Auckland Motorway Alliance - Suicide Resilience Study

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ABSTRACT

In 2016, the AMA carried out a suicide resilience study to assess the impact that these events have on the network. The study also gave treatment options for prioritisation.

New Zealand has an increasing issue with suicide; a record 569 people died from June 2014- May 2015 from any means, i.e. not just transport related. Suicide is also a significant issue for the Auckland Motorway Network (AMA). Between January and Novemember (inclusive) 2016, 8 suicide related fatalaties occurred on the Auckland Motorway network; this exceeds the average 5 vehicle deaths per year recorded (2011-15). There is also an estimated 33 non fatal attempts and 91 suicide threats that have the potential to compromise the efficiency of the network and require a response from emergency services.

Although tragic for those involved in these suicide events and their families, these events also also cause significant congestion to the network. The congestion occurs when traffic lanes are required to be closed for response, recovery and investigation.

This study utilised the NZ Transport Agency's risk management procedures to identify the highest risk type of suicide threat, e.g. threatening to jump, and the highest risk locations on the network. The likelihood of an event was determined by a combination of historical events as well as the number of call outs recorded to the Auckland Traffic Operations Centre (ATOC) of suspicious behaviour. These events were then mapped to determine the ten areas assessed. These areas are based on density and homogenous traffic / road characteristics.

The consequence rating of events was determined by use of the Auckland Motorway Alliance Cell Transmission Model. This model determines total delay effect on the network due to network changes. For each area, various scenarios (e.g. where, what time, how many lanes affected) were modelled to determine the likely Total Delay per event.

The total risk (and risk per bridge) was found from a combination of the likelihood and consequences above. The risk for each area will be used to prioritise screens, to help seeking measures, third party intervention tools, and to influence incident response procedures.

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INTRODUCTION

This paper explores the effect on, network resilience, and provides measures to improve the resilience of Auckland's motorway network to suicides. In 2016, the Auckland Motorway Alliance (AMA) were challenged by the Auckland Motorway Alliance Leadership Team to "see if there is anything further we could do to prevent suicides on the motorway network."

The issue and scale of the problem identified in this study is not only limited to the Auckland motorway area. The Auckland area is under-represented for suicides (by population); Auckland has 32% of New Zealand's population while only 28% of the suicides occur here. This means that as congestion levels in other regions increase, the effect of suicide on network resilience will increase.

Therefore we believe that the treatment strategies and recommendations in this strategy equally apply across other networks.

BACKGROUND

Fatal Suicides

New Zealand has some of the highest suicide rates in the western world. In the Organisation for Economic Co-operation and Development (OECD), New Zealand has the 6th highest rate of suicide per population with the 3rd highest for young males.
Some of the key statistics from the Coroner's reports in 2014/15 include:

- 564 deaths (nearly twice the 2014 road toll of 294)
- Of which 158 (28%) are in the Auckland area
- 75% of deaths are by males
- 3% are from Jumping (falling) from Height,
- 2% are Transport related (including rail)

In 2016, the Auckland motorway network has had 8 Fatalities (See Table 1 below).

Table 1 - Injury / Delay Sites in 2016

Site	Description	Fatal	Attempt	Threaten
1	Inner CMJ	1	2	11
2	AHB	5	4	9
3	SH1 North	0	3	12
4	SH20/20A	0	3	4
5	SH20 Hillsborough	0	6	7
6	East Tamaki	0	3	6
7	Te Atatu	0	1	15
8	Hill to Redoubt	0	7	4
9	Outer CMJ	1	3	5
10	Upper Harbour	0	0	3
	Other	1	1	15
	Total	**8**	**33**	**91**

Attempts

Suicide is a tragic issue across New Zealand. In the case of this study we consider the safety issues that this can cause for road users and the subsequent delay to the motorway network. Auckland Traffic Operations Centre – Smales Farm (ATOC-S) receives approximately 5 calls per day related to dangerous pedestrian / suicidal behaviour. Table 1 above categorises those who are thought to have threatened suicide. It is not possible to give finite numbers of suicidal tendency as ATOC-S records are based on judgements, from camera operators and Police, based on behaviour displayed. The suicidal behaviour numbers are made up of:

- A threatened suicide call every 2 ½ days.
- unstable pedestrians[1] (1 call every two weeks),
- pedestrians on motorways (4 calls per day),
- observing suspicious behaviour, e.g. arguing (1 call every 2 days) and
- other dangerous behaviour, e.g. pedestrians throwing rocks (1 per week).

The above call outs were rationalised through this project to identify those occurrences where suicide attempts are more likely to require lane closure. By analysing five year data, we found that there are three main methods of suicide callout on the network:

1. Running in front of a vehicle (29% of calls, 17% of fatalities),
2. Intentionally crashing a vehicle (13% of calls, 0%[2] of fatalities), and
3. Fall from height / structure[3] (59% of calls, 83% of fatalities),

RISK METRICS

We identified risk levels based on the Transport Agency's Z/44 Risk Management Process and established the following matrices to assess the risk.

Likelihood

The likelihood of an event occurring is categorised based on the HNO threat matrices in the Z/44 specification (see below).

Table 2 - Z/44 Likelihood Table

	HNO Threat Likelihood Rating				
	Very Low	Low	Medium	High	Very High
Likelihood (applicable to Capital Projects)	≤10%	>10% - 30%	>30% - 50%	>50% - 70%	>70%
Frequency (applicable to M&O contracts)	Less than once in 10 years	At least once in a period of >6 - 10 years	At least once in a period of >2 - 6 years	At least once in a period of >1 - 2 years	At least once in a period of 12 months

Consequence

Although the potential loss of life from a suicide is tragic, the focusof this study is the resilience of the AMA network to suicide attempts. Therefore, we have categorised the consequence of a suicide event occurring by the delay experienced per vehicle. Delay is found from the AMA Cell Transmission model (CTM).

The CTM is a first order macroscopic traffic simulation. It is based on the hydrodynamic theory of traffic flow and simulates macroscopic traffic behaviour on a given corridor or network by evaluating the traffic flow and density at finite number of intermediate points at different time steps. This is done by dividing the corridor or network into short, homogeneous sections (cells) and evaluating traffic behaviour in each cell at each discrete time-step.

[1] An unstable pedestrian is a pedestrian who, in the eyes of the ATOC-S camera operator, is acting in a way which they could potential cause harm to themselves or others.

[2] This figure may be under-represented as it is sometimes difficult to discern if vehicle crashes were intentional

[3] Self-harm from an instrument has not been considered as a main method as there is little evidence of this occurring on the motorway network / affecting traffic flows.

Table 3 - Consequence of Event

Media Interest on Delay	Delay per Vehicle (mins)	Consequence
Main Story National News	x>60mins	Very High
National News	60>x>30mins	High
National Paper	30>x>15mins	Medium
Traffic Bulletin	15>x>6mins	Low
None	6>x	Very Low

The average closure time per incident was found by examining the historic incident reports. This found that non-fatal incidents closed the road for on average of 60 minutes. Fatal incidents closed the road for an average of 120 minutes. Table 4 below shows the average closure times for each of the suicide methodologies. For example, an average attempted fall from height suicide closes the road for 80mins whereas a vehicle crash is 60 mins.

Table 4 - Ratio of Non-Fatal to Fatal Events with their Average Closure Times

Attempt Type	Closure	Fall from height[4]	Jump in Front	Vehicle Crashes
Non-Fatal	60 mins	67%*	40%	100%
Fatal	120 mins	33%*	60%	0%
Average Closure		80mins	96mins	60mins

Risk Rating

The Z/44 risk rating table establishes the risk scoring protocols used in this study. These resultant risks range from low to high. The overall risk score is used to rank the sites by highest priority for the second stage of works. The following pages highlight the methodology used to achieve a relative risk ranking geographically and by attempt type (See example in Table 5).

Table 5 – Example Risk Scoring

Site	Site Name	Likelihood	Consequence	Total Risk	
				Score	Threat
2	AHB	Very High	Very High	25	Extreme
3	SH1 North	Medium	Medium	15	High
4	SH20/20A	High	Very Low	7	Moderate

[4] These figures do not include the Auckland Harbour Bridge. Fall from height attempts on the Auckland Harbour Bridge are a special case. Recovery of the person or body occurs off the motorway network, the road is generally re-opened after 25minutes whether the fall resulted in death or not. From Coroner's reports and incident response reports we know there has been at least 4 fatal fall from height off the Auckland Harbour Bridge in the last eight years and approximately ten jumps per year.

FALL FROM HEIGHT

From Coroner's reports, ATOC-S records, and our own callouts, we have 8 fatal falls recorded from 15 incidents that had either some injury or serious delays to traffic. These are recorded from January to November 2016 (inclusive) on the Auckland Motorway Network. Table 6 below shows the location summary of sites where fall from height is threatened.

Table 6 – Threatened Fall from Height Sites in 2016

Site	Description	Fatal	Attempt	Threaten
1	Inner CMJ	1	3	9
2	AHB	5	4	7
3	SH1 North	0	2	11
4	SH20/20A	0	3	4
5	SH20 Hillsborough	0	5	7
6	East Tamaki	0	3	1
7	Te Atatu	0	0	16
8	Hill to Redoubt	0	6	6
9	Outer CMJ	1	4	4
10	Upper Harbour	0	0	2
	Other	0	0	9
	Total	**7**	**30**	**76**

Callout Location

ATOC-S have recorded 113 possible fall / jump from height attempts (sum of fatal, attempted and possible) from January 2016 to November 2016 inclusive. This is recorded from observed behaviour and calls. As shown in Figure 1 below, these attempts are spread throughout the regions with heavy concentrations on the Auckland Harbour Bridge and the inner Central Motorway Junction. This is highlighted in Table 6 above.

Risk

Below is the risk assessment for fall from height using the risk metrics in Table 3 and

Table 4, above.

Likelihood

The likelihood tables below show how the number of callouts in each area is converted to the total predicted number of attempts per year. This data is then rationalised per bridge (without screening) in each area and converted in years per attempt. The likelihood is then assessed in Table 7 below.

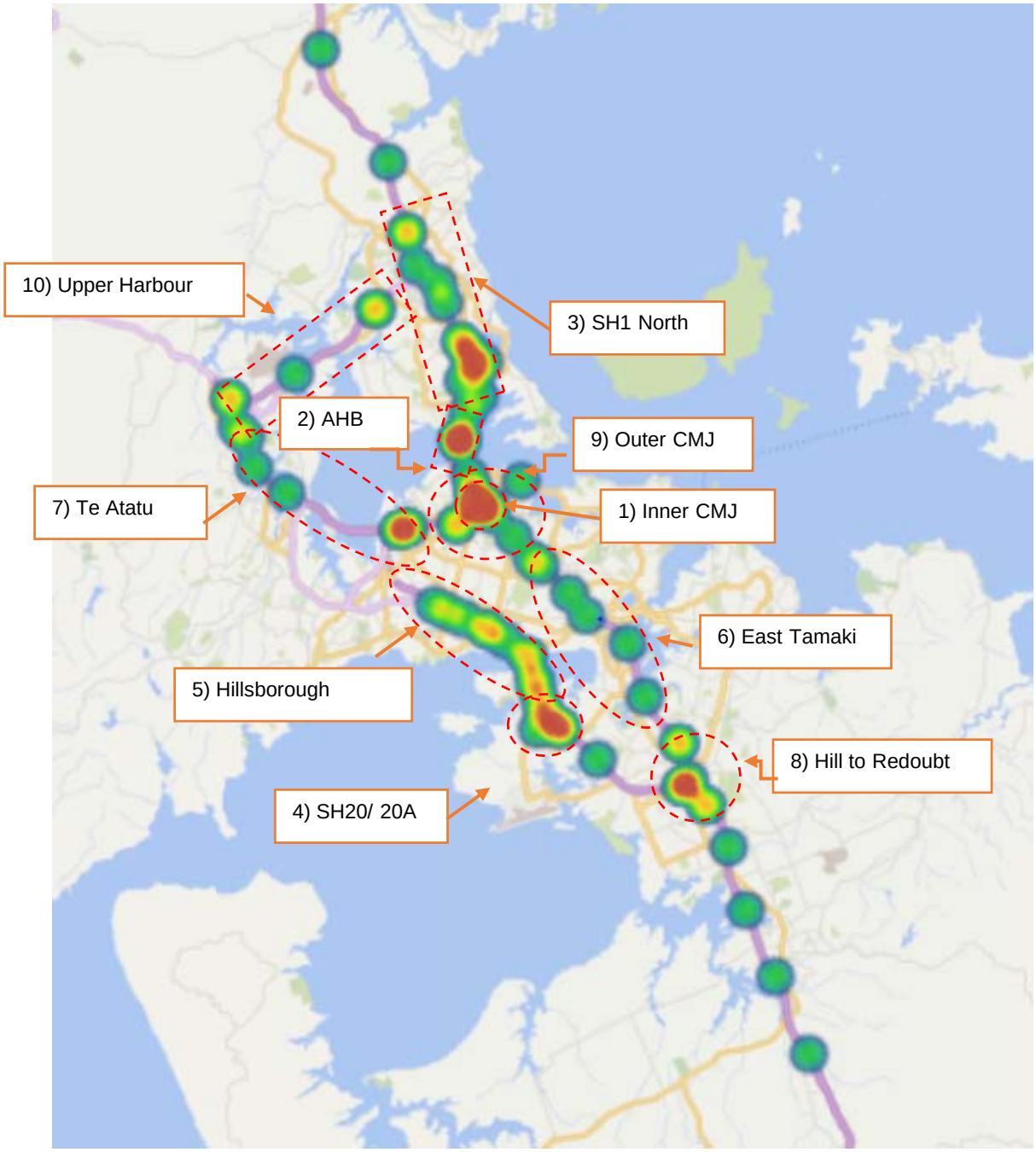

Figure 1 - Heat Map of Possible Suicide Callouts 2016 (Source ATOC-S)

Table 7 - Jump / Fall from height likelihood table

Section	Attempt	Years per attempt per high risk bridge	Likelihood
1	4	1.7	High
2	9	0.11	Very High
3	2	3	Medium
4	3	1.33	High
5	5	2	High
6	3	4	Medium
7	0	>10	Very Low
8	6	1.17	High
9	5	1.2	High
10	0	>10	Very Low

Consequence

In order to determine the consequence, we have chosen one point within each zone and assessed the traffic disruption from one and two lanes being closed for either an unsuccessful (1 hour) or successful attempt (2 hour). This assessment was carried out under the CTM.

Table 8 - One Lane Closure Jump from Height Consequence Table (Delay)

Site	Non-Fatal (1 Hour)		Fatal (2 Hours)		Overall Average		Consequence
	Per Attempt (veh-hrs)	Per Attempt per vehicle (mins)	Per Attempt (veh-hrs)	Per Attempt per vehicle (mins)	Total Delay (veh-hrs)	Delay per Vehicle (mins)	
One Lane Closure							
1	854	45	2,453	55	1,387	48	High
2	447	17	447	17	447	17	Medium
3	176	4	188	4	180	4	Very Low
4	2	0	2	0	2	0	Very Low
5	21	1	25	1	23	1	Very Low
6	77	3	78	3	77	3	Very Low
7	233	9	265	9	243	9	Low
8	0	0	0	0	0	0	Very Low
9	1	0	1	0	1	0	Very Low
10	93	7	93	8	93	7	Low
Two Lane Closure							
1	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Very High
2	974	Catastrophic	974	Catastrophic	974	Catastrophic	Very High
3	2,267	65	10,996	Catastrophic	5,177	Catastrophic	Very High
4	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Very High
5	658	122	3,868	188	1,728	166	Very High
6	1,038	109	6,932	Catastrophic	3,002	Catastrophic	Very High
7	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Very High
8	154	13	510	15	273	14	Low
9	232	6	334	7	266	7	Low
10	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Catastrophic	Very High

A catastrophic delay represents one where the delay becomes too great for the model to assess. Table 8 indicates that doubling the lanes closed (1 to 2 lanes) has a much greater impact than if the closure time was doubled from 1 hours to 2 hours.

Our first recommendation would be to reduce the number of lanes closed due to any incident first. Therefore, for the purposes of future analysis, we have conservatively assumed that only one lane is closed during the studied events.

Resultant Risk

The Total Risk table is shown below. This table indicates the high threat of suicide to the AHB and inner CMJ areas.

Table 9 - Fall from Height Risk Level

Site	Likelihood	Consequence	Total Risk	
			Score	Threat
1	High	Very High	24	Extreme
2	Very High	Very High	25	Extreme
3	Medium	Medium	15	High
4	High	Very Low	7	Moderate
5	High	Low	12	Moderate
6	Medium	Medium	15	High
7	Very Low	High	8	Moderate
8	High	Very Low	7	Moderate
9	High	Very Low	7	Moderate
10	Very Low	High	8	Moderate

RUN IN FRONT RISK

ATOC-S have received approximately 5 calls per day related to suspicious or dangerous pedestrian behaviour around motorways. These calls to ATOC-S are common on Auckland Motorways as all pedestrians seen on the motorway corridor are called in as potential suicide attempts yet it is reasonable to assume that they are not all potential suicide events, e.g. some may be hitchhiking.

ATOC-S monitors pedestrians on motorway closely because of their high risk injury and as walking on motorway is an illegal activity. These call locations are shown in Figure 2 below. Examples of historic run in front of vehicle events and their outcomes over time include:

Minor Injury

1. October 2008 – SH22, 2km south of Glenbrook Road. Vehicle travelling south towards Glenbrook Road when the driver saw a pedestrian running down a driveway towards the road. Vehicle slowed to 40km/h before the pedestrian jumped into the vehicle path. Speed reduction likely reduced injury severity.
2. May 2011 - East Tamaki Over Bridge – Pedestrian has walked out in front of the vehicle travelling northbound. The vehicle was travelling at approximately 60km/h at the time of incidence which probably reduced the injury severity.

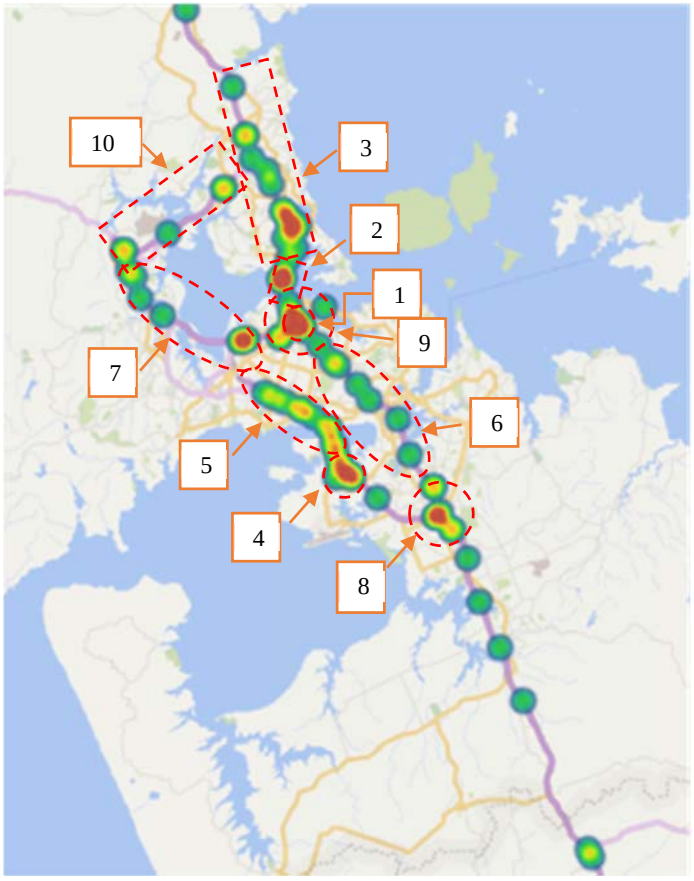

Figure 2- Possible Run in Front of Car calls to ATOC-S 2016

Fatal Injury

3. June 2009 – Wiri Station Road, 10m west of Putney Way - Bus was stationary at lights. Deceased alighted from bus and lay in way of Oil Tanker. When lights changed and oil tanker ran the deceased over. One lane was closed for approximately two hours twenty minutes.
4. October 2010 – Te Irirangi Drive Underpass – Deceased was behind w-section rail on side of road. Police noticed person and attempted to approach them. On seeing the police the deceased jumped the w-section rail and ran in front of vehicle.
5. June 2014 – SH16 Intersection with The Strand – Deceased standing at the intersection threw themselves in front of a westbound truck turning left onto SH16 (Southbound).

In order to assess the potential suicide risk the above data was rationalised to identify likely suicide attempts (and therefore require lane closures). The likelihood and consequence outcomes are reflected in table 10 below.

Risk

The same risk assessment methodology from Fatal Fall above was followed. In general, these risk levels are lower than falling from height risk due to lower likelihood of an event occurring.

Table 9 - Risk Level of Run in Front of Vehicles

Site	Description	Likelihood	One Lane Closure		Overall Risk
			Consequence	Score	
1	CMJ	High	Very High	19	High
2	AHB	Very High	Very High	18	High
3	Northcote	High	Medium	5	Low
4	SH20/20A	High	Very Low	1	Low
5	SH20 Hillsborough	High	Low	3	Low
6	East Tamaki	Medium	Medium	7	Moderate
7	Te Atatu	Very Low	High	2	Low
8	Hill to Redoubt	High	Very Low	1	Low
9	Outer CMJ	High	Very Low	3	Low
10	Upper Harbour	Very Low	High	2	Low

VEHICLES

Over the past nine years (2007 till 2015), there have been 11 attempted suicide vehicle crashes on the Auckland Motorway Alliance network area recorded. This consisted of seven Minor Injury Crashes and four nil injury. It is likely that this number is under-represented as it can be difficult to establish whether crashes were intentional.

Over the past two years, ATOC-S have received 26 possible intentional vehicle crash calls. That relates to 1 call per month on average.

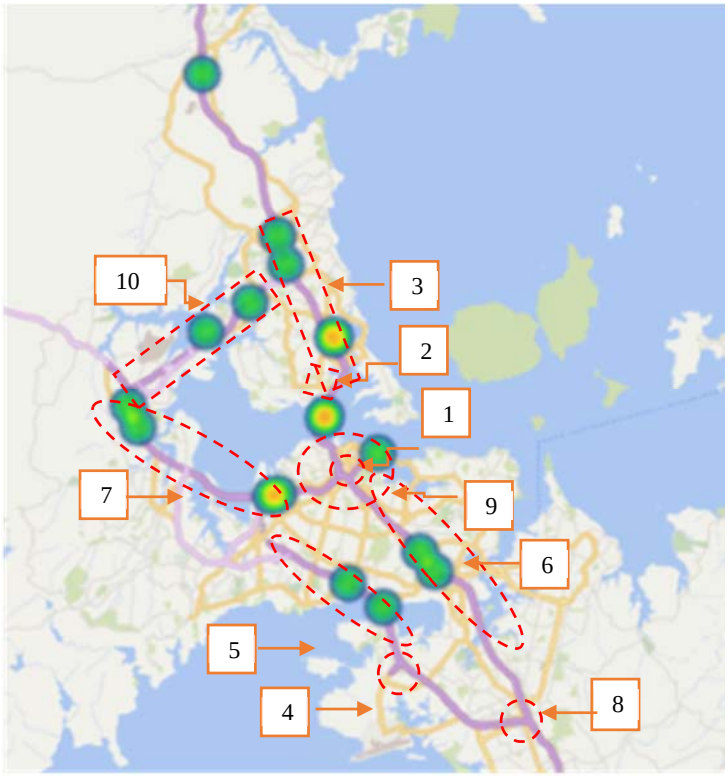

Figure 3 - 'Intentional Vehicle Crash' calls to ATOC-S for 2016

These incidents are recorded at the estimated location where the call came from. As the car travels we would expect that the exact location would be unknown. For the purposes of this report we have assumed that the crash will occur in the same zone at which the call was made. Also, although these events begin as vehicle type suicides, they can become other types as the event goes on e.g. someone threatening suicide from car can then stopped the car at a motorway underpass and jump to their death.

As with the previous examples, the total risk level is found from combining the likelihood and consequences.

Table 10 - Intentional Vehicle Crash Suicide Risk Levels

Site	Description	Likelihood	One Lane Closure		Overall
			Consequence	Score	Risk
1	CMJ	Very Low	High	8	Moderate
2	AHB	Very Low	Medium	4	Low
3	Northcote	High	Very Low	7	Moderate
4	SH20/20A	Very Low	Very Low	1	Low
5	SH20 Hillsborough	Low	Very Low	3	Low
6	East Tamaki	Very Low	Very Low	1	Low
7	Te Atatu	Medium	Low	5	Low
8	Hill to Redoubt	Very Low	Very Low	1	Low
9	Outer CMJ	Very Low	Very Low	1	Low
10	Upper Harbour	Low	Low	6	Moderate

SUMMARY

Table 11 below summarises and ranks all the risk scores for each suicide method, for each site. The table highlights risk area by attempt type. It is important to understand both geographic location and type as this may influence the resilience measure employed.

This table shows that the inner Central Motorway Junction and the Auckland Harbour Bridge are consistently the two highest risk locations. This is of particular concern to the AMA as approximately 200,000 vehicles pass through this area every day. Disruption to this area has the potential to not only grid lock the motorway system, but have flow on impacts to the local road network.

Table 11 also indicates that fall from height (jump) generally has the highest disruption risk to the Auckland Motorway network. This is demonstrated by 7 of the top 10 suicide disruption risks being fall from height.

Table 11 - Summarised Risk Score Ranking

Rank	Site	Description	Method	Score	Level
1	2	AHB	Jump	25	Extreme
2	1	Inner CMJ	Jump	24	Extreme
3	1	Inner CMJ	running	19	High
4	2	AHB	running	18	High
5	3	Northcote	Jump	15	High
5	6	East Tamaki	Jump	15	High
7	5	SH20 Hillsborough	Jump	12	Moderate
8	10	Upper Harbour	Jump	9	Moderate
9	1	Inner CMJ	Vehicles	8	Moderate
9	7	Te Atatu	Jump	8	Moderate
11	3	Northcote	Vehicles	7	Moderate
11	4	SH20/20A	Jump	7	Moderate
11	6	East Tamaki	running	7	Moderate
11	8	Hill to Redoubt	Jump	7	Moderate
15	9	Outer CMJ	Jump	7	Moderate
16	10	Upper Harbour	Vehicles	6	Moderate
17	3	Northcote	running	5	Low
17	7	Te Atatu	Vehicles	5	Low
19	2	AHB	Vehicles	4	Low
20	5	SH20 Hillsborough	Vehicles	3	Low
20	5	SH20 Hillsborough	running	3	Low
20	9	Outer CMJ	running	3	Low
23	7	Te Atatu	running	2	Low
23	10	Upper Harbour	running	2	Low
25	4	SH20/20A	running	1	Low
25	4	SH20/20A	Vehicles	1	Low
25	6	East Tamaki	Vehicles	1	Low
25	8	Hill to Redoubt	running	1	Low
25	8	Hill to Redoubt	Vehicles	1	Low
25	9	Outer CMJ	Vehicles	1	Low

INTERVENTION STRATEGIES

The following intervention strategies have been developed based on similar studies of suicide prevention and overseas examples in places such as San Francisco and Sweden. As with its Safe System Vision of Zero Deaths from Road Accidents, Sweden has the same vision for suicide prevention.

The intervention strategies are targeting a reduction in delay due to a suicide incident and mitigation of safety risks to road users, rather than a focus on reducing suicide events. This paper does not examine the moral implications arising from suicides from structure areas that are not above the carriageway, or whether the entire length of bridges above the motorway requires screening.

Rather, these strategies introduce measures that Road Controlling Authorities, can implement / influence and does not include the other wider measures already in place such as:

- media blackout on suicides to mitigate risk of copycat events
- suicide helplines
- hospital / counselling services

Minimisation

Minimisation is when we attempt to reduce the likelihood of the threat. Some minimisation strategies were explored below.

Restricted Access

Bridge Screens

Screens can act to prevent suicides as well as mitigate risk of objects being thrown onto the motorway. In New Zealand, an Otago University led Study of Grafton Bridge found that screens are extremely effective in this regard. With the removal of barriers, a five-fold increase in suicides was reported. When new barriers were installed along the full length, suicides reduced to zero. While it showed a change in the suicide rate at the site, the regional suicide figures didn't change. This suggests that alternative locations / means were used, hence may mean side screen saturation of the network is required to effect a reduction in attempts.

In Bristol (Clifton Suspension Bridge), a similar study of the results of installing barriers found a significant drop in suicide numbers. This study found that there was no shift of suicides to nearby bridges [4]. An Australian Road Research Board (ARRB) research review of 50 bridges in Australia also found that when screens are installed, suicide numbers did not shift to other bridges but they were unable to determine if they shifted to other means.

Screens are a means to influence where the network is impacted even if we can't be certain to impact the regional number of attempts.

Research of meta-data from throughout the world found that erecting site screens has, on average, a 91% reduction in suicides at that location [3].

The above demonstrates that it is difficult to judge whether erecting screens will have the same effect as overseas. The University of Otago paper showed that the overall regional numbers did not change, rather a shift in site or suicide means occurred. Local input by the Psychological Profession would likely be required to judge the potential benefits in a New Zealand context.

Therefore we have a means to influence where the network is impacted even if we can't be certain that it will reduce the regional number of attempts.

Bridge Manual

Currently, the requirement / justification to erect screens on new bridges is based on thrown object history, demographics and suicide history. This results in new bridges being unlikely to have screens until they have "built" such a history.

Recommend an economic analysis of incremental cost to design screens at the start compared to retrofitting a bridge with an allowance for screens

Since 2015, the AMA has provided inputs to the team drafting the 3rd Update of the Transport Agency's Bridge Manual to ensure that all new bridges have the ability for screens to be erected. The proposal is that the initial bridge design should not only consider the proposed weight of potential screens but has screens that would be easy to retrofit incorporated into the bridge design. This will minimise downstream cost of retrofitting screens.

It is also recommended that an economic analysis of the incremental cost of designing / constructing bridge screens is undertaken at the start of a project, compared to having to retrofit them at a later time.

Partial Retrofit of Screens

This paper is targeting a reduction in delay due to suicide incident and mitigation of safety risks to road users (rather than a focus on reducing suicide events - this is a bigger issue than what a Road Controlling Authority (RCA) can influence alone).

As retrofitting screens can be costly, the cost of installing screens across the whole bridge, versus retrofitting only above motorway sections, would be prioritised. This may allow several structures to be partially retrofitted against one or two whole bridge screening.

Prioritise the installation of screens above road sections rather than whole bridge screening.

This paper does not examine the moral implication around accepting suicides from structure areas that are not above the carriageway, or whether the entire length of bridges above the motorway require screening.

Bridge Screen Priority

In order to properly assess the benefit of restricting access as described above, we propose further works to assess the marginal cost of designing a bridge with screens, and the development of a suicide prediction tool based on the following type of factors:

- Population Density
- Nearby Psychiatric Units
- Vicinity of Bars / Clubs
- Demographics
- Height of Bridge
- Status / Iconic nature of structure, etc.

Further work required to develop a tool to predict suicide sites based on social factors.

Pedestrian Fencing

Pedestrians are restricted from accessing the motorway network. The Transport Agency's Maintenance and Operation manual standard for this fencing is for a height of 1.375m.. It is recommended that high pedestrian access sites that are identified, should be retrofitted with 1.8m high non-climbable fences.

Help Seeking

Help seeking measures include tools such as signs and phone systems. These tools give the suicidal person a chance to gain psychiatric assistance and are supported by overseas research which has found a 51% reduction in suicide attempts. Again, it is recommended that psychological advice be sought to determine the likely benefits received locally if these measures are

implemented. It is recommended that help seeking devices are prioritised as they can be installed on those sites where screens are erected as well as sites without screens.

Third Party Intervention

Third party intervention occurs where measures are introduced to enable support services to intervene before the attempt is made. This may take the form of surveillance systems which recognise some of the key attributes of attempts, e.g. pedestrians loitering, over the rail, walking on road only bridges, etc.

Video analytics could be used to identify potential suicides and intervene before they act.

The intervention measure could also enable the AMA to use advanced video analytics assist in other areas such as deterring graffiti and other acts of vandalism of assets, or being used in evidence based prosecution of offenders.

Mitigation

Mitigation occurs when we attempt to reduce the consequence(s) of the event. The minimisation tools above also have a mitigation affect.

Screens

Screening the high bridges may mean attempts are made from lower heights where chances of fatal injury are lower. Historical data indicates that this can reduce the incident time (road closure) from two hours to one on average and subsequently reduce traffic delays.

Help Seeking & Third Party Intervention

The phones and/or sensor systems can give traffic operation and incident response crews early notification of an event. This early notification can be communicated to motorists, through VMS signs, to slow them in advance of a site and reduce the level of delay. It can also mean that incident response is faster, and delay times minimised, when roads are closed.

Incident Response

As part of other studies, the AMA have identified incident response improvements would could reduce the impact of the incident on traffic. This report gives further gravitas to the value of these measures.

As shown on Table 8, the biggest reduction in delay can be achieved by reducing incident closures from two lanes to one. The AMA has already established measures to open lanes quicker, e.g. Duty Engineer vehicle fitted with push bars, tow trucks stationed at set locations, faster response vehicles, and working with Police to improve survey speed etc.

Incident response procedures are an important part of reducing overall delay to the network.

Safer Roads and Roadsides

Vehicle suicides occur when a vehicle is intentionally crashed into a structure and/or other vehicle(s). It is recommended that barrier upgrades continue to be put in place to ensure that high risk points are protected; and that the wrong way driver program continues to identify and prevent head on crashes.

CONCLUSIONS

Fall from height represents the major risk to the Auckland Motorway network, representing 83% of fatalities due to suicide, over the last 8 years. The above discussion shows that there is no easy answer to preventing suicides from occurring on the network, and there are moral implications in how treatments are carried out. As with the Safer Journeys strategy, we, RCAs, incident responders, health practitioners, etc., have a shared responsibility to reduce the injury resulting

from suicide on our network.

This study indicates that that the following are appropriate intervention measures for further examination:

1. Identify the appropriate body to liaise with regarding the appropriate treatments. Following this, analysis be undertaken and used to prioritise, for the Inner CMJ and Auckland Harbour Bridge areas that includes;
    - Installation of screens,
    - Help seeking, e.g. phones and / or signs, and
    - Third party intervention measures, e.g. video analytics.

2. Undertake analysis to understand the incremental cost of designing structures so that screens can be retrofitted during the structure service life

3. Further explore updates to the Transport Agency's Bridge manual to include:
    - Mandatory installation of screens on dedicated pedestrian and cycle way bridges as a minimum,
    - Structures featuring pedestrian / cycle activity have an appropriate intervention measure identified,
    - Regular revision of the methodology used to determine whether screens are required,
    - Requiring bridges to be designed to allow the retrofit of screens at a later date.

4. Continued emphasis on Incident Response procedures and the time taken to of re-open the road/lane. Of particular importance are the methods used to limit possible lane closures to one lane.

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