

Public summary

This Bachelor's assignment focuses on improving the design of the metal casing used for the wooden storage crates at BOX-it-up. The primary issues identified were the difficulty employees faced when loading the casing into trucks due to its height, and the tearing of the casing when filled and lifted by a forklift. Additionally, the company expressed a strong interest in having the casing insulated. This would allow for a filled casing to be placed outside for a longer period of time.

The research question guiding this project was: How can the metal casing of the wooden storage crates used by BOX-it-up be redesigned to improve efficiency, safety, and reliability in transportation? To address this question, a research phase was conducted, involving stakeholder analysis, equipment analysis, and an investigation into the Z-Box, which is a storage box made by Universal Storage Containers, as well as an investigation into the force applied to the stability bar, which prevents the casing from tipping over when picked up by a forklift. Observational studies and interviews were also conducted, leading to valuable insights, such as when the casing is hardest to handle and how the box is transported. This research was then used to create requirements and design ideas. Some of these design ideas were refined into concepts and detailed designs. The concepts in question include a thicker stability bar, curved brackets, a leaflet, ventilation, insulation, and dimensional changes.

The thicker stability bar prevents the forklift slot from failing, enhancing safety and reliability without any drawback in efficiency. During the research phase, it was concluded that the force on the stability bar would be 9,200 N. According to FEM simulations in SolidWorks, the old stability bar could handle this force with a safety factor of 2 for the welds, however, the force would exceed the yield strength. The redesigned stability bar can handle this force with a safety factor of 5 for the welds and a safety factor of 2.5 for the yield strength.

The curved brackets aim to make loading the casing into the truck more efficient without compromising reliability and safety. For this, a new layout of the truck was designed during the concept phase, and specific parts were designed during the detailing phase.

The leaflet, located on the door of the wooden crate, aims to establish a better communication method for the customer on how to fill the crate. This should enhance the reliability of the service because a better filled box is less likely to damage the items inside. Furthermore, it should increase safety and reliability, as the box should be easier to handle.

The insulation and ventilation could decrease moisture and therefore the chance of water damage and mold to the customer's items. This would make the service more reliable. The dimensional changes are necessary to account for the increased thickness of the walls of the metal casing due to the insulation. Furthermore, the height of the case is crucial when fitting the casing into the truck. During this project, a formula was developed that estimates the optimal height of the metal casing.

At the end of the project, these concepts were put into a final design. Furthermore, a discussion and recommendations section was made which outlines all the uncertainties in this project and discusses how to address them.