

Light Weighting and Communitisation of the 7.5T Axle Beam

By Bharat Forge Limited | Category: Most Innovative Supplier

The front axle beam is a safety-critical component in commercial vehicles. With emission norms changing from BS4 to BS6 and demanding lightweight and fuel-efficient vehicles, Bharat Forge developed technologies to produce lightweight products that result in lower-energy consumption. Product innovation focused on design re-engineering of the front axle beam to make it light, without affecting performance. Using well defined FE Analysis methodology, the team optimized the beam design and achieved a 6.1 kg weight reduction (6%), which was approved and appreciated by TML. The re-engineered beam was also tested at TML.



The Innovation



Overcoming Challenges

Innovation has been the driving force behind Bharat Forge and is applied across every aspect of its business. Its Engineering Team has been working on various projects including developing technologies to minimize carbon footprint and producing lightweight products for engines, transmission, suspension and chassis which translate into lower-energy consumption. The innovation program was initiated during interaction at BFL Technology Day that was held at the TML campus. The Engineering Team at BFL has been using its domain knowledge acquired over the last 40 years in dealing with Global OEMs and Tier 1 customers. This knowledge, coupled with state-of-the-art virtual simulation, 3D modelling and analysis tools along with its own structural durability test lab for the past several years, has developed expertise related to product design re-engineering for light weighting.

Challenge 1: To achieve the weight reduction by maintaining stiffness and strength within defined targets.

The team studied the contribution and impact of the various geometric parameters of the front axle beam on deflection. This sensitivity analysis revealed that the most contributing parameters of the front axle beam in its deflection. Accordingly, those parameters were controlled and achieved the given stiffness and strength targets.

Front Axle suspension assembly



Initial design

Machine weight: 102.7 kg

Optimized design

Machine weight: 96.6 kg

Weight Reduction: 6.1 kg (-6%)



Loads and boundary conditions received from TML on 28/03/2014.

FE Analysis of the existing design was carried out to calculate stresses and deflection, based on which the material removal regions were identified on the beam.

Design iteration process was initiated to meet target weight, stress and deflection ensuring forging feasibility.

8 reviews were conducted between two teams to review design changes and the FEA results along with senior management. This helped to speed up the project.

TML gave feedback on the proposed design modifications. BFL FEA results and TML FEA results were well correlated.

After various iterations, an optimum design was established which had a 6.1kg (6%) weight reduction compared to the TML design and met stress and deflection targets.

A 3D CAD model of the optimized design was shared with TML for review, FE Analysis was conducted using their methodology and feedback.

An appreciation note was received from TML for this innovation.

After TML's design approval, BFL manufactured re-engineered beams and sent them to TML. TML carried out durability validation and observed satisfactory performance and gave the team the following feedback: "The Front Axle Beam has met all the test requirements of vertical endurance and the braking torque test as per DVP. Six samples have been tested through the endurance test and another six samples have been tested for axle brake torque. No further testing of beams is required."

Impact of the Innovation savings

₹16.14 mn