# GRAFTON TRACK ANALYSIS

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11 June 2018

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## INTRODUCTION

A comparison analysis of current and proposed track design was undertaken for Grafton track. Major improvements between the existing track and the proposed design were observed in both the jerk and snap. The maximum jerk existing track would be reduced from more than 10 $m/s^3$ to 2 $m/s^3$ while the snap would be reduced from more than 30 $m/s^4$ to 4.8 $m/s^4$.

## TRACK CURVATURE

The following diagrams show plan view of track path showing curvature features for Grafton current (survey data) and proposed design. The curvature combs in the diagrams show the presence of horizontal transition in the tracks. The dimensions shown in the diagrams are in meters. The useful horizontal transition for the existing track was increased from 11 m to 50 m in the proposed design.

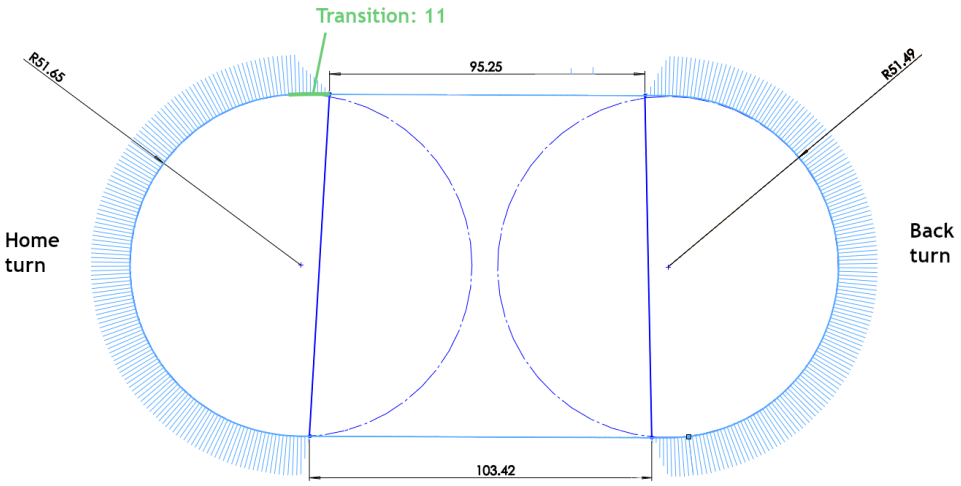


**Figure 1:** Grafton (ref.17021 survey data).

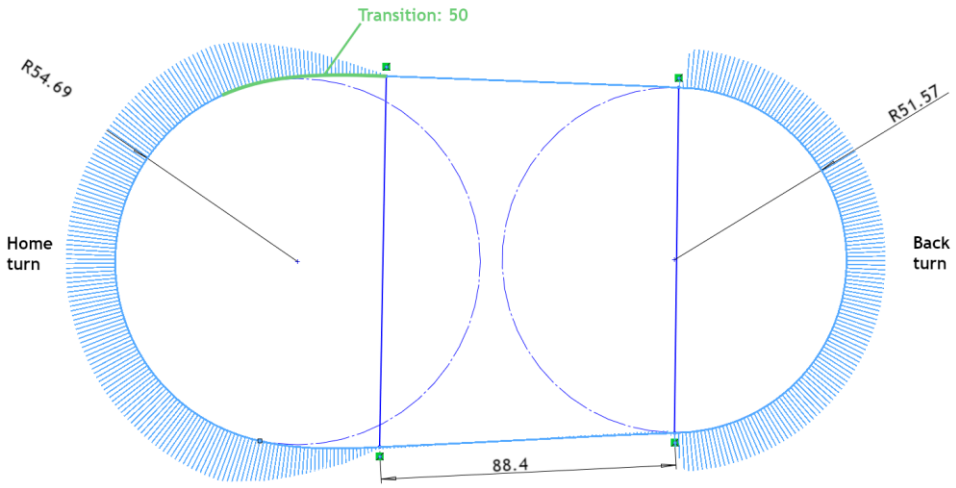


**Figure 2:** Grafton (ref.5142 proposed design data).

## TRACK DYNAMICS

The following graphs compare lure rail track curvature related track dynamics for the circumference of the tracks. Design no. 5142 shows data from proposed track design option as provided by David Allan.

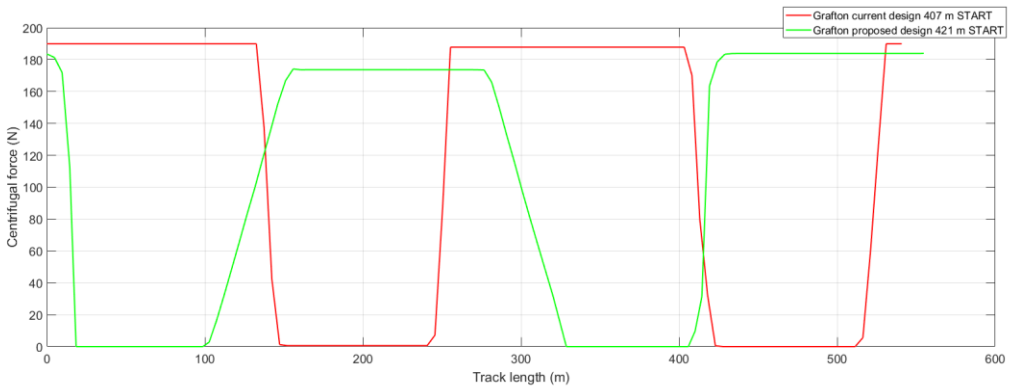


**Figure 3:** Centrifugal force for Grafton track designs.

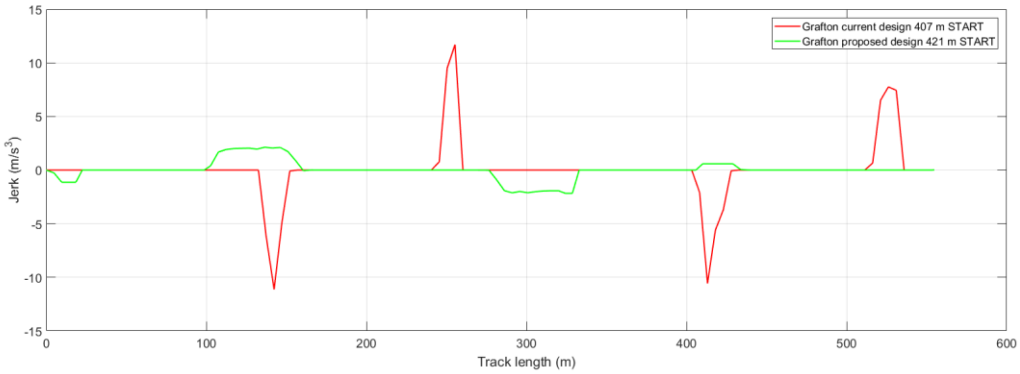


**Figure 4:** Jerk for Grafton track designs.

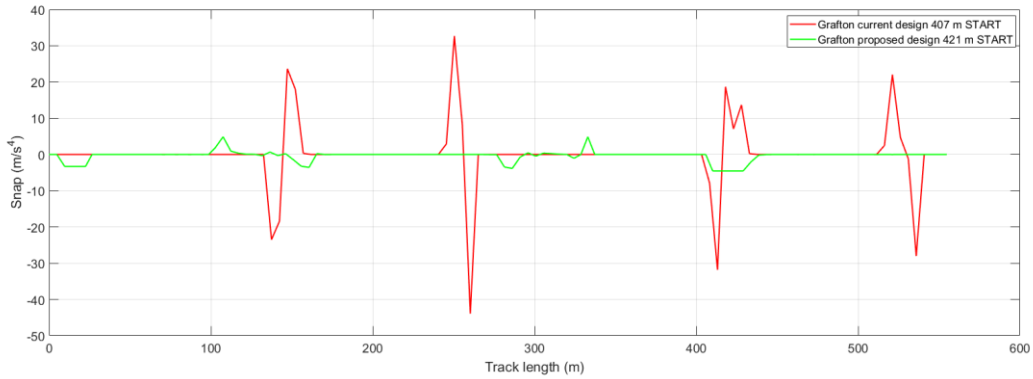


**Figure 5:** Snap for Grafton track designs.

## TRACK VERTICAL TRANSITION

In the current design, surface grade change occurs approximately between the start of bend to the bend apex. In the proposed design this happens from the beginning of horizontal transition to the end of horizontal transition. As a result, the higher percent grade change in the proposed design as shown in the table below is short lived as this occurs in the horizontal transition. Furthermore, proposed surface grade change is less hazardous compared to current percent grade change as this occurs outside of constant bend radius. Finally, the frictional support force from the track on the bend is 33% higher in the proposed design due to maximum bend grade as shown in the table.

**Table 1:** Track surface grade variables.

| Track design | Maximum percent grade change per meter for home turn | Maximum average bend grade (θ) |
|---|---|---|
| **Current** | 0.048 | 4.23 |
| **Proposed** | 0.12 | 5.71 |

## TRACK SHAPE

The following figure shows current and proposed track shapes. As can be seen from the figure limited real estate imposed by surroundings constructions will not allow further modifications to the track.


**Figure 6:** Grafton track satellite view.