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Dear Sir,

Wairoa to Gisborne---Track Review

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Introduction

Between 22nd and 25th of July 2019 an inspection/review was undertaken between the 296.3km (Kiwi Road Wairoa) and 391.6km (Gisborne Port). This exercise was conducted in hirail vehicles and was demanding because of the restricted access due to slips, vegetation and 5 significant drop outs which have severed the line.
There are limitations to this report commissioned by BERL. It is based on this site inspections, 2013 copies of KiwiRail- track logs, the visible track components (given the slip material and vegetation cover) and a desktop review of available data. It is not intended to be a detailed inspection but rather to identify the issues needing to be addressed and comment accordingly.

A similar review of this section of track was conducted June 2013.However, the scenario for that exercise was that the line was to be operated by a private rail company with different standards and objectives (this never eventuated).

For this review the track is being scoped and recommendations made to achieve similar standard as the section that recently reopened between Napier to Wairoa. This being for 40kph running and 16.3 tonnes axle loads. In the warmer parts of the year when rail temperatures are above 30 degrees C, KiwiRail imposes a 40kph temporary speed restriction on identified areas of track which could be subject to heat buckles. Much of this track would require similar speed restrictions if the line speed was raised. At some time in the future (after evaluation), parts could be raised to 50kph operating.

It is assumed that the major issues (particularly the large earthworks and culvert repairs at drop out sites) are addressed (by outside parties). Then the entire track length needs to be reinstated/brought back to a standard that KiwiRail could safely operate on and maintain. The track work could be conducted by outside contractors or possibly under KiwiRail umbrella.

Whatever the system adopted work needs to be prioritized and conducted at multiple sites at the same time to facilitate a timely reopening.

A small project management team (2-3 people) would be required to coordinate such things as; Line reopening program, health and safety and site inductions, outside contractors activities , priority of work sites, communications between various work groups, delivery of bulk materials, coordination with KiwiRail, continual review of work standards, liaison with neighbours, and local bodies etc.

Once the line is reopened it is assumed all inspection and management would be addressed by KiwiRail's existing staff.

It is envisaged that this section of the PNGL will require two distinct phases of track work:

A. Work to reopen the line using a larger renewals gang to address all of the drop out sites relays and the larger resleepering sites. This could be KiwiRail staff from elsewhere in their system or from one of the larger construction firms with rail expertise. It is assumed that the earthworks would be phased over two earthworks seasons with the track work closely following each completed section.

B. A small maintenance gang that would be created just before the line reopens and become the permanent track work maintenance resource. They would be assisted from time to time in the future by visiting renewals gangs for larger tasks such as; face resleeper, rerailing ,turnout renewals, level crossing upgrades etc.

Estimate of costs have been prepared using a mix of historical information, KiwiRail unit rates where known, 'rail contractors'rates and sound practice but without a detailed scope of work in many cases, hence detailed site investigations and subsequent design may alter the eventual out-turn.

Prior to reopening all aspects of this section of track will have to be inspected and signed off by professional heads within KR. (i.e. Track , Structures, Signals etc.)

The following are my thoughts, observations and recommendations for the track aspect of the work required to reopen this section of railway and future track maintenance requirements.

1 Vegetation

This section of track is 95.3km long has only 18.1km that is in regular train use (Gisborne Vintage Railway).The remaining 77.2km (75%) only

traversed in parts by an occasional high rail vehicle and push bike trolley tours.

The section 347km to 357km until recently could only be visited on foot. Just prior to this inspection a hirail excavator was used to clear some intermediate slips and rock falls and by gaining authority to use forestry roads the entire length (except for 4 dropouts) was visited in a hirail vehicle.

Given this usage there has been considerable encroachment of weeds throughout the ballast section and scrub and trees on the berms. This growth in some areas has been slowed to a degree by the large number of feral goats living along the corridor.

A mechanized scrub cutting exercise is required over virtually the entire 77kms of unused track. This would normally be a hirail excavator with a mulching head or saw blade. This machine would require additional support from a bushman with a chainsaw for larger leaning trees and branches. Treescape Ltd is the preferred supplier for KiwiRail and carried out a similar exercise on the Napier to Wairoa section

This exercise should be done at first opportunity because:

- The cut debris invariable falls into the side drain and over the ballast section.
- This debris will be cleaned up by a follow up team engaged in cleaning drains , slips and exposing top of sleepers/fastenings
- It improves visibility/ safety along the track and reduces damage to vehicles

Figure 1, larger trees to cut back

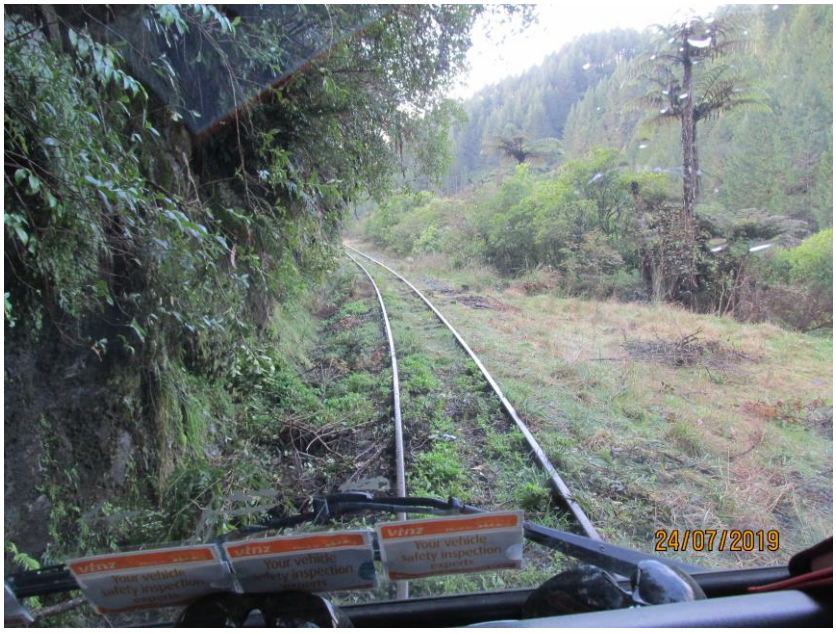

Figure 2, Scrub encroachment

2 Top of Sleeper Stripping

For large section of the unused track there has been mud flows, and grass type vegetation growing on top of the sleepers. In several locations

in the central part of this track (329 to 358km) only the top of rail is exposed. See the photos below.

Figure 3 Track vegetation

Figure 4 Slip material

A highrail machine needs to be engaged with a simple plough to traverse through the section treating all sites to expose top of sleeper and fastenings (to a degree).The same type of plough can be used on a small front end loader but the number of bridges which are likely to be encountered precludes efficient usage.

Figure 5 A suitable plough design

The spilled material from this exercise will then be eventually picked up as part of the drain cleaning exercise described below.

This same plough can be used to clear ballast (new look).

3 Drain Cleaning

Everywhere the track is not on an embankment (fill) the track requires side drains at the base of the ballast shoulder. For large sections of this track these drains are in poor condition. Many have become choked with weeds, silt, slip material and displaced ballast shoulders. A team consisting of a hirail excavator and a hirail tip truck (Komatsu CD60 or Hydrema 912) should be engaged to work in a face initially through the section 345.0km to 360km where the worst issues are. After this area is addressed these resources should be directed to treat the remaining sites at either end of this section of line. Additional funds have been allocated for several of the larger slips (listed in the reopening spread sheet). The dump truck is advocated so that the drain cleanings can be disposed of in a tidy fashion in many instances to the advantage of the formation width (particularly rock / boulders). As mentioned above this exercise will also be the final cleanup of mulching debris and top of sleeper stripping's. The operators must be encouraged to leave tidy completed work at each site they address.

Figure 6 Blocked side drain at Portal

4. On Track Spraying of Weeds in Ballast Section

An initial on- track weed spraying of the track should be conducted once the track has been cleared and drains cleaned.

This should then be followed by annual treatment in early spring before growth becomes to rank (an ultimately becomes a fire risk). Total area 96kms x 6m + yards = 65 ha. This work could be refined- not treating some areas and twice yearly in others.

The contractor (Treescape) used elsewhere on the KiwiRail system should be engaged for all of the vegetation work because of the health and safety and chemical certification/liabilities involved. It was engaged for the treatment of the Napier to Wairoa section of this line.

GVR has previously employed this same contractor for treating its operating area (although its yards seemed to have been missed)

5 Restoring of Track at Drop Out sites

In the 11km track section 347.5 to 358.5 Km there 6 significant drop outs have occurred, each with issues to address. These have been nominated numbers 1 to 6 running from north to south.

Drop Out 1. This embankment at the 358.42km has been rebuilt, the track reinstalled with poor alignment. However, the RHS fill batter is steep; the face scoured out in places and a steel culvert outlet requires better detailing.

Figure 7 Downhill batter and culvert outlet

If this fill embankment is to remain unchanged the track traversing it requires adjusting to a more even horizontal alignment and further away from the edge of the RH batter. This curve also has had some Peruvian sleepers spotted in which will need replacing.

Figure 8 Drop Out 1 poor alignment

Drop Out 2. This site is situated at the 357.14km at the south end points for Beach Loop. The drop out has undermined the South end points 1A and also the back shunt. At the start of any repair work every effort should be made to recover as much undamaged track as possible from this turnout and backshunt. Beach Loop is considered a vital asset to reinstate for train operations and as a staging point for future maintenance and repair activities (i.e. crossing or run around of trains, stabling of tamper group etc.). It is intended to refurbish these components for reinstalling in the same location once the formation and culverting is reinstated.

Figure 9 Drop Out 2. Turnout to recover

Figure 10 Drop Out 2 Backshunt

Drop Out 3. At this location 355.55km the drop out has occurred in the middle of a 100m radius RH curve in 70lb track. First task will be to recover the collapsed track for future reuse. Currently it is possible to off-track and drive around the head of this drop out.

In addition, at this location to the north there has been rock fall damage and a sag in the track has developed due to large scale land movement. On this basis it is proposed to remove this entire section of track to allow access to address all of the formation issues. Then it is proposed to relay this entire length (430m) of 70lb track in new heavy weight rail and concrete sleepers (to join up with 91lb rail at either end)

Figure 11 Drop Out 3 looking north

Figure 12 Rock damaged track

Figure 13 Area of sag

Drop Out 4. This is a significant failure at the 353.9km which has created the largest chasm that requires to be rebuilt and currently has severed all access through the area.
Part of the earthworks will require the recovery of the strewn track down the north face and gulley. This track is 91b rail on TPR sleepers with N fastenings and the majority may be reusable. Some materials may be recovered from track level and the remainder will need to be recovered from the gulley floor once access for plant is created

Figure 14 Drop Out 4. Looking south

Figure 15 Drop Out 4 looking north

Dropout 5. At this location (348.8km) the track was left swinging when the LH batter collapsed towards the river. From the amount of retaining structures, rails scattered down the batter and old wagon bodies along the edge of the waterway there has been an historical problem in this area for some time.

The current failure has left 18 No sleepers hanging. This has subsequently been "pig styed" with other sleepers and wedges to allow the passage of lighter hirail vehicles (probably soon after the main rainfall event by local railway staff).

What is amazing is how this problem has been disguised by rampant weed growth.

To address this site it is proposed to cut the existing track into sets, and remove the timber supporting materials. This will then provide a clear wok area for building of any retaining structures and reforming the formation up to ballast level. Once this is completed, and ballast spread, the original track would be reinstated.

Figure 16 Drop Out 5. As viewed in 2013

Figure 17 Drop Out 5. The same location as viewed 2019

Drop Out 6. This site at the 347.3 km was a surprise as only when information from the 2013 visit was compared that it was appreciated that this failure has occurred in the intervening years since the line was mothballed . It is ironic that on the 2013 visit the bluff just to the south of this site was nominated as a possible quarry site for fill.

The existing track is 91lb rail on TPR sleepers and N type fastenings. Once the track formation and culverting is provided it is proposed to relay 60 meters of new rail on concrete sleepers.

The best parts of the old track should be recovered and reused

Figure 18 . Drop Out 6. Looking south

Figure 19. Drop Out 6. Viewed looking north

Figure 20 . Drop out 6. Looking south 2013

To relink the railway the dropouts Nos 2 to 6 between 347.7 and 357.2km need to be addressed. Because of the difficult site access earthworks, if possible should be initiated at Drop out 6.

It is envisaged that at each dropout site a ballast bed will be provided, rolled and trimmed to the correct surveyed level (for underside of the concrete sleepers). Once the track is constructed a work train can deliver the top up crib and shoulder ballast .An minor alignment issues will be addressed with a excavator (tamping head).The rail access can then advance northward to the next dropout.

The sorting out of drop out 5 should be of relatively short duration then resources can be poured into the largest earthwork site drop out 4.

At all drop sites (except No5) (as part of the earthworks contract) should include the construction of a good access track to the inlet structure for the culverting at each site. This would then allow a hirail excavator to off track and travel down the created access to maintain and clear any debris at the inlet structure. Currently these structures are buried or covered by “jungle” and require a machine to clear. It is believed that all of these drop outs failures have occurred because of inlet blockages.

In difficult access sites, such as the Buller Gorge, the railways have shifted large quantities of bulk material (e.g. gravels, rock, and ballast) by work trains of side tipping wagons. In Gisborne DBM Roadhaul can source light locos, side tipping wagons (YDs) and holds a rail operating licence. This firm could be a useful subcontractor for some aspects of this work and it was this firm that provided the hirail transport and line clearing for the various parties for the current evaluating of this railway.

6 Ballast

It is obvious this line had ballast shortfalls throughout its length prior to the line closure. Large sections of track have barely an adequate profile of ballast. Although most centre cribs are full to top of sleeper often shoulders are deficient or missing. In many instances the ballast profile has been compromised by poor or inadequate placement prior to the

closure events. It has then been contaminated by slip material, poor drainage and rank weed growth.Currently the track is being abused further by neighbours/public using the rail corridor for access on 4 wheel bikes, road 4x4 vehicles and stock grazing(controlled by electric fencing or uncontrolled feral goats).

Figure 21 Damage by 4x4 bike and stock

Figure 22 Ballast section 320km

To address this situation it is recommended that a hirail excavator with a tilt head/wide smooth faced bucket should travel through the entire length attempting to pull up shoulder ballast. From this exercise deficiencies can be identified/prioritized then ballast purchased and imported by either truck or trains to stockpile in the Wairoa Nuhaka section or Matawhero (depending on where the supply is from). Ideally (to avoid double handling) this material will come from Otaki in ballast wagons and be discharged by work trains directly. If YJ wagons are used these can only be partially loaded to maintain the 16 tonne axle loading limit.

As part of this ballasting work a small team with a hirail excavator should attempt to line and box in some 25-30 minor misalignments in the track between Wairoa and the Paritu IB board. These faults appear to be heat related; possibly frozen fish plates, but primarily developed because of lack of ballast section. All of these can be negotiated at reduced speed if not addressed. (Virtually every joint was found to be open)

Figure 23 Misalignment related to ballast section

Some ballasting (top ups) could be deferred until the line is reopened and the trains in the interim would operate at reduced speeds (25kph) over the deficient areas.

Gisborne will basically be an export centre (loaded train out) and trains arriving will be light and could have capacity to convey ballast into this area.

Generally a railway can be maintained in contaminated ballast if it can be kept drained and relatively dry.

There will be a need for ongoing ballast purchases just to maintain the status quo and for any new / renewals work – Dropout repairs, new siding connection, level crossing upgrade etc.

Because of a lack of large sound source material in the Napier Gisborne area smaller graded ballast or screened crushed concrete could be considered.

7 Level Crossings

Public Level crossings are predominately situated at the southern and northern section of this line. Detailing is required to at least 16 No public level crossings prior to trains running. This mainly involves signage and road surfacing. A separate re-evaluation (ALCAM) should be conducted on all of the public roads for particularly the approach signage and view lines vegetation clearance.

There are seven crossing which have flashing lights and bells (FLB). At the five crossings between Matawhero and Gisborne (385.42 to 390.73km) the FLB system has been modified by KiwiRail, because of low rail usage, to operate using a car door type remote with two settings(23 seconds for hirails and 4.0 minutes for train movements). The reliability and suitability of this system should be reviewed once increased rail traffic is proposed. Many of these crossings have static Giveway sign which is an unusual configuration. It has also been suggested that if these FLB are to be brought back into regular use some signal design

work will be required which in the current KiwiRail environment has a considerable lead time.

In this section there are 18No sealed crossings in total which are holding up well and have only been given occasional “pot hole” repair.

It is felt that this level of maintenance could be adopted for some years until rail traffic is significant. The first crossing to need up grading would be Te Uhi Road (SH2) at 296.75km. There is a suggestion that Awapuni Road at the 385.42 may be built on Peruvian sleepers but at this point the is no sign of any failure

Figure 24 Te Uhi Road (SH2) LX

Figure 25 Awapuni Road LX 385.42km

Assume 1 crossing upgrade/5year at say $70K and $8k/a year for maintaining seal on others (pot holes)

The private crossings generally appear satisfactory and the user should be encouraged to maintain the road surface with free draining aggregates.

8 TPR Sleepers- Mainline -plain track

This section of the PNGL from Wairoa to Gisborne is 94.81kms long and nominally contains some 158,000 sleepers (including bridge and turnout sleepers). In some areas it was not possible to assess the sleepers because they were covered in vegetation or slip material.

The vast majority of the line is in face TPRs in medium to fair condition. Most sleepers, particularly on the straight alignment, have not been cross bored. Some screw spike splitting and centre rot (from lack of preservative) were observed but none were found to be requiring urgent replacement and the rail seat areas were still providing adequate bearing. Given that some 80% of this track has remained unused since the line closure there appears to be no perceivable change in sleeper

condition in this area. The remaining 20% (19km) is the length operated on infrequently by the Gisborne Vintage Railway (GVR).

Rough sleeper counts were conducted at several locations and as previously found typically 0 to 6 sleepers/km should be replaced but at this level were not compromising the security of the track.

The section Nuhaka (327km) to Maraetaha (365km) contains all of the 40No tighter curves of 200m radius or sharper and all are in the non-operating section of this line (no gauge push is observable). None appeared to have significant EM80 gauge faults prior to closure and quite possibly have been repaired. No significant bedplate or rail foot notching of sleepers were observed.

The only exceptions were where Peruvian sleepers had been spotted and were rotting, and in an odd joint and yard sleepers where GVR is operating. Also repairing and relaying at Drop out 3 will strengthen 3 of these curves (that are currently 70lb rail)

In all instances where spot resleepering is required this will be done using secondhand TPRs because new hardwoods or composite sleepers are expensive and difficult to source and new concretes are much deeper in section would affect formation and tamping. Spot resleepering in face timber lengths with concrete sleepers is now discouraged by KiwiRail.

It is proposed that all TPR sleepers recovered from dropout sites will classed for reuse .It is anticipated that at least 50% (500No) of the sleepers will be suitable for reuse in the track at other sites.

Generally the sleepers in this area of the PNGL are of a better quality than the secondhand sleepers being generated elsewhere in the KiwiRail system.

To maintain the existing rail sleeper security odd spot resleepering is advocated. These sleepers would installed to replace only those that had failed i.e. centre rot, badly split , bored out joint and Peruvian failures, -

basically to maintain the status quo. Priority would be given to areas where several sleepers have failed in close proximity.

Sleepers should be installed by excavator using minimum excavation and rubbing techniques. This would be followed by local packing to minimize disturbance to the ballast bed/ formation and affects to the running top.

On this basis no face resleepering is envisaged (except for relays at dropout sites). It is also hoped to have the EM80 conduct a recording run through the section as soon as practical to locate any track tolerance issues. It is expected that any gauge faults can be addressed by cross boring, plating or odd spot resleeper.

In summary, it is envisaged that 600 No secondhand TPR sleepers will be required initially to open the track. Then, from year 3 the input of sleepers has been increased to 1000/year to cover the renewals nominated by KiwiRail prior to mothballing. To make up any shortfall some may have to be recovered from uplifted loops, backshunt or possibly purchased from KiwiRail. Currently all TPRs being lifted from KiwiRail's system are re-classed, the best being retained for maintenance resleepering and remainder sold off at $35/ sleeper. On this basis secondhand TPR sleepers to be used in this exercise have been given a value of $40/per sleeper. In the longer term it is proposed that face resleepering of complete curves would be done in concrete sleepers with the South Island shoulder configuration. This would allow current sites of heavy weight rail to be resleepered and or 70lb sites with the medium weight spacer (as being used on the Hokitika Branch). It is hoped that some reasonable SH TPRs can be recovered for reuse from these concrete sites. An alternative could be to use H5 tantalized pine sleepers with galvanized screw spikes (as is being done by other "vintage" railways around the country).Currently KiwiRail is investigating other sources for composite sleepers (with suggested price similar to a concrete sleeper).

After the line is reopened it is proposed for the following years that the maintenance gang would install 600 sleepers per year and a renewals

gang onsite to install a further 400 at heavy spot or face resleepering sites (short visits).

9 Concrete Sleepers

To repair dropouts 3, 4, and 6 and some damaged track adjoining 3 it is proposed to install 1050 No new concrete sleepers with galvanized shoulders as part of face relays.

If possible these should be in the South Island shoulder configuration to allow easy amalgamation with medium weight rail. These sleepers would be manufactured in Christchurch and railed to the PNGL (similar to what is done for the Johnsonville Line)

10 Turnout Sleepers

During this inspection 33No Peruvian turnout sleepers were identified in mainline and loop structures all used by GVR. Most of these had been identified in a previous engineering inspection done in May 2018 but not yet addressed by GVR. It is intended to follow up with them the importance to address these sleepers or the turnouts should be taken out of use.

These replacement sleepers can be sourced from disused turnout in back roads or possible KR. Irrespective it is believed that GVR must address this issue well before the entire line would ever be reopened. In future years the occasional crossing resleeper will have to be with new hardwoods or composite (plastic) sleepers.

11. Bridge Sleepers

Prior to the line closing KiwiRail had nominated 10 bridges to resleeper with 666 No new hardwood sleepers in this section of the PNGL over the next 5 years. This was to replace aging hardwoods and some Peruvian sleepers showing rot.

On this review we basically concur with the hardwood replacement but found the number of Peruvian requiring replacement had escalated to a further 132 No sleepers. It is recommended that all structures with

known Peruvian sleepers have a detailed inspection as looks can be deceptive. Some sites with tidy looking sleepers but when struck with an inspection pick were found to be very rotten.

Figure 26. Over Bridge 258 with failing Peruvian sleepers

The bridge resleepering to replace failed Peruvian sleepers will be a priority. These need to be addressed before any rail traffic (trains) can traverse many sections. This work is further complicated with the need to provide scaffolding for most structures and additional road protection for two over-bridges over SH 2.

<u>Summary of sleeper situation</u>

KiwiRail had planned for this section of line prior to its closing to install at least 4,300 plain track sleepers over the following 4-5 years in 21sites,(excluding bridges) . Using the Kiwirail information as a basis, and considering the drop out site repairs, the following table indicates the likely sleeper input required. Figures do not include level crossings, turnouts, or yards. Using these figures it is advocated that the following re-sleepering regime (assuming earthworks would run over two seasons):

Year	TPR	**Concrete**	**Bridge**	**Remarks**
1	200	400	400	Drop Outs being repaired and Peruvian bridge sleepers
2	400	650	400	Drop Outs being repaired and Peruvian bridge sleepers
3	1000		85	600 installed under maintenance 400 by renewals
4	500	500	85	600 installed under maintenance 400 by renewals
5	100	900	85	Virtually no TPRs reusable

The sleeper numbers can be interchanged between SH TPRs, concretes and composites (plastic) although the concrete is a far superior product in the tighter radius curves they are only suitable for face resleepering. It is recommended that a secure stockpile of sleepers be created at say two locations (Wairoa and Gisborne) and drawn from by track work groups as required.

12 Rail

The rail is predominately 70lb-72/yd.(RB), a little 75lb/yd, a short section 85lb/yd, and good sections of 91lb/yd.in the tighter alignment areas.

The rail is predominately in shorts with 4 hole short fishplates. To the credit of the last KiwiRail track maintenance staff, all appeared tight and all bolts present. Some of the heavy weight rail has been installed with the longer 4 and 6 hole plates. The heavy weight rail has been installed in Ss. (12.8m) Ms. (38m) or Ls (76m) flash butt welded.

There are 14 sites in the KiwiRail database that have been nominated for rerailing (5,430ms) primarily for rail wear. Typically they have 17-18points of wear with one site at 329.95-330.15km recorded as having 20 points (the limit) which could not be located. All of these sites were planned for second hand 91Lb rail recovered from elsewhere in the KiwiRail system.

Recently the KiwiRail EM80 recording car has been equipped with additional laser measuring gear to continuously monitor the rail profile and wear. This should help identify any substandard rail for replacement.

The KiwiRail code allows a maximum wear on all of these rails of 20 points before requiring replacement. These rails at new have a base reading of 6 points and were probably installed when the line was built (1942 or earlier). Therefore in 70 years (6-18= 12points) i.e. 1 point per 5.8 years.

Assuming similar traffic (as when the line was last open) up to a further 10 years of rail life remains (but is somewhat dependent on lubrication).

In the longer term it may be worthwhile swapping some good straight rail with top wear only into curves nearing high total wear.

There may be some opportunities to uplift sidings and reuse the rail. There is little advantage in rerailing in heavyweight rail given there is so much 70lb rail in the section and bedplates would also need to be changed. In the longer term assuming KiwiRail took over the operation of this section of line, it would have the ability to source good used second hand heavy weight rail from elsewhere in their system and install this in sites where face resleepering is to occur. Currently there is a shortage of good second hand heavy weight rail within the KiwiRail system and hence new rail is included in this reopening proposal.

For the dropout sites it is proposed to use 630metres of new 50kg/m rail. This could be supplied by KiwiRail in 25m lengths on rail wagons. The onsite deliver will be dependent on the available rail access from

Wairoa. It could be that the dropout sites are traversed in shorts of any rail and then rerailed once the new rail can be delivered.

13 Fastenings

This section of line has two primary sleeper fastening types being:

- N Type consisting of a 4 holed bedplate, being fitted with 2 x screw spikes fitted with spring washers and a standard clip. This configuration is found in two sizes to accommodate medium weight rail (701b/yd.) and heavyweight rail (91lb/yd.) foot widths. This timber sleeper fastening type should be preferred whenever possible for all track alignments and particularly around joints. The 70lb bedplate is getting harder to source and any recovered should be held for reuse.
- A Clip (NZ clip) consisting of a piece of strap spring steel with a single hole for a screw spike. This fastening has been in use on the KiwiRail system for some 40+ years but is being phased out. However, these fastenings will be adequate for the existing rail, sleepers and the usage planned for this line and only changed out in future face resleepering sites.

Dog spikes and screw spikes with clips can be found on some bridges with older hardwood sleepers. These should be replaced progressively with N type fastening as the opportunity arises.

14 Turnouts

All of the main line turnouts were inspected quickly and were generally all 70lb rail 1:9 structures all on reasonable/good sleepers. The exception being turnouts mentioned in the GVR operating area. Fastenings appeared tight, gauge was good. Some of the newer hardwood sleepers could be Peruvian (but should only be replaced when and if they fail).

No excessively worn frogs or switches were observed.

All of the turnouts should be checked prior to train services resuming.

This should include lubricating switch blades, slide plates and points boxes.

The existing turnouts should last for many years with minimum inputs and should any eventually become high maintenance they could be replaced with a similar or better (91lb) structures from say the Gisborne Yard.

15 Destressing

During this visit almost every joint was showing an expansion gap and given the rail lengths involved and the slow operating line speed proposed, no destressing is planned.

Several minor line misalignments were observed which in almost every instance was at a location of very weak or none existent shoulder ballast. Once shoulder ballast problems have been addressed a small team could rectify the situation ,possible after EM80 recording initial run.

Should any misalignment occur in hot weather these should be addressed/managed by, temporary speed restrictions, cutting additional joints, removing rail, freeing up frozen fishplates, re adjusting rail drift and/or strengthening the ballast shoulder.

16 NDT Testing

Once the line is reopened this section of line should be included in the KiwiRail national NDT recording program and faults addressed accordingly.

17 Maintenance Resources

It is advocated to maintain the track with 2 men equipped with a hirail truck and an operator with a hirail excavator. They would be responsible for a host of tasks, some of the major ones being:

- Patrols, inspections, callouts,
- Slip ,culvert and drain cleaning/clearing
- Some vegetation control
- Assisting loco crews shunting
- Joint maintenance
- Track alignment, EM80 faults
- Resleepering including Peruvian
- Ballast management

It is envisaged that approximately a third of their time (90days) should be engaged in resleepering averaging approximately 7 No sleepers / day (600 sleepers /year). This conservative number was derived by considering all the following aspects to resleeper:

- Picking up sleepers from stock pile and loading on truck
- Travel to site of in gang truck and excavator
- Establishing protection of some form.
- Identifying sleepers to replace
- Removing existing sleeper
- Install new sleeper
- Regauging adjoining sleepers
- Packing and boxing in track
- Reload old sleeper and move to next site
- Repeat most parts of this procedure until 7 sleepers are installed

A secure compound for storing materials, parking vehicles and plant etc. will be required at their home station.

18 Plant and Equipment

It is recommended that the following items will be required by KiwiRail to maintain the track and be an effective gang length:

- Hirail tip trucks with small crane or lifting tailgate. This vehicle would be used for transporting workers, conveying plant/materials and for patrols. Ideally this wants to be a 4x4 drive because of the difficult off road conditions and isolation of some locations.

- A hired hirail tracked excavator (8-12 tonne) with skilled operator, preferably with a tilt hitch and blade. This would be engaged for at least 75% of the gangs work hours (basically assigned to this gang full time or until this section of line is tamed).It would be used for drain and slip clearing, resleepering, ballast regulating track lining, cranage etc. The contractor would be required to provide various attachments but must include a tamping head/sleeper inserter.
- Small plant-The standard KiwiRail track gang allocation will be required, typically being
  - Disc saw for cutting rail $4.4K
  - Petrol Impactor (Bance) for fishbolts and screws.$4.9K
  - Hydraulic Impactor for larger screw spike jobs $14K.
  - Rota broch rail borer
  - Petrol sleeper drill (Tanka)$1K
  - Material trolley for shifting gear in work area$1K
  - Hand tools, bars , spades, shovels , slashers, sledge hammers$1K

19 Track Inspections

These should be conducted at the frequency dictated by the KiwiRail operating code. This will probably be once per week over the entire section and could be added to as part of the KiwiRail track inspector Napier area patrols.

At least once a year the length should be included in the EM80 recording cars program to help quantify the status of the track.

Initially until the Wairoa to Gisborne section is fully restored, the EM80 when carrying out recording Napier to Wairoa should arrange to carryout partial runs as far as continuous track access is available north from Wairoa.

The locally based staff would be responsible for other patrols such as heat, after any significant storm events and following earthquakes.

A detailed engineering inspection of the entire section should be conducted by KiwiRail to review the condition of the track asset. This inspection will verify standards are being maintained, and identify future issues/problems to be addressed.

20 Tunnel Maintenance.

The section has 12 tunnels (No 14 to 26 (tunnel 24 day lighted)) with all built in the 1940s .All structures are concrete lined and appear to be in satisfactory condition with reasonable track. Most portals require drainage detailing to reduce water entering the tunnel.

Tunnel 19 is just under 3kms long and has a couple of locations where the lining has cracked and supporting steel arches and timber has been installed. A section was rerailed in 2011 because of corrosion and the replaced rail is trackside. This should be recovered and the best pieces reused.

Tunnel 26 (1,540metres long) was rerailed in 2009 in 91lb long welded rail with long fishplates.
Since the advent of the Pike River tragedy rail tunnels safety issues have been reviewed and considerably tightened. KiwiRail has introduced policies for tunnels such as:

- No petrol engines
- Hirail trucks “fire hardened”
- Staff visiting tunnels must have training
- Gas monitors to be used
- Self-rescue kits must be on hand whenever working in tunnels over 200m length
- For work in tunnels over 2080m long 2 vehicles must be present.
- Internal signage advising location and distance to portal.

All of these issues will be required to be adopted once KiwiRail reuses this section of track

21 River and Sea Protection Works

It is assumed at this time that the existing river and sea protection works are adequate. However, at every earthworks site, slip clearance where rock/rubble is present, the material is to be sorted and stockpiled trackside ready for future use. Then, when a weakness or failure is observed in the existing armouring, the nearest suitable rock material can be conveyed in by either hirail vehicle or wagon.

22 Other Issues to address

1. Work trains will require significant assistance and coordination with KiwiRail. To get one discharge of ballast to this section of the PNGL will require 3 -4 work trains – Palmerston to Otaki and return, Palmerston to Napier, discharge work train Napier to Wairoa (and north) returning mts.to Napier. Then possibly another work train to convey wagons to Palmerston/ Otaki. This requires considerable organizing by KiwiRail staff and it wants to be set up on a regular cycle.

2. What signaling system to be adopted (TWC?). Currently all interlocking rodding in the GVR operating area have been disconnected. FLB don't operate (but are not covered up either)

3. Alterations/termination of existing rail access lease for this section of line

4. No mainline tamping group tamping is planned for the initial reopening because of the: Generally poor ballast section, amount of light weight rail , slow operating speeds planned and the relative short lengths that would require treatment. Much of this track is holding good alignment (for jointed track) and given that it takes something like 3 million gross tonnes of traffic to settle track after disturbance, tamping sites want to be chosen carefully . A tamping group could be introduced by KiwiRail when deemed appropriated after reopening and sufficient ballast is onsite.

5. Which locations to take delivery/stockpile material and what land is available.(i.e. ballast, concrete sleepers, 25m rails etc.) Kopuawhara and Matawhero?

6. Where would be future freight loading sites be. There appear to be opportunities at several old yard sites.

7. Culvert inspection and maintenance/repairs needs to be given a high priority. The last culvert list from 2013 shows numerous culverts identified in 2010 – 2011 requiring cleaning of inlets. A major cause the drop out failures was blocked waterways. A specific team should be created to address all culverts prior to reopening. In addition culvert locations should be marked at track level (plastic marker peg with size and kilometrage). Once the initial inspection culvert/cleans have been completed the maintenance track team should be able look after ongoing inlet cleaning with the assistance of their allocated hirail excavator.

8. The type of radio communication to be used in this area. Currently GVR and others are using a digital system which provides coverage over the entire Napier- Gisborne coast by L Colvins Communications based in Gisborne. This could be used during the formation restoration work and then the KiwiRail radio system reintroduced once rail traffic resumes.

9. A review of all track side signage should be undertaken for Km and half Km posts, permanent SR, approaching level crossing, curve boards, whistle boards, tunnel signage, station and IB boards etc.

10. There will need to be a publicity drive advising the public and particularly KiwiRail neighbours that trains can be expected at any time and the railway is very much alive.

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23 Costs/ Estimates

The attached excel spreadsheets shows costs that have been derived from various sources (particularly KiwiRail), contractors and other reports.

This is for all track work above formation level or top of bridge beam.

To initially reopen the track the major costs are:

Item	Cost $	Remarks
Bridge resleepering	520,000	At least $650 /sleeper installed
Ballast	160,000	Over $30K per train
Vegetation	170,000	Based on costs Napier to Wairoa
Relay sites	370,000	Drop outs + damaged rail
Spot resleepering	150,000	Using second hand TPRs

This assumes that the reconnection would be spread over 2 earthworks seasons (2 years) and would have costs of around $2.5 million

Savings could be made by, sourcing secondhand materials, refining the Peruvian bridge sleepers to be replaced, and not significantly improving the ballast section.

The suggested costs of ongoing maintenance/renewals (for a further 8 years out) are shown on the second spreadsheet.

These costs are only indicative as the track standards required by KiwiRail are being raised continually, material costs are increasing and second hand reusable materials are getting harder to source.

Making a lot of assumptions, it appears that an annual cost to maintain/ renew the track asset will be $700K-$900K per year. Costs will also be related to the amount of rail traffic and operating speeds.

These costs do not include:

- Any allowance for inflation
- Overheads or profit margins
- GST
- Contingencies
- Penal rates/allowances for staff
- Any incident costs – washout, slip clearance, derailment etc.
- Any repairs to bridge or culvert structures

In summary

This section from Wairoa to Gisborne trackwork can confidently be reopened (as the bones are good) but dedication will be required in maintaining drainage and formation aspects in conjunction with the track structure. It is recommended that the formation restoration work should be address by "outside parties" and the bridge and track repairs be managed by KiwiRail (probably using its "in house" staff and or "preferred suppliers")

This way appropriate materials can be sourced (be it new or recycled from elsewhere in its system) and trackwork created to the standard KiwiRail desires for recommissioning rail services into this area. A high degree of coordination will be required with KiwiRail just to reopen this line.

H Armstrong 10th August 2019