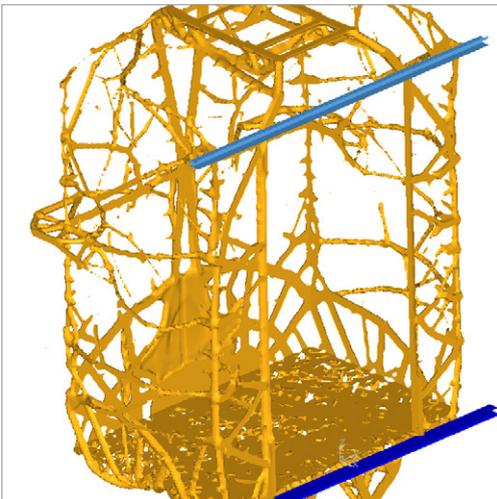


# case study

## ThyssenKrupp Elevator

### Developing a Revolutionary Elevator System for Tall Buildings

Traditional cable pulled elevators are not able to travel more than around 700 meters meaning that for modern skyscrapers, passengers need to change elevator to reach the top. ThyssenKrupp Elevator's wanted to develop an elevator which made use of electro-magnetic drives, allowing them to move away from the restrictive cable design and enabling the elevators to move horizontally as well as vertically. The new 'MULTI' design concept brought its own challenges, chief among these being the fact that the system would not be able to carry as much weight as a traditional elevator. ThyssenKrupp Elevator wanted to explore ways to ensure that the new design was as lightweight as possible in order to maximize the loading capacity of the cabins.



## solution

Altair ProductDesign developed a three stage approach to redesign the supporting structure of the cabin to find a minimum mass solution that didn't compromise on performance or safety. In the first stage, the team performed a topology optimization study using OptiStruct, the design optimization solution within Altair's HyperWorks suite. The team specified the cabin's 'design space' and combined it with data on the expected loads that the elevator would be subjected to during use. OptiStruct suggested areas of the structure where material could be removed which was then interpreted by Altair ProductDesign into a manufacturable design. In the second stage, the team was able to perform sizing optimization where the technology would explore the thicknesses of the cabin's wall facing sheets and the foam core within. Profile sections and sheet thicknesses were optimized in order to find the ideal layout for different material combinations.

The third stage of the project involved exploring new materials as ThyssenKrupp Elevator wanted to investigate the feasibility of using carbon fiber for the cabin's walls. Altair ProductDesign developed an optimization study that would find not only the ideal thickness of the composite material, but also the ideal fiber ply shapes and lay-up orientation of each layer. These processes were applied to two concept designs created by ThyssenKrupp Elevator known as the 'BackPack' and the 'SideGuide', with the aim of providing insight into the best system to continue to develop.

## result

The weight reduction project produced some impressive results. The concept optimization process on the Backpack structure, in combination with the sizing optimization of the sandwich panel walls, managed to produce a cabin that was 42% less than the target weight. If the walls were constructed from carbon fiber, it would be possible to go even further, down to 56% below target.

The SideGuide concept also saw weight savings, 16% lighter than target using traditional materials with the potential to go to 33% under target using carbon fiber. The weight savings gave ThyssenKrupp Elevator additional confidence in the electro-magnetic concept as a practical alternative to the cable system. Motivated by the positive results from this project, ThyssenKrupp Elevators is continuing development of the Backpack concept. The design has now advanced for further testing and prototyping.