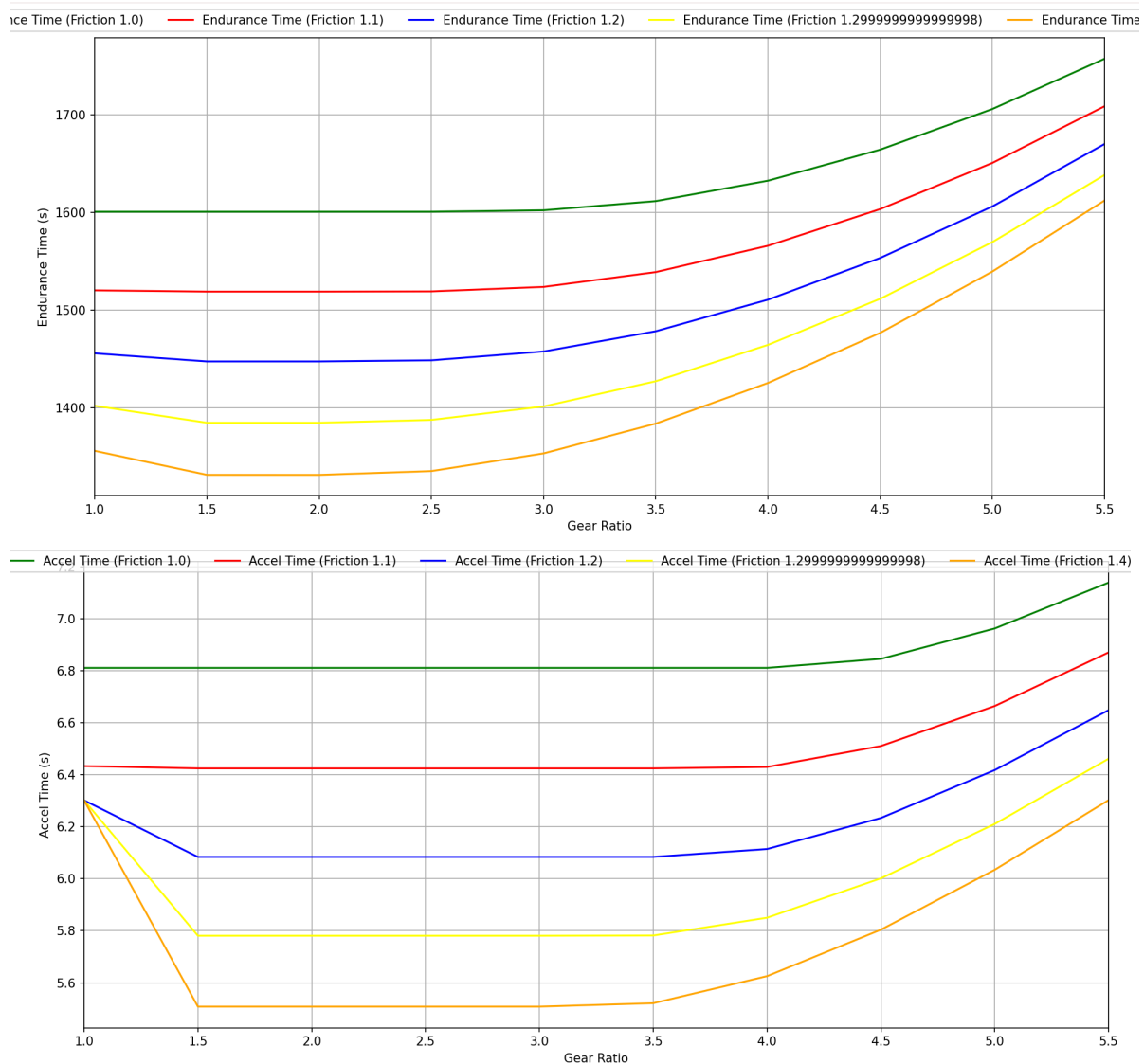


Gear Ratio Summary

The below plots show endurance and acceleration times versus gear ratio, plotted over a range of friction coefficients.

In both plots the same color corresponds to the same friction coefficient:

- Green: CoF = 1.0
- Red: CoF = 1.1
- Blue: CoF = 1.2
- Yellow: CoF = 1.3
- Orange: CoF = 1.4



The locations on the plot where the endurance and acceleration times “bottom out” are the gear ratios for which the car is traction limited. The gear ratio has no effect on the time in this range as lapsim simulates the tires spinning, but eventually gear ratio and time become directly proportional. A higher gear ratio corresponds to a lower top speed, which increases the endurance time.

It should be noted that the endurance time graph is more valuable to consider, as the car is traction limited for the majority of the realistic gear ratios in the acceleration plot.

A higher friction coefficient corresponds to a smaller range of ratios for which the car is traction limited, which physically makes sense. In addition, a higher friction coefficient corresponds to lower endurance times. This also physically makes sense, as the car is traction limited for a smaller portion of time as it accelerates out of each corner of the endurance course.

Theoretically, the gear ratio for endurance is optimized at the point where the line begins to trend upwards from the region of traction limitation. At this point the gear ratio has an effect on the car performance (the car is no longer traction limited), and the endurance time is also minimized.

As can be seen in the endurance plot, for the most realistic sets of friction coefficients, the gear ratio is optimized in the range of 2.75 - 3.0. These findings are relatively consistent with other teams, who run within the range of 2.5 - 3.5. RM26 had an “optimal” ratio of 3.17, but this was assuming a friction coefficient of 1.6. This CoF is towards the higher range of what would be expected. We expect CoF to be within the range of 1.2 - 1.4 for RM28 (per the RM28 json file).