

Engineering Safety Solutions

KiwiRail

Muri Station Risk Assessment Report



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Appendix E1: CV – Bob Lupton

Appendix E2: CV – Michael Holt

Appendix E3: CV – Rex Rewcastle

1 Introduction and Executive Summary

Engineering Safety Solutions (ESS) have been commissioned by KiwiRail to undertake a detailed risk assessment of Muri Station considering its current safety risk profile and the predicted safety risk profile of the station when being used by the Matangi rolling stock.

To support the risk assessment ESS visited the station both during daylight hours and at night. From interviews with KiwiRail Personnel, information provided in other reports related to the station and from data from KiwiRail databases, ESS has been able to undertake a detailed hazard assessment for the station and has subsequently undertaken a risk screening and assessment exercise compliant to NRSS/4 [1] requirements.

The results of the risk screening have identified 63 overall hazards related to the station. Of these risks 28 have fallen into the Medium risk category and by NRSS/4 definition, these risks should be reduced at reasonable cost. The overall quantum of the risks identified suggests that significant attention needs to be given to the station to justify its risk acceptability as an operational station. Amongst others the following hazards exist at the station:

- Excessive platform gaps, the worst on the Wellington network[2].
- Inadequate platform lighting.
- A wooden platform section that is suffering significant decay and provides minimal protection to falls from height.
- Structural defects, possibly from subsidence.
- Unauthorised station access points (including across live tracks) that seem to have become the norm for station access and egress.
- Extremely limited disabled access capability.

Given the nature of the risks at the station, ESS has developed a number of options with respect to alternative actions at the station.

Option 1 – Do nothing and accept the risk levels at the station.

Option 2 – Close the station as an operational entity and provide protection of the rail corridor.

Option 3 – Fully redevelop the station including realignment of the track and platform edge positions.

Option 4 – Partially redevelop the station (as per option 3) but decommission the current wooden platform extension, thus limiting the station to maximum 6 car operation.

The above options are fully detailed in the body of the report.

One positive, in terms of risk at the station, is its incredibly low patronage that the station enjoys. From data and observations it is considered that peak patronage would be in the order of 20 persons a day [3].

Overall in its current operational condition it is the considered conclusion of the Risk Assessment that the station, on the basis of safety risk, is currently not fit for purpose and that considerable corrective work is required.

2 Muri Station Background

Muri station was opened on 28 July 1952 and is a side platform station on the Paraparaumu Line. The station has 2 side platforms and is located in an essentially rural area. The platform shelters date from 1953 and according to a recent heritage survey by Porirua City Council are of high heritage value.

The station is located on a double curve on the railway and as such contains generic hazards simply because of the station's geometry.

The station is very basic in its configuration and utilities and is two generations of station development away when compared with other new stations on the line such as Pukerua Bay.

The station has extremely limited disability supporting functionality and although ramped access is provided to the platforms, the actual platform surface does not support safe disability usage. Similarly the grade level crossing fails to support safe use and has no limit lines or tactile surface indicators to identify safe limits away from the rail track. The excessive platform gaps also make disabled boarding dangerous

At some time in the past, historical research has failed to identify when, a timber section of approx. 40m was added to the up platform. This platform sits at the extreme end of a 280m curve [4] and is poorly aligned to the track – This results in horizontal platform gaps that will exceed (for the Matangi Rolling Stock) 520mm and vertical gaps leading to step down into the train of over 70mm.

The timber platform is in poor condition with excessive rot at platform ends and non compliant safety fencing to the back of the platform. This platform section also fails to include the most basic platform safety provisions such as white and yellow lines.

From observation there is significant platform wear at the interface of the timber platform to the formed platform; civil engineering advice is that this is probably due to subsidence of either the formed platform or the timber platform. Other areas of the formed platform, north end of up platform and south end of down platform also show signs of platform to ramp misalignment and again subsidence is the suspected cause.

The platforms at the station are long enough for 8 car length usage - for the up platform this means the timber platform section has to be used.

The station has no formal car parking, has no dedicated pedestrian access and limited road access. Generally the station would be considered to have poor passenger access.

2.1 Operational

The station is currently served primarily by two, four and six car sets and eight car sets for special events [3]. Future operations with the Matangi fleet are expected to be primarily six car services with the potential for eight car sets. Current peak operations see three trains per direction per hour at the station and this drops down to two train per direction per

hour in the off peak[5]. Through train passenger and freight services also pass through the station and current signalling capacity would allow for a 15 min headway at the station[3].

Trains operate to the station between 05:30 and 23:30 during weekdays, with similar operating hours at the weekends. Level Crossing alarms are switched off between 10:30PM and 7:00AM and as such audible crossing warnings do not operate during early and late train operations.

Patronage estimate show minimal station use and patronage is extremely low. Passenger demographics are heavily weighted towards school children with some adult working age passengers also regularly using the service. Persons of a more mature age are less frequent users of the station (this is possibly linked to the inaccessibility of the station and lack of car parking). No data has been ascertained to disabled usage of the station, but ESS estimate this is zero, given the station inaccessibility and the fact that there is a station within 800m (Pukerua Bay) with excellent accessibility and significant disability access features.

Station stopping positions, particularly on the down platform are currently poorly aligned with station buildings.

The line speed through the station is 40km/h [4].

3 Approach to Hazard Identification and Risk Assessment

3.1 Important Definitions

For the purpose of clarity the following safety risk management terms are defined.

Hazard – A physical condition with the potential for harm

Accident – Loss following an event related to a hazard

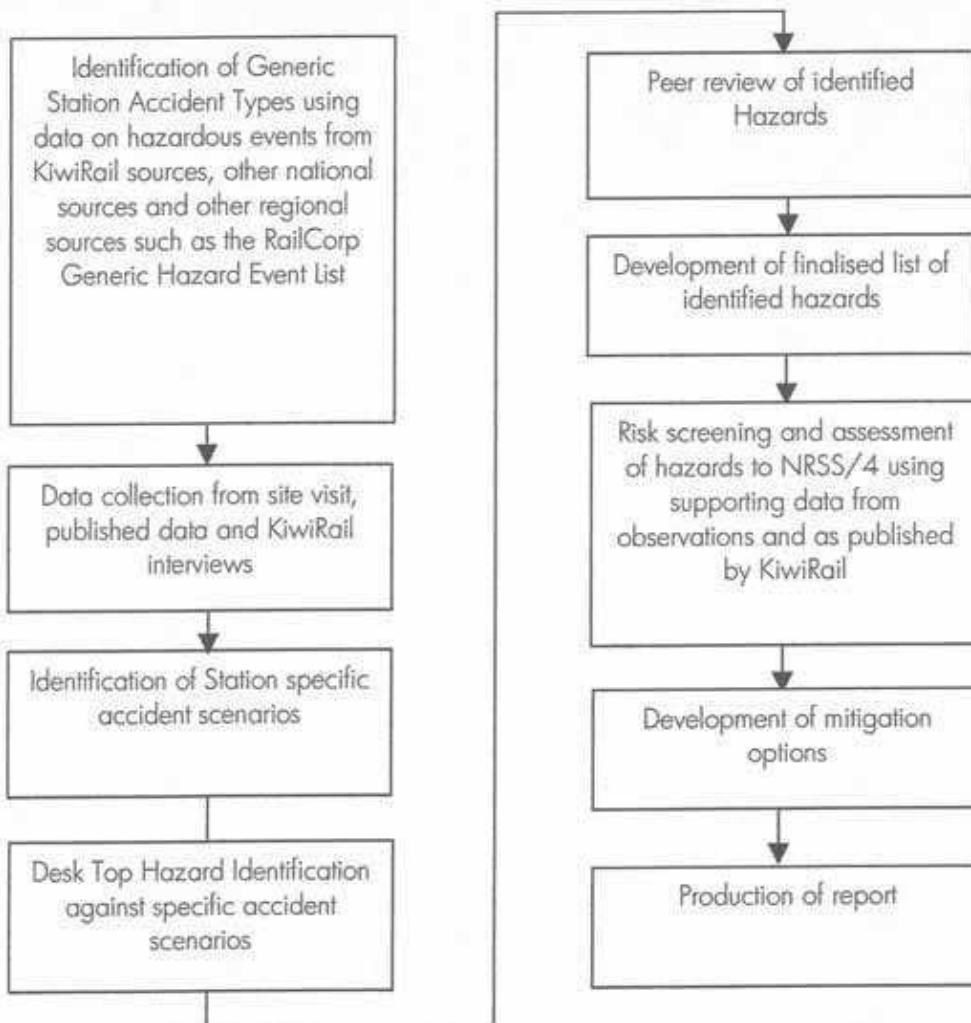
Frequency – How often an accident will occur

Consequence – The consequence of an accident occurring at a defined frequency

Risk – The measure of the frequency of an accident multiplied by the consequence of the accident

3.2 Applied Methodology

Diagrammatically the following approach has been applied to the hazard identification and risk assessment of the Muri station process:



3.2.1 Identification of Generic Accident Scenarios

ESS reviewed generic accident types that have occurred in New Zealand (in addition to KiwiRail data) the ARTA Risk Register [6] for Auckland Rail stations was referred to) and also from other valid regional data, principally RailCorp NSW Generic Hazard Events List[7]. This review led to the development of five generic accident types for Muri station, these being:

- Slips, Trips and Falls
- Caught and Dragged
- Train collision
- Assaults
- Passenger conflict with road vehicles.

From review of collated data, site observations (detailed below) and information from KiwiRail specialists, the generic accident types were defined to specific hazard scenarios for this particular station, these are recorded below and formed the base accident types against which hazard identification was carried out.

Generic Accident	Specific Accidents
Slips, Trips Falls	Slip, trip, Fall at Level Crossing
	Slip, trip, Fall at back of Platform
	Slip, trip, Fall at Platform
	Slip, trip, Fall at Train platform interface
	Slip, trip, Fall over rail tracks
	Slip, trip, Fall at authorised station access point
	Slip, trip, Fall at unauthorised station access point
Caught and dragged	Caught and dragged in train doors
	Caught and dragged by freight vehicle
	Caught and dragged by no stopping train
Train collision	Person hit by train on crossing
	Person on track hit by train
	Road vehicle on pedestrian level crossing hit by train
Assaults	Assault on person on platform

Generic Accident	Specific Accidents
	Assault on person at authorised access point
	Assault on person at unauthorised access point
Passenger conflict with Road vehicle	Passenger hit by road vehicle at eastern access point
	Passenger hit by road vehicle at western access point
	Passenger hit by road vehicle illegally using level crossing

3.2.2 Site Visit

ESS visited Muri station on 1st June 2010 and undertook an extensive data gathering exercise both at the site and from interviews with senior KiwiRail management. Further information has been provided to ESS by KiwiRail following the site visit.

A checklist was produced prior to the site visit to focus and guide the data collection. A copy of the checklist is provided in Appendix D.

The site visit consisted of three elements.

The first element of the site was to review the physical condition and operations at the station. To understand the current levels of station development for comparison purposes other stations on the Paraparaumu Line were visited to assess their general condition.

Stations visited were:

- Takapu road – Older basic station, general good condition
- Redwood – Split station, recently refurbished – very good condition, modern features including good disability attributes, compliant to T200 gauge.
- Kenepuru – Older basic station – very poor condition although on generally straight track with bridge crossing
- Pukerua Bay – Recently refurbished with good, if under utilised, park and ride, significant modern features including good disability attributes, compliant to T200 gauge.

The first visit to Muri station occurred in the off peak, the station was deserted and remained that way for the complete time of the first visit (approx 1.5 hrs). The visit assessed the following station attributes:

Attribute	Observation
PLATFORM	
Platform Lengths	About 170m. Stop marks identified for 2, 4, 6, 8 car trains.
Platform Orientation, with consideration of train crew sighting with respect to door, platform gap incidents	Platform on severe curves. Up sighting good Down sighting limited. For longer trains sighting would need to be done from centre point of the platform at a distance of 2 to 3 m from the platform edge.
Platform Radius	Extreme, particularly towards the south end, track curve data confirms 280m radius.
Surface condition	Up platform – very poor on both formed and timber surfaces. Down Platform- moderate
Platform edge condition	Up platform (timber) – Poor and rot is obvious Up platform (formed) – Poor in places and between platform slabs Down Platform - OK
Platform safety markings	Up platform (timber) – None Up platform (formed) – Poor Down Platform - Poor
Platform falls	For both platforms away from the platform edge
Platform Obstructions	Obstructions on platform with 850mm of yellow line in the form of steel RSJ (presumably for electrification masts but currently unused)
Other observations	<ol style="list-style-type: none"> 1) No pedestrian access, shared with vehicular access 2) Level crossing has no limit lines 3) Level crossing protection bollards missing 4) Illegal access to south end of both platforms and to centre of down platform 5) Damaged lighting and masts 6) No back of platform edge protection,

Attribute	Observation
	both platforms 7) Timber fence to back of timber platform weak, formed of horizontal members, no protection for first 500mm from base.
PLATFORM UTILITIES	
Lighting	Old style except for area on timber platform that has been recently replaced. Lighting physically damaged including Montrose box.
PA	None
CCTV	None
Help Point / passenger communication	None
Safety Signage	Minimal and poorly located
Shelters	Old but functional
TRACK	
Radius and layout	Double curve through station, radius down to 280m
Cant	Not observed
Track Centres	Closer than standard
Centre separation fence	None and visually no room for one
Level Crossing	No passive protection i.e limit lines, Damage to wood crossing and concrete interface points. Lighting obscured by overhanging trees.
ENVIRONMENT	
Background noise	Low, no background noise measured above 65dB(A) in the absence of trains
Vegetation	Yes, reduces station sight lines on down platform, reduces crossing light efficiency
Security issues	Numerous, South end of station particularly bad but overall the station would rate very poorly if evaluated against Crime Prevention Through Environment Design (CPTED) criteria.
Car Parking and intermodal transport	None
Location of next station	Pukerua Bay station with excellent design

Attribute	Observation
	attributes less than 800m from Muri station

The second work element was to visit KiwiRail Offices to understand the operational issues of the station. Section 2 of this report details the information gained. Further following the review with senior management, details on incident and occurrences related to the station were forwarded to ESS.

The third work element was to visit the station during the PM peak to observe passenger use of the station and then as darkness fell to measure the lighting levels of the station. This element of the work produced some interesting observations. It should be noted that during the time of this visit the weather was poor with heavy rain.

- 1) During the complete peak (4pm to 6pm), 17 passengers alighted trains on the up platform, 0 passengers alighted from the down platform, 0 passengers board from either platform.
- 2) Of the 17 alighting passengers, 13 were school children, 4 were working age adults.
- 3) Of the 17 passengers only 5 used the formal access point on the station of the rest 10 used the illegal access point to the back of the timber platform of the up platform; 2 crossed the track at the southern end of the up platform and walked along the rail corridor to a final unobserved exit point.
- 4) A vehicle was observed (Vauxhall Chevette JU4230) at 16:45 crossing the railway via the pedestrian level crossing.
- 5) When the station lighting came on (ambient light levels were 140 Lux), two out of three lights on the southern end of the down platform were defective and the up side level crossing light was severely obstructed by vegetation.
- 6) With effectively zero lux of ambient light the following light measurements were taken

Area	Light intensity (LUX)
Down Platform access area	0 – 40 Lux
Down Platform northern end	Zero Lux in places increasing to 50 Lux approaching lighting masts
Down Platform southern end (note 2 out of 3 lights not working)	Significant areas of zero Lux rising to 50 Lux max approach working light
Down platform edge	Significant areas of zero lux rising in places to 20 lux
Down platform shelter	> 300 Lux
Up Platform access area	0 – 100 Lux
Up Platform northern end	Zero Lux in places increasing to 50 Lux approaching lighting masts
Up Platform southern end	Areas of zero Lux rising to 90 Lux max on timber platform where new modern lighting has been installed

Area	Light intensity (LUX)
Up platform edge	Areas of zero Lux but on average 10 to 20 lux over more than 50% of platform
Up platform shelter	> 300 Lux
Level Crossing	Zero Lux over central areas of crossing 10 – 20 Lux at access points to the crossing

In most cases the lighting levels measured would not comply with general pathway lighting standards (these include passenger waiting areas) as specified in AS/NZ1158, where AS/NZ1158 is considered by ESS to be an appropriate standard to be applied.

3.2.3 Hazard Identification

Following the site visit, collation of data and further data input from Kiwi Rail ESS undertook desktop HAZard IDentification (HAZID) exercise. The exercise was undertaken by Bob Lupton, with input from Rex Rewcastle and was peer reviewed by Michael Holt from the ESS Australian office, CVs of these persons are provided in Appendix E.

The HAZID initially identified 66 hazards related to the station. This number was reduced to 63 following peer review on account of removal of a duplicate hazard and merging 2 other hazards into others of similar type.

The results of the HAZID were provided to KiwiRail under report:

Muri Station Hazard Identification Report 05 June 2010 Issue 1.

The following were the primary findings of the HAZID.

- Based on the current condition of the station the physical hazards that exist, in quantum (63), is significantly higher than those that would be expected of a baseline acceptable station.
- A significant number of hazards exist that relate to the age of the station and lack of focussed maintenance.
- A number of hazards relate to platform / track alignment and are realised with existing passenger stocks.
- A number of hazards relate to illegal use of the station.

3.2.4 Risk Assessment

With the Hazard baseline confirmed, ESS has undertaken a risk screening and a risk assessment against each hazard identified. The risk screening and assessment has been implemented to the requirements of NRSS/4 and each hazard item is annotated against the NRSS.

The Risk Assessment has been undertaken by Bob Lupton and peer reviewed by Michael Holt, some risk rankings were modified following peer review and discussion.

There were constraints to the assessment, these were:

- 1) KiwiRail Rail Incident Summary data [8] limited to 4.5 years and reported incident add little usable data for hazard items identified.
- 2) Minor incidents not reported (this is not unusual).

3) Historic Data on incident not available.

Due to lack of historic data, NRSS calculations all trend to zero with respect to Equivalent Fatality Rates (EFR). ESS have used expert knowledge to allocate appropriate EFRs to hazards where zero trending is provided by calculations. ESS considers this to be a proactive approach given the lack of any credibility provided from results of historic data evaluation.

The risk screening and assessment is fully recorded in Appendix A – Muri Station Risk Register Version 1 12/6/10. Results are summarised in Section 4 of this report.

3.2.5 Options Development

With the risk assessment complete, ESS have evaluated the mitigation needed to address risk issues to a level where they are low and as such acceptable to Kiwi Rail.

Evaluation of the mitigation requirements has lead to the identification of four strategic options. The options results are detailed in section 5 of this report.

4 Risk Assessment Results

The Risk Assessment has resulted in the risk screening of 63 hazards. The results (as defined by NRSS/4) are:

Low Risk Items	=	35
Medium Risk Items	=	28
High Risk items	=	0

The Medium risk Hazards, Cause and Consequences are detailed below.

Generic Accident = Slips, Trips, Falls			
Specific Accident	Hazard	Cause	Consequence
Slip, Trip, Fall on back of platform	Up platform wooden extension - Weak fence to rear of platform	Lack of Maintenance	Fall from height to wooded area below, fall greater than 2m. Potential for major injury
Slip, Trip, Fall on back of platform	Up platform wooden extension – Fence is horizontally barred with no kick boards and significant gap, base to first rail	Poor original design	Fall from height to wooded area below, fall greater than 2m. Potential for major injury particularly with children
Slip, Trip, Fall at platform	Up Platform – Damage between platform nose sections	Wear and Tear, Lack of maintenance	Trips and falls on platform and to track. Potential for major injury
Slip, Trip, Fall at platform	Down Platform lighting levels poor (zero lux in a number of places)	Inappropriate platform lighting	Potential for major injuries due to fall to track.
Slip, Trip, Fall at platform	Down Platform Lighting in operative over 30% of platform (Zero lux areas)	Inappropriate platform lighting	Potential for major injuries due to fall to track.
Slip, Trip, Fall at platform	Up Platform lighting levels poor (zero lux in a number of places)	Inappropriate platform lighting	Potential for major injuries due to fall to track.

Generic Accident = Slips, Trips, Falls			
Specific Accident	Hazard	Cause	Consequence
Slip, Trip, Fall at platform	Up Platform wooden section lighting levels poor (zero lux in a number of places)	Inappropriate platform lighting	Potential for major injuries due to fall to track.
Slip, Trip, Fall at platform	Down platform southern end, Concrete ramp section missing	Subsidence, lack of maintenance	Trips and falls at interface. Potential for major injury (falls to track)
Slip, Trip, Fall at Train platform interface	Down Platform – Platform on curve, large platform gaps (Primarily horizontal)	Platform to track alignment	Trips and falls at interface. Potential for major injury (falls to track or falls between train and track)
Slip, Trip, Fall at Train platform interface	Up platform - Platform on curve, large platform gaps (Primarily horizontal but some vertical towards southern end)	Platform to track alignment	Trips and falls at interface. Potential for major injury (falls to track or falls between train and track)
Slip, trip, Fall at Train platform interface	Up platform - Platform edge damage.	Wear and Tear, Lack of maintenance	Trips and falls at interface. Potential for major injury (falls to track or falls between train and track)
Slip, Trip, Fall at Train platform interface	Up platform – Wooden section - Platform on curve, excessively large platform gaps (both horizontal but some vertical towards southern end)	Platform to track alignment	Trips and falls at interface. Potential for Critical injury (falls to track or falls between train and track and unobserved falls under train from platform)

Generic Accident = Slips, Trips, Falls			
Specific Accident	Hazard	Cause	Consequence
Slip, Trip, Fall at Train platform interface	Up platform – Wooden Section - Platform edge damage.	Wear and Tear, Lack of maintenance	Trips and falls at interface. Potential for major injury (falls to track or falls between train and track)
Slip, Trip, Fall at Train platform interface	Down Platform Edge Lighting poor (Zero lux areas)	Inappropriate platform edge lighting	Trips and falls at interface. Potential for major injury (falls to track or falls between train and track)
Slip, Trip, Fall at Train platform interface	Up Platform Edge lighting levels poor (zero lux in a number of places)	Inappropriate platform edge lighting	Trips and falls at interface. Potential for major injury (falls to track or falls between train and track)
Slip, Trip, Fall at Train platform interface	Up Platform edge wooden section lighting levels poor (zero lux in a number of places)	Inappropriate platform lighting	Trips and falls at interface. Potential for Critical injury (falls to track or falls between train and track and unobserved falls under train from platform)
Slip, Trip, Fall at Train platform interface	Down Platform, Train Guard sighting of passengers clear of train doors prior to departure difficult.	Reverse curve on platform	Passengers in platform gap not observed – Person run over by train (same scenario as Auckland Newmarket fatality in 2009). Potential for Critical injury

Generic Accident = Slips, Trips, Falls			
Specific Accident	Hazard	Cause	Consequence
Slip, Trip, Fall at unauthorised station access point	Up platform, unauthorised access off of south end of platform, poor surface (mud), significant grade and no lighting	Illegally formed accessway	Trips and falls on accessway. Potential for minor injury
Slip, Trip, Fall at unauthorised station access point	Down platform, unauthorised access off of south end of platform, poor surface (ballast), and no lighting. Access is along rail corridor	Illegally formed accessway	Trips and falls on accessway. Potential for minor injury
Slip, Trip, Fall at unauthorised station access point	Up platform, unauthorised access off of south end of platform, poor surface (mud), significant grade and no lighting	Illegally formed accessway	Trips and falls on accessway. Potential for critical injury due to being hit by train

Generic Accident = Caught and Dragged			
Specific Accident	Hazard	Cause	Consequence
Caught and dragged in train doors	Down Platform, Train Guard sighting of passengers clear of train doors prior to departure difficult.	Reverse curve on platform	Passengers in platform gap not observed – Person run over by train (same scenario as Auckland Newmarket fatality in 2009). Potential for Critical injury
Caught and dragged by freight vehicle	Up platform – Yellow line poor, limited passive control to stand behind line.	Lack of Maintenance	Passengers close to platform edge caught and dragged by rail vehicle. Critical injury

Generic Accident = Caught and Dragged			
Specific Accident	Hazard	Cause	Consequence
Caught and dragged by freight vehicle	Up platform - wooden section – Yellow line missing, no passive control to stand behind line.	Lack of Maintenance	Passengers close to platform edge caught and dragged by rail vehicle. Critical injury
Caught and dragged by freight vehicle	Down Platform – Freight Train gauge overhangs southern end of platform	Incorrect platform / track alignment	Passengers close to platform edge caught and dragged by rail vehicle. Critical injury

Generic Accident = Train Collision			
Specific Accident	Hazard	Cause	Consequence
Person hit by train on crossing	No pedestrian stop marks (wait behind line) for crossing – no point of safety identified	Lack of compliant design	Person on edge of crossing hit by train - Critical injury
Person on track hit by train	Use of illegal crossing of platform at southern end of platform.	Passenger and trespasser illegal action, no railway protection of area	Person hit by train - Critical injury
Person on track hit by train	Rail corridor used as an accepted pathway to field path to the south east of station.	Passenger and trespasser illegal action, no railway protection of area	Person hit by train - Critical injury
Road vehicle on pedestrian level crossing hit by train	Passenger crossing is used as an illegal road vehicle crossing (observed)	Passenger and trespasser illegal action, no railway protection of area	Vehicle hit by train - Critical injury

As it can be observed there are patterns of hazard issues and these can be summarised as below:

Primary Hazard Issue	Narrative
<p>Excessive platform gaps both horizontal and vertical on up platform, less serious deviation on down platform</p>	<p>The up platform has excessive platform gaps for the whole of the timber platform. For the timber platform section the horizontal gap represents the worst gaps on the network and the vertical gap (stepping down on to the train) is the second worst.</p> <p>For the formed part of the up platform the vertical gaps on the down platform are the worst on the whole network.</p> <p>A significant length of the up platform is outside of comparable standards for similar aged railways in the UK as standardised in GI/RT/7016.</p> <p>Apart from obvious accident such as falls down the platform gap, other accidents related to falling down in to the train exist due to the poor vertical alignment.</p> <p>To address this issue the platform track alignment needs rectification, it is unlikely (due to the issue being both horizontal and vertical that solutions such as sacrificial gap fillers would be appropriate. It should be noted that existing alignments restrict track geometry adjustments.</p> <p>Data Source: Muri Station Step Distance Review, included as Appendix B to this report.</p>
<p>Up Timber platform in poor condition</p>	<p>The timber platform is in poor condition from its interface with the formed part of the platform, its poor surface condition, through to the poor back of platform protection.</p> <p>Realistically the platform requires a complete rebuild to address the hazard issue.</p>
<p>Up platform (all) platform nose damage and rot, some damage on down platform</p>	<p>Platform nose repairs are required along the formed section of the platform and the timber sections requires rebuild to address this issue.</p>

Primary Hazard Issue	Narrative
Station Lighting poor for all station areas.	Station lighting needs complete redesign and rebuild to address this issue. The lighting levels are lower than ambient street lighting standards.
Platform surface defects both platforms but worse on up platform	Platform surface defects are numerous – the platforms should be resurfaced to address this issue.
Down platform, right of way sighting.	The down platform sight lines are compromised from the front and back end of the train. This could be addressed by operational procedure with the right of way always being confirmed from the central point of the station. A better solution would be the installation of visual aids to support right of way processes.
Illegal station accesses	<p>Illegal station access occurs at the southern end of the station and to the centre of the down platform. These illegal accesses should be destroyed and isolated to address this issue. It is likely that security staff action will further be required to encourage use of the formal station accesses.</p> <p>The illegal access points encourage track crossing with out protection and are also a significant security risk.</p>
White and yellow line defects primarily on up platform	A simple solution to this issue is to repaint and maintain white and yellow lines. The current timber platform would need rebuild for line application to be effective.
Lack of passive level crossing protection	Passive protection of the crossing is required to address this issue in the form of white limit lines and tactile surface indicators.

Under the guidance of NRSS/4 all of the above issues should be addressed if they can be done at reasonable cost.

In terms of prioritisation of risk issues, issues that relate to the higher predicted EFR's should be addressed first, these issues are a subset of the above and are:

Primary Hazard Cause	Cause (corrective action to address)
Excessive platform gaps both horizontal and vertical on up platform, less serious deviation on down platform	Platform to track alignment
Station Lighting poor for all station areas.	Adequate lighting for all station areas
Down platform, right of way sighting.	Platform to track alignment, provision of visual aids

5 Development of Options

ESS have assessed the medium level risks identified against hazards identified and have detailed suggested additional controls to these. These are fully documented in the risk register in Appendix A of this report.

ESS consider that with the implementation of risk mitigation, the operation of Muri station can achieve acceptable risk levels. ESS notes the KiwiRail WARP preliminary costing^[9] for Muri station improvements and considers that to mitigate the current risks an investment cost of approx. NZ\$1M would be required.

As such ESS have developed the following options with respect to the risk control of the station.

Option 1 – Do nothing and accept the risk levels at the station.

This risk acceptance option is a zero capital cost option. The problem with this option is that when a significant incident occurs at the station, KiwiRail could be open to prosecution under both the Railways Act and the OHS Act with respect to the statutory requirement to “take all practicable steps to protect persons”.

ESS do not recommend this option.

Option 2 – Close the station as an operational entity and provide protection of the rail corridor.

This option is a relatively low cost option, around NZ\$120K. This option will significantly reduce operational risk. Passenger benefit would be lost but this should be considered as minimal with the recent improvements to the next nearest station at Pukerua Bay which has been recently refurbished to high standard and includes an under utilised park and ride facility.

Option 3 – Fully redevelop the station including realignment of the track and platform edge positions.

KiwiRail estimate show that the cost of this option is between NZ\$900K and NZ\$1.54M. ESS consider that the cost to address the critical safety issues would be in the order of NZ\$1M.

Option 4 – Partially redevelop the station (as per option 3) but decommission the current wooden platform extension, thus limiting the station to maximum 6 car operation.

This option would address risk and reduce risk mitigation cost to an estimated NZ\$750K. The downside of this option is limiting the size of trains that can utilise the station – consideration would need to be given to whether this option is operationally feasible.

6 Conclusion and Recommendations

From the risk assessment undertaken it is easy to draw the conclusion that the current station exhibits so many hazards that the station should not be considered fit for purpose. If not addressed the risk associated with these hazards are likely to increase with the introduction of the Matangi rolling stock which will lead to increased platform gaps.

If not addressed, risk would also increase due to any of the following risk drivers:

- 1) Increase in patronage
- 2) Increase in train frequency
- 3) Increase in crime levels at or around the station.
- 4) Further degradation to station condition.

ESS therefore strongly recommend that action is taken to address current hazards and risk levels. ESS are of the opinion that the current level of risk related to the station does not fall into the acceptable category.

ESS has identified three viable risk mitigation options and the preferred choice of these is totally reliant upon availability of funds and willingness to use those funds on a station with such low patronage. ESS is not privy to the availability of funds related to this station and as such the following recommendations are provided for those who are privy to funding availability

If significant funds are not available then ESS recommends that the risk reduction strategy to be followed is a complete closure of the station, with works limited to providing protection to the rail corridor in the area of the closed station.

If moderate funds are available and it is operationally acceptable to do so, then station refurbishment and track realignment, and partial platform closure, to the effect of having a station limited to 6 car maximum operations should be actioned.

If reasonable funds are available, then a complete station rebuild should be undertaken.

ESS recommend that in the short term, prior to the implementation of station improvement that the station should be subject to restrictive working arrangements, such as providing platform assistance personnel at the station, to minimise risk.

7 References

No.	Reference
[1]	KiwiRail - NRSS/4 – Risk Assessment
[2]	Aurecon – Muri Station Step Distance Review Report 18/2/10
[3]	KiwiRail – from interviews with Senior Managers
[4]	KiwiRail – Curve List
[5]	Metlink – Paraparumu Train Line Timetable
[6]	ARTA – Risk Register managed by ESS
[7]	RailCorp - Generic Hazardous Event List
[8]	KiwiRail – IRIS report 08/06/10
[9]	KiwiRail WARP Platform Upgrades – Rough Order Costs – Muri Station 28/5/09

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