P4 Reflection

My project aims at transforming heritage architecture into a new function while caring about how to protect the old building against earthquake damage in the seismic context of Groningen.

Preliminary Research

The preliminary research before P2 mainly concerns about how to make an old building earthquake proof while taking its heritage value into account. To get the proper results, three researches are carried out, first is about the evaluation of heritage value for a non-nominated historical building, and by this research I come to the conclusion of transformation requirement for a heritage building during seismic resistance operation, and meanwhile, I use this method to evaluate my building, Onderdendamsterweg 8 to find out exactly which part is going to be preserved during the renovation. The second research focuses on the mechanism between earthquake damage in brick walls, and by studying the formation relation between the force flow and the forms of cracks in the brick wall, I get a better understanding of the design principles for the seismic resistance operation in brick walls. The third research is trying to figure out several ways of design that can help the building with seismic proof while still keep its own historical value.

The research methods for this phase is mainly literature review and research by design.

Design

The design starts with my reading of the agricultural landscape in Groningen, which is the dominant feature of the site. Combining with the research on the topic of earthquake resistance operation in a historical building, I start to develop my own structure scheme. Responding to the spreading landscape in the site, two strip form new structure are added in the existing farmhouse. These two structures also serve as the supporting structure for the old brick walls. The principle of the intervention structure is to stiffen the brick wall (to make the wall itself strong enough as a single component) while release the restraint from the wall to the ground, thus the walls become facade member hanging to the new structure rather than load bearing structure. In this way the affection from the earthquake to the wall will be minimized.

To choose the right new structure, two facts should be under consideration, the compatibility with the old structure, and the possibility for earthquake proof. Timber is the main material for the new structure, because its light weight, its compatibility with the old timber brick farmhouse, and its ability of damping via the connections. The final structure is constructed with CLT wall as the load bearing structure (meanwhile, the property of CLT makes it easier to stiffen the brick wall and avoid in-plate and out-of-plate movement while eating the least space in the old farm) and frame as the roof structure (light weight, flexibility and a respond to the old farm space).

For the main principle, stiffening the components and releasing the restraints, new connections are designed for the wall-foundation joints and wall-beam joints. Both connections take use of the property of steel, the elastic stage and the plastic stage. And both joints are replaceable for maintenance. During an earthquake, the steel components of the joints will deform, take the tension caused by earthquake and try to recover their
shape to keep the house in place in the first stage. While in the plastic stage, the steel components will deform totally. During both the steel joints take in the shaking energy. After the earthquake, one can replace the yielded steel components with a new one.

The research methods in this phase is mainly research by design. Especially for the structural design, to try out all the mistakes is a very important way to test the proposal and find a proper solution.

The final result of the project doesn’t have a direct link to the operation ways developed in the preliminary research. The reason for this is because for a practical project, there are way more limits and requirements than in a research. However, the transformation requirements do help me to evaluate my building and decide what to keep and preserve; while the seismic design principles are the main guide during my development of a new structure.

Social affection

The design is not only a single project. The structure can be a model for other heritage buildings in seismic intervention.