Structural Stress Simulation of a 5,200 Cubic Foot Covered Hopper Railcar Design — BNSF Logistics

"*Finite Element Analysis (FEA) has for decades been the accepted requirement in approving new railcar designs for unrestricted interchange service across North American railroads. Using reliable FEA software is an integral part of our design work process. Ansys Workbench allows us to quickly take existing CAD models and convert them to Finite Element Models that are analyzed based on the structural load case requirements stated by the Association of American Railroads (AAR).*"

Christof Hettiger
Mechanical Engineer **/** EIT BNSF Logistics

In the rail industry, hardware testing is a tedious and expensive process that is frequently restricted to research and development at the Masters and Ph.D. levels. For typical railcar manufacturing, this advanced level of detail is unnecessary and cost inhibitive to entering the market. As more and more railcars are phased out due to service age, there is a continuing demand for new railcar designs to be built. Moreover, freight transit by railcar is favored by many companies due to its low cost per high volume shipment. In lieu of hardware testing, a faster and less expensive method must be used to check the structure of these proposed designs. Consequently, simulation has become the accepted standard for this type of verification.

/ Technology Used

- Ansys Mechanical
- Ansys DesignModeler

/ Business Challenges

A new customer of BNSF Logistics LLC (BNSFL) requested that a stress analysis be performed on their own covered hopper design. When it became clear that significant structural changes would be needed to pass Association of American Railroads (AAR) requirements, the customer requested a larger scope of work beyond FEA verification. Consequently, BNSFL was tasked to deliver both the modified CAD design and supporting stress analysis. Project success hinged on simulation to demonstrate the railcar's structural integrity.
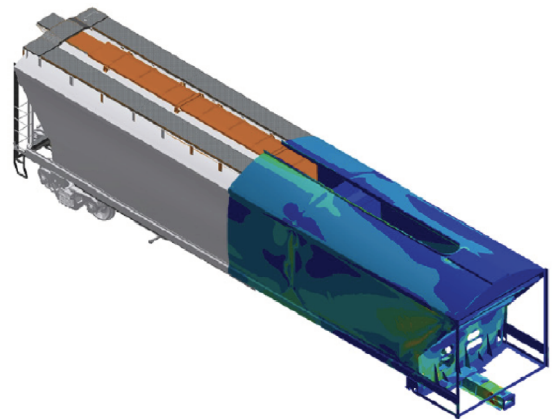
/ Engineering Solution

Together with Ansys, BNSFL was able to deliver a reliable railcar design to the customer. Ansys was specifically chosen as the simulation solution for its following features:

- Ease of model integration from other CAD software.
- Advanced features for linear and nonlinear analysis.
- Reliability in precision and accuracy.
- Industry reputation of being the leader in structural simulation.

/ Benefits

Ansys aided in BNSFL's success by:

- Providing a reliable way of receiving stress feedback from an original CAD model.
- Allowing a quick turnaround process, which helped deliver an on-time drawing package to the customer.
- Presenting an alternative means of verification that is significantly more cost-effective than traditional hardware testing.

CAD Model Conversion to a Finite Element Model.
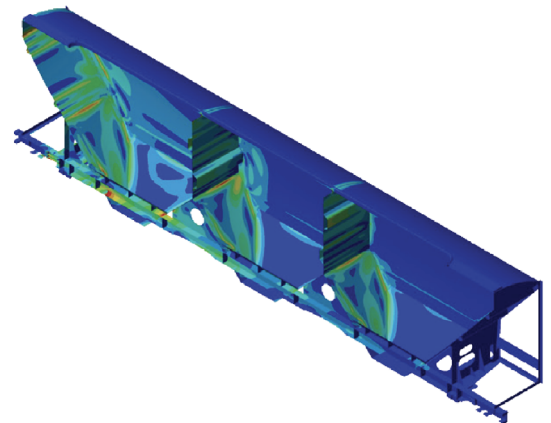
Half Model Railcar Simulating Stress from Impact Loading.

/ Company Description

BNSF Logistics LLC, a registered engineering firm, specializes in railcar design, stress analysis, wind turbine blade transport and cargo securement, providing over 100 collective years of experience in the rail industry.

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