Redesigning the StowMover

Public summary

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This Industrial Design Bachelor's thesis was provided by self storage company Salland Storage. The assignment is to redesign a self storage trailer, called the StowMover. On top of the StowMover, a container can be placed. This container is called the StowBox. Together with the StowMover, it forms the modular self storage concept of Salland Storage.

The concept allows customers to drive the StowBox home with general driver's license B. At home, the customer can load the StowBox like any other moving trailer. Back at Salland Storage, the StowBox can be lifted off the StowMover and stored inside the facility. The StowBoxes are stacked three high, optimally using the space inside the facility. When the customer needs the StowBox again, it can simply be placed on the StowMover, so it can be driven to the (new) home.

The current StowMover is designed and manufactured in 2012. In order to improve the handling for the employee and load capacity, it needs to be redesigned. With the current StowMover, it is quite difficult and time consuming to place the StowBox onto the StowMover. It is essential that this gets improved with the redesign. When increasing the load capacity, besides allowing the customer to load more content, the safety will increase as well. Also, there are no manufacturing details available for the current StowMover. If Salland Storage wants to expand the number of StowBoxes, or sell the StowBox concept on its own, it is important that a new StowMover can be constructed. This is why, together with improving the aforementioned points, it is important that a solid and manufacturable trailer is developed, defining all important parameters.

The research question that guided this thesis is: "How can the StowMover be optimised, either in design, material or configuration, to increase the effectiveness of coupling to the StowBox, while maintaining low weight, low costs and road safety?" A background and relevance research resulted in a picture of the current situation, as well as a basis in trailer design itself. With this information, a study on the frame was performed, which resulted that a steel V-shaped frame is the safest and most efficient in terms of material use. Although the usage of steel results in a heavier frame, aluminium is not durable enough for the frequent and variable usage of the StowMover.

To ensure road safety, requirements made by the RDW (Dutch road monitoring organisation) and ball load calculations have been performed. The RDW requirements constrain sizes and make sure the trailer will be accepted on the road. The ball load has been optimised to ensure it falls within the recommended values, resulting in a stable trailer. This defined the axle placement and the main dimensions.

The first thing that got tackled in the design phase was an optimised StowBox placement on the StowMover. The StowBox has four feet in its corners, which can be used to guide the StowBox onto the StowMover. Funnels and ramps have been designed to ensure the StowMover gets slotted in its correct position, simplifying the alignment for the employee. Figure 1 shows the funnel for the StowBox feet, whereas figure 2 shows the general placement of the StowBox onto the StowMover.

Figure 1 – Funnel to guide the StowBox onto the StowMover

Figure 2 – StowBox on StowMover placement

Then the rough frame was designed, defining the main dimensions. This rough design was detailed with lighting placement and wheels which define the ride height. The frame itself was then finalised, choosing a generally available material which is easy to work with and meets the safety factor requirement. The safety factor ensures the frame can handle unsuspected load cases without failing. Finally, the support legs and mud guards are made to fit the final frame dimensions.

After evaluating the final design, it concludes that designing a lighter StowMover with a similar or higher load capacity is not possible without significantly reducing the safety. To ensure safety and a high load capacity, the new design is constructed from steel and not aluminium. Although the new StowMover is heavier than the old StowMover, it is capable of carrying up to 25% more weight. With this increased load capacity, the objective has been reached.

Figure 3 – The final StowMover design