GRADUATION PLAN

Seismic-Retrofit

An architectural solution to reinforce earthquake damaged masonry buildings and improve the existing architecture quality by using light-weight complementary constructions.

MSc Graduation
P2 Research Paper
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Tutor: J. Schroen Pierre Jennen

Personal Information:

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Studio:

Name of studio:	Architecture Engineering Intecture Seismic Studio
Teachers:	Job Schoren, Pierre Jennen

Argumentations of the choice of the studio:

As the graduation pjoject, I would like to have the chance to formulate the context, technical research and program all by myself.

Also this studio gives me the opportunity to combine my technical fascinations and program to solve social issues, which I believe is an important ability of a professioanl architect.

Title:

SEISMIC RETROFIT - An architectural solution to reinforce earthquake damaged masonry buildings and improve the existing architecture quality by using light-weight complementary constructions.

Location: Groningen

Problem Statement:

As the environment in Groningen has been chaning due to the extraction of natural gas, new design strategies should be made to improve the stability of the buildings. The majority of building in this area are built with unreinforced masonry, which performs poorly during earthquakes. Safety became the keyword of the renovation of existing buildings and the standard of new designs.

Building the new, or reusing the existing? As there are many masonry buildings damaged or threatened by earthquake, and it is expected the earthquake will not last for more than 50 years, I want to focus on the transformation of masonry buildings into new public space by using complementary wood construction. Also this area is facing a series of society problems. More and more people leave the place because their worry about safety issue, which leads to many vacant buildings and the lack of public facilities in this area.

In this case, the solution to deal with restoration in Groningen can not be merely based on engineering, a collaboration between architects and engineers at the beginning of the project is necessary to develope an appropriate solution not only seismic proof but also meet new social and functional requirements.

Structure Weakness

- Frequent earthquakes in Groningen caused by Gas extraction.
- Different degrees of damage on masonry buildings.

Architectural Weakness

- Need more public facilities to ensure people's daily life.
- Vacant buildings or new functional requirements.
- Call back the identity of culture of Groningen.

Society Weakness

- The area is now losing people -- people are losing confident of the area.
- Not enough attention to prevent the damage in further quakes.

Overall Design Question:

An architectural solution to reinforce earthquake damaged masonry buildings and improve the existing architecture quality by using light-weight complementary constructions.

Research Question:

A wood light-weight complementary construction system as an architectural solution to reinforce and reuse earthquake damaged masonry buildings.

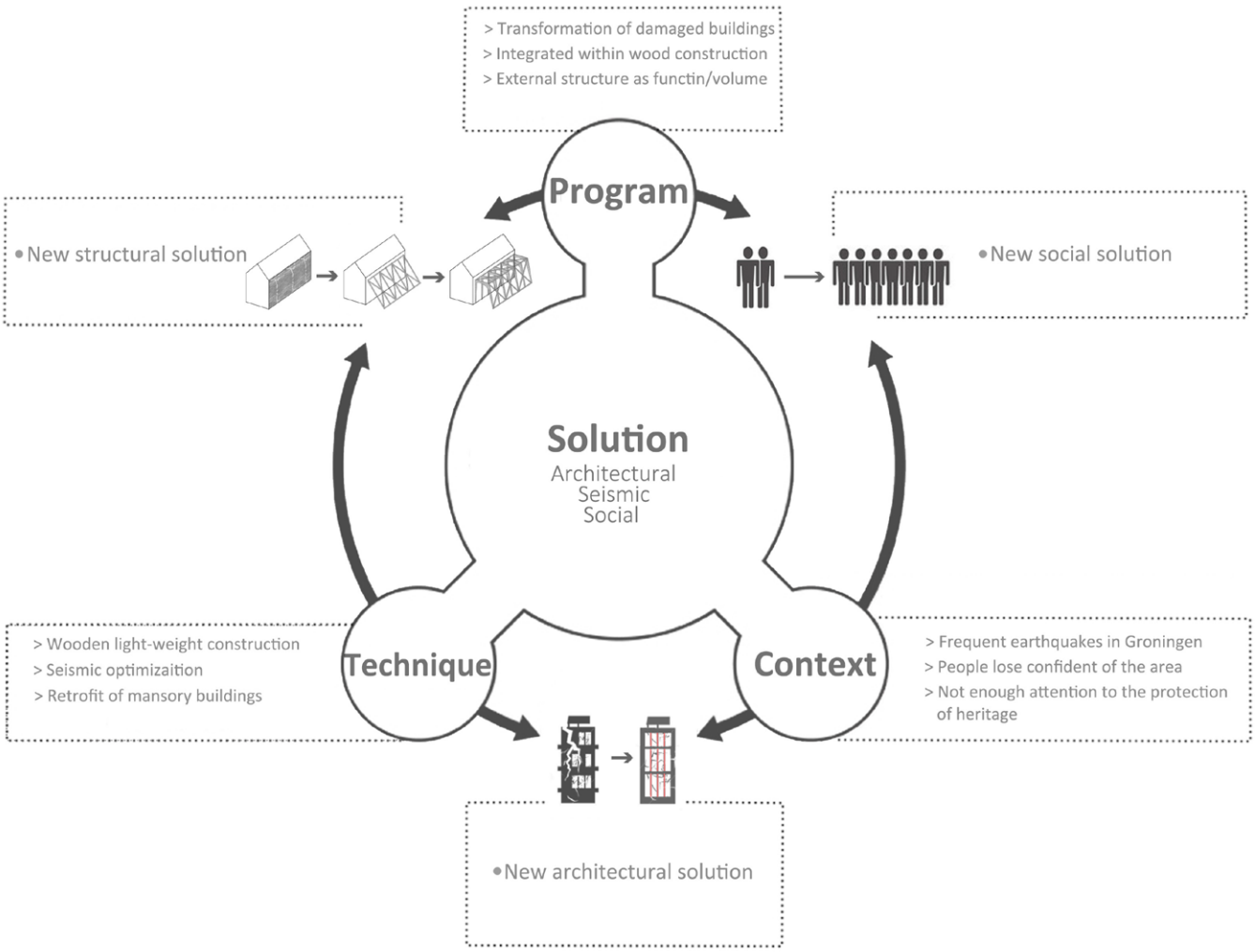

Figure 1: Context, Program and Technology.

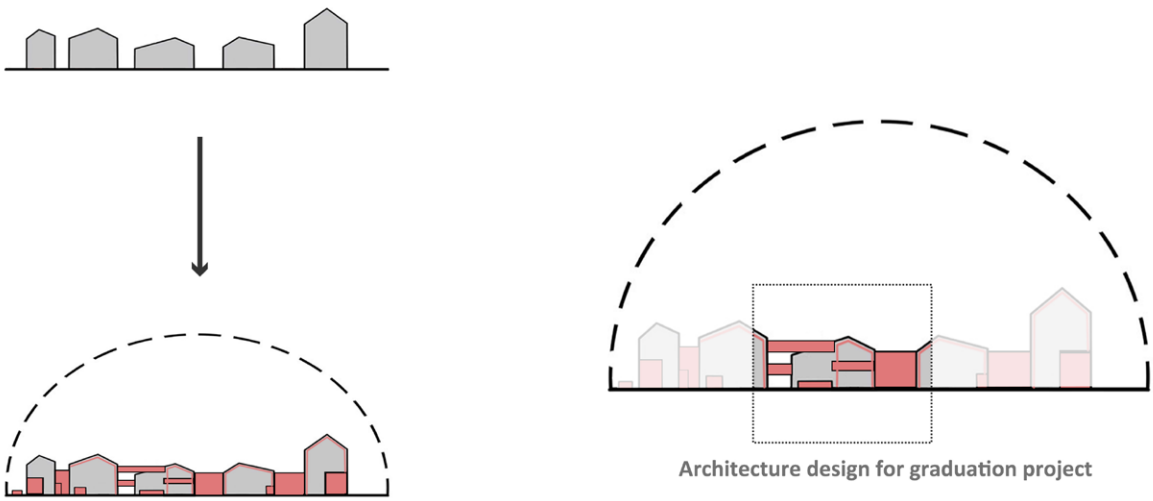

Figure 2: Diagram of objectivity.

Objective:

The graduation project aims to find an architectural seismic solution to reinforce the damaged masonry buildings and improve the earchitectural quality to meet new requirments, which can furthermore be an example of restoration of masonry buildings in the whole area and other areas with similar condition.

The research focus on the optimization of wood light-weight structure as a seismic solution, and the functional potential of a structural construction as an architectural solution. The whole construction system could work on different scale of masonry buildings based on the analysis of different context.

With the study of structural behavior and the optimization of light-weight wood construction, the research could support further design with more inputs of engineering knowledge, give guidance at the beginning of the design of a restoration project.

Methodologies:

Context:
The study of the context is based on the analysis of site and the study of existing building in Groningen, mainly contain three parts:
Site analysis, Damage analysis, Value assesment.
(mapping, reference analysis, damage attached to a certain time line, suggestion of restoration)

Technique:
The study of the technique is based on the design of wood constructions for the protection of masonry buildings. Finding theory support through literature study and case study. And also focus on the optimization of the structure for earthquake situations by understanding earthquake response controlled structure ststem.
(literature study, case study, design research, simulating and calculating)

Program:
The study of program is to make innovation which combines the context study and technique study, mainly through case study and design.
(case study, design research)

Planning:

(Detailed planning in attached drawings)

Present to P1 (22-09 – 25-10/04-11)
-Site analysis, mapping, reference analysis
-Investigation and study of earthquake damage and existing building in Groningen
-Investigation on research literature
-Begin technical research

P1 to P2 (04-11 – 17-01/27-01)
-Finish the analysis
-Case study
-Further study of technical research
-Study on the seismic joints.
-Study and design on wood constructions
-Simulating and test on wood constructions
-Begin design of architectural program

Relevance:

Through my graduation project, I want to find a solution to deal with the vacant earthquake damaged building in Groningen, which has a big social and finacial value. Also this solution can be an example of transformation and the system can be applied to other earthquake areas.

Literature:

Andrew Charleson (2008), Seisminc Design For Architects: outwitting the quake.

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Farshid Moussavi. (2009). *The Function of Form.* Actar and Harvard University Graduate School of Design.

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Graduation Plan	Pavilion&Poster																					
	Graduation Plan																					
Research	Literature																					
	Joints & Design																					
	Simulating																					
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Design	Site Study																					
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