Bulk materials such as iron ore transported by bulk carriers are commonly unloaded by the use of grabs. The unloading process is time consuming and increasing the unloading capacity is of big importance for terminals. A validated co-simulation developed by the TU Delft in cooperation with Nemag enables to test grabs in the virtual environment. In practice a variation in unloading capacity is seen, due to dynamic operational conditions, such as different crane operators and bulk surface irregularities. To improve grab design the influence of operational conditions on the unloading capacity is investigated. Based on those results a design modification has been proposed and showed promising results.