A division of Transnet limited

ICTM (TRACK TECHNOLOGY)

TECHNICAL REPORT

Rail curve grease test: Bio rail curve grease (NGLI-O)

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SUMMARY

Technology management was approached by a supplier from GTI lubricants to test their new wheel flange product with the belief that the new product can be our solution to the reduction of the wheel and rail wear. The product name is the Bio rail curve grease NGLI-0. The product was tested at Ermelo departure yard using an M&S lubricator. The test site was located at km 145.

The supplier provided Technology Management with a batch of grease to conduct the tests. The first time the grease was tested, it could not be filled in the lubricator as the grease had hardened. The properties of the grease were unknown as the supplier did not provide the data sheet of the product therefore the first trial of tests were unsuccessful.

The supplier was then notified about the problem and in turn modified the product to be softer and the data sheet of the properties of the improved grease is attached in the appendix.

This report presents the results obtained from the test carried out at Ermelo departure yard.

The results show that the improved lubricant tested was within the limits of good and acceptable lubrication but did not spread enough to cover complete curve length. The grease did not have a sufficient slump as it formed voids in the lubricator and needed to be stirred frequently so will require a trained personnel to be on site all the time in turn will increase the maintenance on the lubricator as a result will minimise production.

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1 . INTRODUCTION

This report presents a lubrication test conducted at Ermelo departure yard for a new NGLI-O GTI lubricant.

2 . OBJECTIVES OF THE REPORT

The main objectives of the test are as follows:

2.1 To determine the suitable wheel- flange lubricant to be utilised optimally

2.2 To be able to minimise the rail wheel wear on curves so to maximise rail and wheel life

2.3 To determine the most cost effective and effective flange lubricant

2.4 To determine an environmentally friendly lubricant

2.5 To determine if the GTI lubricant is suitable to be an approved trackside lubricant

3 . PROBLEM DEFINITION AND SITE DESCRIPTION

3.1 A lubricator is situated in Ermelo departure yard to lubricate the departure yard curve. There were complaints that the lubricant is not consistent at different temperatures. The existing lubricant was not tested to determine if the claims were true or not.

3.2 A new local supplier approached technology management in the efforts to test their rail curve lubricant so to alleviate the problem. The new lubricant was tested in Ermelo departure yard km 145 using the M&S lubricator situated at the yard next to a curve where the fully loaded trains depart.

3.3 The lubricator is situated in a tangent a distance away from the beginning of the curve. The distance from the beginning of the curve to the lubricator was not measured in this case.

4 . SITE INVESTIGATION AND TESTING

4.1 The first site visit was conducted by the Track department of Information Communication and Technology Management (ICTM) in April 2012 and a test was done of the new GTI lubricant of which the test was unsuccessful because the lubricant had hardened in the containers. The supplier then delivered the softer lubricant for further testing. The appearance is grey semi-solid with vegetable oil odour, the boiling point is over 375ºC and its specific gravity is 92@16ºC.

4.2 On the 25th of July 2012 Technology Management started with the testing of the improved lubricant and testing was conducted using a tribometer which measures the coefficient of friction. The test results are shown below.

4.3 Results of the first trial of tests

4.3.1 The site was cleaned on the day for preparations so to remove the old lubricant from the rail and also to remove the residue from the old lubricant to avoid mixing of the lubricants. The supplier issued Transnet with 15kg x 4 buckets of the new grease and Transnet also bought 150Kg worth of the new lubricant to enable Technology Management to conduct effective testing to ensure quality of the lubricant.

The table and the graph below shows the results obtained during the first trial of testing from the end of the curve to the beginning of the curve. The curve is a left hand curve so to measure the high leg we had to start from the end of the curve because the machine used can only measure in one direction only.

Mp	fficient day 1	fficient day 2	fficient day 3	fficient day 4
18	0.15	0.28	0.31	0.09
16 and 17	0.12	0.43	0.45	0.13
15	0.13	0.38	0.44	0.13
14	0.12	0.39	0.4	0.14
13	0.11	0.39	0.43	0.14
12	0.15	0.26	0.39	0.14
11	0.15	0.23	0.32	0.15
10	0.15	0.26	0.32	0.12
9	0.15	0.27	0.32	0.13
8	0.16	0.30	0.32	0.13
7	0.18	0.21	0.26	0.15
6	0.20	0.18	0.21	0.15
5	0.27	0.21	0.23	0.17
4	0.30	0.21	0.22	0.14
3	0.29	0.33	0.22	0.16
2	0.30	0.22	0.19	0.19

Table 1: Average coefficient of friction between mast poles from Km 145/02- Km 145/18

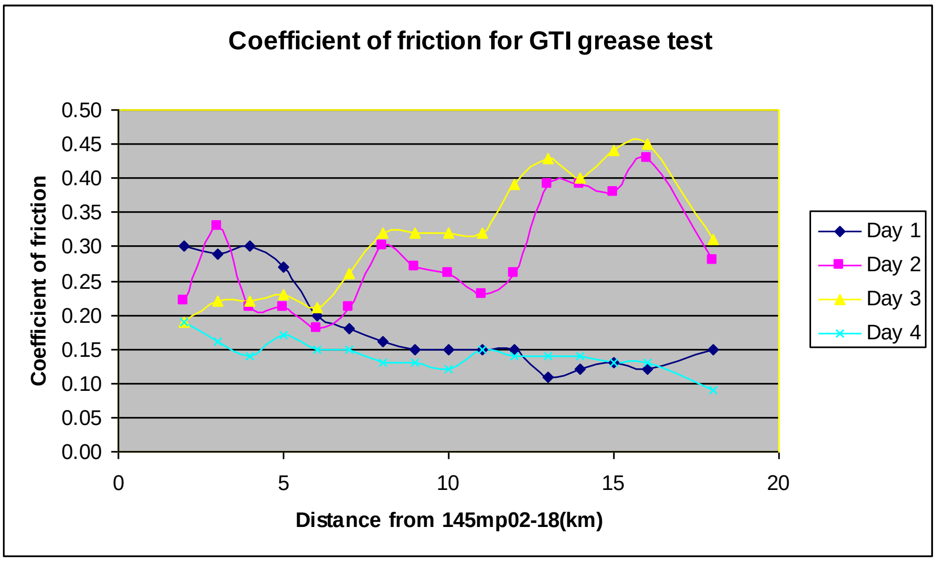

Figure 1: Average Coefficient of friction throughout the curve

4.3.2 The figure 1 above is the results obtained during the first trial of tests. Average coefficient at km 145/02 is the average from km 145/02 to the grease pot. Days 2 and 3 were measured in the morning hours around 09h00 and days 1 and 4 were measured during the day around 13h00. The temperatures were ranging between 23-42 degrees Celsius. The graph above indicates that the lubricant operates optimally at high temperatures of which it is within the limits of good lubrication of 0.15-0.20 throughout the curve and at low temperatures it is within the acceptable lubrication limits of 0.25-0.30 for just 66% of the curve from the pot to km 145/11 the rest of the curve is observed to be dry.

4.3.3 On the week of the 18th -20th September 2010, second and final trial of testing was conducted by Technology management to monitor the consistency of the lubricant.

4.3.4 The lubricant was again tested at different rail temperatures and times of the day to measure the effects of temperature on the lubricant. A tribometer was run throughout the curve to be able to obtain the variation of the coefficient of friction so to measure the average coefficient of friction of the curve and to be able to identify if the tested lubricant lies within the Transnet lubrication limits.

The lubrication limits according to Transnet with regards to the coefficient of friction are as follows:

Parameter	μ
Good lubrication	0.15-0.20
Over lubrication	< 0.15
Acceptable lubrication	0.25-0.30
Average lubrication	0.20-0.25
Poor lubrication	0.30-0.35
Dry	0.35-0.57

Table 2: Lubrication condition and limits

The results below were obtained during the final trial of tests:

4.4 Results of the second trial of tests

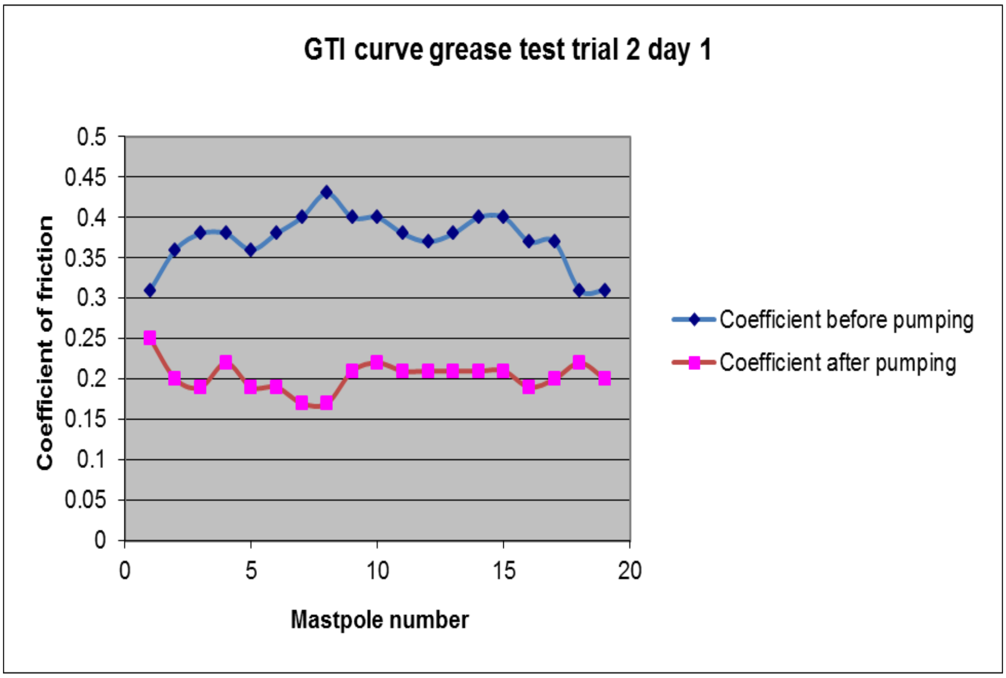

Figure 2: Average coefficient of friction day1

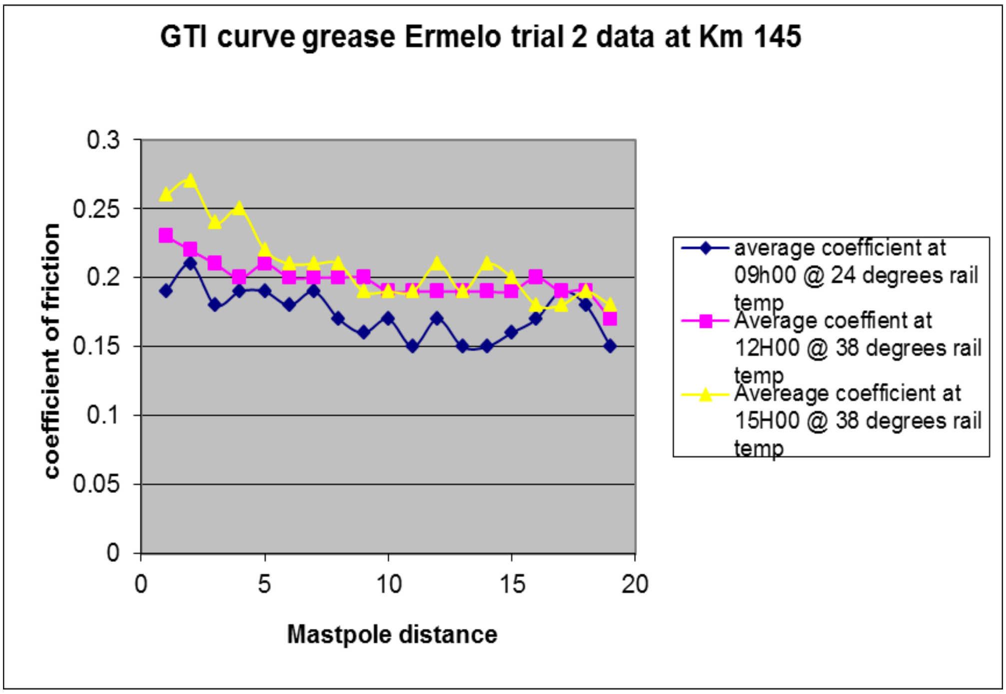

Figure 3: Average coefficient of friction day2

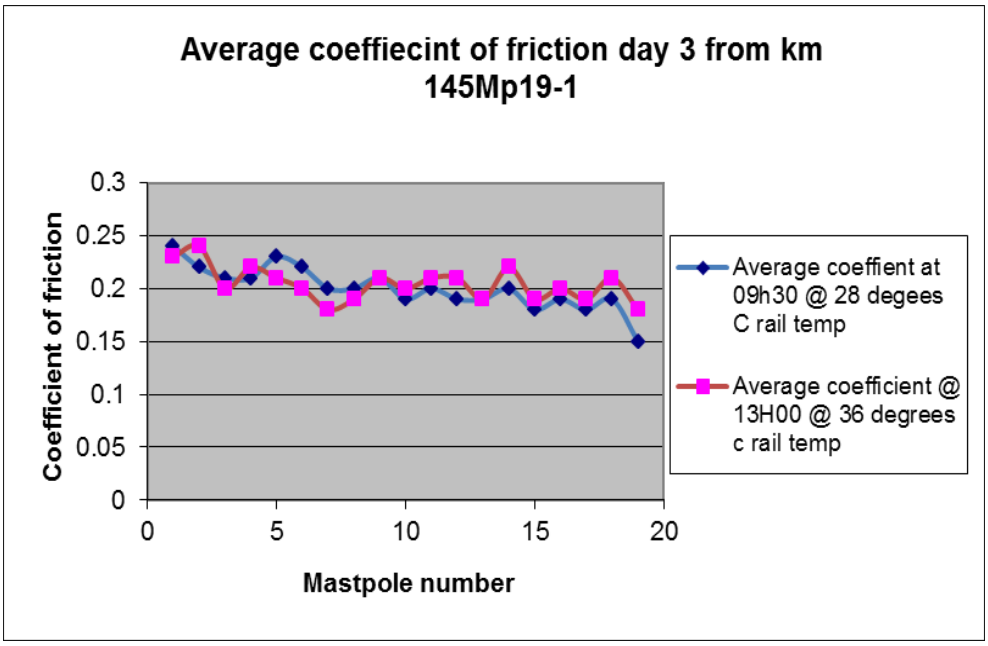

Figure 4: Average coefficient of friction day3

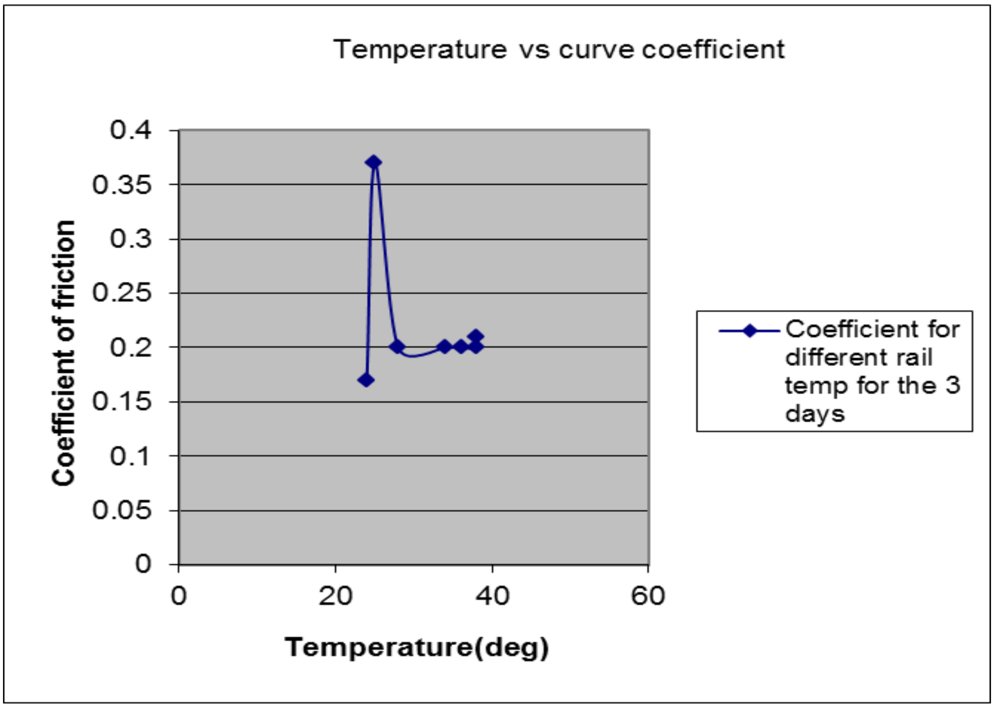

Figure 5: Relationship between the coefficient of friction and temperature

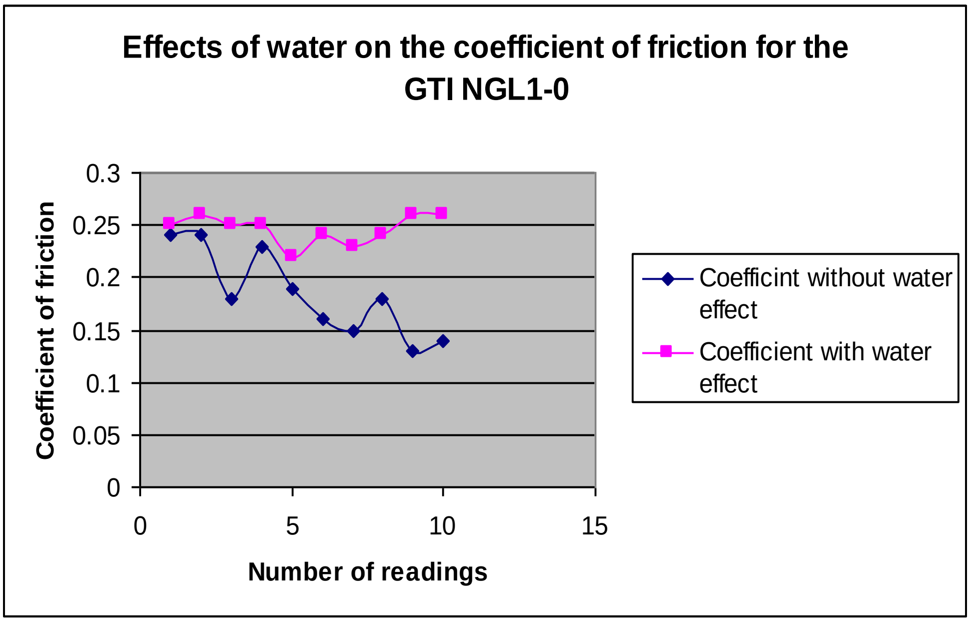

Figure 6: Effects of water on the coefficient of friction

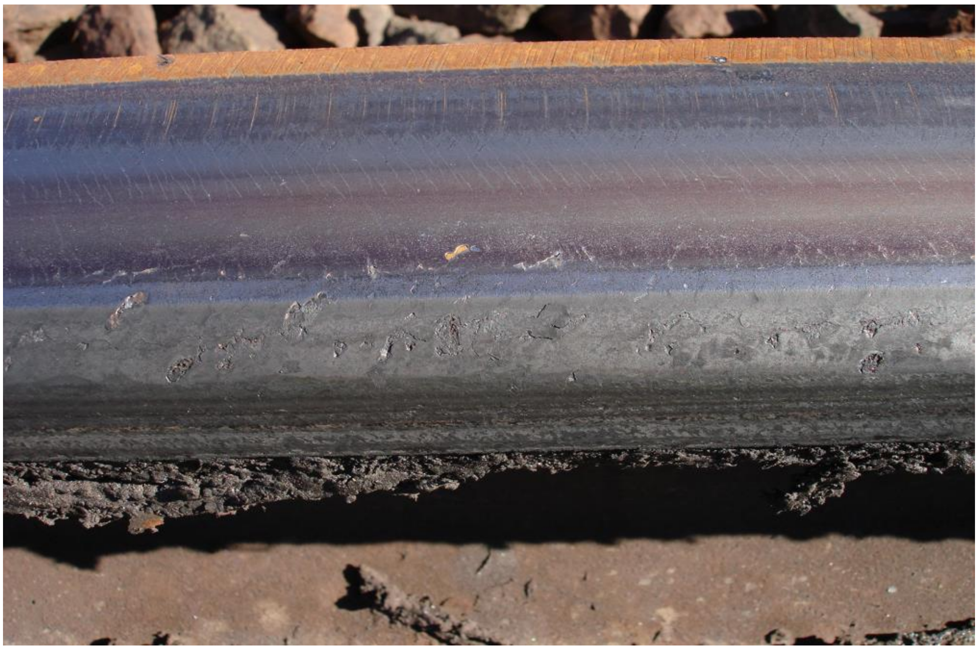

Figure 7: Lubricant filling up the cavities formed by flaking by forming a hard lubricant

5 . DISCUSSION OF RESULTS

5.1 The blue curve in figure 2 demonstrates the coefficient obtained in the morning after 3 days of lack of adequate lubrication of the high leg of the curve at Ermelo yard Km 145, the reason is that the grease could not settle in the pot from self-weight so it created a void in the pot which needs a trained official to open the pot and stir the lubricant meaning that during weekend the curve was running dry due to volumes of traffic and thus could potentially increase the wear rate. The red curve was obtained some time later during the day after pumping was established to release the lubricant so the coefficient dropped from being above 0.35 to range between 0.18 and 0.25.

5.2 Figure 3 and 4 illustrates the consistency of the lubricant. In figure 3, 89.5% of the curve yields a coefficient of friction ranging between 0.15-0.25 throughout the day and in figure 4, the whole curve's coefficient of friction ranged between 0.15-0.25 throughout the day. Therefore figure 3 and 4 demonstrates that the lubricant varies between good and average lubrication throughout the day at different rail temperatures and thus the lubricant is consistent.

5.3 Figure 5 above is an indication of how the coefficient of friction varies with temperature. The 0.37 value was obtained when the curve was measured after three day of not adequate lubrication due to the lack of slump of the lubricant and there was no one available to monitor if the grease in the lubricator was slumping enough on its own to fill up the voids created in the lubricator through pumping so this indicates that the flow of the grease is poor, otherwise the grease remained consistent when it was stirred at 30 min intervals.

5.4 Figure 6 shows the effects of water on the lubricant in case of rainy seasons. Ten tribometer readings were taken from the grease pot to the first mast pole, the blue graph on figure 6 shows the coefficient of friction of the lubricant under dry conditions and the purple graph shows the behaviour of the lubricant under wet conditions and although the readings seem a bit high the coefficient still remains consistent due to the properties in the lubricant that forms a hard lubricant to minimise rail wear and of which the lubricant provides average lubrication to the curve.

5.5 Figure 7 shows a typical view of how the lubricant spreads on the gauge corner of the high leg in the curve and clearly the lubricant is able to fill the cavities created by flaking on the rail so the lubricant enables a smoother finish to the surface thus aids in minimising the rail and wheel wear.

6 . CONCLUSION

6.1 The grease is within the limits of good and acceptable lubrication based on the Transnet lubrication chart but the slump is poor.

6.2 The grease is acceptable in terms of minimising the friction and unacceptable based on the slump.

7 . RECOMMENDATIONS

7.1 It is recommended that the grease needs to be tested at different locations to assess its performance and consistency.

8 . ACKNOWLEDGEMENTS

The author would like to thank Mr S. Mthethwa and the Ermelo depot personnel for the assistance in carrying out the test and also Mr K. Mistry and Dr R. Frohling for their inputs and also the strain section.

9. REFERENCES

9.1 Rail lubrication and its impact on wheel/rail system by de Koker; Frohling and Amade

9.2 Rail lubrication on the Richards Bay Coal line by J.J de Koker