Department of MECHANICAL ENGINEERING
THE UNIVERSITY OF UTAH

Train Cabin Fridge

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STADLER

BACKGROUND

Our team is partnering with Stadler US Inc, recognized for its tailor-made train solutions. The project's centerpiece is the integration of a 56-liter refrigerator into the operator's cabin of a FLIRT (Fast, Light, Intercity, and Regional Train) model. Committing to both industry regulations and Stadler's rigorous standards, our approach leverages CATIA CAD software.

PROBLEM

Stadler received a customer request for the installation of a 56 L fridge within the operator's cabin of a Fast Light Intercity and Regional Train (FLIRT). While this project builds upon an existing platform design, it marks the first instance of a fridge being integrated into this type of train. The primary purpose of this fridge is to offer storage and preservation for food and beverages, enhancing the convenience and comfort for the train operator during their shift.

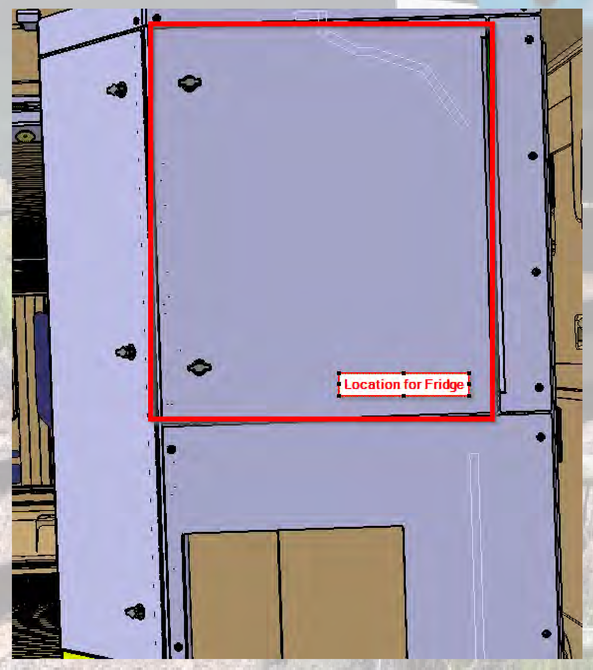


Figure 1: Location for Fridge

FINITE ELEMENT ANALYSIS

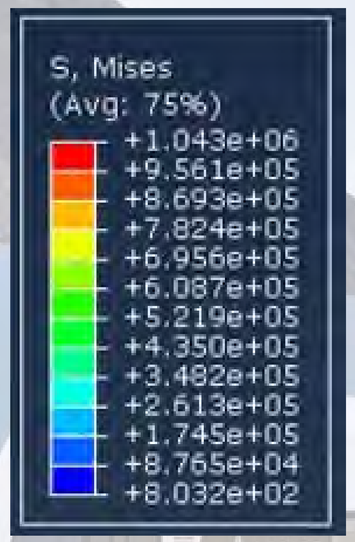


Figure 2: Maximum von Mises stress found in linear elastic FEA model

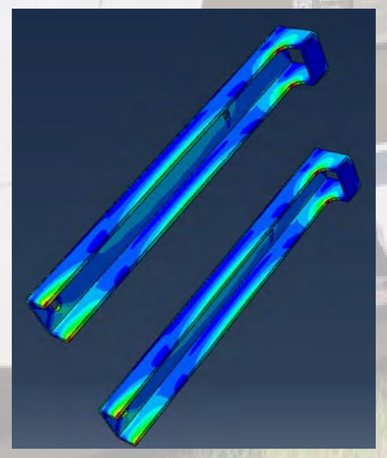


Figure 3: Stress contour for bracketry slats. Highest stress concentrations at ends.

3D analysis of bracketry slats holding up fridge in ABAQUS. A linear elastic, isotropic model made from Aluminum T6-6061 was constructed (no plastic deformation assumed). Applied pressure of 45 Pa simulates fridge resting atop the slats. Slat faces are fixed at both ends and the mesh consists of tetrahedral elements. The maximum von Mises stress the slats can undergo is 1.043e+06 Pa. A subsequent failure analysis was conducted by hand on a section of one of the slats using the Goodman failure criterion. The element is modeled as a bar with centered hole in the middle and notched edges. Factor of safety is found to be 15 (n=15) and the load at failure is 347 MPa.

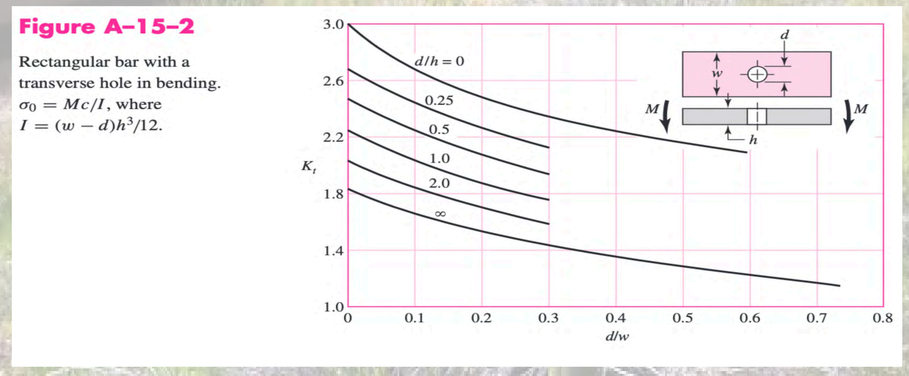
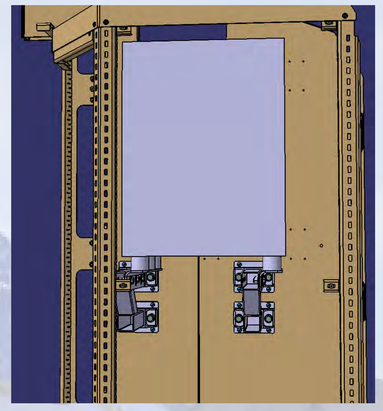


Figure 4: Assuming a section of a slat looks like the above, one can gain Kt factor, used in calculating the mean and alternating stresses for the Goodman line equation.

*Taken from Design of Mechanical Elements: Dr. Bart Raeymaekers

FINAL DESIGN



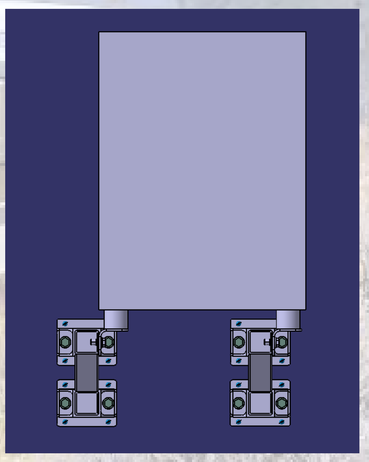


Figure 5 & Figure 6: Fridge with Brackets

CONCLUSIONS

The project was executed with a keen eye on cost-effectiveness, minimizing the impact on regular train operations, and adhering to Stadler's rigorous quality standards. Overall, the addition of the refrigerator has enhanced the comfort and convenience for train operators during their shifts, which is anticipated to potentially improve job satisfaction and operational efficiency.