

# deconstruction, reconstruction

## a case study for construction with reused concrete elements from demolished buildings

The goal of this master thesis was to conduct a study on how a reinforced concrete building that is to be demolished can be broken down into elements and how these elements can be used to construct a new building at a different location.

### Motivation

1. The high energy consumption and CO<sub>2</sub>-emission of cement and concrete production.
2. The high level of demolition of reinforced concrete buildings currently happening in Germany.
3. Abandoned buildings in rural areas versus record numbers of new constructions in cities.

### Case Study - City Hall Ahlen

For the case study the city hall of the city of Ahlen was chosen. It was built in 1970 according to plans by Brigitte and Christoph Parade and is to be demolished in the next few years due to asbestos deposits and damage to the façade. According to a structural engineer's report, the reinforced concrete structure is still completely intact.

First, the entire reinforced concrete structure - the core of the building - of all three wings of the building was analyzed. In the further course of the work, the focus was then primarily on the nine-story administrative wing and its floor plan based on a triangular grid.

The technique of concrete sawing was chosen to cut up the existing structure. A basic triangular cutting grid based on the existing floor plan was developed, which allows to create individual parts with corresponding widths and lengths, facilitating the assembly. The size of the parts depends on the loading volume of a truck and the load capacity of a crane.

The standard floors are cut into parts of different sizes based on the cutting grid. Due to the shape of the original floor plan, the result was mainly parallelograms and trapezoidal shapes as well as some special shapes.

On a site on the outskirts of Ahlen, about 4.5km from the location of the city hall, an apartment building is to be constructed from the parts of the demolished building.

For the building design, based on several previous test designs, a mixture of precise pre-planning of the layout of the future apartments and grid-based cutting of the existing building was applied. The design process was therefore influenced both from the deconstruction, as well as the reconstruction.

The resulting building is made from 440 parts from the town hall and includes 23 both one- and two-story apartments between 90m<sup>2</sup> and 140m<sup>2</sup>. Due to the use of the recycled parts, each individual apartment has an individual floor plan.

In accordance with courtyard house typologies, the individual apartments receive light and ventilation through narrow courtyards. This allows the building to be denser and the site to be used more efficiently, so that less ground needs to be sealed. At the same time, the courtyards, each located between two individual apartments, offer the possibility of communal use as a garden or meeting space for the inhabitants.

The cut-to-size elements rest on a semi-precast reinforced concrete beam. By means of a subsequent reinforcement connection, the „old“ parts and the „new“ beam are friction-locked together.

The exterior shape of the building is determined by the cut-to-size parts in the interior. The internal structure can be read from the façade with its zigzag-like projections.

### Conclusion

The reuse of reinforced concrete components makes sense not only from a resource and energy-saving perspective, but also from an architectural one. The apartments of the resulting building exhibit unexpected qualities in many places due to the use of the cut-to-size parts: angled floor plans as well as seemingly oversized columns create unusual yet attractive spaces. This type of architecture would very likely not have been created by conventional new construction planning. At the same time, the knowledge about the origin of the building fabric shapes the identity of the building and can thus create a special relationship between the residents and their house.