

STRATEGIC CASE RESILIENCE INSIGHTS

PURPOSE

This note is for Agency staff and consultants who are developing strategic cases where resilience is identified as a problem. It gives examples and insights using a resilience lens on the planning process and can be used by anyone developing a strategic case who is needing to incorporate resilience into their thinking.

BACKGROUND

The insights and examples discussed in this paper have been gathered by the Resilience Business Improvement Project Team. It reflects a review of some of the early strategic cases that have been the basis of the NZTA's (Priority Corridor) business case programme from a resilience perspective, and informed by thinking that has occurred during the project.

A number of useful tools and information can be found [on the NZTA website](#) to assist with considering resilience.

WHAT IS RESILIENCE?

Resilience is about keeping roads open (as much as possible) during an unplanned event so people and businesses can make the trips they need.

Resilience is **not** about managing congestion or traffic jams.

WHY IS RESILIENCE IMPORTANT – STRATEGIC PERSPECTIVE

Our customers, infrastructure partners and Government expect a transport network that is resilient, robust, reliable, able to adapt to adverse events and protects them from harm. They expect us to maintain or quickly restore reasonable levels of service when things go wrong, and to be prepared for adverse events.

Our roads and highways are lifelines to essential services – whether social or economic.

With growing demands on the transport network and climate change (including an increasing incidence of extreme weather events), building and maintaining a resilient network is an important part of our core business.

RESILIENCE INSIGHTS AND EXAMPLES

Definitions

When crafting a Problem Statement and Investment Objective Statement, it is important to define early on what is considered to be resilience (particularly as opposed to reliability¹), and to articulate this in the business case.

We define resilience as “the availability and restoration of road function when there is a weather or emergency event (unplanned, including crashes), whether there is an alternative available and the road user information is provided.”² Or “keeping roads open (as much as possible) during an unplanned event so people and businesses can make the trips they need”.

When defining resilience:

1. Define the time scale or magnitude of an event. Consider both high probability low impact (small floods, ice and snow), and low probability high impact events (such as large earthquakes). Our recommendation is that both are considered, or at least referenced if other work is already considering some aspects of this, to ensure that all resilience issues are addressed and integrated responses are promoted.
2. Consider the type of disruptive event – is it a resilience issue or is it a reliability issue? The terms “resilience” and “reliability” are often mixed up, and used interchangeably. While the impact may have some similarities, the resulting investment decisions from these words may differ.
 - **Reliability** is from the perspective of the road user, that their journey travel time is consistent or doesn't vary too much between trips at the same time of a day or week.
 - **Resilience** is focused on the availability of the corridor and its ability to withstand and recover from disruptive events that threaten its availability.

A caution about defining road crashes

The factor most inconsistently defined and dealt with in business cases around resilience is road crashes. In general crash-related disruption issues are usually more directly related to a safety issue and better addressed by considering them as a safety problem. In some cases a closure resulting from a recurring crash problem may be also considered a reliability issue rather than resilience or safety issue.

If crashes are retained in resilience assessments, then it is the impact on the network availability outcome which should be highlighted (not the direct crash costs) and explicitly identified as one of the various contributors to network outages. Inclusion is relatively straightforward as each crash outage is relatively short duration, and can be captured within the assessment of the short duration outages.

Problem statements

The problem statement is fundamental to the business case approach. If there is a resilience problem on the corridor, it is critical that it is captured correctly in the problem statement – taking into account the definitions above. If resilience is not captured in the problem statement, it will be difficult to add it later in the process, or to invest in resilience if resilience is subsequently determined to be a problem.

¹ Reliability may be considered to be related to impacts on travel time consistency related to poor geometrics, vehicle mix and demand/capacity issues.

² One Network Road Classification Performance Measures Framework and One Pagers – The Road Efficiency Group

The problem statement informs the benefits, investment objectives, and the performance measures. These in turn affect the identification of the recommended options through the multi criteria analysis process, in the programme business case stage.

Problem statements are developed by considering the cause and effect. For example;

Cause: Substantial recurring flooding events coupled with the lack of suitable alternative routes

Effect: Significantly limits the movement of people in Northland.

When defining a resilience-related problem statement, it is important where possible to consider the following points in the cause element:

- What type of events impact the availability of the network?
- What is the frequency of these types of events?
 - High impact, low probability – earthquakes, Tsunami
 - Low impact, high probability – minor floodings, slips, snow/ice
- Are alternative routes available, and are they likely to be affected by the same event as the studied corridor? Are vehicles, particularly large freight vehicles, able to access the alternative route, or are they stuck there until the main route is opened?
- What has happened historically, and what can be reasonably expected to occur e.g. location of active fault lines)?

If little information is available early on while drafting the initial problem statement, effort should be made to consider additional evidence later as Problem Statements are reviewed for re-confirmation.

It is also useful to consider how to segment or break up the route. Resilience issues often align with changes in topography/geography (where safety issues are also often more prevalent). Therefore a problem statement may apply to a particular segment or section of the route, but not another. This is something to discuss during the Investment Logic Mapping workshop.

The effects of a problem may be varied, and should relate to desired Outcomes provided or associated with successful State highway functioning:

- Economic (freight, businesses and tourists)
- Social
- Safety
- Reputational
- Driver frustration
- Difficult emergency response – can also impact a greater regional response

Finally, the guidance for developing any problem definition suggests testing the potential statement against the following questions:

- Is it clear what the problem is that needs to be addressed?
- Is there evidence to confirm the cause and effect of the problem?
- Does the problem need to be addressed at this time?
- Is the problem specific to this investment (or should a broader perspective be taken)?

Examples of problem statements

It is important that problem statements are specific to the route. Below are some examples from recent strategic cases (with some comments on their appropriateness³):

- Sections of SH1 are susceptible to road closure and traffic delays resulting in economic & social impacts greatest where there is no viable detour route

³ Note that the problem statements are reviewed and refined through each stage of the business case as more evidence and knowledge is gained through the process.

- Comment: It is unclear what the real cause of the problem is, it would be useful to name the type of event that causes the closure. It would be good to understand whether these closures are frequent and whether they are long closures.
- Key sections of State Highway 1 are vulnerable to closure from forces of nature and crashes, resulting in delays and economic impacts
 - Comment: The term forces of nature could be more specific so that we really understand what is being referenced. For example is it flooding, tsunami or earthquake.
- The Port Area is a key enabler to recovery after a High Impact Low Probability event, but the network infrastructure to and from the Port is vulnerable to such an event, further risking the region’s ability to recover
 - Comment: This is a good example of being specific about the location, and the type of event that is being considered. It would be useful to be written so that the Benefit and Outcome Statements can be strongly aligned to it.
- Constrained topography, the geology and lack of alternate routes results in poor network resilience
 - Comment: This problem statement is very generic, and could refer to a large portion of the State Highway network. It needs to be more specific on type of events that hinder the resilience of the network, and also more specific on the effect by aligning to the desired outcomes.

And from the State Highway Resilience National Strategic Case⁴:

- Poor highway resilience may impede critical services from providing disaster response and recovery support
- Unreliability of some highways impacts businesses and undermines economic growth (we acknowledge now that this problem statement is inconsistent with definition discussion earlier in the document, and is not considered to be a good example)
- The risky environment of some roads increases the possibility of harm to road users

The following table is an example from a recent strategic case, illustrating the supporting material that reflects the discussion of the how cause and effect/consequence was considered in forming the problem statement. This is a useful method to support the problem statement, although in this example it could be improved by better highlighting the links between the cause and consequences.

Table 1. Cause and effect

Cause	Consequence
SH1 has sections that are prone to closure from natural events (extreme rainfall, sea surge, earthquakes)	Adverse economic impacts for local businesses Disruptions to freight and visitor traffic
The remoteness and mountainous terrain of some sections of the state highway is such that it is particularly vulnerable to closure from road crashes (e.g. lack of alternative routes, topography, bridge pinch points, poor alignment and narrow width, and slow response times to move larger vehicles)	Negative effects on emergency services Community severance – disruptions to telephone and other infrastructure networks leading to loss of local communications
Lack of practical alternative routes	

Ref: Christchurch to Picton Strategic Case

⁴ Note that as a National Strategic Case the problem statements are less specific than what would be expected for a corridor strategic case.

Benefits

The guidance for developing a benefit statement suggests considering the following questions:

- Are the benefits of high value to the organisation (furthering its priorities and objectives)?
- Have the benefits that will result from fixing the problem been adequately defined?
- Will the performance measures (KPIs) that have been specified provide reasonable evidence that the benefits have been delivered?
- Is there a logical connection between the effect of the problem and the benefits, and their KPIs?

Examples of benefit statements

The following are examples from recent strategic cases. It can be seen that the benefit statements are rather brief and generic. Benefit statements should be tangible, achievable and related to the problem statements.

- Route enables economic growth
- Reduced economic impact of road closure
- Minimised economic impact of high impact low probability events
- Reduce social and economic impact of high probability low impact and low probability high impact events
- Improved regional resilience

It should be noted that the KPIs will need to align with the benefit statement, and therefore need to be targeted, practical and measurable. Some examples of this are included later in this document.

Evidence base

The purpose of the evidence base, which is progressively improved throughout the Business Case phases, is to assess the robustness of the problem and benefit statements from current information and stakeholder knowledge. It is not expected to be complete but should acknowledge the gaps and identify areas of focus for future stages, should the business case progress.

NZTA business case guidance states that the strategic case should not involve extensive data collection or new work. The evidence base should be developed with existing information. For this reason the Resilience Project has sought to develop a nationally consistent assessment of resilience risks that can be used in the strategic case. The maps for high impact low probability hazard exposure can be found [here](#) on the NZTA's resilience webpage.

Another useful source is TREIS. It is widely known that the information in TREIS is not complete or rigorous. Nevertheless, a combination of the Network Outcomes Contracts and focus on journey management approach is leading to an improvement in the information in TREIS. However, it is important to check all accessible data to ensure that it makes sense before reporting on it.

In developing the evidence base, the following points should be considered:

- Real data of past events often come from TREIS. Extract the type of event and the duration of outage, and if possible the estimated frequency or return period for at least 5 years of data
- Media reports often provide useful information on road outages
- For high impact low probability events consider how probable an event is, and what the magnitude will be, and what duration the outage will be (see Hazard Exposure maps)
- Alternative routes: what is the distance and duration, what risks the alternative route faces including possible concurrent disruption to the main route, can all modes of travel use it, does it have capacity, can vehicles turn around (particularly freight vehicles, or will they have to wait it out)
- Information on the social, economic and safety impacts (information on MapHUB)
- Are customers able to be informed before, during and after an event
- Consider the impacts on the state highway infrastructure including; undermining of the road foundation or loss of sealed surface and sediment blocking streams or culverts
- Are there life lines networks along the corridor

- Does the corridor provide access to hospitals or other key emergency or essential community services
- Local flooding registers are often held by regional councils which can be useful
- What are tourist numbers, how would they change, what would the impact be (MBIE, Statistics NZ or TLA websites)
- What type of freight relies on the corridor, is it sensitive (perishable), can it use other routes, are there High Productivity Motor Vehicles on the route that can't use alternative routes?
- Engaging with the public and key stakeholders can provide good information through local knowledge on the impact of an event to the local area

Examples of evidence base information

The following information illustrates TREIS information in table and graph form, and a mapped example of detour route analysis.

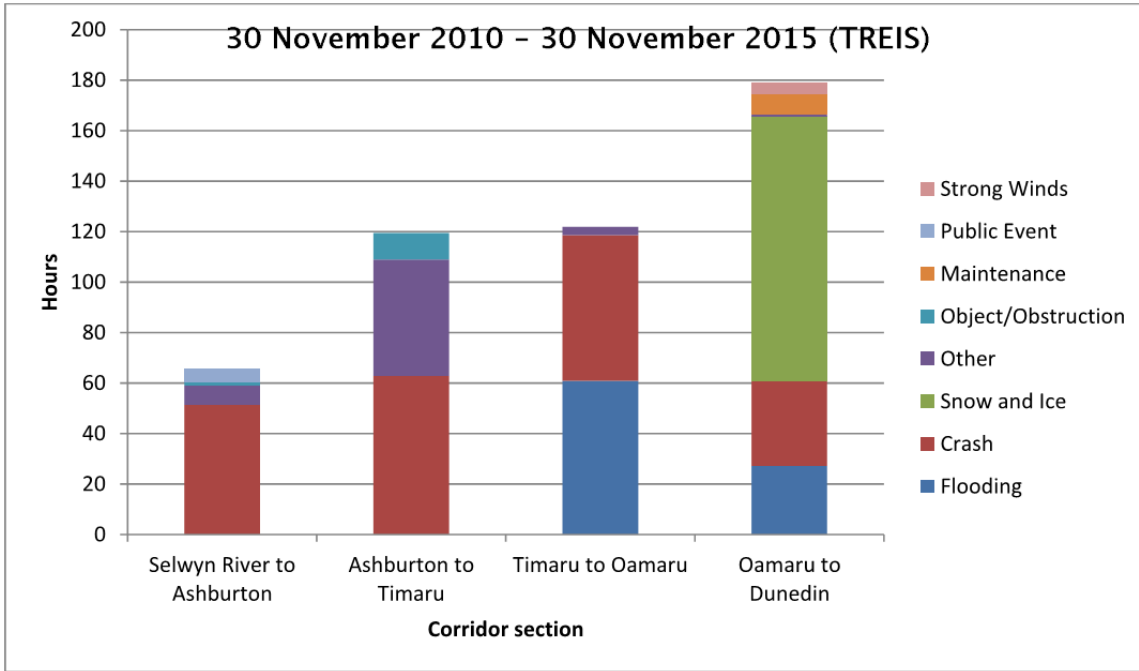
Table 2. Analysis of road closures

	Hamilton - Taupo	Taupo - Turangi	Turangi - Waiouru	National State Highway Network (2009/10)
Total closure incidents 2003 - 2013	66	16	132	
Total duration of closures (h:min)	265:40	72:5	1389:35	
Average number of closure incidents per year (2003 to 2013)	6.6	1.6	13.2	
Closures per km of state highway	0.57	0.14	1.14	
Traffic incidents (% number/% closure time)	97%/94%	88%/83%	26%/9%	50%/20%
Environmental incidents (% number/% closure time)	1.5%/5%	6%/2%	3%/1%	50%/80%
Weather incidents (% number/% closure time)	1.5%/1%	6%/15%	71%/90%	
Average length of closure (h:min)				
- Overall	4:02	4:30	10:32	15:00
- Traffic incidents	3:50	4:20	3:45	7:48
- Environment and weather	8:50	5:50	13:10	22:06
Max/min lengths of closure (h:min)	15:30/0:15	10:25/1:30	69:40/0:25	

Ref: SH1 Hamilton to Waiouru Strategic case

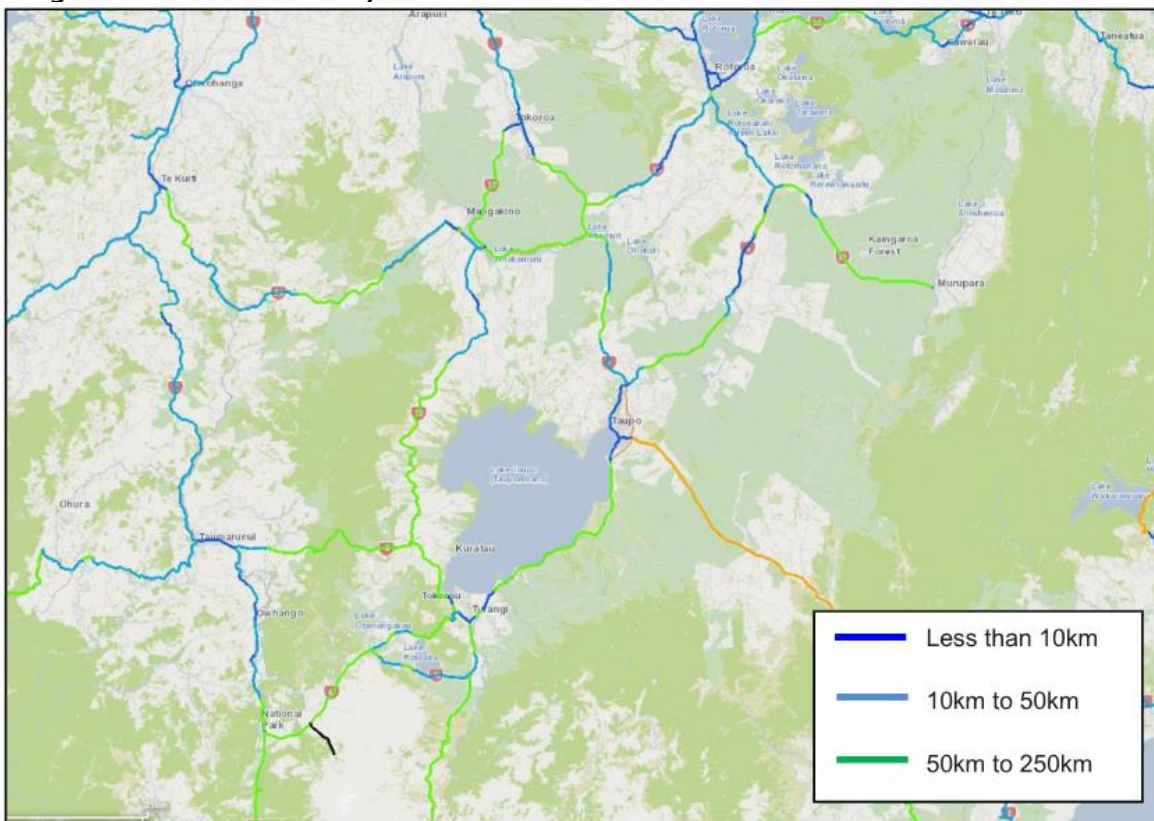
The graph below highlights the importance of segmenting a route, as the cause of network outages can change significantly along the route.

Graph 1. Road closure causes analysis



Ref: Christchurch to Dunedin Strategic Case

Image 1. Detour route analysis



Ref: SH1 Hamilton to Waiouru Strategic case

Strategic Context

The strategic case should include recognition of the contributing policy documents and general evidence base upon which the Problem and Benefit Statements, and Investment Outcome Statements are developed.

This could include the:

- Government Policy Statement on Land Transport Funding
- The Agency's Long Term Strategic View
- National Resilience Strategic Case
- National Resilience Programme Business Case
- Joint Resilience Operating Policy
- One Network Road Classification
 - For example; the target customer level of service for resilience on a National (high volume) road states that the route or a viable alternative should always be available or that there is a very rapid restoration of the route to normal operating conditions in the event of a closure.

The strategic context should also include Regional Land Transport Plans, other regional or district strategies and plans, that may look more specifically at the problems or opportunities in the region. These will often refer to resilience as a key outcome they are seeking.

Performance measures

The performance measures (KPIs) are there to assess whether or not the expected benefits have been achieved, and whether there has been a return on the investment. This establishes the link between the problem, benefit, key performance indicator and the selected intervention.

This will require baseline information for each KPI. Before selecting the KPI's you need to ensure that the information is collected on a regular basis and is available so that it can illustrate the impact of the investment.

Examples of KPI's and measures

- number of resolved road closures >2hrs, and >12hrs
- number and duration of closures
- Projected isolated time
- Projected time to reopen route
- Improved recovery timeframes

More guidance on performance measures, and library of possible measures, can be found on the Planning and Investment Knowledge Base webpage:

<https://www.pikb.co.nz/home/monitor-investment-performance/nzta-investment-monitoring-overview/framework-for-investment-performance-measurement/>

CONTACT

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