty equivalent approach are set out in **Table 1**.

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Collective Risk Thresholds (estimated DSi casualty equivalents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>Low Medium</td>
<td>0.3 - &lt;0.6</td>
</tr>
<tr>
<td>Medium</td>
<td>0.6 - &lt;1.1</td>
</tr>
<tr>
<td>Medium High</td>
<td>1.1 - &lt;1.6</td>
</tr>
<tr>
<td>High</td>
<td>≥1.6</td>
</tr>
</tbody>
</table>

Intersections that are assessed as having a ‘Medium High’ or ‘High’ Collective Risk are deemed to be high-risk intersections.

Collective Risk is the primary risk metric used for prioritising intersections for road safety countermeasures, as high-risk sites are locations that have the greatest potential for reduction in road trauma.
4.2 Personal Risk

By contrast, Personal Risk measures the risk to each person using the intersection. In practice only the number of motor vehicles is routinely available, so Personal Risk is calculated from the Collective Risk divided by a measure of traffic volume exposure. Intersections with the highest risk per motor vehicle are ranked as the worst from a Personal Risk perspective.

The measure of traffic exposure used to calculate Personal Risk is based on the product of the flows on each leg of the intersection (Product of Flow).

The Product of Flow formula (PoF) is:

\[ PoF = \left( \text{average}(Q_{\text{major}_1}, Q_{\text{major}_2}) \cdot \text{average}(Q_{\text{minor}_1}, Q_{\text{minor}_2}) \right)^{0.4} \]

- \( Q_{\text{major}_1} \) and \( Q_{\text{major}_2} \) = the two-way link volume (AADT) on each leg of the major road.
- \( Q_{\text{minor}_1} \) and \( Q_{\text{minor}_2} \) = the two–way link volume (AADT) on each leg of the minor road. At a T intersection the same equation is applied, but with \( Q_{\text{minor}_1} \) set as the side road AADT, and \( Q_{\text{minor}_2} \) defined to be zero.

The PoF measure is used because it relates directly to the number of potential conflicts between vehicles at an intersection and better accounts for exposure at intersections of major roads and side roads with low volumes. In theory, the crash risk would follow a relationship that is the square root of the conflicting flows (mathematically raising the product to the power of 0.5), but in practice, raising the flows to a power of 0.4 provides a better straight line fit to the crash data, and better compensates for the reduced risk that is observed at higher traffic flows.

The traditional traffic exposure measure that is used in road safety analysis is crashes per 100 million vehicle kilometres travelled. So the Personal Risk metric is also adjusted to represent DSi casualty equivalents per 100 million vehicle kilometres travelled.

The Personal Risk calculation formula is:

\[
\text{Personal risk} = \frac{\max(\text{reported F&S crashes}, 0.5, \text{estimated DSIs based on severity indices}) \cdot 10^8}{\left( \text{average}(Q_{\text{major}_1}, Q_{\text{major}_2}) \cdot \text{average}(Q_{\text{minor}_1}, Q_{\text{minor}_2}) \right)^{0.4} \cdot 5 \text{ years} \cdot 365 \text{ days} \cdot 1.7}
\]

The 1.7 factor in the denominator of the equation is a conversion factor that approximates a correction for both the distance each vehicle travels through an intersection (100m) and the difference resulting from raising the PoF by 0.4 instead of the theoretical exponent of 0.5.

The Personal Risk thresholds based on the estimated DSi casualty equivalent approach are set out in Table 2. The thresholds have been determined by analysing a large number of existing intersections, and set so that Medium High and High Personal Risk intersections together make up approximately 5% of all intersections in New Zealand.
### Table 2 - Criteria for Identifying Intersection Personal Risk

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Personal Risk Thresholds (estimated DSi casualty equivalents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;6</td>
</tr>
<tr>
<td>Low Medium</td>
<td>6 - &lt;10</td>
</tr>
<tr>
<td>Medium</td>
<td>10 - &lt;16</td>
</tr>
<tr>
<td>Medium High</td>
<td>16 - &lt;32</td>
</tr>
<tr>
<td>High</td>
<td>≥32</td>
</tr>
</tbody>
</table>

Intersections that are assessed as having a ‘Medium High’ or ‘High’ Personal Risk are deemed to be high-risk intersections.

Personal Risk is the most relevant risk metric for communicating road safety issues with the public, as risk is defined at an individual level.

#### 4.2 Level of Safety Service

Level of Safety Service (LoSS) is a measure of actual intersection safety performance relative to that expected based on a reference set of intersections. A conceptual framework for using LoSS to identify dangerous sections of road was formalised by Kononov and Allery [3] in North America, under the name Level of Service of Safety. This was included as a performance measure in the Highway Safety Manual [4], and extended to intersections. Ideas from this publication were drawn on to develop existing work by Durdin [5] into LoSS as it now exists in the High Risk Intersections Guide.

The LoSS method defined in the High-Risk Intersections Guide is derived from the general flow crash prediction models contained within the NZTA’s Economic Evaluation Manual (EEM). The method takes into account the speed environment, intersection form and amount of traffic travelling through an intersection.

LoSS charts have been produced for each of the five intersection types in urban and rural speed environments. Applying the general flow crash prediction models in the EEM produces an estimated number of injury crashes for a ‘typical’ intersection with a given PoF. Intersections where the number of injury crashes is less than expected from the crash prediction models are deemed to have better than average safety performance for the given PoF. Conversely, intersections with more injury crashes have worse than average safety performance.

In order to provide meaningful metrics for practitioners, the extent to which the observed number of injury crashes compares with the expected performance was separated into five LoSS bands as shown in **Table 3**.
### Table 3 - Level of Safety Service Bands

<table>
<thead>
<tr>
<th>Level of Safety Service (LoSS)</th>
<th>Safety Performance</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>LoSS I</td>
<td>0-30th percentile</td>
<td>The observed injury crash rate is lower (better) than that expected of 30% of similar intersections.</td>
</tr>
<tr>
<td>LoSS II</td>
<td>30th-50th percentile</td>
<td>The observed injury crash rate is lower (better) than that expected of 50% of similar intersections, and higher than that of 30%.</td>
</tr>
<tr>
<td>LoSS III</td>
<td>50th-70th percentile</td>
<td>The observed injury crash rate is lower (better) than that expected of 70% of similar intersections, and higher (worse) than that of 50%.</td>
</tr>
<tr>
<td>LoSS IV</td>
<td>70th-90th percentile</td>
<td>The observed injury crash rate is in the worst 30%, lower (better) than that expected of 90% of similar intersections, and higher (worse) than that of 70%.</td>
</tr>
<tr>
<td>LoSS V</td>
<td>90th-100th percentile</td>
<td>The observed injury crash rate is in the worst 10 percent band - higher (worse) than that expected of 90% of similar intersections.</td>
</tr>
</tbody>
</table>

The banding helps practitioners understand the extent to which the safety performance of the intersection is consistent with a ‘typical’ intersection of that type in the same speed environment with similar traffic flows. LoSS I is the best level of performance while LoSS V is the worst. An example LoSS chart from the *High-Risk Intersections Guide* is shown in Figure A.

![Figure A - LoSS Chart for Urban Signalised Crossroad Intersections (source HRIG)](image_url)

Intersections where the observed injury crash performance is substantially worse than predicted (e.g. LoSS IV and V) can be suggestive of a fundamental deficiency with the
intersection. In some instances these deficiencies can be addressed with lower cost countermeasures, such as modifications to signal coordination, controlling approach speeds or improving sight distances.

It is possible, but uncommon, for some intersections to have high Collective or Personal risk metrics, and a low to moderate LoSS e.g. LoSS I or II. Intersections with this risk profile are likely to require safe system transformation countermeasures to deliver safety improvements, such as changing the intersection form. For instance, a priority rural crossroad with LoSS III could still have a high Collective Risk and conversion to a roundabout is likely to be much more effective than improvements under the same control type.

The relative safety performance of different intersection controls with varying traffic volumes is presented in the High-Risk Intersections Guide. This enables the change in DSi casualty equivalents that could be expected from a transformation to a different control to be estimated. This can be compared with the existing DSi casualty equivalents to estimate the potential to crash saving benefits that might be achieved from a transformational change.

The LoSS indicator adds an extra dimension to the understanding of intersection safety performance. It provides a consistent and straightforward method for Road Controlling Authorities to assess their intersections against comparable intersections from around New Zealand [6]. It enables practitioners to identify those intersections where road safety benefits are most likely to be realised, and indicates what type of improvement is likely to be most appropriate. The indicator is likely to have a significant impact on how transport professionals prioritise safety improvement budgets and work. This approach helps to highlight intersections that perform poorly compared to similar intersections, even if their total or per-vehicle crash rate is not high enough to make them stand out.

5. CALCULATING INTERSECTION RISK METRICS

The calculation of the Collective and Personal risk metrics, and the LoSS indicator for an intersection requires the following information:

- Crash history;
- Speed environment;
- Intersection form and control type; and
- Traffic link volumes (on all legs of the intersection).

The first three pieces of information are required to calculate Collective Risk, as application of severity indices to the crash history is a function of intersection form and control type as well as the speed environment in which the intersection is located. Personal Risk requires knowledge of the number of vehicles travelling through an intersection on a per leg basis. No further intersection specific information is required to calculate the LoSS indicator.

Crash history is obtained from the New Zealand Transport Agency’s Crash Analysis System (CAS). The other information is typically collected by a Road Controlling Authority...
and stored in a Road Assessment and Maintenance Management (RAMM) database or equivalent system.

Given the information requirements are readily accessible; it is a relatively straightforward process to calculate the risk profile of any one intersection. With a sound understanding of the assessment techniques in the High-Risk Intersections Guide, in the author’s experience it takes around 30 minutes to one hour to source information and manually calculate both risk metrics and the LoSS indicator for an intersection that has more than one reported injury crash.

Although the calculation of a risk profile of an individual intersection is not a time consuming exercise, a smarter, more time-efficient method needed to be developed for the purpose of screening an entire network so all high-risk sites could be identified and prioritised.

5.1 Making a Network-Wide Intersection Study Economic and Efficient

Transport data by its very nature is spatially referenced i.e. relative to a particular point or length of the transport network. For this reason, different sets of transport data can be brought together inside a geospatial environment and used for a variety of purposes [7].

Using Geographical Information Systems (GIS), a process has been developed where complex models are applied over a road centreline dataset that contains all the necessary attributes and crash information to calculate the risk metrics for every intersection within a network.

The first part of the process involves the preparation of a base layer upon which the risk mapping models can run. The key element of the base layer is the road centreline dataset. This is typically obtained from RAMM and contains speed, intersection control and traffic volume attributes. The quality of RAMM information varies from one Local Authority to the next, so some ‘cleaning’ is usually required to ensure the road centreline is fully connected, has a complete set of attributes, and accurately represents the geometry of the network.

Once the base layer has been prepared, crashes are assigned to the road centreline network based on their geocoded location. Models are then run to assign crashes located within 50m of an intersection to an intersection. Complex models are then run that apply severity indices to specific crash movement types for injury crashes at each intersection. The sum of the DSi casualty equivalents for each crash are then added together to give the overall DSi casualty equivalent value for the intersection, which is known as the Collective Risk.

Models are then run which derive the Personal Risk value from the Collective Risk value by extracting traffic flows on all legs of the intersection and calculating the PoF. The PoF is then inserted into the Personal Risk calculation formula. Finally, LoSS is then determined by comparing the observed number of crashes to the estimated number of crashes calculated from the applicable crash prediction model for the intersection.

An example of the outputs of the GIS process, as applied in Auckland, New Zealand, is presented in Figure B.
The GIS process enables the risk profile of each and every intersection in a network to be assessed in a standardised, equitable and repeatable manner. In larger urban areas, it would be uneconomical and inefficient to carry out a network-wide high-risk intersection screening assessment without the use of GIS.

6. MAPPING THE RISK OF INTERSECTIONS IN NEW ZEALAND’S URBAN CENTRES

In August 2012 the New Zealand Transport Agency established a new KiwiRAP\(^1\) technical committee charged with overseeing and directing the risk assessment process for local roads with an emphasis on the urban network as this appeared to be where the next biggest gains could be made. This risk targeting programme was referred to as ‘Urban KiwiRAP’ even though some of the urban authorities have significant rural road components.

The new committee comprised representatives from the New Zealand Transport Agency, Auckland Transport, the Tauranga, Christchurch and Dunedin City Council’s as well as representatives from the consulting industry. Each of the local authorities represented on the committee participated in a trial to develop and test risk mapping and star rating assessment processes for their urban networks.

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\(^1\) KiwiRAP is part of the international family of Road Assessment Programmes (RAP) under the umbrella of the International Road Assessment Programme (iRAP).
Part of that project involved the risk mapping of approximately 27,000 intersections using GIS-based risk mapping processes. The Collective and Personal Risk statistics for the networks of the four participating regions in the Urban KiwiRAP project are presented in **Table 4** and **Table 5** respectively.

**Table 4 - Intersection Collective Risk Profile Statistics**

<table>
<thead>
<tr>
<th>Region</th>
<th>Number (Proportion) of High-Risk Intersections</th>
<th>Number (Proportion) of Injury Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auckland</td>
<td>271 (1.6%)</td>
<td>2,094 (22.8%)</td>
</tr>
<tr>
<td>Tauranga</td>
<td>17 (1.0%)</td>
<td>114 (18.8%)</td>
</tr>
<tr>
<td>Christchurch</td>
<td>81 (1.5%)</td>
<td>792 (24.9%)</td>
</tr>
<tr>
<td>Dunedin</td>
<td>32 (1.1%)</td>
<td>246 (19.7%)</td>
</tr>
</tbody>
</table>

**Table 5 - Intersection Personal Risk Profile Statistics**

<table>
<thead>
<tr>
<th>Region</th>
<th>Number (Proportion) of High-Risk Intersections</th>
<th>Number (Proportion) of Injury Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auckland</td>
<td>395 (2.3%)</td>
<td>2,549 (27.7%)</td>
</tr>
<tr>
<td>Tauranga</td>
<td>25 (1.3%)</td>
<td>141 (23.3%)</td>
</tr>
<tr>
<td>Christchurch</td>
<td>172 (3.2%)</td>
<td>1,243 (39.0%)</td>
</tr>
<tr>
<td>Dunedin</td>
<td>76 (2.7%)</td>
<td>449 (35.8%)</td>
</tr>
</tbody>
</table>

Tables 4 and 5 show that the thresholds in the High-Risk Intersection Guide result in less than 5% of all intersections within these regions being classified as high-risk. However, these intersections account for up to 39% of all intersection injury crashes within a network.

The disproportionality between the proportion of intersections identified and proportion of all intersection crashes means that safety efforts can be targeted at relatively small part of the network while still addressing a significant proportion of intersection risk at a network level.

Given the finite resources available to improve road safety, it is imperative that road safety investigations and investments are targeted at the parts of the network where road safety benefits will be maximised. The detailed analysis of the four urban networks could not have been delivered without the use of GIS. This demonstrates the value of GIS as road safety network screening tool.
7. ROBUSTNESS OF THE DSI CASUALTY EQUIVALENTS APPROACH AS A PREDICTOR OF FUTURE HIGH SEVERITY CRASHES

The DSI casualty equivalents approach is based on the premise that certain crash types are more likely to result in high severity outcomes than others, and this varies as a function of the intersection type, control and speed environment. The identification of high-risk intersections via this process transforms historic injury crashes (usually over the past 5 years) into DSI casualty equivalents on the presumption that historic crash trends will continue.

The relationship between the number of injury crashes and the corresponding Collective DSI value for all intersections in Auckland using 2008 – 2012 crash data is shown in Figure C.

Figure C - Comparison of Injury Crashes and Collective DSI at Intersections in Auckland

Figure C shows that Collective Risk, expressed as DSI casualty equivalents, generally increases as injury crash numbers increase. The points above the dotted line are intersections with crashes that have a higher than average probability of DSI outcomes if crash trends continue.

Under the DSI casualty equivalents approach, intersections are prioritised on the basis of Collective DSI i.e. uppermost on the y-axis, whereas under traditional approaches to road safety, those with the greatest number of injury crashes i.e. furthest right on the x-axis, would have been prioritised.

Undoubtedly there is some overlap between the two approaches. However, Figure C shows there are group of intersections with high Collective DSI but only a moderate total number of injury crashes. Under traditional approaches, these intersections may have been overlooked from investigation because their overall crash history may not have been considered sufficiently high to warrant investigation. The estimated DSI approach ensures the intersections with the greatest risk of a future high-severity crash are highlighted for investigation.
The predictive robustness of the DSi approach has been compared against other approaches to identifying high-risk intersections by analysing fatal and serious crashes at intersections in Auckland in 2013 (Table 6).

Table 6 – Prediction of Fatal and Serious Casualties in 2013 based on different prioritisation techniques

<table>
<thead>
<tr>
<th>Approach</th>
<th>Number of Intersections</th>
<th>Number of Fatal and Serious Casualties in 2013</th>
<th>DSi per Intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td>High DSi Collective Risk</td>
<td>63</td>
<td>16</td>
<td>0.25</td>
</tr>
<tr>
<td>≥2 Fatal or Serious Crashes</td>
<td>138</td>
<td>18</td>
<td>0.13</td>
</tr>
<tr>
<td>≥3 Fatal or Serious Crashes</td>
<td>36</td>
<td>3</td>
<td>0.08</td>
</tr>
<tr>
<td>≥ 8 Injury Crashes</td>
<td>142</td>
<td>22</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Table 6 shows that intersections identified as having a ‘High’ Collective DSi based on 2008 – 2012 crash data were a stronger predictor of fatal and serious casualties in 2013 than other traditional approaches of prioritising by historic fatal or serious crashes or by the numbers of injury crashes above a certain threshold. It is acknowledged that the analysis is based on a short after period; however the early results are encouraging and supportive of a shift towards prioritising intersections on the basis of DSi.

Further evidence of the robustness of the DSi casualty equivalents approach is evidenced by close analysis of the site classified with the highest Collective DSi in Figure C. The intersection is a priority controlled crossroads in a high speed (rural) environment. At the time of the assessment the intersection had a crash history of two serious injury crashes and nine minor injury crashes in the five year analysis period. Prior to completion of the risk profiling of the Auckland network, the intersection had previously been identified by the Road Controlling Authority as an intersection with safety issues, however it was not considered a high-priority intersection for treatment, and improvements were ultimately deferred as budgets tightened.

Within weeks of the risk profiling being completed, there were two separate high-severity crashes at the intersection which resulted in the deaths of two people. These unfortunate crashes at the intersection, which were of the same crash movement type that produced the high DSi value, go some way to confirming the robustness of the DSi methodology.

This suggests that lives can be saved by following the assessment techniques described in the High-Risk Intersections Guide and prioritising intersections for investigation and improvement based on the risk of DSi crashes occurring in the future.

8. UNLOCKING THE TRUE VALUE OF TRANSPORT DATA

Road controlling authorities put great effort and expense into collecting large quantities of high-quality transport related data. Often this data is collected with a specific purpose in mind, which results in the true value of the data never being realised because of the narrow range of applications for which it is used.
Exploring the potential of existing data sets is a smart way of creating value. Transport data by its very nature is spatially referenced i.e. relative to a particular point or length of the transport network. For this reason, different sets of transport data can be brought together inside a geospatial environment and used for a variety of purposes, such as calculating the risk profile of every intersection within a transport network.

In a tight fiscal environment it makes sense to explore methods of creating value from existing assets. This is especially relevant in the transport sector as budgets are always subject to scrutiny and changing political environments; however the community’s expectations remain high.

Given the finite resources available to improve road safety it is imperative that road safety investigations and investments are targeted at the highest risk parts of the network to maximise the likelihood that projects will deliver the greatest road safety benefits and help achieve the desired outcomes of Safer Journeys.

The Urban KiwiRAP risk mapping provides a demonstration of the value that can be added to data collected by road controlling authorities and shows how GIS is an ideal platform for that unlocking value.

9. CONCLUSIONS

The DSi casualty equivalents indicator provides an estimate of the number of future deaths or serious injuries if recent crash trends continue. The indicator has been developed to give effect to Safer Journeys shift in focus from reducing crashes to minimising the likelihood of high-severity crash outcomes. Analysis of recent fatal and serious crashes at high-risk intersections indicates the DSi approach appears to be a sound predictor of the likely incidence of future fatal and serious crashes.

Under traditional approaches to road safety many intersections that actually pose high-risk may have been overlooked, because their overall crash history may not have been considered sufficiently high to warrant investigation. Prioritising intersections for investigation and improvement based on the DSi casualty equivalents approach to risk suggests that more lives can be saved in the future.

The key to identifying high-risk intersections is to undertake analysis at a network-wide level. As transport data is spatially referenced, GIS can be used to calculate the risk profile of each and every intersection in a network in a standardised, equitable and repeatable manner. In larger urban areas, it is simply uneconomical and inefficient to carry out a network-wide high-risk intersection assessment without the use of GIS.

Road controlling authorities put great effort and expense into collecting large quantities of high-quality transport related data. However, the true value of this data is often unrealised because of the narrow range of applications for which the data is used. The network-wide risk profiling process provides a demonstration of the value that can be added to a road controlling authority’s activities.
10. REFERENCES