

P11 Bogie Engineering, Design & Analysis

Case Study

BACKGROUND

Late in 2009 KiwiRail commissioned Motovated to engineer a bogie in support of their new Tranz Scenic rail cars. These rail cars were due to be delivered in early 2011 and were to be a significant step forward in terms of ride quality for KiwiRail. As such the requirements for the new bogie's ride, maintainability and durability were high, and the timelines tight. Bread and butter for Motovated!

Bogies are effectively the connection between the rail car (or carriages) and the track. They carry the wheels, axles, brakes and suspension, and isolate the passengers from noise and vibration. As such they were critical to the success of the new cars, especially on the challenging showpiece lines of the TranzAlpine and Coastal Pacific routes.

Adding to the challenge was the need to develop new suspension technologies including a new axle box in support of the tight space constraints imposed by under carriage clearance issues.

SOLUTION

In conjunction with rail specialists Interfleet Technology and KiwiRail's Mechanical Design Group; Motovated went through an extensive design optimisation process to ensure the ride quality and safety requirements were met, all within the tight design constraints required. Once the dynamics were optimised a significant strength and manufacturability exercise was undertaken to ensure maximum life at minimum cost.

Motovated worked closely with the Mechanical Design Group for validation of their stress analyses and KiwiRail's Hillside Engineering Group with respect to manufacturability. Finite Element Analyses (FEAs) were used for validation of the MathCAD stress analyses, including fatigue. The frame was especially challenging due to the extensive welding analyses required, while the axle box presented its own challenges due to the inherent flaws in steel castings.

Motovated then worked with Holmes Solutions to actually physically test their designs, validating the 25 year minimum design life up-front. Strength assured!

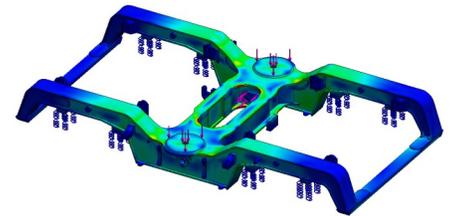
RESULT

The synergy between Motovated, Interfleet, Holmes Solutions, KiwiRail's Mechanical Design Group & Hillside Engineering provided a phenomenal solution to a challenging problem. And they said it couldn't be done here in New Zealand!

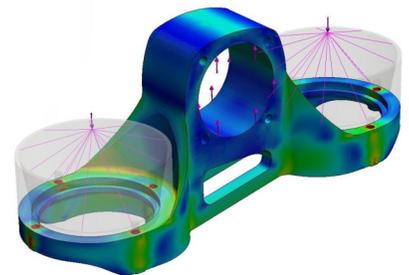
Proof once again that with a good Kiwi attitude, and partnering to bring all of the required skills together, **We Can!**



KiwiRail's P11 Bogie Rendering



Fabricated Frame FE Stress Analysis



Axle Box Finite Element Analysis

“KiwiRail chose Motovated to assist in the design of a new railway passenger bogie. The team are highly-skilled, innovative and practical engineers. They worked through many iterations, continually having to accommodate external and unexpected constraints and boundary conditions. The company is NZ-owned, and it has a definite ethic to support local industry. They have shown without doubt that they were the right choice. Great value!”

Allan Cannell, Project Manager
KiwiRail Mechanical Design Group