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RAIL NETWORK

Track Performance Assessment:

Upington - Kakamas

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Executive Summary

A high-level visual assessment of track and rail condition was conducted for the Upington-Kakamas branchline route to establish the requirements to repair and reinstate the route for operation. The route has remained closed since 2018 and before closure, the route serviced commodity trains. Due to the challenge presented by track damages and accessibility to conduct a continuous route inspection, different sites were visited between the following stations Upington-Klippunt, Dyasonsklip-Kanoneilandweg, Kanoneilandweg-Geelkop, Geelkop-Keimoes and Noordvoor-Kakamas.

The track condition and rail performance remain inconclusive due to the unavailability of data needed for analysis such as that obtained from the IMV, UMC and compliance reports. However, the overall state of the route is provided through a visual assessment from the spot inspection findings. No data was available to review the historic incidents such as derailments, rail breaks or kickouts that may have occurred previously to provide an overview about the previous performance of the rail route.

The most predominant rail type is 30kg/m and the overall condition of the rails is good for the sections inspected. However, there is a high number of rails and fishplates that were stolen between Upington and Klippunt. Ballast is generally in a good condition with the exceptions of completely fouled ballast between km 4 to km 8, the poor ballast profile between km 27 to km 30 and lastly erosion of shoulder ballast and fouling at the Kakamas Bridge. However, due to the line not in use for over 4 years majority of route is covered in vegetation, which requires ballast screening, ballast regulating and ballast replenishment to get the line reinstated. Majority of the sleepers are steel and are still in a good condition. However, there is an issue of theft between km 4 and km 8. The condition of the sleepers covered in sand and vegetation could not be inspected so the condition is unknown. Some of the wooden sleepers at the Kakamas Bridge are burnt and are required to be replaced.

The Kakamas Bridge could not be fully inspected as the handrails have been stolen posing a safety risk. It was observed that there were sections with burnt sleepers, slacks and corrosion of the steel bridge. Therefore, maintenance is required to reinstate the bridge. Level crossings inspected were in poor condition and indicated non-compliance to SANS3000-2-2-1. A detailed inspection of all the level crossings as per SANS 3000-2-2-1 must be conducted to ascertain the condition and the necessary corrective measures as well community awareness at level crossings. Vegetation control is also an issue in the Upington-Kakamas route. It prevented conducting the inspection using the trolley as it had obstructed view of the track and identifying locations were rails and fishplates were stolen.

Overall, the Upington-Kakamas route is in a poor and damaged condition in some parts. Intensive construction and repair works are required. However, the work scope and load cannot be quantified due to a very limited assessment. The report therefore, highly recommends a digital form of inspection conducted using either a helicopter or drone wherein video images of the entire route can be captured.

1. Introduction

A high-level visual assessment of track and rail condition was conducted for the Upington – Kakamas route to establish the requirements to reinstate the route for operation. A trolley inspection was not possible due to overgrown vegetation and the theft of rails and fishplates. Spot inspections were conducted between the following stations Upington-Klippunt, Dyasonsklip-Kanoneilandweg, Kanoneilandweg-Geelkop, Geelkop-Keimoes and Noordvoor-Kakamas.

1.1 Background

Transnet Freight Rail (TFR) has a directive to transport millions of tons of commodities annually across different parts of the country through its vast rail network and rolling stock infrastructure. The rail network comprise of different lines types classified according to the axle loading capacity and yearly tonnage throughput. Branchlines being one the line classes are characterised with marginally low traffic volumes and a lower axle loading. There are number of branchlines within the country, some of which are used seasonally and some completely non-operational.

It is TFR's business desire to have all branchlines fully operational and be of economic value to the country, more especially in the now times of adverse economic market conditions. In support of the government's plans of economic expansion and in line with the organisational socio-economic plans, TFR is on a venture to revive non-operational branchlines in the hope to bring about a positive economic change. It is for this reason that Upington – Kakamas branchline has been identified for potential business and the need for an assessment was initiated.

1.2 Limitations

A comprehensive technical track condition and rail performance assessment could not be undertaken due to lack of the IMV data and MICA inspection information. Furthermore, very limited access and stolen track rendered the impossibility to trolley the railway line. As a result, the evaluation was limited only to limited spot visual assessments conducted on the 7 April 2022.

2. Route Overview

The Upington - Kakamas railway is a 88 km long single-track as seen in Figure 1, non-electrified railway line in the Northern Cape Province falling under Kimberley South Depot. The route infrastructure is composed of 30 kg/m rail fastened onto steel sleepers.

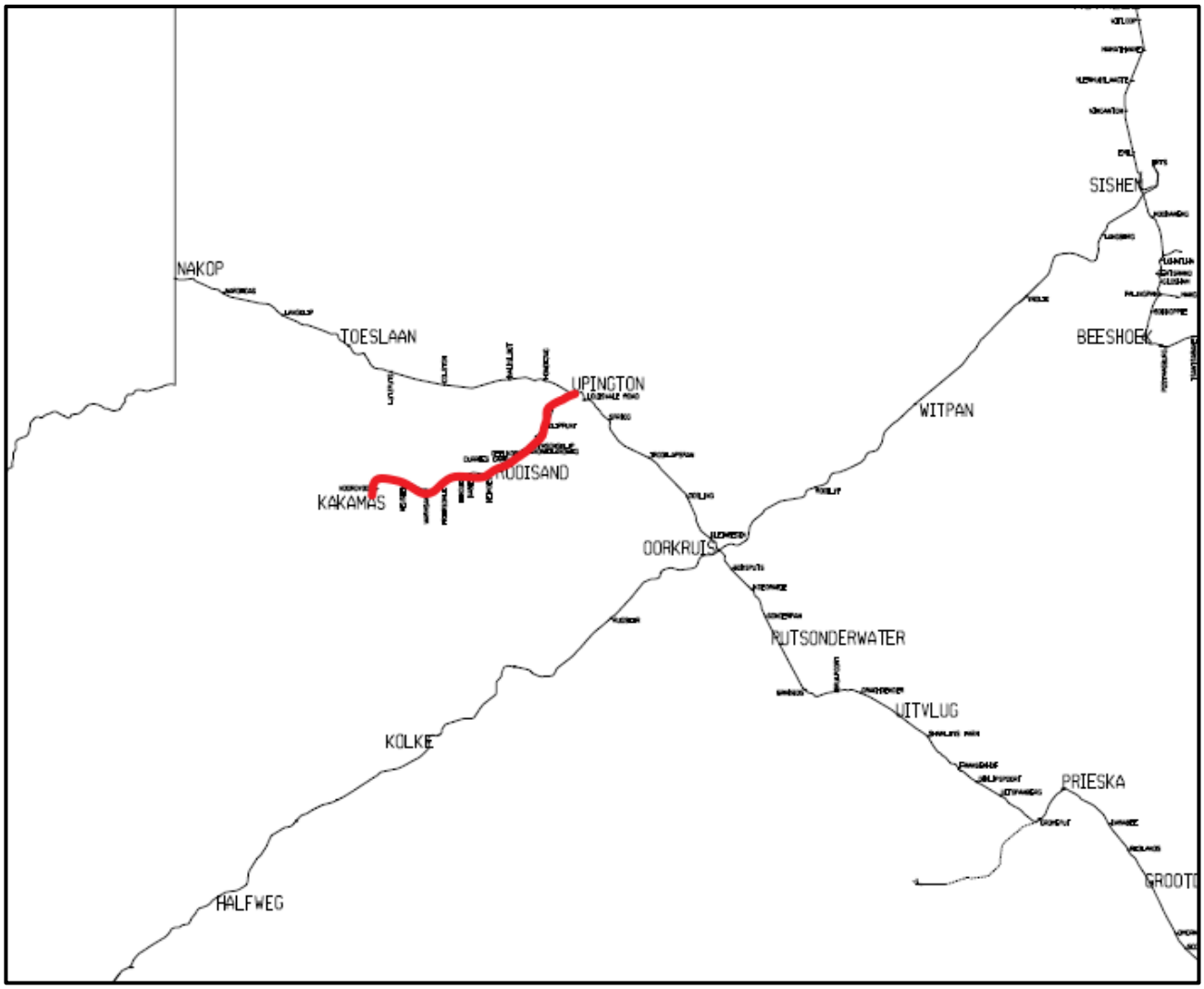

Figure 1: Upington-Kakamas rail route

3. Visual Assessment Findings

Due to the challenge to inspect through the trolley or walking continuously along the track, the visual assessment was conducted in a spot manner. A generic assessment of the track components will be provided based on the findings of various sites that were visited.

3.1 Rails

The Upington-Kakamas route has 30kg/m rails that are connected by fish plates. This connection has the advantage of less stress induced rail breaks or kickouts. The onsite assessment indicates that the rails are in an average condition. However, there is rust forming along the length of the track due to being unused since 2018 see Figure 2 below. The fishplates are missing from km 4 up until km 8 (between Upington and Klippunt), as seen in Figure 3 and 4. Figure 5 shows the fishplates on both legs at km 28/ km 29 (between Kanoneilandweg and Geelkop). The fishplates are intact with only one bolt missing on the right leg, with battered ends, metal flow and noticeable gap as seen in Figure 6.

Figure 2: Condition of rails at km 6

Figure 3: Missing fishplates and bolts at km 4

Figure 4: Missing fishplate and bolts at km 7

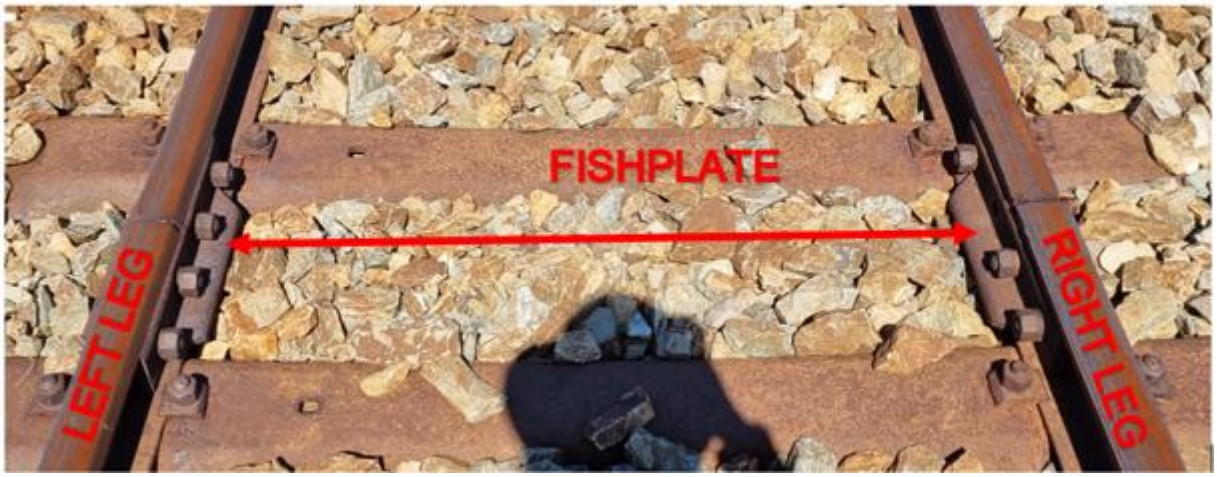

Figure 5: Fishplates on both legs at km 28/ km 29 (between Kanoneilandweg and Geelkop)

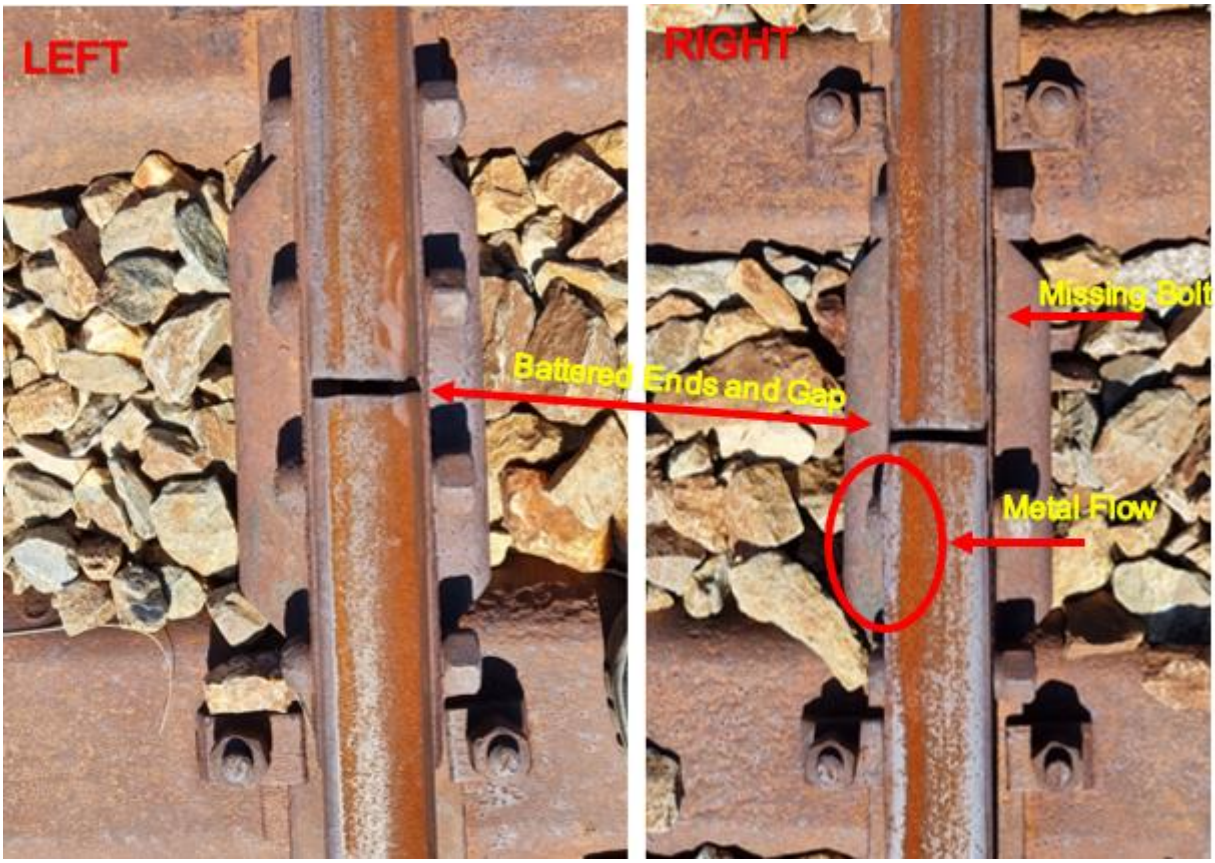

Figure 6: Left and Right Leg defects at km 28/ km29 fishplate

3.2 Ballast

Ballast is an important component in the track structure as it provides drainage and resist forces exerted onto the track. After inspecting the track there were sections that were completely fouled km 4 to km 8 as seen in Figure 7 and 8. The ballast condition improves from km 27 to km 30 however, the ballast needs re-profiling as seen in Figure 9. Lastly, the shoulder ballast erosion and fouling at the start of the Kakamas bridge at km 86 as seen in Figure 10. Ballast regulating, replenishment and screening will be necessary to restore condition of the line.

Figure 7: Completely fouled Top ballast layers at km 4

Figure 8: Completely fouled crib and shoulder ballast at km 8

Figure 9: Improved ballast condition but still requiring re-profiling at km 28

Figure 10: Shoulder ballast erosion and fouling at the Kakamas Bridge Abutment

3.3 Sleepers

The main purpose of sleepers is to maintain the track gauge, profile, alignment and distribute the load from the rail to subgrade. Any defects on the sleeper or fastening system negatively affects the track structure. The Upington-Kakamas route has predominantly steel sleepers, with concrete sleepers found at some level crossings and wooden sleepers found at the Kakamas Bridge. During the inspection between km 4 and km 8 there were missing steel sleepers and sleepers fully submerge in sand as seen in Figure 11 and 12. Between km 27 to km 30 the sleepers and fastenings are intact and seem to be in a good condition as seen in Figure 13. There were only two locations were fastenings were missing as indicated in the Figure 14; this has an insignificant impact on the track structure. There were a few sleepers burnt on the Kakamas Bridge as seen in Figure 15, the entire Bridge could not be inspected due to it being unsafe to walk with no hand railings.

Figure 11: Sleepers fully submerge in sand at km 4

Figure 12: Missing steel sleepers at km 7

Figure 13: Sleepers and fastenings are intact and in a good condition between km 27 to km 30

Figure 14: Missing bolts at km 4 and km 26 respectively

Figure 15: Burnt sleepers on the Kakamas Bridge

3.4 Turnouts

Turnouts allow trains to switch between tracks. In the Upington –Kakamas route turnouts can be found at all stations, which were used as loop lines into private sidings or loops for empty trains or On Track Machines (OTM) to stand while loaded trains pass. Looking at the train control diagram (BBC 1681) for this route there are 31 loops of which only 18 are operational as of 2017. There are also a total of 55 turnouts of which only 39 are found on the operational lines. While conducting the on-site assessment, two turnouts were inspected at Kanoneilandweg km 27 and Geelkop km 30. The train control diagram for these stations are shown in Figure 16, with Kanoneilandweg non-operational and Geelkop operational. The turnout at Kanoneilandweg seem to be in a good condition with all the components and hand tumbler still intact as seen in Figure 17 and 18 respectively. The turnout at Geelkop also seems to be in a good condition with all the components intact and the hand tumbler is broken as seen in Figure 19 and 20 respectively. At both locations there is vegetation growing either on the turnout or in proximity of the turnout.

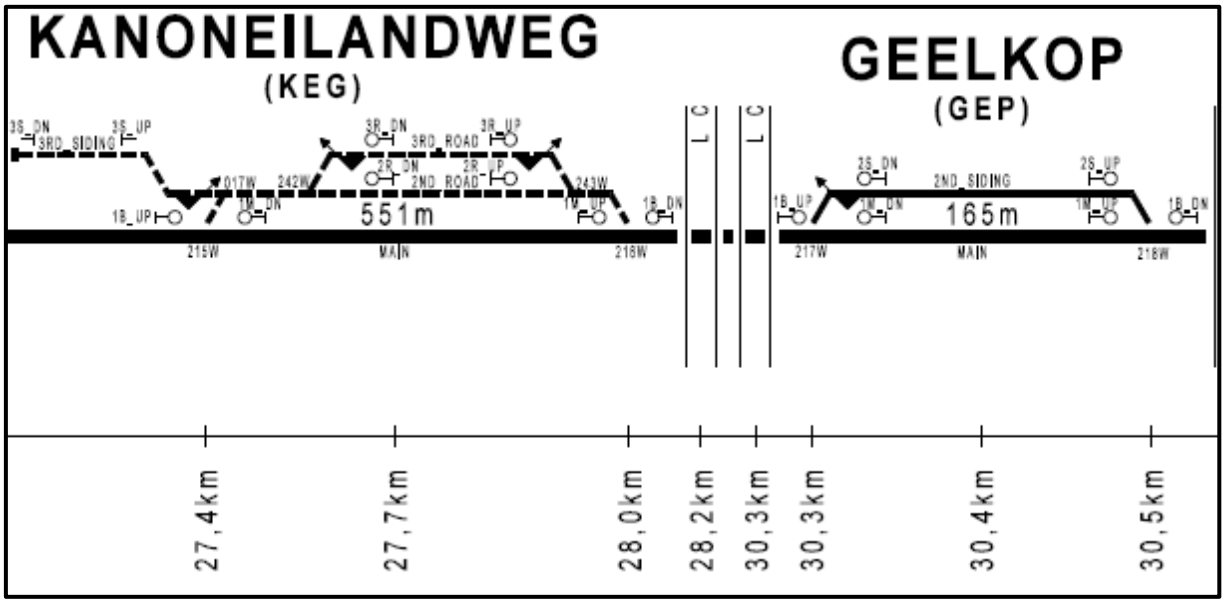

Figure 16: BBC 1681 Train Control Diagram for Kanoneilandweg and Geelkop

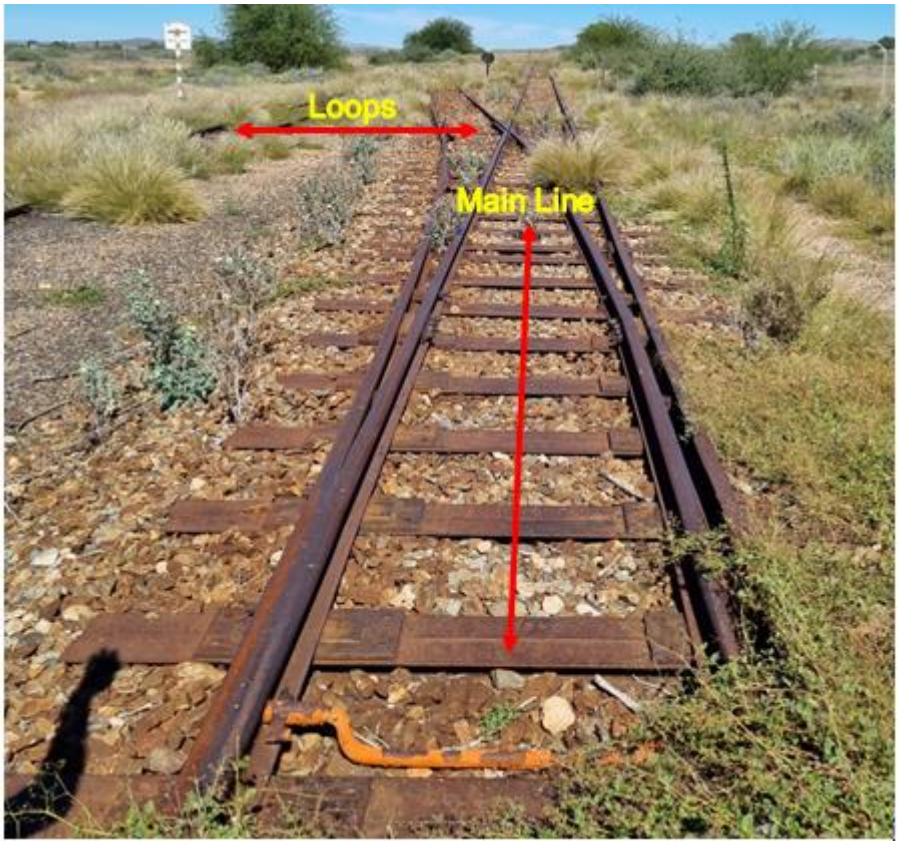

Figure 17: Turnout at Kanoneilandweg in good condition, with over grown vegetation

Figure 18: Hand Tumbler in good condition and surrounded by vegetation

Figure 19: Turnout at Geelkop in good condition, with over grown vegetation

Figure 20: Hand Tumbler is broken and surrounded by vegetation

3.5 Bridges

The Upington-Kakamas route has three bridges as indicated in Table 1 (BBF0901) and only the rail bridge is at Kakamas. The track infrastructure appeared to be in a good condition with the following concerns: burnt sleepers, missing hand railings, slacks and corrosion to the steel structure, as seen in Figure 15, 21 and 22 respectively. The entire bridge could not be inspected due the missing hand railings and no access to the bottom of the concrete supports. Therefore, refurbishment to preserve the steel members is required.

Table 1: List of Bridges for Upington-Kakamas route (BBF0901)

Section	Section description	Km	No of spans	Description	Bridge type	Deck Material	Structure Type	Bridge number
9-08	Upington - Kakamas	21.600		Road Bridge near Dyason' Klip	Road Bridge			76-53
9-08	Upington - Kakamas	42.182		Road Bridge near Keimoes	Road Bridge			9104
9-08	Upington - Kakamas	86.628		Orange River Bridge at Kakamas	River Bridge			1379

Figure 21: Slacks along the length of the track and missing hand railings on the right

Figure 22: Corrosion of steel bridge

3.6 Culverts

Culverts are an essential supporting structure to the track that allows water to be transported from one side to the other. There are numerous culverts along the route, during the site visit some were seen while driving alongside the track and some could be visually inspected. The condition of the culverts vary from in good to poor condition with no blockages to others with trees and debris at the inlet/outlet. The culvert in Figure 23 is at km 13 (between Upington-Klippunt) which is in a good condition. The culvert in Figure 24 is between Geelkop and Keimoes. It is a long spanning culvert; there are no service roads to do a close-up inspection, and there appears to be in a good condition.

Figure 23: Culvert in good condition at km 13

Figure 24: Culvert between Geelkop and Keimoes appears to be in a good condition

3.7 Level Crossings

Level crossings are the intersection between road and railway. The SANS3000-2-2-1 provides the technical requirements and operating standards for level crossings. The Upington-Kakamas route has roughly 25 level crossings (BBC 1681) all listed in Table 2. All level crossings inspected is indicative of poor condition and non-compliance to SANS3000-2-2-1. Observations at these level crossings proved absolutely no adherence to safety protocols when approaching a level crossing. Figure 25 is a level crossing between Upington and Klippunt and Figure 26 is an illegal crossing. Figure 27 shows the faded stop sign at km 13. Figure 28 is between Klippunt and Dyasonsklip, roughly km 22, the gravel road was graded covering the rails and the excess material obstructing both ends of the track. Figure 29 is roughly at km 25 with an uneven tar road perpendicular to the track. Figure 30, which is around km 27, has a gate placed on the track and sand covering the track. Figure 31 is between Geelkop and Keimoes, there is sand and vegetation growing between the rail and concrete blocks. A detailed inspection of all the level crossings as per SANS 3000-2-2-1 must be conducted in order to ascertain the condition and the necessary corrective measures as well community awareness at level crossings.

Figure 25: Level Crossing at km 7 covered in sand

Table 2: Upington-Kakamas List of Level Crossings

	Station	Km
1	Upington-Klippunt	2.8
2	Upington-Klippunt	9
3	Upington-Klippunt	15.1
4	Klipplunt-Dyasonsklip	22.6
5	Klipplunt-Dyasonsklip	22.7
6	Klipplunt-Dyasonsklip	23.6
7	Klipplunt-Dyasonsklip	24.2
8	Klipplunt-Dyasonsklip	24.3
9	Dyasonsklip-Kanoneilandweg	25.3
10	Dyasonsklip-Kanoneilandweg	27.3
11	Kanoneilandweg-Geelkop	28.2
12	Kanoneilandweg-Geelkop	30.3
13	Geelkop-Keimoes	30.6
14	Geelkop-Keimoes	31.3
15	Geelkop-Keimoes	32.3
16	Geelkop-Keimoes	33.9
17	Geelkop-Keimoes	34.5
18	Geelkop-Keimoes	38.9
19	Geelkop-Keimoes	42.9
20	Geelkop-Keimoes	43.41
21	Keimoes-Kabies	44.3
22	Keimoes-Kabies	45
23	Keimoes-Kabies	48.1
24	Neushek-Noordvoor	85.4
25	Noordvoor-Kakamas	87.9

Figure 26: Illegal Level Crossing at km 4

Figure 27: Faded and skew stop sign at km 13

Figure 28: Graded road covering the track and excess material obstructing the line at km 22

Figure 29: Uneven tar road across track at km 25

Figure 30: A gate build on track and track covered in sand at level crossing at km 27

Figure 31: Sand and vegetation between rail and concrete block at the level crossing at km 43

3.8 Theft and Vandalism

Theft and vandalism of TFR's assets are concerns in areas surrounded or encroached by communities and have less security. During the route inspection between km 4 to km 13 sections of rails, sleepers and fishplates that have been stolen as seen in Figure 32, 33 and 34. There is also an illegal dump that has been formed at km 7, with rubbish being blown onto the track as seen in Figure 35. The hand rails have also been stolen from the Kakamas bridge as seen in Figure 36.

Figure 32: Stolen rails, sleepers and fishplates at km 4

Figure 33: Stolen rails, sleepers and fishplates at km 6

Figure 34: Stolen rails, sleepers and fishplates at km 7

Figure 35: Illegal dump adjacent to the track at km 7

Figure 36: Handrails stolen along the Kakamas Bridge

3.9 Vegetation

Vegetation when not controlled can grow in the ballast, obstruct ballast drainage, affect the visibility at crossings, interfere with safe movement of trains and prevent inspection of the track. During the investigation, it was evident that the vegetation was not controlled and all of the above has occurred. This is the resultant of the line closure since 2018 (4 years). The pictures of the overgrown vegetation on track and the service roads are seen in Figure 37 to 42.

Figure 37: Overgrown vegetation at km 4

Figure 38: Overgrown vegetation at km 8

Figure 39: Overgrown vegetation at km 22

Figure 40: Overgrown vegetation at km 27

Figure 41: Overgrown vegetation, trees growing in the centre and adjacent to the track at km42

Figure 42: Overgrown vegetation before the Kakamas Bridge

4. Conclusion

The Upington – Kakamas route has been visually assessed at a few selected and accessible spots. A definite and detailed conclusion cannot be made on the condition and performance of the entire route due to limitations highlighted earlier regarding accessibility and safety. Therefore, for the purpose of this report the overall track condition and rail performance was obtained from the visual evaluation findings.

4.1 Track Condition

- IMV information was not available for review of track condition parameters including the TQI, Standard Deviations of geometric parameters and C-Exceedance density per km.
- SAP data on kickouts was not available.
- Spotted ballast condition indicated signs of fouling. In some areas, there was no ballast profile and in some areas, ballast could be seen as it was buried together with the rail and sleepers underneath the soil.

4.2 Rail Performance

- History of rail breaks and ultrasonic defects is unknown due to unavailable relevant reports
- Rails seem to be in a good condition
- With no IMV information, condemned rails could not be identified.

4.3 Bridge and Structures

- Not all bridges and culverts were inspected.
- Inspected level crossings were not in conformance with SANS 3000: Part 2-1-1 requirements.

5. Recommendations

Based on the visual assessment findings, the following are part recommendations for the Upington- Kakamas route:

- Intensive track and rail repairs are required. However, those cannot be quantified at this stage.
- In order to conduct a full condition and performance assessment, the IMV data or data collected physically through track and rail wear gauges is required.
- Considering the challenge with the trolley and to continuously walk the entire route a digital form of inspection is highly recommended. This can be achieved aerially through a helicopter or using a drone. A video captured at close range can aid identify accessible areas, overgrown vegetation, other defects in affected areas. Furthermore, areas where vandalism or theft has occurred can also be established.