RAIL OVER ROAD BRIDGE STRIKES – DISCUSSION OF AN EMERGENCY RECOVERY IN A METRO AREA

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Rail over road bridges in New Zealand in common with many other countries are prone to being damaged by vehicle impacts, particularly in urban areas. Through discussion of the steps taken to recover from a vehicle impact that caused significant damage to a rail bridge at Silverstream in the Wellington Metro area and temporarily closed the Wairarapa Line in January 2015, this paper will outline the strategies KiwiRail has developed for:

- Management of the immediate response and assessment to ensure public and passenger safety
- The management structure of an effective multi-disciplinary emergency response team (from initial condition assessment to technical development of a solution and implementation on site)
- Key management factors that must be considered e.g. balancing urgency against risk, resources and available information - Documentation and cost management measures required to ensure maximum cost recovery

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1.0 Introduction

The purpose of this paper is to discuss the impact of vehicle strikes on rail over road bridges, both financially and structurally. The paper will also discuss ~~and to discuss~~ the incident management lessons learned from the response to a bridge strike incident at a rail over road bridge near Silverstream in Upper Hutt, New Zealand.

This paper will discuss:

- The management of the immediate response and assessment when a bridge is damaged to ensure public and passenger safety;
- The management structure of an effective multi-disciplinary emergency response team (from initial condition assessment to technical development of a solution and implementation on site);
- Key management factors that must be considered when implementing repairs, e.g. balancing urgency against risk, resources and available information; and
- Documentation and cost management measures required to ensure maximum cost recovery from liable third parties.

The majority of the rail over road bridges in New Zealand are steel girder structures on concrete abutments. Where there has been a history of vehicle impacts on a bridge there is often a retrofitted impact beam. This paper does not include a discussion of impact beam design but the standard impact beam design in use in KiwiRail is for a large SHS section and historically this may have been concrete filled.

Most bridge strikes result in far more damage to the vehicle than the structure it has hit. In particular, railway bridge girders are often more robust than the equivalent span road bridge girder. However, there are on average one or two incidents a year where significant damage to a bridge span is experienced.

Picture 1 - A typical example of a truck that has come off worse after a bridge impact with little actual damage to the bridge span (Photo Credit: Unknown)

Picture 2 and 3 – A particularly bad example of damage to a span. The truck caught fire after it became wedged under a span of a rail bridge over SH1 near Marton. No-one was injured at this incident. (Photo Credit: Richard Greenfield)

The main driver when recovering from a bridge strike is usually to return the bridge to use as fast as possible but it is the responsibility of the engineer to ensure that this is done with appropriate consideration of risk and safety.

The cost recovery process is discussed in more general terms; it doesn't focus on the Silverstream Bridge as the cost recovery process for this incident is ongoing at the time of writing and is commercially sensitive. The KiwiRail Bridge Strike Cost Recovery process has been developed over a number of years and through a number of significant incidents. A number of significant lessons have been learned that have been incorporated into this process.

The KiwiRail Cost Recovery Process is not proposed as a generic template for all organisations as particular asset management processes and local legislative requirements will vary from country to country and asset to asset. The purpose of this paper in terms of cost recovery is to raise the issue of cost recovery, highlight the value of having a robust process to implement this and discuss the lessons learned that have informed this process.

2.0 Bridge Strike Cost Recovery

2.1 Introduction to Cost Recovery

This paper concentrates on the particular instance of cost recovery in the case where a privately owned vehicle has damaged a rail over road bridge. These circumstances are by far the most common in terms of numbers of incidents but significant costs have been recovered from a variety of circumstances. Examples include:

- Damage to a steel viaduct from a tree thrown off the top by contractors working for KiwiRail;
- Overheight contractor's hi-rail dump truck impacting a low-clearance tunnel;
- Damage to trains and overheads from trees on privately owned land falling into the KiwiRail corridor;
- Trimmings from forestry operations blocking culverts and causing washouts or debris collecting on bridge piers;
- Damage to trains from vehicles or stock struck at level crossings or while trespassing on the corridor;
- Removal of dilapidated structures over the rail corridor.

It is not just the physical repair costs that can be recovered; all costs incurred in responding to the incident or due to delays caused by the incident can be recovered.

The KiwiRail Bridge Strike recovery team was established in 2011 and was successful in several large recoveries. However, it took time to establish a robust process to maximise cost recovery and gain momentum and buy-in from other business units. A cost recovery process was formalised in 2014 and a full time team established to manage this process CHECK.

The purpose of the Incident Recovery Team is not just to maximise cost recovery and minimise financial losses to KiwiRail but to remove the significant workload of dealing with incidents from internal KiwiRail engineers. This allows them to focus on their core responsibilities of asset management and maintenance.

Annually, KiwiRail records an average of 34 reported bridge strikes. In several cases the damage to the tracks and supporting structures has required significant remedial action. Bridge strikes pose a continuous risk to KiwiRail in terms of road user safety and the operational continuity of the network.

It is often noted through the normal structures inspection regime that there are many minor scrapes and impacts on spans over roads that are never reported. In parallel with the work on cost recovery, the Incident Recovery Team also takes a lead for KiwiRail in developing links with the trucking industry and the media to inform the public about the risks of not reporting incidents and their legal responsibilities.

Following a bridge strike, operational demands usually require KiwiRail to complete repairs as soon as possible in order to maintain an operational network. As a result, costs often have to be recovered retrospectively after remedial works have been completed. This is not the standard method for recovering costs from insurers and there is some inherent risk that not all costs incurred will be successfully recovered. The procedures used by KiwiRail have been developed with time and experience and minimise the risk of costs being unable to be recovered after the fact. It should be remembered that prior to 2011 almost no costs were recovered from insurers, so any recovery is an improvement!

An additional source of cost for KiwiRail following a strike can be characterised as business interruption costs which are caused by disrupted train movements. Business interruption costs are those attributed to freight, suburban transit (Tranz Metro), and labour on hold or affected by closed lines.

Historically a non-significant bridge strike costs KiwiRail on average $18,000, not including business interruption costs, which were historically not recorded. Table 4 outlines the number of strikes recorded over 2010 to 2014 and the associated total costs.

Financial Year	Costs incurred by KiwiRail	Costs recovered by KiwiRail	Number of Strikes
10/11	$1,063,898	-	32
11/12	$319,677	$126,931	33
12/13*	$341,912	$99,147	28
13/14	$429,598	$1,290,339	29
14/15	$1,087,203	$1,053,772	49

** Formal cost recovery process implemented*

Table 1. Summary of KiwiRail costs following a bridge strike

In difficult or contested cases there can be a time lag of many years between the incident and final settlment on cost recovery. This means that comparisons between costs recovered versus costs incurred in a particular year are not necessarily useful. The table above clearly demonstrates an increase in costs recovered once a process and team to manage the claims is in place.

The costs to the business of running an Incident Recovery Team is negligible as the costs recovered far outweigh running costs. However, as reducing the number of bridge strike incidents is part of the remit of the Incident recovery team, it is hoped that eventually the team will need to be centrally funded as the costs available to be recovered are reduced.

2.2 Background to KiwiRail Asset Management Structure

KiwiRail bridge assets are significantly different to those found on the New Zealand road network. In many cases the rail infrastructure was in place before the roading infrastructure was developed. This has left KiwiRail with many historic issues of low clearance rail over road bridges where the roading asset has been installed after construction of the rail corridor. This does however have the advantage that while most of the rail over road bridges are owned and maintained by KiwiRail, the local authorities or NZTA usually have responsibility for signing and managing the clearances under rail bridges and are ultimately liable for repair costs if no responsible party can pursued for costs e.g. hit and run.

KiwiRail structures assets are inspected in detail every 6 years and in brief every year. There is an internal staff of Structures Inspectors around the country and each inspector is responsible for a particular section of the network. Most of the inspectors are trade qualified and have worked their way up from the KiwiRail structures maintenance gangs. This means that while they have an excellent knowledge of the asset and the particular conditions at a given site, they are not qualified engineers and if any significant damage is found during an bridge strike inspection the decision on what action is required is passed up to an engineer.

Each inspector is partnered with a structural engineer from the Structural Engineering team. This Inspectorate Engineer is responsible for the asset management decisions and assessment of inspection reports for their area and in the case of a bridge strike they will be the first person contacted if an engineering opinion is required.

2.3 Bridge Strike Team Roles and Responsibilities

A summary of the roles and responsibilities of key individuals involved in the management of a bridge strike incident is illustrated in table 2. The relationship between the internal and external parties is illustrated in figure 1. Not every incident will involve all parties and some of the positions in the chart are interchangeable e.g. in the case of a hit and run the local authority often become to party being claimed against as ultimate responsibility falls on them in New Zealand.

Organisation / Person	Responsibility	% Time Required
KiwiRail – Inspector	Examination of asset after an incident has occurred. Completes Incident report.	As required
KiwiRail – Engineering	Reviews Incident report and where necessary provides guidance/approval on the proposed repair design.	5-10%
KiwiRail – Property	Advice on property matters.	As required
KiwiRail – Incident Recovery Manager	High level management of incident repairs. Manages cost recovery process.	100%
KiwiRail – Financial Recovery Advisor	Provides costs for loss adjustors. Recovery of costs.	100%
KiwiRail – Senior Corporate Counsel	Legal assistance in significant incidents or where recovery becomes protracted.	As required
Internal or external Engineer	Completes design specifications. Construction monitoring.	Engaged as required
Internal or external Project Manager	Tendering work. Contract administration. Construction monitoring.	Engaged as required

Table 2. Bridge strike key roles and responsibilities

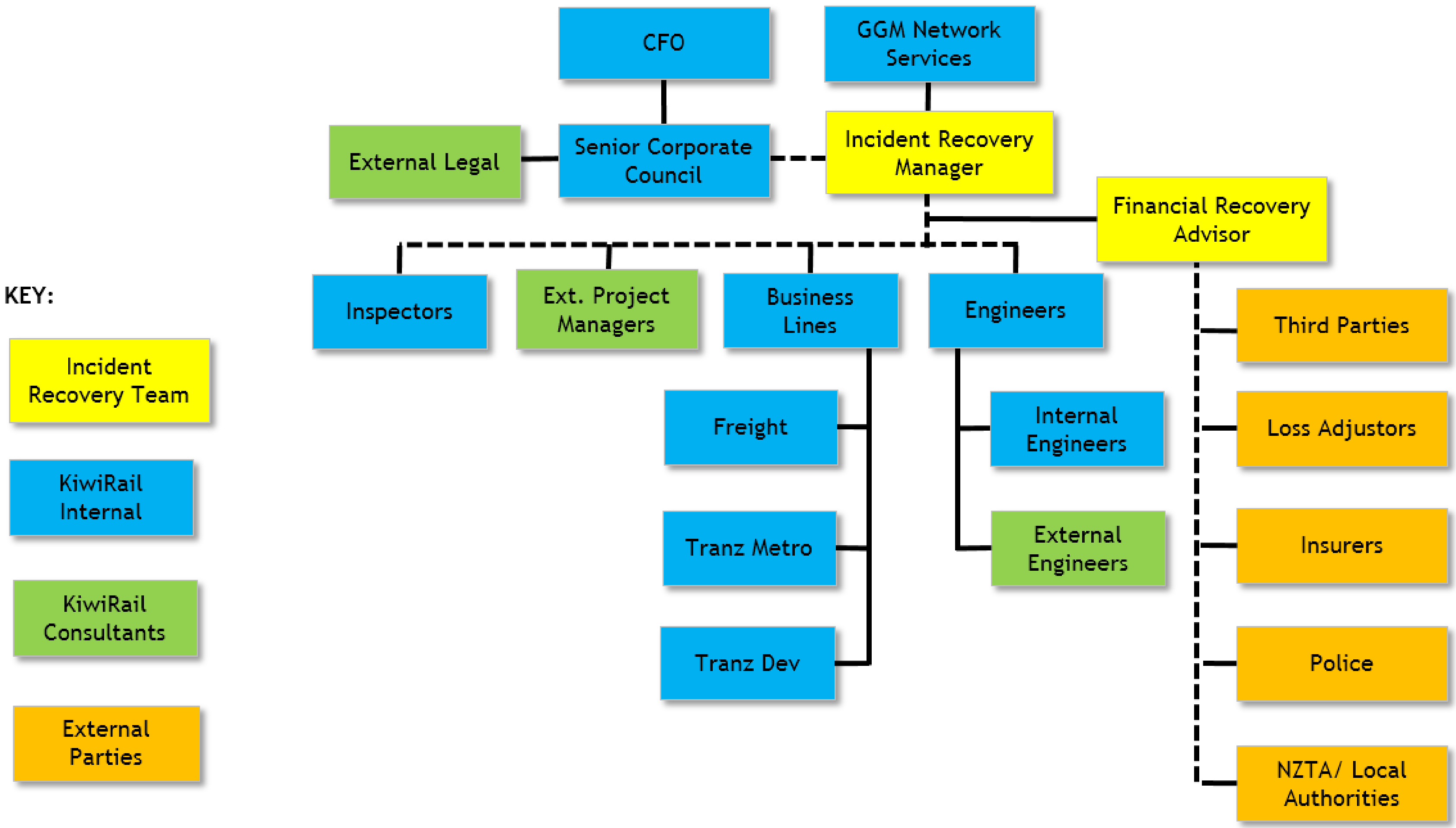


Figure 1 – Bridge Strike Relationship Chart

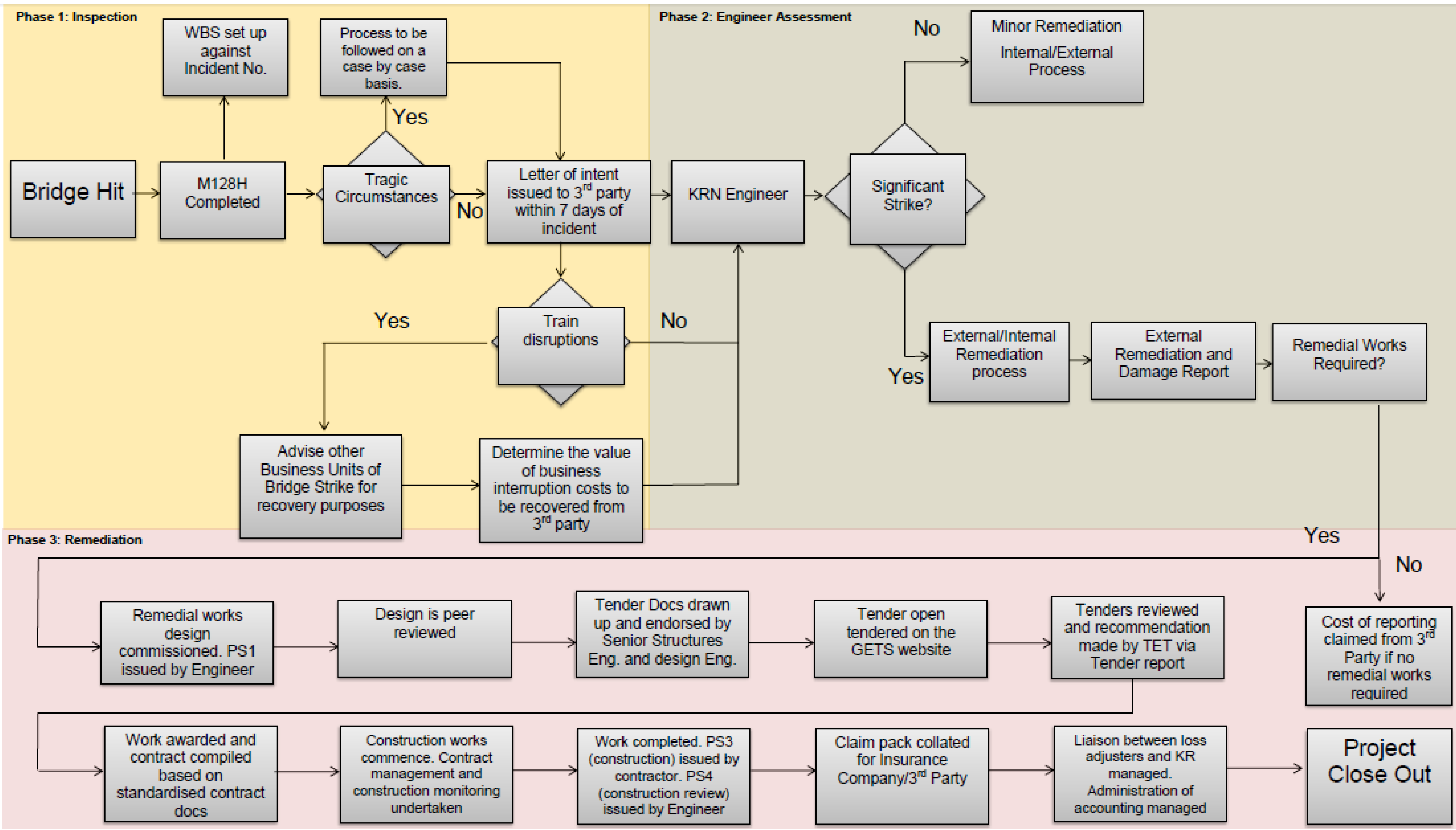


Figure 2 – Incident Response Flow Chart

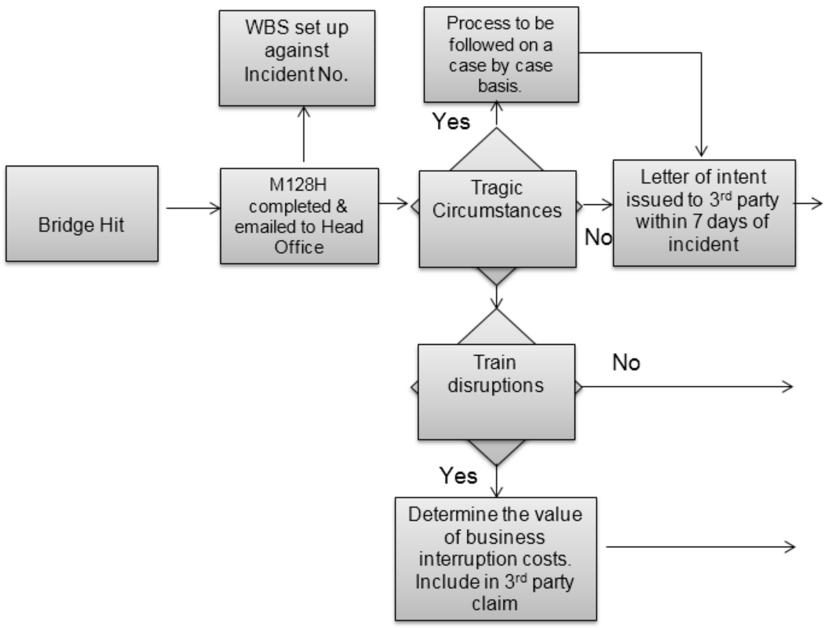
2.4 Bridge Strike Response Process

As illustrated in figure 3, KiwiRail's response to Bridge Strikes consists of three distinct phases: inspection, engineer assessment and remediation. This section will discuss each phase.

The foundation of all cost recovery claims associated with Bridge Strikes is the M128H form. This form, developed by KiwiRail, lists the information that should be recorded during the initial response. This form not only provides basic details to the engineer for assessment of the structural implications of the impact, but also provides an outline of the basic information needed to provide a sound basis for a cost recovery claim. This form has been devlopoed by KiwiRail over a number of years and has proved to be a good balance between detail and efficiency, e.g. it does not request information that is not in some way useful and hence allows a fast and efficient response.

The local Structures Inspector is trusted to make calls on opening the bridge after inspection to traffic, or not. But caution is always encouraged and if there is any significant damage the call on opening the bridge to traffic is usually elevated up to the Inspectorate Engineer.

2.4.1 Phase 1: Inspection



Initial Response Notes

- Attending the scene of the incident is the first priority following a Bridge Strike. The level of damage must be assessed as soon as possible in order to maintain the safety and continuity of the railway network.
- The bridge is inspected by a KiwiRail Structures Inspector, who completes a preliminary assessment of the damage and fills out an M128H damage report form.
- An M128H is an internal KiwiRail bridge hit report which is completed on inspection to document the details of a bridge strike incident. An example of a M128H report can be found in appendix 1 of this report.
- KiwiRail has often been unable to claim back all costs associated with the initial inspection due to the lack of recorded information. It is critical that the Inspector records all time associated to the incident including travel time to and from the inspection, inspection time and the overall distance travelled. All

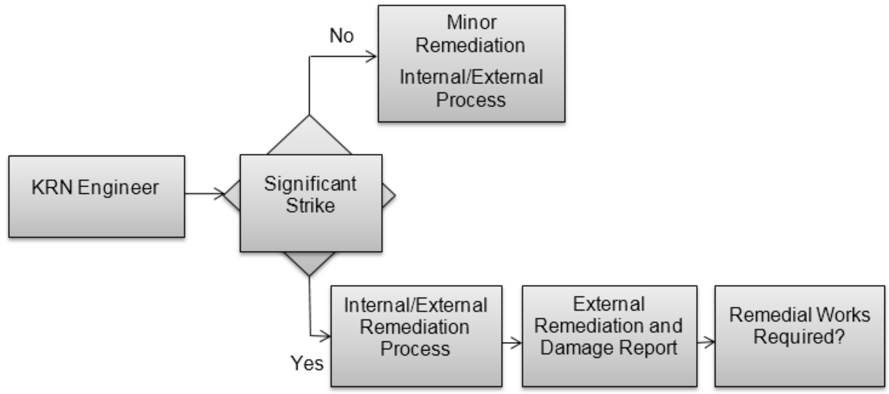
time expended is recorded against an incident number in the KiwiRail work management system. The incident number is created by Train Control as soon as the incident is reported.

- When a Bridge Strike incident is reported the line is closed until the Structures Inspector has been to the site to ensure the structure is fit for purpose.
- If the damage resulting from the bridge strike is such that the KiwiRail Structures Inspector is not able to authorise train movements, the KiwiRail Structural Engineering team is advised. In such cases, it is likely that debris needs to be removed from the track and temporary repairs or propping of the bridge may be required before train services are resumed.

Cost Recovery Notes

- Costs associated with the loss of business due to closed lines can be calculated as business interruption costs. If the line has to be closed it is important to start the process of determining the costs at this early stage by engaging with the relevant Freight or Metro teams.
- If a temporary speed restriction is placed on the bridge following the initial structures inspection, the cost of the loss of time due to the speed restriction on freight or passenger schedules should also be on charged.
- A copy of the M128H form, along with copies of any photographs taken of the damage is e-mailed to the KiwiRail Incident Recovery Team and the Inspectorate Engineer for the relevant area. These notes are essential to progress a cost recovery and a robust data management system must be in place to record all information associated with the incident.
- Where necessary, any other relevant information such as risks and safety issues are clearly communicated via email or phone with the Road Controlling Authority (RCA) to ensure roads and pedestrian ways are safe for the public. Details of the RCA personnel (where known) should be included in the M128H for any future follow up work required in this area.
- After the incident has been inspected, the Third Party responsible for the strike is contacted and once their details are confirmed, a letter of intent is issued. This letter provides the Third Party with notification of KiwiRail's intent to pursue all costs for damages and allows the third party an opportunity to coordinate with their insurers as soon as possible. An example of this letter can be found in appendix 2.
- If there are tragic circumstances the process to be followed should be assessed on a case by case basis. It is important to be sensitive and give the Third Party the respect they deserve during this time. Notification of a fatality should be escalated to Senior Management and KiwiRail's Media Liaison Team should also be notified.
- In the case of a 'hit and run' bridge strike where the 3rd Party is unidentified, the Bridge Strike Process should be followed in order to recover the costs from the relevant road controlling authority (the local council or NZTA).

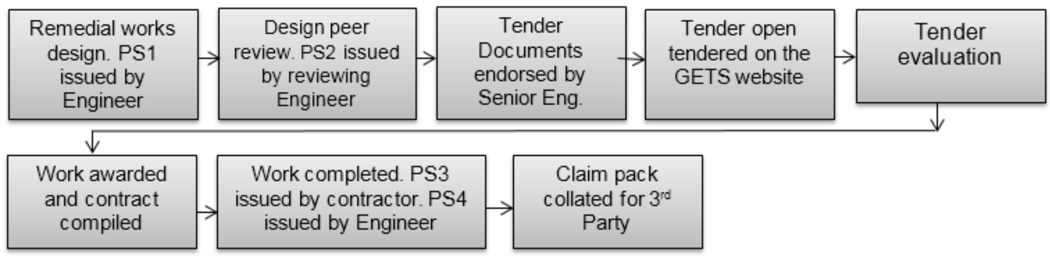
2.4.2 Phase 2: Engineer Assessment



Notes:

- An M128H report must be reviewed by a KiwiRail Structural Engineer and a briefing obtained from the relevant Structures Inspector.
- The KiwiRail Structural Engineer is responsible for determining whether or not the damage to the bridge can be considered 'significant' or not. As a guide, a bridge strike will be considered significant when there is damage to the bridge span and/or any structural damage to the impact beam.
- If the bridge strike is determined to be significant, it is then decided whether the remedial process will be carried out using internal resource or whether an external contractor will be engaged.
- A Damage Report (whether internal or external) is commissioned to document the extent of damage and recommend repairs.

2.4.3 Phase 3: Remediation



Phase 3:

- The structural design of the remedial solution must be completed by a suitably qualified Engineer. A PS1 (Producer Statement – Design) is issued by the Engineer.
- As a matter of course all designs and specifications are peer reviewed for quality control purposes. The peer review is conducted by a suitably qualified Engineer experienced with KiwiRail procedures and bridge repairs.
- A PS2 (Producer Statement – Design Review) is then issued by the Reviewing Engineer.
- Once the designs and specifications have been reviewed, a Request for Tender (RFT) document is compiled and the work procured as per normal KiwiRail procurement processes. It is necessary for KiwiRail to demonstrate that it has attempted to seek the best market price. It is important that this tender process is well documented and all documentation must be retained in order to support the cost recovery claim.
- Once KiwiRail has received tenders from the Contractors, tender evaluations are carried out. These evaluations are conducted with the Engineer who compiled the specifications and the individual who will be administrating the Contract.

2.5 Cost Recovery Process

The cost recovery process, as followed by KiwiRail's Financial Recovery Advisor, ensures the effective recovery of any financial cost incurred as a result of a bridge strike. For cost recovery to be successful it is important that KiwiRail captures all relevant information at the initial bridge strike/inspection and throughout the recovery process.

In tragic circumstances the Incident Recovery Team will seek media representation from KiwiRail's Media Liaison Team and consult with Management before proceeding.

Provided the relevant details are known, KiwiRail aims to contact the 3rd party within a week of the bridge strike in order to:

- Confirm with the 3rd party that KiwiRail is aware of the strike.
- Ensure correct details of 3rd party (Company/Owner Driver) name, address & contact details (Check against M128H report)
- Confirm whether the 3rd party is insured, and if so, obtain the name of the Insurance Company/Broker.
- Determine whether a claim has been lodged and, if so, obtain the claim number. If not, KiwiRail will hold the third party liable.
- Address any questions. It is important NOT to discuss any costs with the 3rd party / insurer. It is common for insurance companies to enquire about costs. The response to these queries must be that the costs are yet to be quantified. Any figures discussed could be used by the insurers at a later date to counter the final claim.
- Notify the 3rd party that a letter is being sent regarding the bridge strike and summary of KiwiRail Bridge Strike Process following an incident (Refer to the letter of intent).

It is important to communicate with the 3rd party, the loss adjuster and/ or their insurer regarding progress on repairs throughout the remediation process. If requested, the 3rd party or their insurer can inspect the damage prior to repairs being carried out.

Where recovery becomes protracted, legal assistance is sought from KiwiRail's Senior Corporate Counsel. Senior Counsel will determine how to proceed by giving direction or commissioning external litigation advice on the issue to assist with assessing the prospects for recovery or achieving recovery in the circumstances.

2.5.1 The Cost Recovery Pack

The cost recovery pack, which physically documents KiwiRail's remediation process, is forwarded to the loss adjuster/ 3rd party/ insurer and includes the following information:

- Copy of initial letter to 3rd party
- M128H report
- Previous Maintenance reports (if necessary)
- Contract Documents
- Request for Quotation letters
- Submitted tenders
- Tender evaluation report
- Letter of acceptance

- Costs (invoices etc) associated with the above documents
- Internal staff costs (Receipts are to be scanned and kept with the main bridge file for any rental, accommodation and miscellaneous costs associated with the Bridge Strike.)
- Business Interruption costs where applicable should be taken into account when filing a claim. Refer Clause 2.5.3 below
- KiwiRail Deposit Slip

Invoices will only be raised for costs associated with Bridge Strikes where:

- They have been agreed between KiwiRail and the Third Party.
- Payment is being made after settlement.

It is not uncommon for insurers to argue betterment following bridge repairs and it is important to remember this during both the recovery and response phases. Where possible, it is important to consider the likely stance of the third party and attempt to ensure all costs are recovered by repairing only what is necessary. In some instances, it may be necessary to make repairs which put the bridge in better condition post-strike than it was pre-strike. In these cases, KiwiRail will start by seeking recovery for full costs, if in the particular circumstances it is reasonable to do so.

2.5.3 Business Interruption Costs

Business interruption costs are unique to an incident (e.g. all costs associated with Freight, Tranz Metro, Tranz Dev or any other business unit) but standardised quantities can be used to record these costs. Any costs associated with idle time as a result of closed lines are captured and are requested from Freight, Tranz Metro, or the other Business Unit on a case by case basis. The Business interruption costs take into account diesel, drivers time, transporting passengers/goods by other means (road or different routes) and yard or labour costs associated with any of the above. These costs can generally be broken down into four categories:

- Alternative transport costs
- Road bridging costs
- Operational Labour costs
- Revenue losses
- Speed restriction costs

2.6 Public Profile of Cost Recovery

There appears to be anecdotal evidence that in general, the majority of the public support the right of KiwiRail to recover costs. In a recent incident where a car was hit by a train at a level crossing, the motorist (who was not badly injured) publicly questioned the appropriateness of being contacted by KiwiRail the day after the incident to be advised that KiwiRail would seek to recover costs. Of the 36 online comments in response to this story in the media there were some comments questioning the safety of the level crossing, but there were no were no comments in support of his position.

http://www.stuff.co.nz/dominion-post/news/local-papers/kapiti-observer/72123925/Motorist-to-be-pursued-for-cost-of-Capital-Connection-crash

2.7 Future Developments

The process outlined above has proved successful in helping recover significant costs, but a parallel aim of the Incident Recovery Team is also to reduce the number of Bridge Strikes and other third party incidents that occur. In the case of bridge strikes this has involved engaging with trucking companies to inform them of their responsibilities in the event of an impact. The Incident Recovery Team also co-ordinate with local Councils to ensure that all bridge clearances are appropriately signed (signage is the responsibility of the relevant road authority in New Zealand).

When a significant bridge strike occurs that causes disruption to road or rail users the KiwiRail communications team manages the dissemination of information to the relevant authorities and media outlets. KiwiRail takes advantage of these incidents to inform the public of the safety risks of unreported bridge strikes and the consequent delays and disruption that can follow on from failing to check the height of vehicles.

The risk of un-reported bridge strikes and the damage from them is also being addressed. There is a project underway to install cameras at high risk bridges. The aim of this is to gain a better understanding of the number of minor hit-and-runs that go unreported, provide evidence for pursuing claims and provide real-time warnings to train control that an impact has occurred.

The economic costs to the wider community of the road delays at the Br 30 WL site discussed in the next section are significant. This combined with the regular occurrence of impacts at this site meant there was a good case for cost sharing with the local council to reduce the inherent risks of this site. Replacement of existing spans with new shallower spans to improve clearances at this site is planned for Christmas 2015 and costs for this will be shared with Upper Hutt City Council, Greater Wellington Regional Council & NZTA. However, only costs associated with the like-for-like replacement costs can be recovered from the relevant insurance company.

2.7 Key Points

- All losses are recoverable, not just the cost of physical repairs to the asset e.g. business interruption, staff time, bus replacements, trucking, administration costs, disbursements (hotels, meals, travel) etc.
- Even where there is no significant damage found, costs for inspection and business interruption can be claimed.
- Insurers will not pay for betterment and all betterment costs must be able to be separated out from the baseline costs of repair or replacement back to the original condition before the incident
- Never discuss costs with insurers until you have evidence based figures to discuss. Early discussions on cost can be used to challenge later claims.
- Comprehensive and clear documentation is essential as only costs which can be proven can be recovered.
- Develop a process and engage with other business units before an incident happens

3.0 Br 30 WL Bridge Strike of 7th January 2015

3.1 Introduction

Bridge 30 Wairarapa Line (Br 30 WL) is near Silverstream in Upper Hutt, New Zealand. Br 30 WL was struck by a vehicle and badly damaged in January 2015. This section is not intended to be a discussion of the technical details of the repairs used at this site as the calculations and detailing used were relatively straightforward and are not of particular note in themselves. The intention of this section is to illustrate a typical timeline of an emergency recovery project and to discuss the management structure and decision making processes used to achieve a fast and safe return to service.

3.2 Site and Bridge Description

Bridge 30 WL is in the metro area of the Wellington Railway Network.

It carries over 220 passenger train movements per week along with a number of freight services and is a vital link on the rail network for commuters between Wellington and Upper Hutt and the Wairarapa. The alignment of this bridge allows for trains to pass at full line speed of 80kph. The number of trains passing this site and the high line speed mean that wrong line running or speed restrictions have a significant impact on the passenger train timetable at this site and wrong line running is only practical for diesel hauled services.

The bridge consists of 15 spans for the up and down mains (30 spans in total), the spans for each main sit on shared piers. The majority of the spans on the bridge are 60ft riveted plate girders that cross the Hutt River but at the northern end of the bridge the last 2 spans are shorter and shallower 30ft SPG's over the 2 lanes of Eastern Hutt Road.

The Eastern Hutt Road is a vital link between Upper and Lower Hutt. The alternative route avoiding this bridge is a diversion of 15km due to the need to cross the Hutt river. Closure of this road adds significant commuter traffic to SH2 and consequently causes significant delays to vehicle commuters.

Picture 4 – Google Streetview image of span prior to Jan 2015

The road is the main access point for a waste facility and many of the previous strikes recorded at this site were caused by over height dump trucks. Clearance is also different on each site of the road hence it is possible for a return trip to result in an impact from a vehicle that safely passed the site in the opposite direction.

Br 30 Wl is approximately 20 minutes drive from the KiwiRail head office in Wellington CBD and a similar distance from the regional depot at Kaiwharawhara where the Structures Inspector and KiwiRail Structures Gang are based.

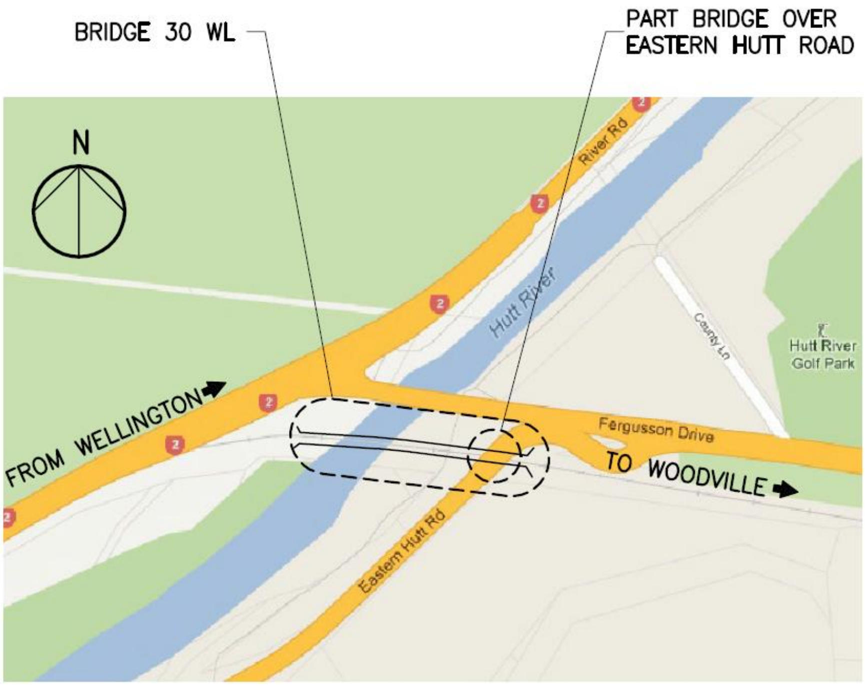


Figure 3 – Location of Br 30 WL and in relation to the roading network

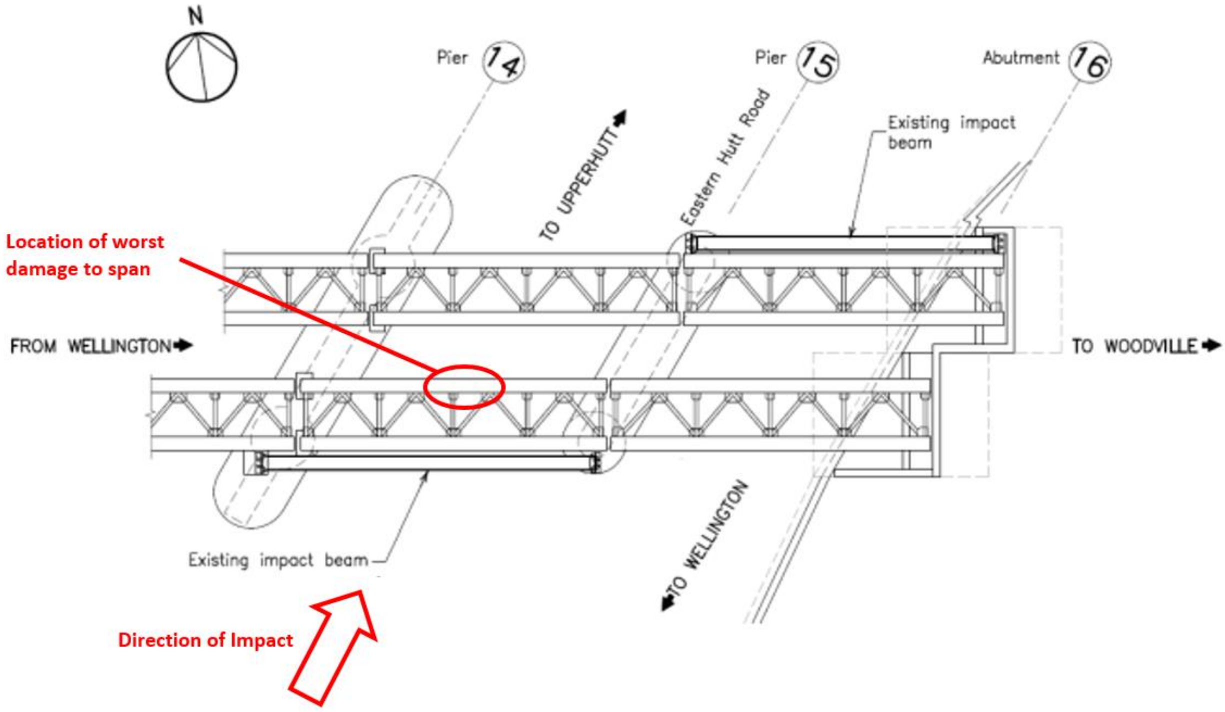


Figure 4 – Plan view of the Br 30 WL spans over the road and the location of worst damage

3.4 Structural Damage Description

From an inspection of the damage to the impact beam and the span and piers it appears that the impact beam was the first part of the structure to be hit. The force of the impact appears to have cartwheeled the forklift up into the first span, causing the damage to the bottom flange of the span, before falling off the flatbed sideways and gouging the concrete of the pier.

The force of the impact caused the following damage to the bridge;

- Side 1 SPG – Bottom Flange
  - 150mm global deformation laterally of bottom flange
  - 90mm local deformation laterally of bottom flange (over a 1600mm distance)
  - 45mm local deformation vertically of bottom flange
  - Localised flange tearing at the point of maximum deflection
  - Buckling in the web
  - Yielding of bolts to the centre diaphragm
  - Some cracking in concrete around holding down bolts
- Side 2 SPG - Top Flange
  - Yielding of bolts to the centre diaphragm
  - Some cracking in concrete around holding down bolts
- Side 1 and 2 - Top Flange
  - No obvious deformation or damage but approx. 10mm lift in track level at the point of impact.
- Impact Beam
  - Deformation of approx. 40mm laterally
  - Holding down bolts at both ends yielded

Picture 5 - Side 1 bottom flange global lateral deflection (Photo Credit: Michael Luke)

Picture 6 – Approx 60mm tear in bottom flange (Photo Credit: Graham Boorman)

3.4 Technical Description of Temporary Repair Strategies

The following section talks in detail about the process that led to the decision of which repair strategy was progressed, this section presents a brief description of the design philosophy and analysis used.

The technical design of the temporary bracing solution was relatively simple. While the span was clearly badly deformed an unsuitable for use, analysis of the remaining effective sections suggested that there was sufficient capacity remaining in the damaged girder after an allowance had been made for the section area lost to the tear in one of the flange angles.

The web was buckled but did not show any signs of tears or cracks and as long as the buckling moments due to eccentric loading could be restrained it was felt that it was capable of still carrying load.

The design philosophy was to;

- Increase the buckling (bending moment) capacity of the web to cope with eccentric loading
- Restrain the lateral forces likely to be induced by the lateral eccentricity of the bottom flange and transmit these lateral forces to the abutments.

Note: It was felt that propping alone was inadequate due to the risk of a failure via lateral movement of the girder or buckling of the web which could have led to a significant deflection at track level and cause a derailment risk.

Two approaches were taken to assessing the lateral forces in the bottom flange.

- A free body diagram as per figure 3 was assessed and the forces assessed and resolved at various points along the span with variation of shear.
- Resolving of forces in the bottom flange as per figure 4

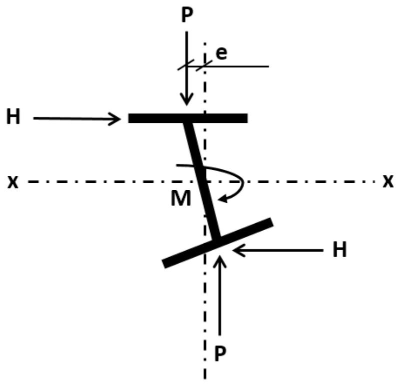


Figure 3 – Free body diagram for estimating lateral forces to be restrained in deformed flange

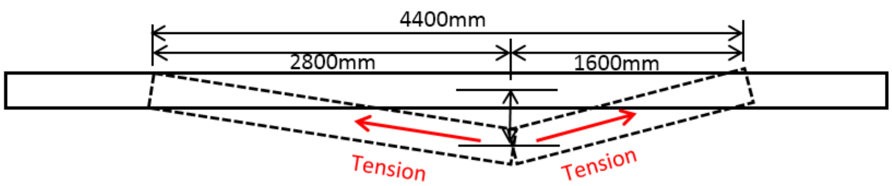


Figure 4 – Resolve forces in bottom flange

After discussion it was decided that both options were potentially valid and the difference in applied loading was nominal so the cross bracing was designed for lateral forces from both potential sources. The cross bracing was designed to intersect and transfer load to the existing undamaged span cross bracing and diaphragms.

The bucking in the web was dealt with by installing a 100x100 Equal Angle to brace the web and increase its flexural capacity at various points along the span. The flexural forces in the web and hence stiffener were estimated from the free body diagram in figure 3.

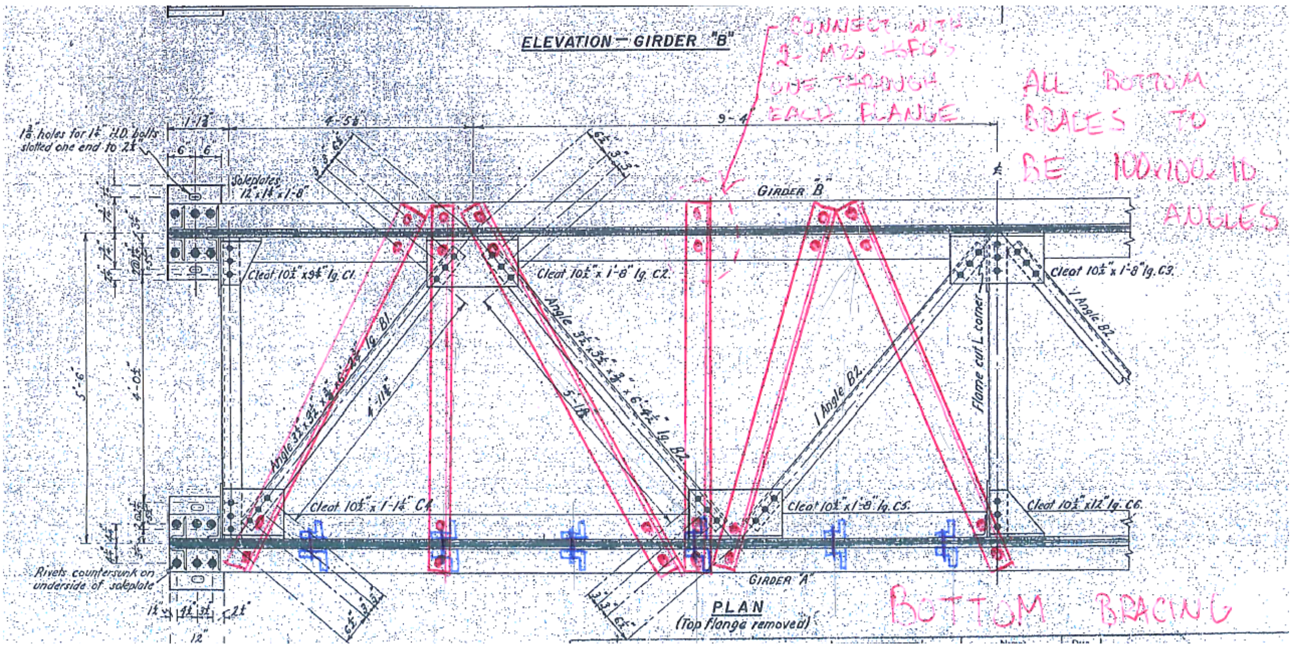


Figure 5 – Extract from site sketches for temporary bracing repair


Picture 7 and 8 – Temporary cross bracing and web stiffeners installed (Photo Credit: Cody Young)


Picture 9 and 10 – The sleeper pigsty installed under the span (Photo Credit: Derek Jansen)

3.3 Timeline of the Response

Wednesday 7th January 2015

2.00pm

The line was closed at 2pm as soon as Train Control received a report of damage from the police.

Subsequent investigations concluded that a forklift on the back of a flatbed truck struck the impact beam over the northbound lane of Eastern Hutt Road. It appears that the forklift was knocked backwards on the flatbed of the truck and the forks were spun upwards into the span on the far side of the impact beam causing the damage to the span as the truck passed underneath. The driver of the truck is reported to have carried on driving till he found a safe place to pull over and re-secure his load. He claims that because he saw police at the scene of the accident he did not think he needed to call anyone to report the accident. The KiwiRail Incident Recovery team took the lead in following up on witness report of a forklift causing the damage and contacted forklift companies in the Wellington region. The driver owned up being the culprit a few days after the accident.

It appears that in this case the police were on the scene of the accident soon after it happened and it is not thought that any passenger trains passed over the span before the damage was reported to train control.

2.30pm

The local structures inspector was on site shortly after the incident and carried out the initial inspection which confirmed that the line should remain closed. The Inspector called on the Structures Engineering team for support at this time and traffic control contractors and a scissor lift were arranged as it was clear the span had been significantly damaged and would require closer inspection.

3.00pm

The Inspectorate Engineer and another engineer familiar with the bridge attended the site. One lane of the road was closed to allow closer inspection with a scissor lift. At this point the Metro operator was informed that it was unlikely the span would be re-opened for the evenings commute but a call on closure for the next morning was deferred until a 4pm conference call.

4.00pm to 5.00pm

The initial measurements from site were called into the office and the first pictures of the damage were received back in the office. It is at this point that the author began took control of the incident as it was clear that a significant response was required and an experienced engineer was needed to co-ordinate activities.

In the office, an initial conference call with Train Control and the Metro operators was held. At this point the decision was made that the span would be closed to trains for the next days morning and evening peak services. At this point the Metro operator and Network Control outlined the key operating restrictions that would inform the response;

- Only diesel Wairarapa services can wrong line run
- Decision on closure for a commuter period required as far in advance as possible as bus replacements past the closed section needed to be organised
- Decision on re-opening must be notified 12hrs in advance as driver rosters need to be organised and the public informed e.g. must only advise on re-opening time when risk of missing deadline is very low due to bus replacement and public information requirements
- Key deliverable is to re-open the span as soon as possible, speed restrictions would be acceptable only in the short term

As the end of normal office hours approached an engineer was delegated to;

- Contact a steel supplier to confirm the immediate availability of steel sections
- The traffic management contractor used in the afternoon was asked to arrange for a single lane closure the next day to allow repairs/replacement to take place.
- A steelwork fabricator was contacted and an after hours number procured in-case guidance on constructability was required later in the evening. Fabricators arranged to be on-site with equipment for welding and bolting in the morning.
- Experienced steel fabricator asked to provide guidance on time needed to alter a span or fabricate a new span – Initial estimate was 3 weeks.

5.00pm to 9.00pm

The engineers who had been on-site assessing the damage arrived back in the office. A workshop between the two engineers who had been on site and the other three engineers who were available in the office was held. A number of options were considered and discarded;

- Leave as-is and allow trains back on unrestricted - This was set aside immediately as the damage was assessed as too significant to allow trains back on at line speed.
- Leave as-is and allow trains back on with a TSR - This was set aside as the damage was assessed as too significant to allow trains back on at any speed.
- Swap out with a spare span - This option was the initial preferred option, however a span suitable for a quick swap out could not be found. While several spans were located around the country that could be modified to suit this site, they all required some time and effort to prepare. Several were located on disused sections of line but would have required a work crew to dismantle and remove from their existing site which would have

slowed down work. Several sets of emergency bridge spans were also located in Hamilton. The spare span option was handed to an external engineer to progress while work on the initial repair was progressed.

A decision was made to progress options for initial temporary repair as an anticipated 3 week wait for a spare or new span was deemed unacceptable.

An experienced consultant was engaged to progress the replacement/modified span replacement options independently and more accurately assess the time needed to get a new span fabricated and to site ready for installation

The first stage of designing the initial temporary repairs was to assess the forces and weaknesses in the spans imposed by the deflections and damage. Refer to section 3.4 for more details of this design and process. An experienced consultant was asked to provide peer review for the repair options throughout the night as the design progressed.

Pizza was ordered at 7pm – This is a recoverable cost!

The form of the project team was decided at this point and roles were delegated to progress multiple work fronts concurrently. Team on this project is outlined below.

Group	Focus	Details
Project Lead – Jennifer Critchley	Co-ordinate multiple work fronts	Main point of contact for all communications
Progression of temporary span replacement by; • Samuel Grave - KiwiRail Structures Professional Head • Cody Young – KiwiRail Senior Engineer • Rob Park - Independent Consultant Engineer	Get a temporary replacement span to site as soon as possible	Arrange shipment of the emergency bridging units Design modifications
Progression of temporary propping/ strengthening • Jennifer Critchley – KiwiRail Structural Engineer • Derek Jansen – KiwiRail Structural Engineer Peer review by Matt Spooner of Novare Design	Get trains running over the damaged span as soon as possible	Design the temporary propping/ strengthening
Implementation and site liason by; • Michael Luke - Novare Design • Graham Boorman - KiwiRail	Co-ordinate site resources and provide information to design teams in the office	Implementation of the temporary propping/ strengthening
Incident Recovery Team • Emma Cowell – KiwiRail • Ron Cameron - KiwiRail	Ensure potential for cost recovery is not compromised	Main point of contact for Police

Table 3 – Initial response team roles and responsibilities

9.00pm

The two engineers who had been on site in the afternoon were delegated supervision of the temporary repairs on site in the morning and so were sent home to rest.

The third office engineer was also sent home as the design methodology had been challenged through collaborative review and a consensus had been reached.

A risk assessment of the situation was carried out and it was concluded that while the repairs should theoretically carry the train loads there was a risk of unseen damage e.g. fractures to joints or members hidden by paint or dirt. It was decided that this risk would be mitigated by installation of a propping system to take over should the span deflect and fail. A sleeper pig-sty system was chosen as the materials were easily available, the KiwiRail gang was known to be familiar with their construction and a pig-sty provides a large stable prop that spreads load across a large area and hence reduces risk of point loading causing ground instability or damaging buried services.

9.00pm to 2.00am

The two remaining engineers took the role of technical lead and detailed design. The calculations were prepared in such a way as to ensure alteration the next day would be straightforward as it was acknowledged that a more accurate measure-up the next day and site constraints would likely require alteration of the details. Detailed calculations were prepared, microstran models set up, repetitive calculations were set up in excel, details were sized with plenty of spare capacity.

Sketches of the repair works were prepared and e-mailed to the fabricators and the site engineers. A package with multiple copies of sketches was prepared and left for the site engineers to pick up in the morning before heading to site.

Thursday 8th January

7.00am

The two site engineers attended site and work began on site with preparation of the road to enable single lane opening. A complication of the site not anticipated the night before was that there was a central kerb between the opposing lanes of the road and a ramp had to be constructed to allow vehicles to cross this. This was compounded by poor communication within the traffic management team and a failure to understand the urgency of the situation.

This delayed the start of work on repairs till around mid-day.

9.00am

The KiwiRail Structures Gang was engaged to prepare to construct the sleeper pig-sty after the fabricators had finished on-site. The sleeper pig-sty propping system would block access to install the cross-bracing sections when complete.

1.00pm

Work on the steelwork repairs began.

Again, the urgency of the situation was not well understood and the steelwork did not progress as fast as it could have. At this point it also became apparent that fitting flat sections of angle onto a buckled plate affected drilling access and welding and the stiffener spacing and bracing layout had to be modified.

2pm to 3pm

A more accurate site measure-up now that the time constraint of having to work around a short road closure was removed revealed that the initially estimated maximum deflection of the span had been underestimated. The new measurements were updated into the detailed calculations and a revised set of sketches e-mailed to site.

4.00pm to 9.00pm

Fabricators worked on installing the temporary cross bracing.

9.00pm to 8.00am

KiwiRail staff began constructing the sleeper pigsty.

Friday 9th January

8.00am to 3.00pm

The office design engineers visited site to inspect the fabrication work completed. Some of the welds were found to be undersized and some of the bolted connections were not appropriately packed out. Alternative steelwork fabricators had to be called to site to rectify this.

The KiwiRail gang completed work on sleeper pigsty.

3.00pm

The site was cleared while a test train was run. A single locomotive was run over the span 3 times and the span observed from multiple angles to check for any unexpected deflections.

3.30pm

Clearance was given to Network Control that the span could be re-opened for use for normal commuter traffic under a 10kph speed restriction.

4.00pm

A workshop on new/modified span design results was held back at the KiwiRail offices. The decision was made to go with modification of the KiwiRail emergency bridging units available in Hamilton. The consultant investigating this agreed to complete detailing of this over the weekend.

Saturday 10th January

10.00am

Engineering inspection of the temporary repairs to assess if there had been any change in condition since installed. A rigid compressible material was secured in the small gap between the span and the pigsty to monitor maximum deflections. A train was observed running over the span and measurements taken afterwards.

Emergency Bridging units delivered to Eastbridge Ltd in Napier to be modified to suit the location at Br 30 WL. Work commenced on fabrication over the weekend with initial already details confirmed by the consultant conducting the design of the modifications.

Sunday 11th January

Engineering inspection of the temporary repairs to assess if there had been any change in condition since installed.

Monday 12th January to Friday 16th January

Detailed designs for the modified spans were received from the consultant engaged to complete this and the fabricator confirmed that the spans could be delivered to site by the following weekend.

Work on planning the block of line to install the modified spans was initiated. Fabricator confirmed they could have the spans ready and delivered to site on Sat 17th January. A 24 hour block of line from 4.00pm Sat 17th January to 4.00pm Sun 17th January was negotiated with Network Control and planning to complete the temporary span replacement was undertaken.

24 Hours Block of Line for Span Replacement – 4.00pm Sat 17th Jan to 4.00pm Sun 18th Jan

Both lanes of Eastern Hutt Road were closed to allow free access around site and to reduce risks to the public from cranes swinging over the road.

The work was intended to be completed with a night shift and a day shift. The overheads were de-energised and slewed to allow the crane to remove old span and install the temporary span and re-instate the impact beam.

The temporary span arrived from Napier as planned on the morning of Sat 17th. The old span was removed and the new span craned into position from the truck it had arrived on. The old span was removed from site and transported to the KiwiRail Woburn depot.

The new span had sleepers already installed while in Napier by the local KiwiRail Structures Gang.

Holes for the holding down bolts were drilled in the piers and bed plates shimmed and located ready for the day shift to install the holding down bolts and grout up the plates.

The impact beam had been removed prior to the temporary bracing repairs taking place. This was re-shimmed and installed after the span work had been completed.

The track was re-instated and the overheads re-energised before the site was handed back to Network Control at 4.00pm. Trains were cleared to run with no speed or weight restrictions and normal services resumed.

3.4 Lessons Learned

The following is a deliberately informal look at the lessons learned by the author during the process of reinstating the damaged span at Br 30 WL. Key elements and approaches that it is felt worked well are highlighted alongside mistakes and oversights. While a review process of performance was undertaken and involved parties were consulted for feedback during compilation of this paper, the opinions expressed are essentially the personal opinions of the author.

3.4.1 The Team

Share the love

A critical element of this response that made it successful was the good working relationships within KiwiRail and within the wider contractor and consultant community.

Eastbridge Ltd in Napier have been fabricating and refurbishing railway spans for many years and needed little support to be able to deliver the spans required for this recovery. Novare Design have worked alongside both KiwiRail and Eastbridge for many years and are experts in rail bridge design in the New Zealand environment. They also have the unique experience of having had engineers seconded into KiwiRail to work as Inspectorate Engineers and hence are also familiar with the local area management teams as well as the head office Structural Engineering team.

The local area management team works with many local contractors and it was their knowledge and contacts that allowed a traffic management contractor to be on-site within an hour of the bridge being struck and fabricators first thing the following morning.

The close working relationship and experience of the Structural Engineering team at KiwiRail head office meant that while the author was technically leading the response on this incident, in reality the focus was more on acting as a liaison with external parties rather than managing the team internally. The engineering team within KiwiRail knew what needed to be done and needed little direction or management. Also, because the team is used to working collaboratively, ideas could be analysed and challenged constructively so there was no need to step in to impose decisions Everyone instinctively understood the urgency of the situation and the need to make robust decisions quickly.

While some external parties familiar with KiwiRail process and bridge strike incidents proved invaluable in a fast and efficient response, delays during the response were commonly due to external parties that did not understand the urgency of the work at hand.

Two's company, three is better, more is awesome!

Having the resources to delegate investigation into different option streams and not have to manage the worksite while trying to carry out detailed design was a key factor that allowed physical works on a robust temporary repair solution to start within less than 24 hours of the bridge being hit.

Progression of multiple work fronts also allowed design of the temporary replacement span to be completed in time for it to be fabricated and installed within less than two weeks of the incident.

However, once the initial temporary bracing repairs were in place and the initial critical response was over it became easy to become too involved in the technical details of the temporary span replacement and lose perspective on the key issues that needed to be addressed. Feedback from the KiwiRail communications team was that while the initial response was well co-ordinated and communicated, communication during the block of line was not as efficient and some key updates were missed. With hindsight, it would have been useful to have two engineers on site for the final portion of the block of line so that communication on progress could be maintained without holding up progress on resolution of issues on site.

Know your asset

The search for a spare span should have been relatively simple. However, the key factors of span length and depth were not able to be independently searched in the asset database and the drawing reference for each spare span had to be manually checked to see if it was a suitable depth. In addition, the spare span database was not up to date. Once the search broadened to incorporate spans on disused sections of line it was found that these spans had not been updated into the new asset management system that was being implemented at that time in KiwiRail.

The spare and disused spans have now been added to the new asset management system and a search query on span AND depth can now be undertaken with ease. A process that took 4 hours during this incident response will now take 10 minutes.

<u>Don't Panic</u>

KiwiRail engineers are used to dealing with emergency recoveries. The inherent risks of the landscapes that the New Zealand rail network runs through as well as the historic issues that have been inherited mean that floods, washouts, landslides and earthquakes combine to cause a number of track outages and emergency recoveries every year. The knowledge of having dealt with worse before takes the stress out of dealing with the current incident, and just as importantly, the KiwiRail management team understand that the engineering teams are capable of dealing with incidents. The engineering teams at KiwiRail are trusted to get on with recoveries and the senior management teams stand back and provide support as necessary.

3.4.2 Communications

<u>Use the media to your advantage</u>

While the bridge was out of service and one lane of the road closed there was significant media interest in the incident. KiwiRail has always used this coverage as a platform to inform the public of the dangers of over-height loads and to make sure that it is clear that the delays are not KiwiRail's fault. In this case, the media coverage is also thought to have contributed to the culprit owning up to the accident after the Incident Recovery Team made an appeal for information while informing commuters of the likely delays. The culprit contacted police shortly before he was identified to KiwiRail by a witness. This allowed the Incident recovery team to pursue a claim with an insurance company without having to wait for the police to confirm the liable party.

<u>Consult with your client</u>

While it was important to get the line open as soon as possible It was more important to the Metro management team that advised timelines were not changed. Organising bus replacement services and rostering drivers meant that a last minute decision to open the line earlier than planned would have been useless and a last minute decision not to open the line as planned would have been disastrous.

Even in an emergency recovery, it is important not to assume what the key drivers are but to make sure that the affected parties are consulted with and listened to.

<u>Be like Elsa – Let it go!</u>

The insults hurled at engineers by irate drivers who have been held up behind traffic lights while you install a large stack of sleepers in the middle of the road are many and varied. Be aware that no-matter how much media coverage your side of the story gets, some members of the public will come to their own conclusions and will feel the need to share their thoughts with you.

As an aside, when you finally stop for lunch it is probably a good idea to hide behind some bushes if you are a near a busy road as this only provides more subject matter for passing motorists.

The advantage of fatigue and exhaustion is that it becomes easy to assess priorities. A polite apology to members of the public with queries is acceptable and it is important to focus resources where they are most efficient e.g. engineers doing engineering and communications teams communicating.

It is also important to remember that it is easy to criticise decisions with the benefit of hindsight. As an engineer is can be hard to forgive mistakes but it must be remembered that decisions were made within the limitations of the information available at the time. Criticism within KiwiRail was minimal as this is a concept that is well understood.

<u>Keep calm and carry on</u>

I have received feedback from many workers on-site (not always in relation to the authors own temperament) that a calm and measured manner is appreciated and achieves results faster than a panicked and agitated approach. Having worked with and for both management styles on sites it is important to make a concerted effort to remain calm and measured. The view of site workers is that seeing the person in charge panic causes panic amongst others and leads to mistakes and accidents. A calm person is much easier to approach and hence problems and issues are picked up and dealt with quickly rather than being ignored in order to try and avoid conflict.

3.4.3 Risk Management

Know the limits and work with them

It is the responsibility of a professional engineer to assess and manage the limitations of the available data. In this case, while the large deflections and damage were evident, there was an awareness that only a relatively brief visual inspection had been completed and there was a risk of unseen critical damage. This was acknowledged early on in the workshop phase and was dealt with by installing back-up plans (the pig-sty) and implementing a testing phase (run an empty test train before the packed commuter train).

No-one makes good decisions at 2am

It is important to acknowledge fatigue and the effect it will have on your decision making capabilities. Whilst working late at night on the temporary bracing design and detailing, constant review and checking was done by the two engineering working side by side to complete the designs. This review and checking was far more comprehensive than would normally be undertaken because it was acknowledged that there was a high likelihood of fatigue leading to mistakes.

Document Everything

Having the luxury of a team of engineers working on this project meant that an engineer could be delegated to document everything e.g. what ideas were discussed and why they were discarded.

In the event that anything went wrong this documentation would have shown that a robust process was followed risks were considered when designing the temporary repairs.

The act of documenting decisions is a useful tool to draw discussions to a close and when questions were raised at 1am, what had already been discussed and documented could be reviewed to satisfy the team that the query had already been dealt with.

Don't compromise

It is important to be constantly aware of the risks and consequences of decisions. Throughout the day on Friday, particularly when it was insisted that some of the welding be re-done, there were grumbles around site that "the bloody welds are fine" and that there was a risk of delaying the evening peak trains. It is the responsibility of the engineer to remove external pressures from technical decisions to ensure a safe decision is made above all else.

Monitoring

Monitoring inspections are a key tool in reducing the likelihood of a risk eventuating, with the intention being to pick up signs of failure before failure can occur.

While the temporary bracing appeared to be working well there was still the risk of failure due to unseen damage. A temporary monitoring system for span movement was set up using the sleeper pigsty as the datum point. A few different DIY options were trialled but the most successful was the use of blocks of florists dry foam (often called Oasis). This is a rigid but easily compressible Styrofoam that does not exhibit any elasticity and hence when glued hard up against the edges of the flanges and under the span, maximum movements between inspections could be recorded. However, the anticipated fabrication time of 3 weeks was revised down to just over a week so performance monitoring did not prove to be as important in this case as initially anticipated.

3.4.3 Preparation and Planning

Site Access is a key requirement

For future incidents of this type it is recommend that if a road closures is anticipated this should be organised as soon as it is known that the scale of the incident warrants it. Due to the particular site conditions at Br 30 WL, installing traffic management took up half a day. In a normal project this would be relatively insignificant but in this case where the entire recovery took just over 48 hours this was a significant amount of working time and lead to steelwork fabricators working tired and in the dark which is probably what led to the poor quality welding that had to be re-done.

The road closure could conceivably have been in place by the evening of the day the incident occurred. This would have meant that a more accurate measure-up could have taken place and would have reduced the amount of time lost on site waiting for details to be re-worked and checked. This re-checking did not cause significant delays but it did cause a significant amount of stress and frustration on-site and could have been avoided had the measure up been able to be more thorough.

<u>Failure to plan is planning to fail</u>

Blocks of line for span replacements are planned for months in advance on normal renewal projects. Detailed programmes are prepared, plant and materials are assembled, back-up plans are put in place, risks are assessed and mitigated, preparation work is undertaken and methodologies are carefully reviewed.

There is a limited amount of planning that can be done in 5 days. The difficulties encountered during the BOL for installing the temporary span were numerous and caused significant delays and issues with the final quality of what was installed. Issues that could have been avoided with better planning include;

- Only 30mm drill bits were available to drill the 30mm diameter holding down bolt holes. All site matched holes had to be gas cut which was messy, poor quality and time consuming.
- The holes cored in the concrete piers in advance of the BOL where this was possible were of inadequate depth as reinforcement had been encountered and there was no time to revise this detail.
- The masonry drilled holes done during the BOL kept getting jammed with debris and nearly all of the holding down bolts installed were under-depth in the end.
- Bolt heads stuck out from the underside of the bottom flange and the impact beam could not be lowered to mitigate this.
- Not enough epoxy mortar was ordered and more had to be found at short notice
- The holding down plate details were incorrect meaning more new holes had to be gas cut in the baseplates.
- Working at height was difficult to complete safely with limited pre-installed barriers etc. In the event, the author ended up doing some of the work needed in exposed locations as they were the only person on site with a work positioning harness that meant they could hang over the edge to access some of the details. The safety rescue system in this case relied on staying within reach (managed with short fixed length lanyards) and being about 50kg lighter than most of the workers on site and hence easy to haul back up if stuck.

The above issues were not critical in this case as the span installed was only ever intended as a temporary solution, however it is felt that this does prove the value of the intense planning and preparation that goes into a normal BOL. The above issues delayed completion of the span installation by around 6 hours and while the end of BOL deadline was achieved it was not achieved with much time to spare and the quality of the final installation was compromised.

<u>Go go gadget</u>

Having had experience of dealing with a catastrophic bridge strike in 2010 without a smartphone or laptop it was considerably easier to communicate with site during this project using smartphones to pass pictures and sketches backwards and forwards rather than verbally describing the damage to the design team back in the office and vice versa for repair details. However, a tablet or larger screen would have been useful when passing revised sketches and details back to site after the modifications were made and the KiwiRail engineering team now have a stock of tablets that can be taken to site as needed.

Being familiar with the technology is also important. Learning how to use a new app or function of the smartphone or tablet while in the middle of a time sensitive project is not practical.

<u>Expect the worst</u>

The frustrations of the BOL meant that re-installation of the impact beam could easily have been deferred to a later date. Knowledge of the high risks of bridge strikes at this site led to the decision to press ahead with the impact beam installation during the BOL.

The impact beam in front of the temporary span was hit 3 days after the bridge re-opened. The impact beam did its job and the temporary span was not damaged.

4.0 Conclusions

A robust cost recovery process is an essential tool in running a financially efficient rail business. While the Incident Recovery team has an important role to play in lobbying the trucking industry amongst others to reduce the numbers of incidents, it is unlikely that bridge strikes and other third party incidents that cause delays to timetables and damage to infrastructure will ever be eliminated. Maximising cost recovery from third parties is a viable option for minimising the impact of incidents on the business.

A cost recovery process would be pointless without an associated engineering resource that can be mobilised to reinstate the running of trains as soon as safely possible. Managing an incident recovery requires a careful balance of urgency and risk management and effective communication across disciplines and teams is key. The unique drivers on an incident recovery project lead to unique solutions and approaches that would not otherwise be considered. However, irrespective of financial and operational pressures, it is the responsibility of the professional engineer to ensure safety of the public and staff at all costs.

5.0 Acknowledgements

The authors would like to thank all those who helped review and provide feedback on this paper and who have helped develop the Incident Recovery Process and set up the Incident Recovery Team. In particular;

Michael Luke and Matthew Spooner of Novare Design. Rob Park of Parsons Brinkerhoff. Dennis Basire of Eastbridge. Frederick Johnsson of Johnson Fabricators. Rob Whight, Todd Moyle, Ron Cameron, Derek Jansen, Graham Boorman and Cody Young, Hamish Fenwick, Glen Mitchell and Robin Walker of KiwiRail. Richard Greenfield, John Kilkenny and Samuel Grave formerly of KiwiRail.

The authors also like to express gratitude to all of the contractors and site staff who helped with the recovery from the Br 30 WL incident in January 2015.

6.0 Disclaimer

Any opinions, finding and conclusions or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of any associated organisations.

7.0 References

Much of this paper is based on personal experience however the authors wish to reference the following reports commissioned by KiwiRai that have formed the bases for much of the detail in this paper.

Cowell, E., Greenfield, R. (2nd September 2014). "*Bridge Strikes Process Plan – Response and Cost Recovery"* A report to KiwiRail by the KiwiRail Incident Recovery Team.

Luke, M., Somerville, N., Spooner, M., (3rd March 2015). "*Damage Report for Bridge 30 WL, Eastern Hutt Road, Upper Hutt – Damage due to Bridge Strike on 7th January 2015*", a report to KiwiRail by Novare Design

Appendix 1 – M128H Form

KiwiRail

BRIDGE HIT REPORT - M128H

Bridge: ______________ **Line:** ______________ **Kilometrage:** ______________

Address: (street name) (town) ______________ **Clearance:** signage actual ______________

Date of impact: ______________ **Date / time of day** ______________

Inspection by: ______________ **Date of Inspection:** ______________

Received:	Engineer:	Date:
Strike Register :		WO No.
Diaried:	Typed:	Checked:

DETAILS OF INCIDENT	ACTION TAKEN / (ACTION REQUIRED)
HOW KIWIRAIL / INSPECTOR WAS NOTIFIED:	Notify local council / NZTA:
	ref number:
155 call out number:	Notify local police:
Names/company/ hours attending including travel time per person:	Police Report No.:
VEHICLE & LOAD DESCRIPTION	
Registration Numbers: -	Travel mileage (include return trip and multiple
Height of Truck: -	entries for more than one vehicle): 38.2km
Load description: -	Line closed (time) / Line opened (time)
	Road closed (time) / Road opened (time)
VEHICLE OWNER / DRIVER DETAILS:	
Vehicle company name:	
Drivers name and contact number: -	
Drivers licence no: -	
Vehicle company representative name & number: -	
DAMAGE TO BRIDGE	
	Photograph damage and signs, save photos in:
	W/struct/bridges/line/Bridge No./date of strike
Other costs incurred:	**ENGINEERING ACTIONS**
Materials:	1. Create Incident No. to collect costs
Plant hire:	2. Notify insurance company
	3. Arrange Engineering Report
	4. Arrange Repair/Replacement Work
Continue on an M128A form or blank sheet if required.	5. Process costs to insurance
Signed:	**Date:**

Appendix 2 – Sample Letter of Intent to Third Party

Without Prejudice

KiwiRail Holdings Ltd
PO Box 593
Wellington

19 February 2014

Company name
Address
Attn:

Re: Bridge Strike at Bridge number and street location
Vehicle & Registration number:

Dear ___________

It has come to our attention that your vehicle (details shown above) has hit our Bridge no./line located on street

At this stage KiwiRail has not ascertained the nature or extent of the damage and costs incurred, however this letter is notice that a claim against you is possible.

If you hold insurance that will cover a claim by KiwiRail for this incident, please forward a copy of this letter to your insurer and advise the undersigned:

- The name of your insurer;
- The type of insurance policy and the name of the Person/Company under which the policy is held; and
- If a claim in relation to this incident has been made, the claim number.

If you are uninsured, please advise us of your intentions towards liability.

Please note that this letter is given to you on a without prejudice basis, this does not in any way limit KiwiRail's ability to make any claim, or conduct itself otherwise in relation to the bridge strike incident.

Please find **enclosed** a summary of KiwiRail's process in dealing with this incident.

If you have any queries relating to this letter or wish to discuss its contents please contact the undersigned.

Yours faithfully

Ron Cameron
Accounts Receivable Corporate Finance
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Summary of KiwiRail's Bridge Strike Process following an incident:

- Initial inspection of the structure & safety assessment at the time of the incident
- Engineers Assessment & Damage Report
- Contract/Tender documents compiled
- Scope of works tendered
- Repairs undertaken
- Close out of project

(Any of these documents or status updates on this process can be requested at any stage)

Factors to be taken into consideration:

- If the Bridge is required to be closed for any length of time the cost of 'Business Interruption' to any of our services will be evaluated and recovered.
- Any protracted claim will be passed onto our legal team and all associated cost will be on-charged.
- It is at our discretion that from the date costs were incurred to KiwiRail interest at 5%pa will be included in the claim.