Redesign of Drywall Systems

Public Bachelor Thesis Summary

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Summary

The increased need to conserve material and energy resources, as well as growing concern about environmental concerns and economic uncertainty, have prompted minimalist approaches to architecture and engineering. This introduced a new requirement for lowering the used building materials and elements to the bare minimum. When analysing a building's total material inputs, it is feasible to infer that interior partition walls contribute the most to material inputs when compared to other non-load bearing structural elements. Another point to note is that many building designs are not adaptable to changing lifestyles and household composition.

The usage of non-constructive metal stud partition walls (Figure 1) is widespread in finishing construction. They are made of metal studs to which plaster board is fastened. Tape and plaster are used to finish the seams and screw holes. The ultimate effect is a quick and cheap construction and more importantly a clean, flat wall.
Nonetheless, this solution is not fully circular. Every year, hundreds of buildings in the Netherlands are demolished or changed. Only the metal studs from the partition walls are salvaged as scrap metal; the rest is construction waste. Because of the finishing, the screws are no longer accessible, implying that the wall cannot be disassembled to its original components and materials. There are technical possibilities. Given the enormous number of partition walls, the housing issue, and the numerous interior building transformations, a successful solution will have a significant influence.

This research was done with the cooperation of Saxion Industrial Design Research department, Obimex B. V. and Wordlenig Design Studio. Obimex as being the distributor of numerous brands of gypsum panels and drywall components. Contributed to this research by sharing their valuable experience and knowledge. In addition, Saxion Industrial Design Research Department aided with the Life cycle analysis conducted during this thesis. Lastly, Wordlenig assisted with the application of design thinking and methodology in the investigation of the research question.

In order to investigate the research question; *"How can the partition wall systems be redesigned to increase circularity?"* a thorough analysis of the current product and stakeholders was conducted.

Upon first investigation It was discovered that gypsum currently had a lot of problems with recycling and disposal. Hence, at first the focus was on getting the gypsum panels to be reused more. Following the conclusion of the initial investigation, a surface level Life Cycle Analysis was conducted. As a result, it was discovered that the metal studs receive a zinc coating that has a high negative impact on the environment. Hence, the importance of reusing the metal studs has increased as a result of this finding. This phase was concluded with a list of requirements and potential pathways for ideation.

After concluding the analysis phase, a detailed ideation was conducted on each component of the drywall. Through regular meetings with Obimex and evaluating concepts against the requirement list, the final concepts were chosen to be developed in more detail. These concepts were then modelled using Solidworks to get some insights before spending materials and time prototyping them. This proved to be a very efficient method in spotting possible problems before they were materialized. Hence, some concepts were also filtered during this phase. Lastly, the final concepts were prototyped in the metal workshop of University of Twente and preliminary tests were conducted before the final testing was done. Through some trial and error and scientific testing methods with control groups. Components for the final testing were then created as a result of this process. Lastly, a whole 2-meter wall (Figure 2) was created at the testing facilities of Obimex.

Although due to time constraints the user testing was not fully done, results achieved with the final testing were promising. A full wall construction was achieved, few other minor problems were spotted. The answer to the research question was found as removing destructive fastening and construction methods from the overall process. With the addition of special new components, the whole wall could be disassembled, and the components could be reused, yielding a fully circular drywall product.

Figures

Figure 1 - Metal stud wall system

Figure 2 - Final Result