

A Study on the Effect of Temperature on Painted Rails.

1.0 Introduction

A quick study is being undertaken on painting rail to see what the effect will be on the rail temperature, especially during warmer periods. A small section of rail at Hazelhatch, Ireland was chosen to paint and study the effects.

2.0 Experimental Set-Up

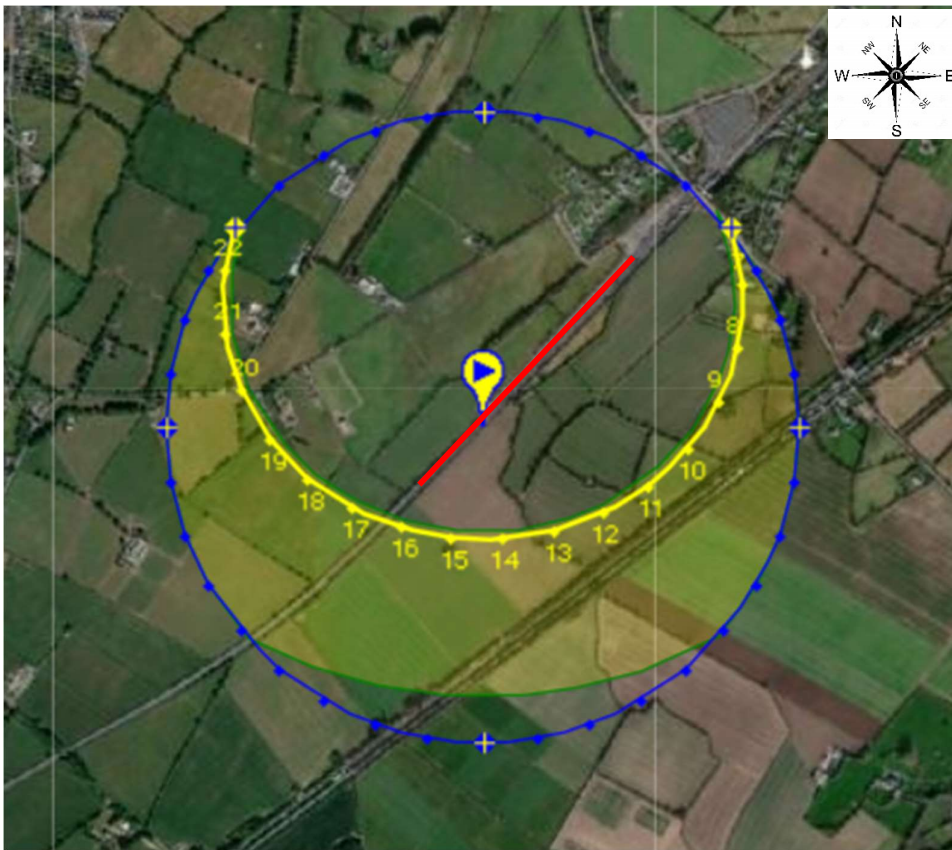


Figure 1: Track Orientation & Sun Path

The section of rail chosen is at the western side of the maintenance yard at Hazelhatch. The track orientation is at $44^\circ / 224^\circ$. A section of rail approximately 20m in length was painted with an off-the-shelf white paint.

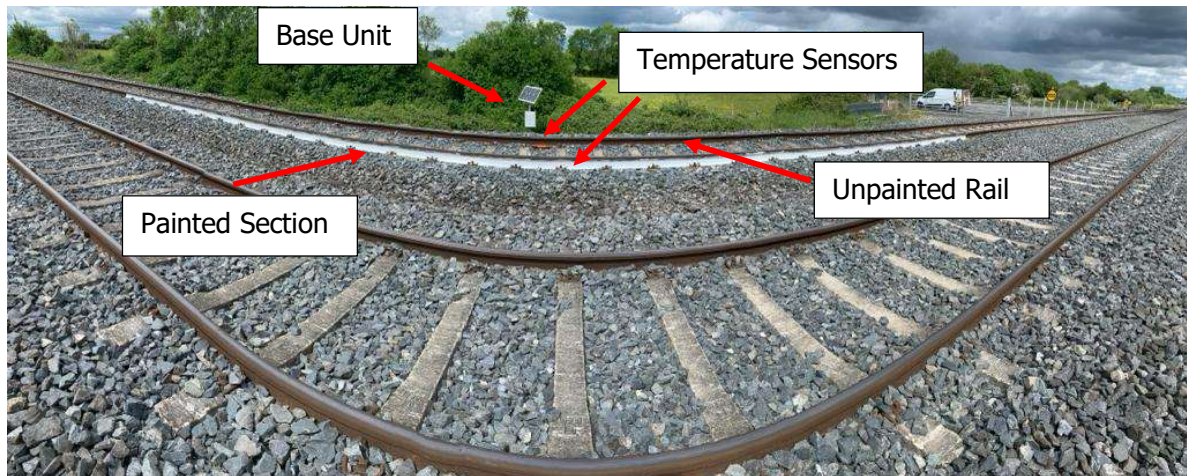


Figure 2: Painting/ Temperature Sensor Set-Up

The testing was commenced on 22-May-2022 and is currently continuing. The temperature measurement was taken using TrenTrace Remote Temperature Monitoring system supplied by Aldorex Irl Ltd. (<https://trentrace.com>) The test site was located at the permanent RTM location for Hazelhatch. A second temperature sensor was fitted, the permanent temperature sensor being fitted to the unpainted rail, the second temperature sensor being fitted to the painted rail. Temperature measurements are taken approximately once every 30 minutes from the foot of each rail. The temperature measurements are not synchronised i.e. they do not occur at the same time.

3.0 Results

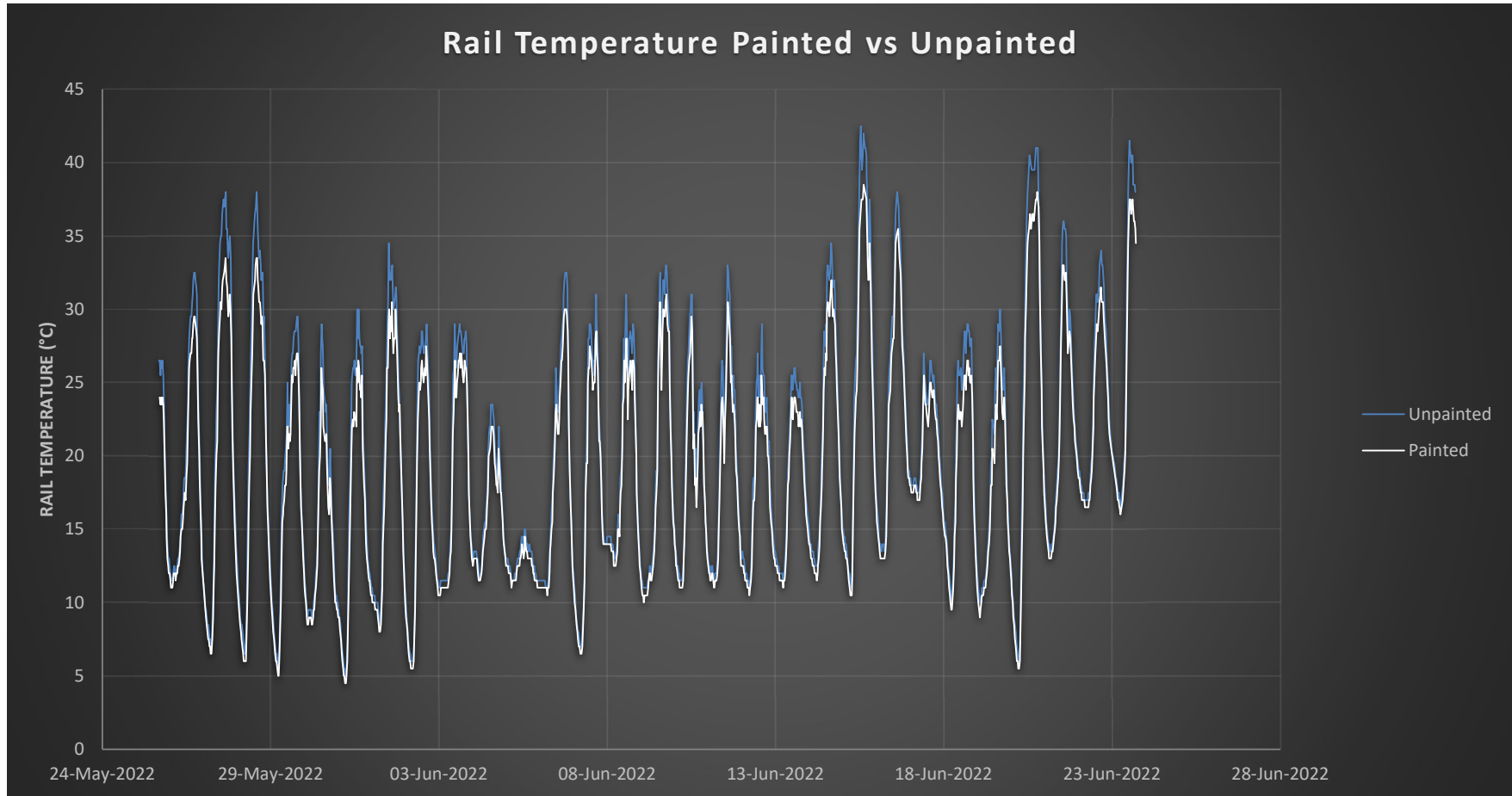
3.1 Weather During Period

During the period under investigation, the weather was mixed with mostly cloudy and wet weather. There were, however, a couple of days where the sun shone and the temperatures rose.

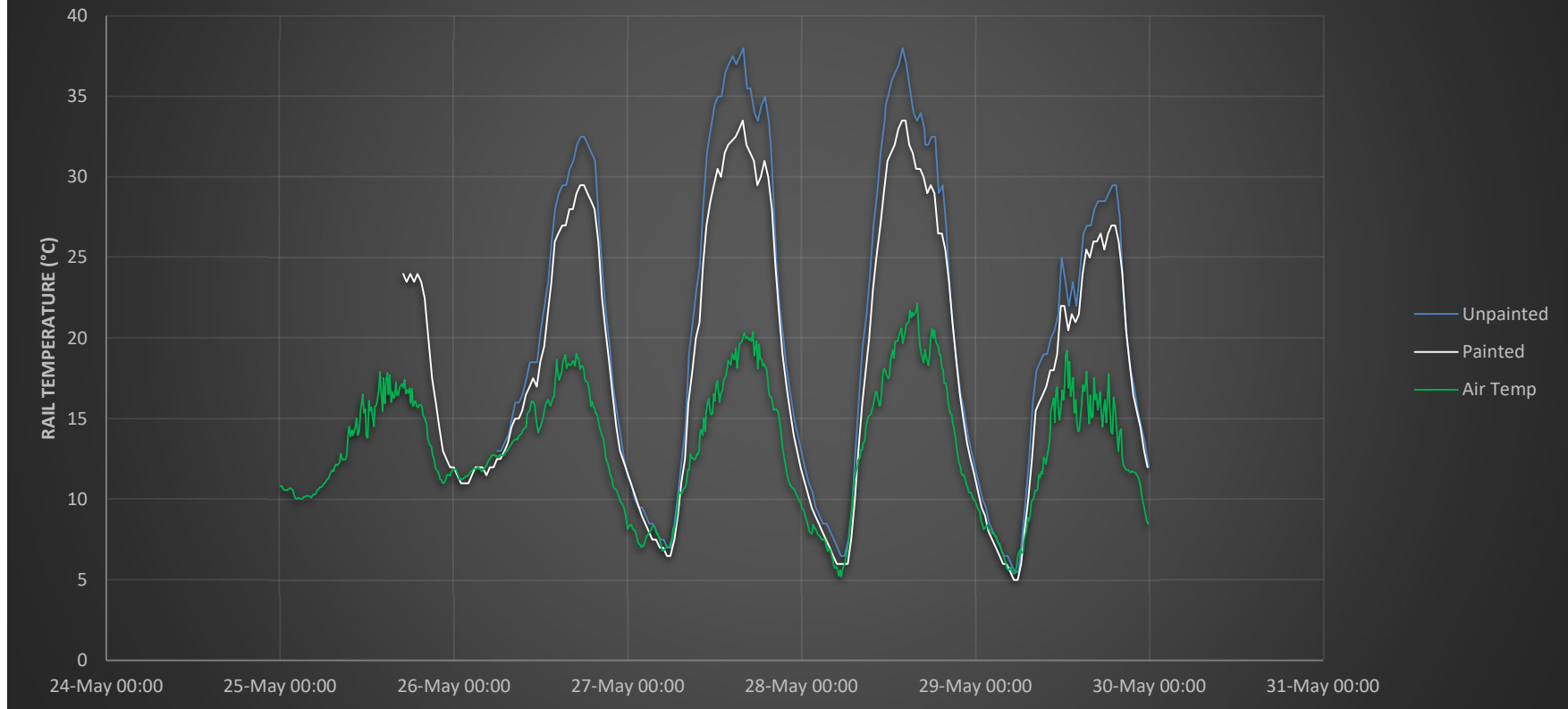
Maximum Air Temperature: 25.5°C

Minimum Air Temperature: 5.0°C

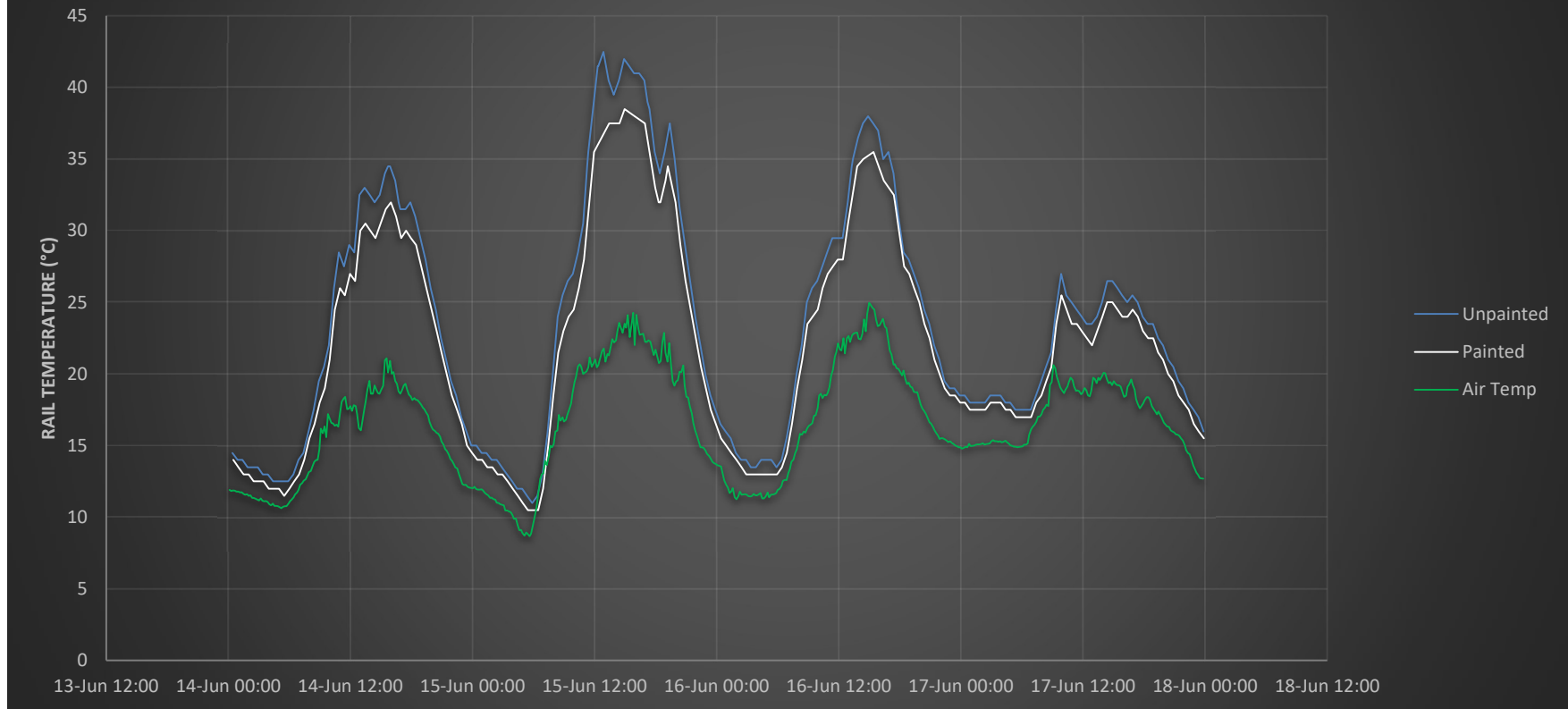
The Air Temperature measurements were taken in Cherryville (32km distance)



Rail Temperature Painted vs Unpainted (Warmer Period) 25-May to 29-May-2022



Rail Temperature Painted vs Unpainted (Warmer Period) 14-Jun to 17-Jun-2022



The first chart displays the temperature of both the unpainted and painted rails over the course of the study. Although it is quite difficult to see temperature differences, it can be readily identified that the difference in temperature between both is of greater significance at higher temperatures. There is only a small difference between the temperature at night. In all cases, the temperature of the painted rail was lower than that of the unpainted rail during the day. At night when temperatures were lower (lowest recorded Air Temperature during the period: 5°C), the difference was quite small (average difference < 1.0°C)

Date	Unpainted		Painted		Difference	
	Min Temp (°C)	Max Temp (°C)	Min Temp (°C)	Max Temp (°C)	At Min Temp (°C)	At Max temp (°C)
25-May-2022	11	29.5	12	24	1.0	-5.5
26-May-2022	11.5	32.5	11	29.5	-0.5	-3.0
27-May-2022	7	38	6.5	33.5	-0.5	-4.5
28-May-2022	6.5	38	6	33.5	-0.5	-4.5
29-May-2022	5.5	29.5	5	27	-0.5	-2.5
30-May-2022	9	29	8.5	26	-0.5	-3.0
31-May-2022	5	30	4.5	26.5	-0.5	-3.5
01-Jun-2022	8.5	34.5	8	30.5	-0.5	-4.0
02-Jun-2022	6	29	5.5	27.5	-0.5	-1.5
03-Jun-2022	11	29	10.5	27	-0.5	-2.0
04-Jun-2022	11.5	23.5	11.5	22	0.0	-1.5
05-Jun-2022	11.5	15	11	14.5	-0.5	-0.5
06-Jun-2022	11	32.5	10.5	30	-0.5	-2.5
07-Jun-2022	7	31	6.5	28.5	-0.5	-2.5
08-Jun-2022	12.5	31	12	28	-0.5	-3.0
09-Jun-2022	11	33	10	31	-1.0	-2.0
10-Jun-2022	11.5	31	11	29.5	-0.5	-1.5
11-Jun-2022	11.5	33	11	30.5	-0.5	-2.5
12-Jun-2022	11	29	10.5	25.5	-0.5	-3.5
13-Jun-2022	11.5	26	11	24	-0.5	-2.0
14-Jun-2022	12.5	34.5	11.5	32	-1.0	-2.5
15-Jun-2022	11	42.5	10.5	38.5	-0.5	-4.0
16-Jun-2022	13.5	38	13	35.5	-0.5	-2.5
17-Jun-2022	16	27	15.5	25.5	-0.5	-1.5
18-Jun-2022	10	29	9.5	26.5	-0.5	-2.5
19-Jun-2022	10	30	9	27.5	-1.0	-2.5
20-Jun-2022	6	41	5.5	38	-0.5	-3.0
21-Jun-2022	13.5	36	13	33	-0.5	-3.0
22-Jun-2022	17	34	16.5	31.5	-0.5	-2.5

From an informal analysis of the results, the trend seems to be that the difference in temperature between the unpainted and painted rails grows as the rail temperature increases. The largest difference between temperatures occurred on 14-Jun-2022 when the unpainted rail reached 42.5°C, the painted rail maximum being 4°C lower.

4.0 Conclusion

From the initial findings, there is definite potential in exploring the technique further. The rail temperature of the painted rail was lower than the unpainted rail during daylight hours. It also appeared that the difference in temperatures increased as rail temperatures increased.

Things to consider for further testing:

- A longer section of rail should be painted e.g. 500m
- Different types of paint should be explored. There are speciality paints on the market aimed at surface temperature reduction although their cost may be prohibitive
- The testing should be continued in the hope that higher rail temperatures can be reached to see if the gap in temperatures continues to grow at higher rail temperatures