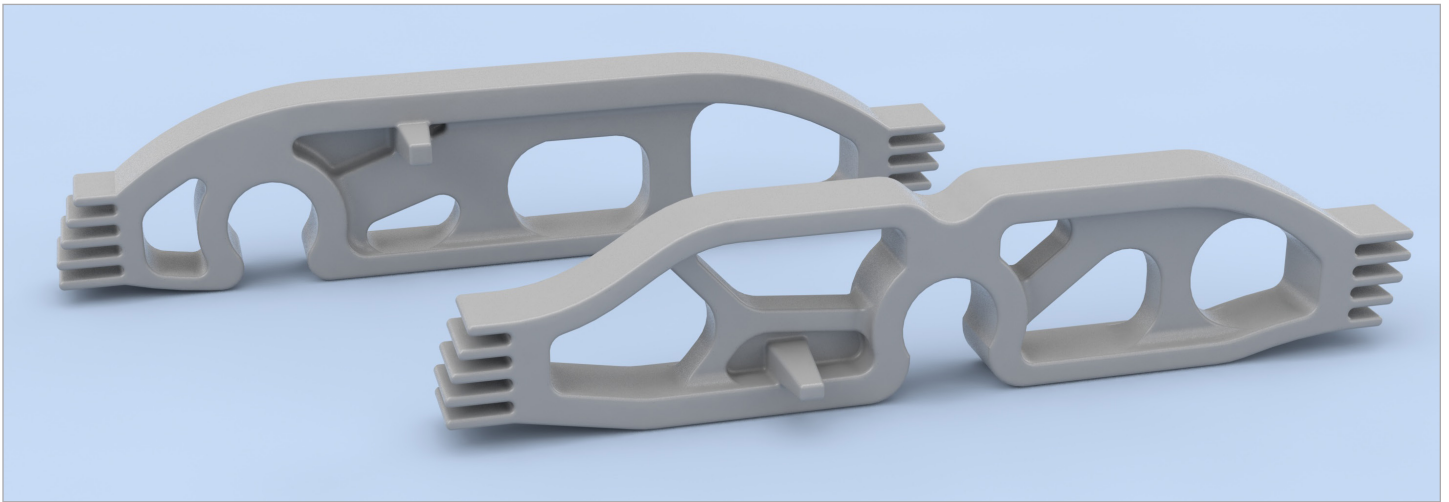


## Minimizing Material Use for an Innovative New Building Product



# Re-Loc

### Key Highlights

#### Industry

Construction

#### Challenge

Minimize manufacturing costs and bring part to production level

#### Altair Solution

Design optimization study conducted to minimize material use. Numerous enhancements to product functionality.

#### Benefits

- Up to 55% reduction in material
- Production costs halved

**In the construction industry, speed and cost are both vital to the success of any new building project. Contractors are often under very tight deadlines to complete their specific task and any delay can cause significant knock-on effects to the next step in the construction process.**

The walls of many modern building are made using concrete bricks (often referred to as breeze block) that are built up in consecutive layers before being covered by a more attractive layer of brick. These concrete blocks are reinforced with steel bars that are cemented inside the bricks' cavities for additional strength.

The positioning of these bars play a crucial role in defining the overall strength of the wall. Placement must be done before the concrete can be poured into the cavities

meaning that they must be held in place during the construction and setting process.

Re-Loc is a UK based company that developed a new product to help to accelerate this process. The Re-Loc product is a clip that fits tightly inside the concrete brick's cavity and attaches to the steel bar, holding it securely in place. The team had already developed a rough design and proved that it could perform its intended job, but problems arose when it came to the manufacturing cost of the product.

With potentially many hundreds if not thousands of the clips being required to fit inside a single structure to hold the bars in place, the product had to be very cheap to produce and easy to use. The potential cost of Re-Loc's initial design meant it was not feasible for mass production.

# Re-Loc Success Story

**"With the aid of Altair ProductDesign, the optimization process has provided Re-Loc with a secure future. Testing, design modifications and optimization puts my product ahead of competitors by making it the best that it can be. The product can be proven a success even before manufacture, saving time and money. Many thanks to the team at Altair."**

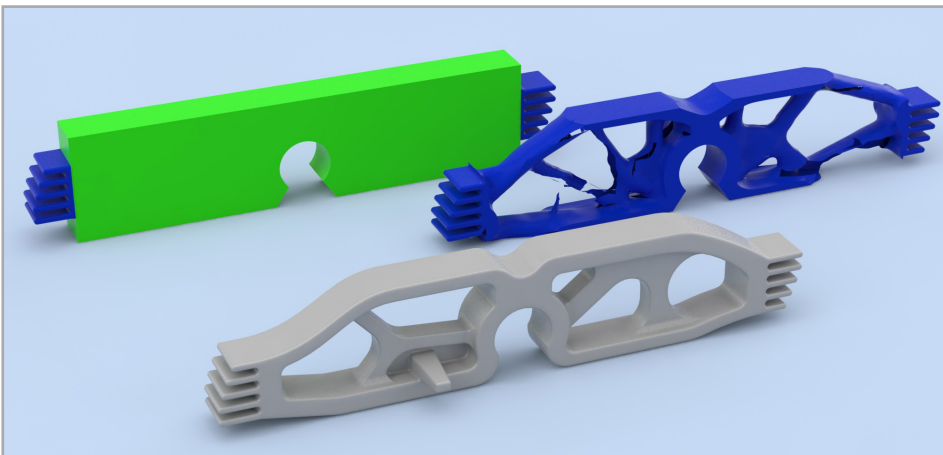
**Robin Holthusen**  
Owner  
Re-Loc

Re-Loc approached Altair ProductDesign to explore ways of reducing material use and cost from the part and to bring the design to a production level which could then be made into a prototype. In addition, Re-Loc was open to any design improvements that Altair ProductDesign's engineers could suggest to make the product perform as well as possible. Two versions of the product were targeted, each holding the bars in different locations within the brick for use in different types of load bearing walls.

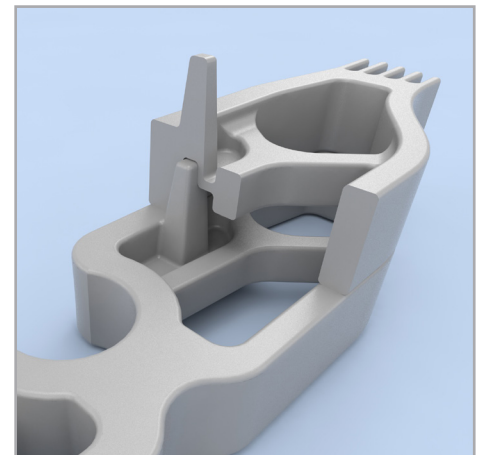
Re-Loc had a number of objectives that it wanted to meet when redesigning the product. The part had to be sufficiently stiff to maintain the position of vertical and horizontal bars relative to the inside surfaces of the hollow blocks. It had to allow the concrete to be poured through or around itself and must be able to endure all the environmental aspects (humidity and temperature) during use.

Altair ProductDesign's first task was to perform a study to explore materials for

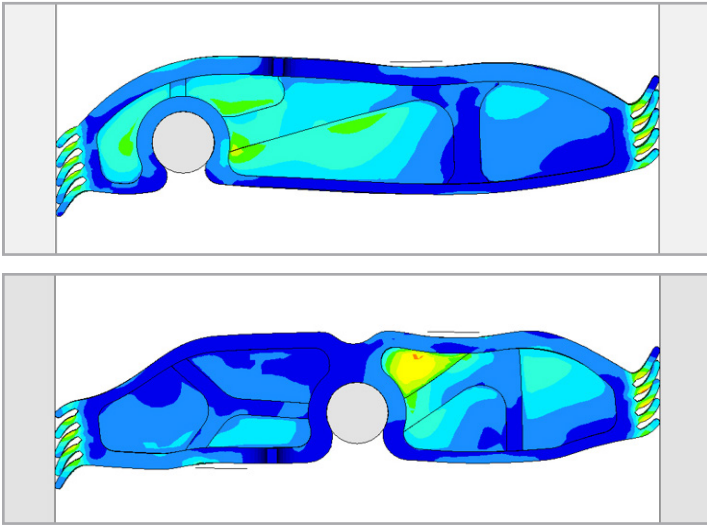
the part which needed to have adequate stiffness and strength properties as well as being suitable for low cost, high volume manufacturing. Metals and ceramics were discounted due to cost and wood (molded pulp) was found to be unsuitable due to the extra storage considerations required by a product that could not get wet. The team found that an injection molded polymer or foam would be the best options for consideration as they were both low cost and could achieve the required strength requirements.



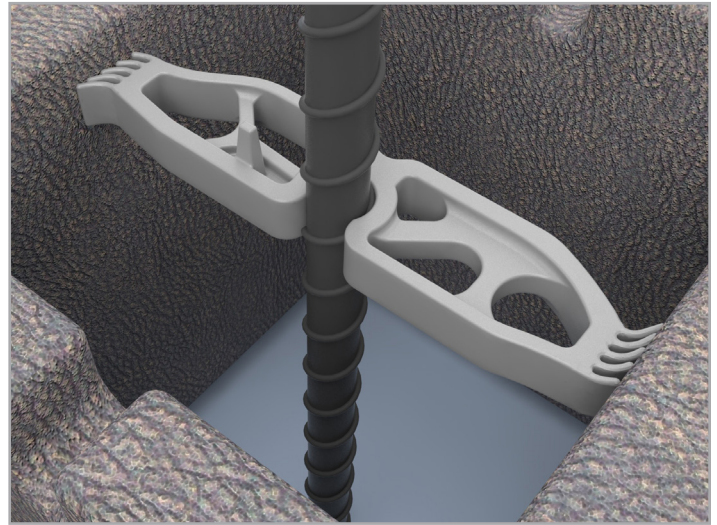
*Optimization process showing the design space (green), topology result (blue) and the final interpreted design (grey)*



*The Re-Loc is stackable to save on storage space*



*Simulating the stress distribution on the two part variations during installation*



*Re-Loc fits inside a brick cavity and holds the reinforcement bars in place*

The team's next step was to perform a dynamic simulation analysis on the existing design to discover the current performance levels to help benchmark any new design concepts developed. The product works by clipping against the steel bar, lowered into the cavity and being twisted against the side brick's walls by hand. This whole positioning event was analyzed using Altair's HyperWorks suite of simulation tools.

With the performance data from the original design captured, Altair ProductDesign's next task was to perform a topology optimization study on the component to investigate ways of improving the design and removing material. Altair's engineers built a finite element model of the part in HyperMesh and brought it into Altair's design optimization solution, OptiStruct. The part was divided into sections that could not be altered by the software (the 'fingers' which make contact with the brick's walls and the clip which attaches to the bar) and areas that could (the volume around these areas). OptiStruct was able to use this information along with data on the load cases that the part would undergo during use, to suggest a design that

placed material where it was needed while removing it from areas where it was not.

The topology results were interpreted back into a detailed CAD design by Altair ProductDesign and the team applied their experience to suggest further enhancements to the overall design to maximize performance. These changes included making the member width thicker, increasing the part width from 19 to 25mm to improve flexion stiffness, changing the finger's center line to align with the center of the bar to improve load distribution and increasing the tightness of the fit around the bar so it adds to the overall stiffness of the product.

A more fundamental change involved modifying the length of the fingers to improve contact distribution throughout the range of brick dimensions and reducing the gap between each finger to help prevent buckling. Finally, the team identified a modification that could save space when the parts were in storage by allowing the parts to slot together and stack on top of one another instead of being distributed loose. The design was then analyzed to ensure it

would work as required when being installed and the results compared against the original design.

The process of optimizing the design, making additional modifications and running analysis, was repeated for the part that held the bar in the alternative position.

The final design produced by Altair ProductDesign successfully met the performance targets set at the beginning of the project. The new part now uses 45%-55% less material than the original design, saving as much as half the material costs. The team's involvement in selecting materials, analyzing performance, optimizing material use and suggesting additional enhancements has assisted greatly in turning the Re-Loc product from a great idea into a highly engineered, manufacturable, high performance product.

**Find out more at:**

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## About Altair

Altair empowers client innovation and decision-making through technology that optimizes the analysis, management and visualization of business and engineering information. Privately held with more than 2,200 employees, Altair has offices throughout North America, South America, Europe and Asia/Pacific. With a 30-year-plus track record for high-end software and consulting services for engineering, computing and enterprise analytics, Altair consistently delivers a competitive advantage to customers in a broad range of industries. Altair has more than 5,000 corporate clients representing the automotive, aerospace, government and defense, and consumer products verticals. Altair also has a growing client presence in the electronics, architecture engineering and construction, and energy markets.

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## About Altair ProductDesign

Altair ProductDesign is a global, multi-disciplinary product development consultancy of more than 800 designers, engineers, scientists, and creative thinkers. As a wholly owned subsidiary of Altair Engineering Inc., this organization is best known for its market leadership in combining its engineering expertise with computer aided engineering (CAE) technology to deliver innovation and automate processes. Altair ProductDesign utilizes proprietary simulation and optimization technologies (such as Altair HyperWorks) to help clients bring innovative, profitable products to market on a tighter, more efficient time-scale.

[www.altairproductdesign.com](http://www.altairproductdesign.com)

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## About HyperWorks

HyperWorks is an enterprise simulation solution for rapid design exploration and decision-making. As one of the most comprehensive, open-architecture CAE solutions in the industry, HyperWorks includes best-in-class modeling, analysis, visualization and data management solutions for linear, nonlinear, structural optimization, fluid-structure interaction, and multi-body dynamics applications.

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