In manually operated warehouses, the need for proper racking protection is high. When a forklift - often weighing two to three tonnes - accidentally collides with a racking column (often referred to as ‘upright’), serious damage can be inflicted upon the racking structure. A ‘small’ dent of only a couple of millimetres can already cause the upright to buckle under the load it is carrying. Consequently, entire pallet rack structures can collapse, forcing the warehouse to temporarily shut down and possibly inflicting critical injuries on warehouse employees.

NEDCON is a company that specialises in the design and development of racking structures and corresponding upright protectors. One of these products is called the ‘Stiffener’, a V-shaped steel profile mounted directly onto the upright. The Stiffener is meant to mitigate the impact forces caused by a collision without damaging the upright. However, recent feedback has proven that there are some points of improvement for the Stiffener. For instance, ease of installation and replacement. Also the capabilities in terms of impact energy will be examined.

Because of this feedback, NEDCON has expressed the need for a redesign of the Stiffener. Since the focal points of the redesigning process will be the structural endurance and the ease-of-use of the Stiffener, the main research question is: *“How can the design of NEDCON’s Stiffener be improved with regards to safety and maintenance?”*

In order to properly redesign the Stiffener, a traditional design approach is followed. Starting off with an elaborate analysis phase, the strengths and weaknesses of the current Stiffener are carefully examined, as well as the needs and wishes of various stakeholders regarding the points of improvement of the Stiffener. The methods used in the analysis phase include stakeholder interviews, the analysis of design standards and an impact test. The analysis phase concludes with the formulation of a list of requirements, which together span all the demands and wishes for the redesigned product.

Consequently, multiple concepts for the redesigned Stiffener are developed. A morphological diagram is used in the creation of multiple partial design solutions, which each aim to improve one specific aspect of the Stiffener. These partial design solutions are then combined into six different concepts. To decide on a concept direction, visual prototypes are exposed to the various business units of NEDCON in an expert review. The various stakeholders thus get the opportunity to voice their opinion about the concepts.

After a decision has been made, the phase of concept detailing and testing ensues. Through two iterations, concepts are improved and evaluated according to the list of requirements. While the first iteration comprises of three radically different concepts that are tested through an FEA simulation and a prototype impact test, the second iteration consists of two concepts very similar to one another. The end result of the last phase is this set of concepts proposed for the redesign of the Stiffener.

The analysis phase confirmed the need for easier mountability and replaceability of the Stiffener, as well as the need for proper technical documentation of the Stiffener's capabilities. After an elaborate concept development phase and multiple detailing iterations, which included the evaluation of the concepts through the testing of high-fidelity prototypes, the end result is a Stiffener with significantly increased ease of installation and removal.