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Royal HaskoningDHV Company case for Joint Interdisciplinary Project

Design and construction management of earthquake resisting buildings for Groningen with recycled materials.

1 Introduction

Royal HaskoningDHV has been making a world of difference in people's lives since 1881. In this spirit, we have been working on the earthquake project in Groningen for more than three years. Hundreds of structures in North-East Groningen have been provided with recommendations for reinforcement measures. Often these measures are very costly. The structures are a lot safer, however they are still constructed with masonry. This means that damage like cracks are unavoidable.

Figure 1: Building in Groningen strengthened with wooden frames

Please note, we are a trusted advisor for CVW and that therefore we want to offer several solutions from an advisory point of view. Instead of retrofitting the building, one could also design a new building and demolish the old one. We drew the following set of requirements for your assignment.

- The new building must be able to withstand an earthquake of 5.0 on the Richter Scale without showing significant damage.
- The new building needs to be CO2 neutral.
- The new building must have a high architectural value.
- We want to primary make use building materials that come from other buildings in the area. We have a large data set of objects. You can use this data to select your components.
- How do we insure the quality of the reused building materials?
- We need to plan the logistics. How do we make sure the elements get from one place to another? What is the maximum size? Do we need a temporary storing point?
- Create a digital twin of the new building so we can measure the performance during future earthquakes.

Key words: earthquake design, architecture, logistics, digital twin, urban mining, co2 neutral

2 Objective

The objective is to create a preliminary design of at least one house. Include all the requirements stated above. Write a plan how this can be scaled up for a thousand buildings.

3 Scope

The project location will be determined together with the students. You could work at our headquarters in Amersfoort or our office in Rotterdam. Or perhaps you want to work in Delft one or two days a week. This can all be discussed.

Time scope: this project will start on Monday September 3rd 2018 and finish at Friday November 9th 2018. For now, this is a stand-alone project.

4 Student selection

Students from the following faculties can participate in the project:

- Civil Engineering and Geoscience
- Architecture
- Technology, Policy and Management
- Mechanical. Maritime and Materials Engineering

5 Business coach

Koen van Viegen will be the business coach of Royal HaskoningDHV. Koen is a structural engineer. After finishing his masters at TU Delft, he worked on the Groningen earthquake project for three years. He is also highly involved in the company's digital transformation. The business line Industry & Buildings will be involved in the coordination of the project.