



**WAIROA TO GISBORNE
INVESTMENT STUDY
DESKTOP REVIEW OF STRUCTURE
ASSETS**

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1. INTRODUCTION

The Wairoa to Gisborne section of the Palmerston North to Gisborne Line (PNGL) is 96km long and was closed to railway operations in 2012, following 4 significant washouts during a large storm. Wairoa is at 294km and Gisborne is at 390km on the PNGL.

This is a high level¹ report on a desktop review of the structures assets along this section of the line.



2. SCOPE OF STUDY

This study will outline the information held on the bridge and tunnels assets on the Wairoa to Gisborne section of the PNGL and give recommendations for the next stage.

¹ As specified in Offer of Service from KiwiRail dated 21 August 2019

3. LIST OF STRUCTURES ASSETS BETWEEN WAIROA AND GISBORNE

This report is based on the information as currently contained within Maximo, and may not be fully up to date due to the line's mothballed status.

There are 49 bridges along this section of the PNGL and 12 tunnels. Two of the bridges carry roads over the railway, rather than supporting the railway over an obstacle.

For information, Maximo reports that there are also:

- 59 retaining walls.
- 252 culverts.

along this section, but these are not within the scope of this report.

4. PRINCIPAL OPERATING PARAMETERS

These are the operating parameters, as described in the 'Principal Operating Parameters as at October 2018' document. These must be confirmed from the Rail Operating Code prior to any trains operating on this section of the line. It is assumed that if the line is re-opened, then these levels of service will apply. Any increase to these is likely to require significant cost.

4.1. Nominal maximum allowable axle load.

The maximum axle load permitted along this section of line is 16.3 tonnes.

Based on the rating data contained within Maximo, all the structures along this section of the line are capable of sustaining this load.

The analysis was undertaken using a train consist of two locos and five wagons, all of 16.3 tonne axle loads. There were no elements highlighted as not being capable of carrying this loading.

The rating exercise should be updated prior to works trains operating, using up to date element condition, once detailed inspections have been undertaken.

4.2. Maximum container height on standard container wagons

The maximum container height is shown as 9'6", when loaded on a 911mm high wagon.

4.3. Maximum line speed

The maximum line speed for Express Freight trains along this section of line is given as 40km/h.

4.4. Maximum load width (using running rights for FC log wagon)

FC log wagons can operate along this section of line, but their tips must be lowered.

5. CONDITION OF THE STRUCTURES

The current inspection status of the assets along this section the line are out of code and rail vehicles are not be allowed to operate until appropriate detailed inspections, and any identified critical works, have been implemented.

Between 347km and 357km there is a high risk to staff safety when undertaking inspections due to the track washouts, lack of access and poor communications coverage and therefore any inspections along this part of the line are excluded from current mothballed line requirements. A safety plan and appropriate mitigations should be in place before any future inspections are undertaken.

The items identified in this report have been extracted from historical inspection reports. Defects may have worsened since the old inspections were completed and new defects may have occurred since. It is recommended that any next stage of the study needs to include undertaking detailed inspections of the assets to ascertain their current condition and status.

Since this section of the line was mothballed, it has not been checked following significant events such as heavy rain or earthquake, so there could be other major defects present that are not included in the old inspection reports.

Where items had been identified at the time of the old inspection for renewal within a specified timeframe and this has not been done, then it is assumed that this must be completed before to work trains traverse over the structure. This can be reviewed once new detailed inspections have been completed.

The following works items are excluded from this report, as they form part of the other disciplines' workbanks:

- Sleeper renewals.
- Vegetation control.
- Below rail drainage, including through tunnels.
- Track and formation works.
- Retaining walls/ slope stability (apart from bridge and tunnel wing walls and ballast guards).

5.1. Bridges

Generally:

- The concrete bridge elements do not require significant work to allow operational services to commence. However, some concrete spalling and crack repairs will be required to be completed within the first 10-years of operations.
- All steelwork elements are in a deteriorating condition but only some minor repairs, such as to corroded joints or bracings, will be required to allow train operations to commence. The steel elements will require cleaning and repainting with 10-years of commencement of operations. The priority of the painting is to be determined once detailed inspections have been undertaken.
- The timber elements require the most amount of work to be completed prior to train operations. Timber deteriorates at a quicker rate than concrete and steel and so some minor defects that were not identified as requiring works in the historical inspection, may now require some work.

Some other items that need to be considered prior to commencement of reopening include:

- Bridge 280 has a water gauge fixed to it that is owned by Gisborne District Council, and they may require access to this. The gauge may require relocation once train services commence, as access to it will be restricted.
- Bridge 290 has a weather station on it that is owned by NIWA. This may require relocation once train services commence, as access to it will be restricted.
- Railbike Adventures Limited currently have a deed of lease to operate a rail venture between 295km and 385.3km on the line.
- Gisborne City Vintage Railway Incorporated have a tourism licence to occupy the line between 373km to 391.3km.

5.2. Tunnels

The inspection reports for the tunnels are older than for the bridges and do not contain photographs, therefore there is less information available. The tunnels appear to be in a stable condition, however there are 4 tunnels that have some significant cracking.

Although the old inspection reports do not highlight any signs of active movement, some repairs to the cracks and stabilisation of the tunnels may be required. This can be assessed after up to date tunnel inspections have been undertaken. If stabilisation measures are required, then these could represent a significant cost, however not all of the stabilisation works may be required prior to the commencement of operational services.

In general, the works required to the tunnels are likely to include:

- Installation of drip shields or water management systems, where water ingress is dripping directly on to the track or other asset.
- Installation of signage, both portal warning signs and tunnel distance signage.
- Crack and spalling repairs.

Works that may be required, but are in the scope of other disciplines:

- Vegetation clearance around portals, and behind the portal headwalls.
- Clearance of the below track drainage systems.
- Removal of ballast that is contaminated with fines.

Refuges are no longer used, therefore any work identified in the old inspections to clean reflectors or re-paint refuge markings is no longer applicable.

Note that tunnel 15 has a history of land slip at the south portal, although any works associated with this are outside the scope of this report.

6. INDICATIVE COST ESTIMATION FOR CORRECTION OF IDENTIFIED DEFECTS

Cost estimates are for onsite costs only and exclude any travel and overnight allowances. The estimates are based on the work required found at the time of inspections and assets could have deteriorated further, or developed new defects.

Much of work required prior to opening is on the timber elements of the structures.

Some of the assumption used include:

Activity	Cost	Notes
Blast and painting of steel elements	\$20k per span	Existing paint is likely to contain lead and so mitigations must be taken during works to ensure that this is not released into the environment
Timber pile stumping	\$9k	
Timber cap renewal	\$10k	
Timber corbel renewal	\$6k	
Installation of tunnel drip shields	\$200 per m	Due to the condition of the tunnel linings, it is assumed that 600m (10% of tunnel length) of drip shield installation will be required prior to train operations.
Installation of tunnel portal signage	\$2k per tunnel	Required prior to commencement of operational services.
Installation of tunnel distance signage	\$2.5k per tunnel	Required within six months of commencement of operational services.
Installation of ribs in tunnel	\$6k per metre	Assume that 50m length is required prior opening and that additional 300m is required within the first 10-years of opening.
Crack and spall repairs		Assume that \$40k of repairs are required prior to opening, and a further \$500k within the first 10-years.

Based on the assumptions, the estimated cost of works required are:

Asset class	Works to complete before work trains run	Works to complete before operational service commences	Work to complete within the first 10 years of operations
Bridges	\$302,200	\$162,665	\$1,124,000
Tunnels	-	\$484,000	\$2,330,000
Total	\$302,200	\$646,665	\$3,454,000

These are ballpark figures and it suggested that a 60% contingency is added to cover such things as:

- Deterioration since the old inspection was undertaken.
- Additional defects occurring since the historical inspections.
- Costs of access.
- Lower level of detail contained in the tunnel inspection records.

The uncertainty in these estimates can be reduced by undertaking detailed inspections and obtaining up to date information on the works required.

7. FINDINGS

The desktop study has found that:

- Current inspection status of the structures assets are out of code.
- Between 347km and 357km there is a high risk of staff safety when undertaking inspections.
- Identified work lists are based on historical inspection reports and defects may have worsened, or new defects occurred, since they were undertaken.
- Third party equipment is mounted on bridges 280 and 290, which may require relocation once train service commence due to access restriction.
- There are two grants of rights that apply on this section of the line.
- There is less information available in the old tunnel inspections reports than in the old bridge reports.
- There are some areas of significant cracking in the tunnels, which may require stabilisation/ strengthening works.

It should be recognised that re-opening the line will require additional on-going maintenance resource and funding.

8. RECOMMENDATIONS

1. Undertake detailed inspection of all structures assets along the line. (At this stage, it is estimated that this would cost around \$100,000 and could be completed in around three months). This cost will be refined if the detailed inspection is required.
2. Undertake clearance survey on all overbridges and tunnels.
3. It would be beneficial if the vegetation control activities could be completed prior to the inspections, but this is not essential.
4. Update identified works list and re-prioritise the works, especially those that must be undertaken prior to any works trains crossing the structures and those that relate to the tunnels.
5. Determine future level of service requirements for the line.
6. Re-calculate ratings for all bridges, based on updated condition information and determine if any strengthening requirements are required.
7. Undertake engineering investigations on structures as required (eg those in poor conditions with poor ratings and stability concerns)
8. Investigate the resourcing required to reinstate inspection and maintenance regimes, and whether there is sufficient capacity within the organisation to be able to deliver this.

Appendix 1 BRIDGE DETAILS

Bridge number	Bridge type	Date of last detailed inspection	Bridge description
Bridge 248	BRIDGE \ RAIL	2017	Bridge 248 PNGL consists of three steel spans on four timber piers
Bridge 249	BRIDGE \ RAIL	2014	Bridge 249 PNGL consists of five steel spans on six timber piers
Bridge 250	BRIDGE \ RAIL	2011	Bridge 250 PNGL comprises three steel spans on four piers of timber piles
Bridge 250A	BRIDGE \ RAIL	2014	Bridge 250A PNGL comprises a single steel span on two timber piers
Bridge 251	BRIDGE \ RAIL	2014	Bridge 251 PNGL consists of three steel spans on four timber piers
Bridge 252	BRIDGE \ RAIL	2012	Bridge 252 PNGL consists of a single steel span on two concrete piers
Bridge 253	BRIDGE \ RAIL	2014	Bridge 253 PNGL consists of three steel spans on four timber piles
Bridge 253A	BRIDGE \ RAIL	2015	Bridge 253A PNGL consists of three steel spans on four timber piled piers
Bridge 254	BRIDGE \ RAIL	2011	Bridge 254 PNGL comprises five steel spans on five timber piers and one concrete pier (pier 4)
Bridge 255	BRIDGE \ RAIL	2012	Bridge 255 PNGL consists of three steel spans on four timber piers.
Bridge 256	BRIDGE \ RAIL	2015	Bridge 256 PNGL consists of six steel spans on timber piles
Bridge 257	BRIDGE \ RAIL	2015	Bridge 257 PNGL consists of four steel spans on five timber piers
Bridge 258	BRIDGE \ RAIL	2015	Bridge 258 PNGL comprises three steel spans on four timber piers
Bridge 260	BRIDGE \ RAIL	2015	Bridge 260 PNGL consists of six steel spans on seven timber piles.
Bridge 261	BRIDGE \ RAIL	2010	Bridge 261 PNGL comprises four concrete ballast deck spans on five concrete piers. Piers 1, 2 and 3 on concrete piles, piers 4 and 5 on concrete pads
Bridge 262	BRIDGE \ RAIL	2010	Bridge 262 PNGL comprises five concrete ballast deck spans on six concrete piers
Bridge 262A	BRIDGE \ RAIL	2015	Bridge 262A consists of one steel span on two timber piers
Bridge 263	BRIDGE \ RAIL	2010	Bridge 263 PNGL comprises size concrete ballast decks on seven concrete piers. All piers are on concrete piles with the spans and piers poured as one
Bridge 264	BRIDGE \ RAIL	2005	10 span concrete ballast deck. Piers 1 and 11 are expansion piers. Piers 2 to 9 are concrete piers on a concrete base and pier 10 is a sliding pier

Bridge number	Bridge type	Date of last detailed inspection	Bridge description
Bridge 264CA	BRIDGE \ RAIL	2015	Bridge 264CA PNGL is an open culvert comprising a single timber span on two concrete abutments
Bridge 265	BRIDGE \ RAIL	2015	Bridge 265 PNGL is a nine span concrete viaduct with ballast deck
Bridge 266	BRIDGE \ RAIL	2012	Bridge 266 PNGL consists of four skew concrete ballast decks on five concrete piers
Bridge 267	BRIDGE \ RAIL	2012	Bridge 267 PNGL consists of three steel TPG spans on four concrete piers
Bridge 267A	BRIDGE \ RAIL	2012	Bridge 267A PNGL consists of two steel spans on three concrete piers
Bridge 268	BRIDGE \ RAIL	2012	Bridge 268 PNGL consists of a single steel span on two concrete piers
Bridge 269	BRIDGE \ RAIL	2012	Bridge 269 PNGL consists of three concrete ballast deck spans on four concrete piers
Bridge 270	BRIDGE \ RAIL	2012	Bridge 270 PNGL consists of a single concrete ballast desk span on two concrete piers
Bridge 271	BRIDGE \ RAIL	2015	Bridge 271 PNGL consists of six steel spans on seven concrete piers. Piers 2 to 5 comprise two concrete legs on a concrete base
Bridge 272	BRIDGE \ RAIL	2015	Bridge 272 PNGL consists of a single concrete ballast deck span on two concrete piers
Bridge 273	BRIDGE \ RAIL	2015	Bridge 273 PNGL consists of two concrete ballast deck spans on three concrete piers
Bridge 274	BRIDGE \ RAIL	2015	Bridge 274 PNGL consists of five steel spans on six concrete piers
Bridge 275	BRIDGE \ ROAD	2014	Bridge 275 PNGL is a road overbridge giving farm access from SH2
Bridge 276	BRIDGE \ RAIL	2015	Bridge 276 PNGL consists of six steel spans on seven concrete piers
Bridge 277	BRIDGE \ RAIL	2015	Bridge 277 PNGL consists of four steel spans on five concrete piers
Bridge 278	BRIDGE \ RAIL	2015	Bridge 278 PNGL consists of three steel spans on four concrete piers
Bridge 279	BRIDGE \ RAIL	2015	Bridge 279 PNGL consists of five steel spans on six concrete piers
Bridge 280	BRIDGE \ RAIL	2015	Bridge 280 PNGL consists of five steel spans on six concrete piers
Bridge 281	BRIDGE \ RAIL	2015	Bridge 281 PNGL consists of three steel spans on four concrete piers
Bridge 282	BRIDGE \ RAIL	2015	Bridge 282 PNGL consists of five steel spans on six concrete piers
Bridge 283	BRIDGE \ ROAD		Bridge 283 is an overbridge carrying SH2 over the railway
Bridge 284	BRIDGE \ RAIL	2009	Bridge 284 PNGL consists of four steel TPG spans on five concrete piers

Bridge number	Bridge type	Date of last detailed inspection	Bridge description
Bridge 285	BRIDGE \ RAIL	2012	Bridge 285 PNGL consists of a single steel span on two timber piers
Bridge 286	BRIDGE \ RAIL	2019	Bridge 286 PNGL consists of three steel spans on four piled concrete piers
Bridge 287	BRIDGE \ RAIL	2019	Bridge 287 PNGL consists of a single steel span on two concrete piers
Bridge 288	BRIDGE \ RAIL	2019	Bridge 288 PNGL consists of three steel spans on four concrete piers
Bridge 289	BRIDGE \ RAIL	2019	Bridge 289 PNGL consists of four steel spans on five concrete piers
Bridge 290	BRIDGE \ RAIL	2019	Bridge 290 PNGL consists of 28 steel spans of different types and 29 concrete piers of different types.
Bridge 294	BRIDGE \ RAIL	2019	Bridge 294 PNGL consists of three steel spans on four timber piers
Bridge 295	BRIDGE \ RAIL	2019	Bridge 295 PNGL consists of five steel spans on six timber piers

Appendix 2 TUNNEL DETAILS

Tunnel number	Length (m)	Date of last detailed inspection	Tunnel description
Tunnel 14	46	2003	Concrete lined with straight sides
Tunnel 15	118	2005	Concrete lined curved walls
Tunnel 16	109	2003	Concrete lined straight walls
Tunnel 17	63	2005	Concrete lined with straight walls
Tunnel 18	122	2004	Concrete lined with straight walls
Tunnel 19	2992	2004	Concrete arched shaped profile
Tunnel 20	136	2006	Concrete lined with straight walls
Tunnel 21	62	2006	Concrete lined with straight walls
Tunnel 22	110	2006	Concrete lined with straight walls
Tunnel 23	935	2006	Concrete lined with straight walls for first 815m and then curved walls for the remaining 120m.
Tunnel 25	89	2007	Concrete lined tunnel with a horse shoe shaped profile
Tunnel 26	1443	2005	Concrete lined with straight walls

Appendix 3 IDENTIFIED DEFECTS ON BRIDGES

Asset	Works to complete before work trains run	\$	Works to complete before operational service commences	\$	Work to complete within the first 10 years of operations	\$
Bridge 248	Pier 3 corbel 1 member 1: replace	\$6,000	Pier 1 pile one: restump at 3500 u/c	\$9,000		
	Pier 3 corbel 1 member 2: replace	\$6,000	Pier 2 cap: fit split bolt	\$160		
			Pier 2 corbel 1 member 1: replace	\$6,000		
			Pier 2 corbel 1 member 2: replace	\$6,000		
			Pier 4 pile 1: stump at 1600 u/c	\$9,000		
			Guard rails: replace 16 missing joint bolts	\$255		
Bridge 249	Pier 1 pile 2: stump at 1300u/c	\$9,000	Wing walls end 2 side 2: replace	\$850		
	Pier 1 boltwork: overhaul	\$300	Hook bolt: overhaul (12 missing)	\$2,075	Creep strap: paint	\$800
	Pier 2 pile 3: stump at 2200 u/c	\$9,000				
	Pier 2 corbel 1 member 1: replace	\$6,000				
	Pier 2 corbel 1 member 2: replace	\$6,000				
	Pier 3 cap: replace	\$10,000				
Bridge 250	Pier 2 pile 1: stump at 1400 u/c	\$9,000	Pier 1 stud 1: replace	\$2,500	Clean and spot paint rivet heads along spans 1 to 3	\$10,000
	Pier 2 cap: replace	\$10,000			Pier 1 cap: replace	\$10,000
	Pier 2 boltwork: tighten	\$400			Pier 3 corbel 2 member 1: replace	\$6,000
	Pier 3 stud 1: replace	\$4,200			Pier 3 corbel 2 member 2: replace	\$6,000
Bridge 250A	Pier 1 pile 2: stump at 1300 u/c	\$9,000	Wing walls: repair all 4 wing walls	\$2,900	Span 1 spot paint	\$5,100
	Pier 1 cap: replace	\$10,000				

Asset	Works to complete before work trains run	\$	Works to complete before operational service commences	\$	Work to complete within the first 10 years of operations	\$
Bridge 251	Pier 2 corbel 1 member 1: replace	\$6,000	Wingwalls side 1 end 1: rebuild	\$500	Span 1 bottom cross brace member end 1: replace	\$3,100
	Pier 2 corbel 1 member 2: replace	\$6,000	Hook bolts: replace 9	\$630		
Bridge 252					Clean and spot paint	\$5,100
Bridge 253	Pier 3 pile 1 stump at 1300 u/c	\$9,000	Pier 3 pile 2 walings: replace packer	\$320	Blast and paint all spans	\$60,000
	Pier 3 corbel 2 member 1: replace	\$6,000	Span 3 end 2 sides 1 and 2 bed and sole plates: replace	\$2,450		
	Pier 4 sill: replace	\$6,050	Pier 2 boltwork: overhaul	\$2,000		
	Pier 4 stud 1: replace	\$2,300				
	Pier 4 stud 3: replace	\$2,300				
Bridge 253A	Pier 2 cap: replace	\$10,000				
	Pier 2 top bolster: replace	\$5,000				
	Pier 4 cap: replace	\$10,000				
Bridge 254	Pier 3 corbel 1: replace	\$6,000	Pier 2 corbels: pack level	\$2,500	Span 5 end 2 top cross bracing member: replace	\$6,400
			Pier 3 cross brace at water level: replace	\$2,000	Span 5 lattice brace at gusset at centre line: replace	\$14,800
					Blast and paint all spans	\$100,000
Bridge 255	Pier 1 cap: replace	\$10,000	Pier 1 boltwork: overhaul	\$500		
	Pier 1 bolster: install split bolts both ends	\$600			Blast and paint all spans	\$60,000
	Pier 2 pile 3: stump	\$9,000				
	Pier 2 corbel 2 member 1: replace	\$6,000				
	Pier 2 corbel 2 member 2: replace	\$6,000				
	Pier 3 cap: replace	\$10,000				

Asset	Works to complete before work trains run	\$	Works to complete before operational service commences	\$	Work to complete within the first 10 years of operations	\$
	Pier 3 corbel 1 member 1: replace	\$6,000				
	Pier 3 corbel 1 member 2: replace	\$6,000				
	Pier 4 pile 1: stump at 1300 under sill	\$9,000				
Bridge 256	Pier 1 cap: replace	\$10,000	Pier 2 sheathing: replace 2 boards	\$700	Paint creep strap and pier 1, 3, 5 and 7 bracing	\$20,000
	Pier 2 row 2 pile 2: fit split cylinder	\$3,750	Pier 7 sheathing: replace missing boards	\$700		
	Pier 8 pile 1: restump at 3200 u/c	\$9,000	Wingwall side 2 end 1: rebuild	\$300		
	Pier 8 cap: replace	\$10,000	Hook bolts: overhaul	\$2,100		
Bridge 257	Pier 1 pile 3: replace splice	\$300	Wingwall end 1 side 1: rebuild	\$300		
	Pier 2 pile 1: restump at 1800 u/c	\$9,000	Hook bolts: replace 5	\$300	Blast and paint all spans	\$80,000
	Pier 3 corbel 2 member 1: replace	\$6,000	Holding down bolts spans 2 to 4: replace nuts	\$600		
	Pier 4 cap: replace	\$10,000				
	Pier 5 pile 1: stump at 1300 u/c	\$9,000				
Bridge 258			Pier 2 cap: fit split bolt at end 2	\$325		
Bridge 260			Footway decking: replace missing panel	\$2,000		
Bridge 261					Span 1 beam 2 concrete spall repair	\$3,100
			Handrail: replace		Span 2 deck and beam 1 concrete spall repair	\$1,600
					Span 3 beam 2 concrete spall repair	\$1,600
					Span 4 deck concrete spall repair	\$550
					Span 4 beam 1 concrete crack repair	\$1,500
					Pier 5 wingwalls concrete repair	\$5,000

Asset	Works to complete before work trains run	\$	Works to complete before operational service commences	\$	Work to complete within the first 10 years of operations	\$
Bridge 262			Handrail: replace handrail span 3	\$800	Pier 2 concrete spall repair	\$1,200
					Pier 3 leg 1 and 2 concrete spall repair	\$1,200
					Pier 4 concrete crack repair	\$550
					Wingwall end 2 side 1 rebuild	\$4,000
					Wingwall end 2 side 2 new wall required	\$5,000
Bridge 262A	Pier 1 pile 3: stump at 1300 u/c	\$9,000				
Bridge 263			Handrail: repair top rails	\$1,900		
Bridge 264			Handrail: repair end 1 and centre	\$1,200	Clear part blocked weep holes and reseal	\$4,200
Bridge 264CA						
Bridge 265						
Bridge 266						
Bridge 267			Ballast guards ends 1 and 2: replace top hardwood	\$1,200		
Bridge 267A					Blast and paint all spans	\$40,000
Bridge 268					Blast and paint all spans	\$20,000
Bridge 269						
Bridge 270						
Bridge 271					Blast and paint all spans	\$120,000
Bridge 272						
Bridge 273						
Bridge 274			Pier 1 Tie back pile 1: stump at 1500 u/c	\$9,000		

Asset	Works to complete before work trains run	\$	Works to complete before operational service commences	\$	Work to complete within the first 10 years of operations	\$
			Pier 1 Tie back pile 2: stump at 1500 u/c	\$9,000		
Bridge 275						
Bridge 276			Hook bolts: overhaul 36	\$3,500	All span hold down bolts: clean and paint	\$2,400
			Wing wall end 1 side 2: repair with 2 sleepers	\$600		
Bridge 277			Span 3 side 1: replace 20 rusted rivets		Blast and paint all spans	\$80,000
			Hook bolts: overhaul 68			
Bridge 278			Span 2: replace 10 rivets	\$6,200	All span hold down bolts: clean and paint	\$4,700
Bridge 279			Hook bolts: overhaul	\$2,450		
Bridge 280			Wing wall end 1 side 1 and 2: rebuild	\$900		
Bridge 281			Scour protection to be added to pier 2 face 2	\$8,000		
			Wingwalls: replace 12 deteriorated sleepers	\$1,500		
Bridge 282			Hook bolts: overhaul	\$1,000		
Bridge 283						
Bridge 284					Blast and paint all spans	\$80,000
Bridge 285			Pier 1 pile 3 restump	\$9,000	Blast and paint span	\$20,000
			Pier 1 pile 4 stump at 700 u/c	\$9,000		
			Pier 2 pile 3 stump at 800 u/c	\$9,000		
Bridge 286					Blast and paint spans	\$60,000
Bridge 287					Blast and paint span	\$20,000

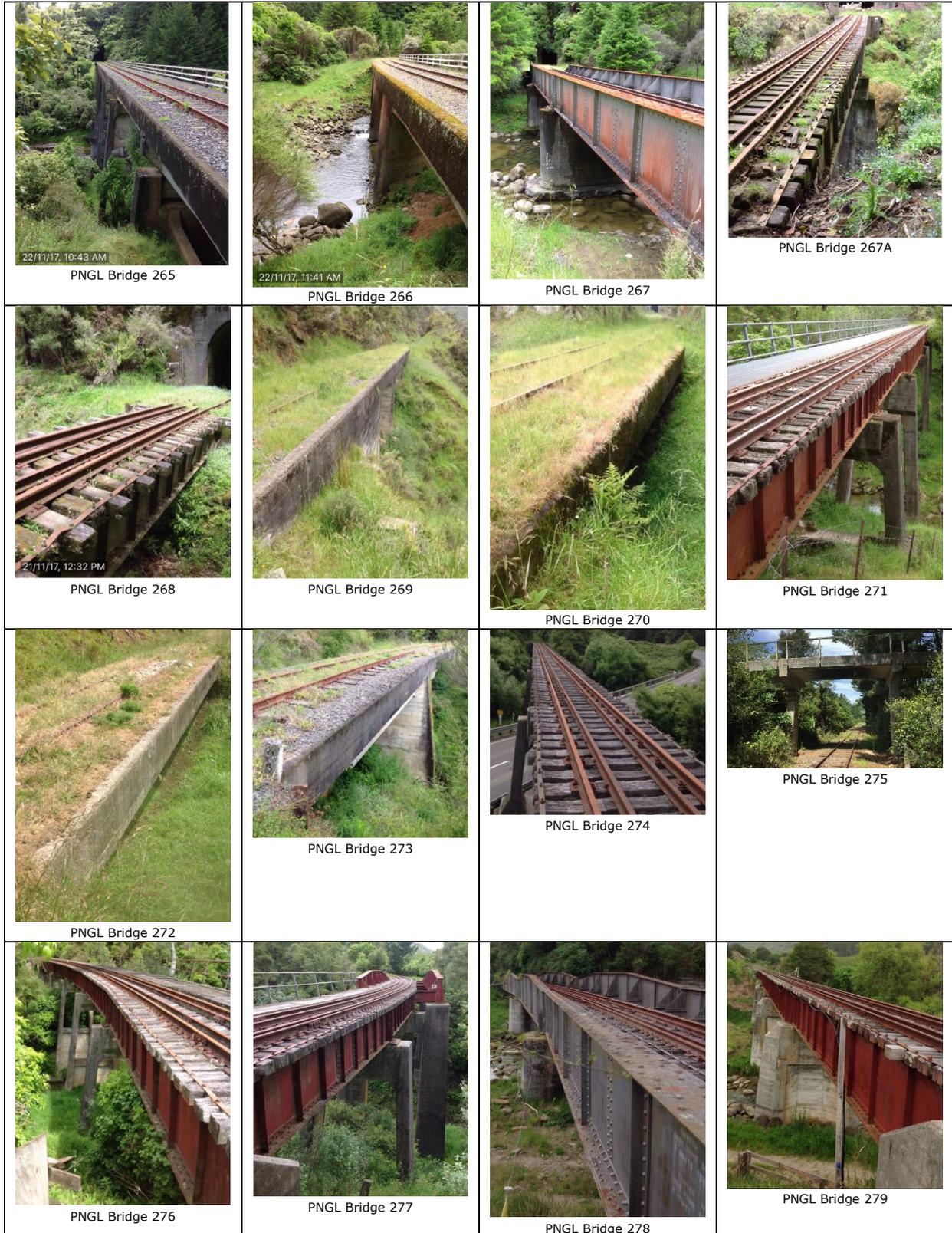
Asset	Works to complete before work trains run	\$	Works to complete before operational service commences	\$	Work to complete within the first 10 years of operations	\$
Bridge 288					Blast and paint spans	\$60,000
Bridge 289					Blast and paint spans	\$80,000
Bridge 290			Walkway: renew 1 board	\$300	Various piers: concrete spall repairs	\$20,000
			Sliding joints require easing	\$300		
Bridge 294			Pier 4 pile 2 stump at 2500 u/c	\$9,000		
			Pier 1 pile 2: fit split clamp at top	\$580		
			Footway: fix down mesh and build up ground at end 1	\$1,000		
Bridge 295			All boltwork: overhaul	\$1,000	Blast and paint spans	\$100,000
			Pier 2 cap: replace	\$10,000		
			Pier 4 pile 5 stump at 1500 u/c	\$9,000		
			Footway: fix down mesh	\$270		

Appendix 4 IDENTIFIED DEFECTS ON TUNNELS

Asset	Works to complete before work trains run	\$	Works to complete before operational service commences	\$	Work to complete within the first 10 years of operations	\$
Tunnel 14			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 15			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 16			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 17			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 18			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 19			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 20			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 21			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 22			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 23			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 25			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Tunnel 26			Install tunnel portal warning signs	\$2,000	Install tunnel distance signage	\$2,500
Line wide			Installation of drip shields	\$120,000	Installation of stabilising ribs	\$1,800,000
			Installation of stabilising ribs	\$300,000	Concrete crack and spall repairs	\$500,000
			Concrete crack and spall repairs	\$40,000		

Appendix 4.1 BRIDGE PHOTOGRAPHS

 <p>PNGL Bridge 248</p>	 <p>PNGL Bridge 249</p>	<p>PNGL Bridge 250</p>	 <p>PNGL Bridge 250A</p>
 <p>PNGL Bridge 251</p>	 <p>PNGL Bridge 252</p>	 <p>PNGL Bridge 253</p>	 <p>PNGL Bridge 253A</p>
 <p>PNGL Bridge 254</p>	 <p>PNGL Bridge 255</p>	 <p>PNGL Bridge 256</p>	 <p>PNGL Bridge 257</p>
 <p>PNGL Bridge 258</p>	 <p>PNGL Bridge 260</p>	 <p>PNGL Bridge 261</p>	 <p>PNGL Bridge 262</p>
 <p>PNGL Bridge 262A</p>	 <p>PNGL Bridge 263</p>	 <p>PNGL Bridge 264</p>	<p>PNGL Bridge 264CA</p>



 <p>PNLG Bridge 280</p>	 <p>PNLG Bridge 281</p>	 <p>PNLG Bridge 282</p>	 <p>PNLG Bridge 283</p>
 <p>PNLG Bridge 284</p>	 <p>PNLG Bridge 285</p>	 <p>PNLG Bridge 286</p>	 <p>PNLG Bridge 287</p>
 <p>PNLG Bridge 288</p>	 <p>PNLG Bridge 289</p>	 <p>PNLG Bridge 290</p>	 <p>PNLG Bridge 294</p>
 <p>PNLG Bridge 295</p>			