

Farms & earthquakes, Preventive seismic retrofit of a farm

Coen van Vreden
AE graduation studio
2015-2016



Graduation Plan

Version: 06
08-01-2016

Personal Information

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Studio: Architectural Engineering

Teachers

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Argumentations of choice of the studio:

I have always been really fascinated with engineering or technical solutions in general. To combine that with architecture is an interesting combination because some might say they are the opposite. But if you can combine them and understand both sides, than you could really bring a project further. Relevant topics, or current problems are also a fascination of mine. I feel the urge to solve them and contribute to the innovation that is needed in the built environment.

Architectural Engineering studio seems for me the right place to work on topics that are relevant, and are innovative. It can combine my fascinations, to make it a graduation project where I can work on with pleasure.

Graduation Project

Title

Farms & earthquakes, preventive seismic retrofit of a farm.

Problem Statement

In the Netherlands there was never a problem with earthquakes, but since a couple of years this changed. Due to the gaining of gas by NAM there are now more and more earthquakes in the Province of Groningen. The existing building stock is not constructed to deal with these kind of forces, what is resulting in cracks in buildings and them not being safe anymore. This is also a social problem because the people in Groningen feel not supported with their problems, and feel unsafe in their own house.

The government is currently working at NPR document (national practice guideline) that will consist of guidelines to build safer buildings that will not collapse with heavy earthquakes. This guideline will eventually be for the new to build buildings in the earthquake zone to demand them to build in a way that the building will not collapse in an earthquake. But if it was your house you would not even want new cracks in the wall every month. This is also a huge problem for monuments, because if you want to preserve them, should not be an option. But currently there is too little focus on heritage in the province of Groningen.

Monumental buildings in Groningen are different than “normal” buildings because there is a bigger need to protect and preserve them. With heritage it is always a question of how to treat them, and in what way can they be permanently changed to preserve them. Because the focus of the government for now is to prevent buildings to collapse or people from dying, they are not trying to keep the heritage completely intact.

Goal

For this graduation project the aim is to gain more knowledge in what there should be done with the heritage in Groningen that have a problem with earthquakes, and what the possibilities and changes are. To narrow the project more the focus will be on monumental “head-neck-body farmhouse” in Groningen.

It is interesting to look for an architectural solution that brings something extra to the buildings. For this graduation project there is chosen for a solution for the heritage that can make the building be more earthquake resistant, but without major interventions that would change the monument permanent. The research aims to find a way that determines which solution will harm the monument the least. Temporary solutions are also investigated because they might be an interesting option for monuments due to the assumption that if the NAM would stop with the gaining of gas that it will take 20-50 years for the earthquakes to strongly decline or even vanish. This is because it took the same time for the earthquakes to show after the first drilling. So eventually the earthquakes and therefore a temporary structure is no longer necessary in the future. This creates an unique situation where buildings need to be created that can last earthquakes, but this does not need to be forever.

A design with a new function should help the monument to be more earthquake resistant. It can be because of the financial support of the project there will be money available, or because the structure of the new function is helping the monument to be more earthquake resistant. For the province of Groningen it shows that even old buildings can be save again.

Overall design question

How to transform the typical monumental ‘kop-hals-romp’ farm in Groningen into a building with a new function that is more earthquake resistant?

Sub questions:

- How is the current construction of the building organised?
- What solutions are there to make the building earthquake resistant that would not change the monument permanently?
 - How temporary should this solutions be?
 - What are the pros and cons for each solution?

- What function should there be, or is necessary?

Thematic Research Question

How can the typical monumental 'kop-hals-romp' farm in Groningen be preventively more earthquake resistant with solutions that are reversible so they will harm the monument the least?

Sub questions:

- What problems in general should be repaired, and can therefore be excluded from the solutions?
- What are the general problems and damages for the kop-hals-romp farm?
- Case study
 - What are specific problems and damages of the case study?
 - What can be solutions for the case study?
 - What can be reversible solutions?
 - How should the connection be between the building and the solution?
- What can be concluded out of that case study that can be helpful for the kop-hals-romp farms in Groningen in general?

Methodologies

- Literature search on following subjects:
 - How to make existing buildings (prefer heritage) earthquake resistant.
 - What are current techniques + approaches for retrofit.
 - How do the forces of an earthquake work.
 - What are techniques + approaches for new earthquake resistant buildings.
 - Are there examples of the combination of existing and new building that need to be earthquake proof?
- Case study
 - Compare earthquake measures to the chosen farm.
- Interviews
 - Interviews with architects in what solutions there already are and what lessons they already learned.
 - Interviews with historic preservation organization.
- Research by design
 - Search for the possibilities that resulted out of the structural need for making the heritage earthquake resistant.
 - Look for architectural solutions of the seismic principle solutions

Relevance

In the province of Groningen there is too little focus on preventively earthquake resistant solutions. It is not only a matter of safety, but preserving the monuments. Because of the earthquakes a lot of monuments are already damaged. The temporary nature of the

solutions is also an important aspect. Because the earthquakes are expected to eventually stop in 20-50 years, earthquake resistant solutions might be allowed that normally are not allowed for monuments. This project can be an example of the possibilities there are in the earthquake solutions. Vacant monuments in combination with earthquake solutions can have new functions that bring the monument back to life.

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MSC3

2015/2016

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