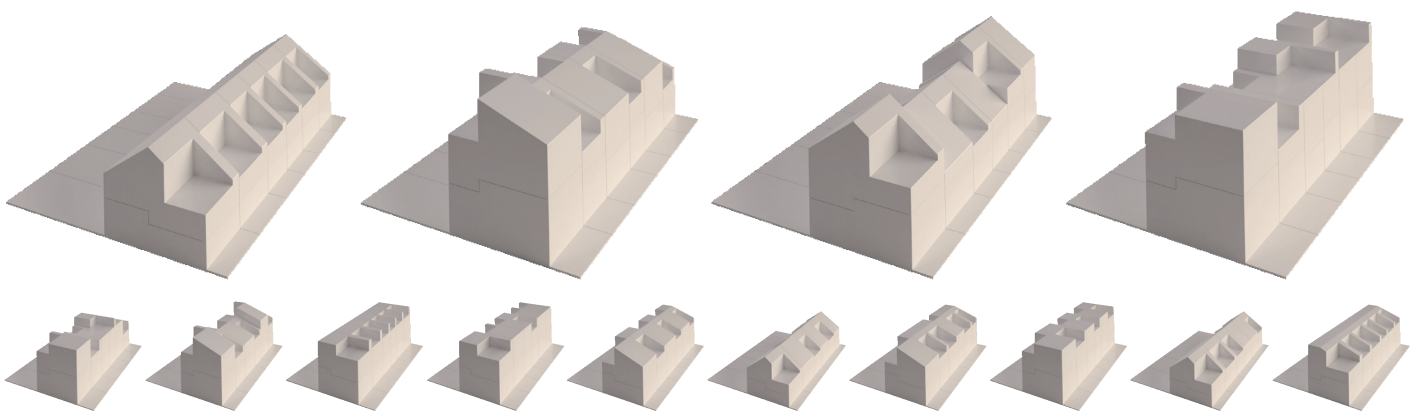


Report Summary

Quality Enhancement in Housing Construction
through higher Diversity and Flexibility
and Customized Mass Production
exemplified in Stacked Row Houses

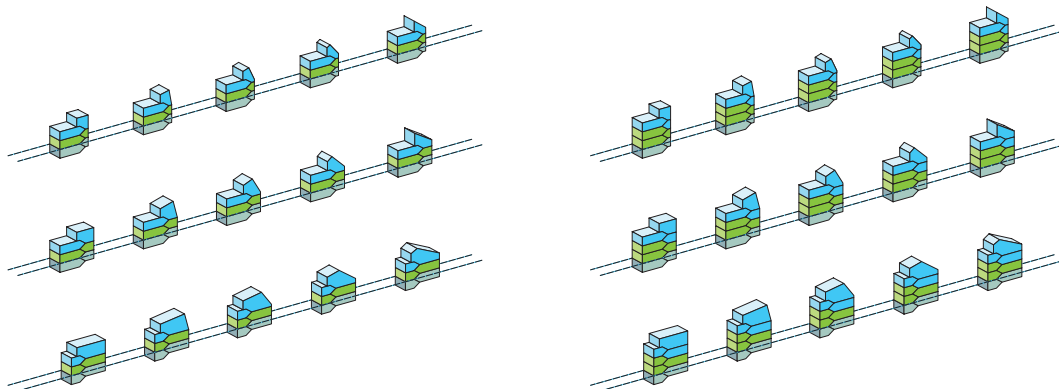


Overview

The topic and aim of this research is to examine, if and how individualized diversity in housing construction can be achieved without cost disadvantage. We utilize the capacity of parametrized planning models and CAAM fabrication methods. Exemplarily, we develop a parametrized rule-based typology as a planning tool and implement it in the software Autodesk Revit Architecture. The typology consists of stacked row houses of various sizes. It can be applied in areas of diverse urbanity and density and meets the demands of the variety of contemporary forms of living. We show how the dull monotony of serial mass produced housing complexes can be superseded by individualized diversity – both internally, in the individually partitioned and adaptable apartments as well as externally, in the distinguished facades and quarters.

The typology describes stacked row houses in dependency of internal parameters like residents' profile, size, orientation and external parameters like characteristics of site and planning regulations. The tool is an additional implementation to Revit Architecture and generates through parameters of a digital 3D model a proto-architecture providing the basis for further detailed planning. Allowing for different methods of customized mass production, this proto-architecture creates buildings that can be cost-efficiently produced.

We present basic typology studies, explain the development of the typology systematics, show the design of the software tool, demonstrate its scope in several case studies and evaluate them. This research project constitutes the first part of a development project in cooperation with the building company TreuHandStelle GmbH in Gelsenkirchen and its subsidiary company THS Consulting GmbH. Following steps will be detailed planning and realization.

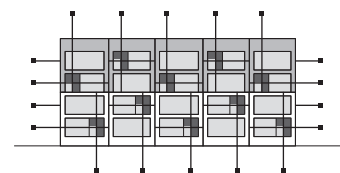
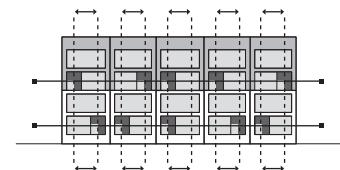
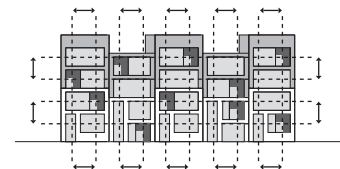


Topic and Method

The aim of our research is a digital tool that plugs into Autodesk Revit Architecture. It will create digital models of assemblies of stacked row houses according to a range of parameters: site and urban context, orientation, future residents' profiles.

We carried out four parallel surveys: existing typologies for single family homes, current developments and future trends in the development of requirements for single family homes, software tools for developing parametrized building models and fabrication processes for producing buildings from the digital models.

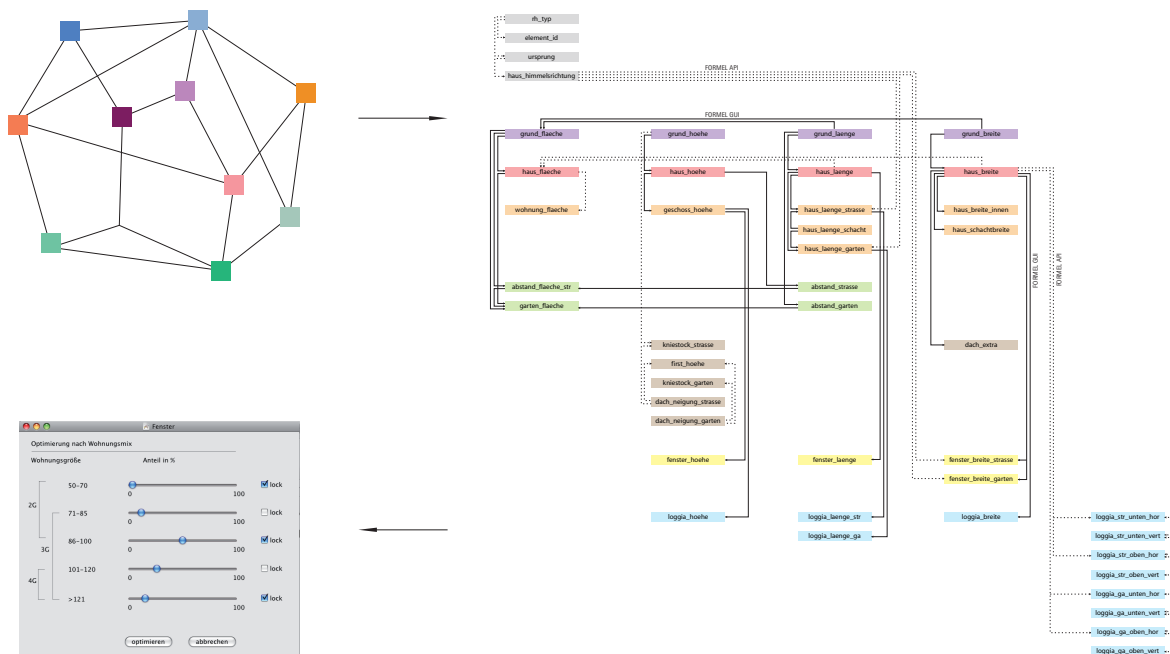
The parametrized typology was developed in consecutive steps containing as a programming guideline all relevant information for the plug-in tool: Basic conditions of the typology were set up by means of the criteria diversity, flexibility, energy efficiency, fabrication methods and cost-effectiveness. The typology itself was developed in parts - via planning elements like plan layout, section layout, shape of roof, facade etc. - as parametric rule-based elements with connections and dependencies between each other and translated into parametric 3D models.



Digital Plug-In Tool

The plug-in tool is programmed in the application programming interface of Revit Architecture in C#. The tool is implemented as an external tool. It is started by the building site conditions of size and orientation. In the next step the user can choose and specify building and user requirements, i.e. size of the apartment, slope of roof, use of solar energy. Using all this information the plug-in tool starts placing 3D model houses on the site. The 3D model houses that are placed by the tool are modelled in Revit Architecture as so called „family“ instances with specific characteristics defined with the aid of parameters of the building elements. Through these parameters constraints and dependencies can be defined and controlled via introduced formulas of different complexity.

The functioning of the tool was tested on exemplary sites of the cooperation partner. It generates assemblies of stacked row houses that are optimized according to the typology's criteria. Time-efficient generation of diverse constellations of housing arrangements could be shown. Also, further complementary and optimizing tools were defined.



Outlook

From the result of this research project we plan to extend our investigations:

We intend to select one of the case study designs, develop it in detail and actually build it to demonstrate the capacities of the new tool and typology in creating urban structures and family homes that offer diversity, individuality and richness that reflect the individual characteristics of their residents - without creating higher costs but instead being slightly cheaper than current standards due to the use of CAAM methods.

Another investigation will be into the possible transfer of the planning methods using parametric modeling to other typologies beyond housing, i.e. kindergartens or supermarkets. We plan to examine and compare the specific characteristics of different typologies of varied uses, the possibility of parametric rule definition and its application in planning processes.



Project Information

Editor

Technical University Darmstadt
Department of Architecture
Institute of Design and Building Technology
formerly Prof. Dipl.-Ing. Karl-Heinz Petzinka
formerly Dipl.-Ing. Günther Schaller p.p.
Prof. Dr.-Ing. e.h. Klaus Daniels p.p.
Dipl.-Ing. Heike Matcha
El-Lissitzky-Strasse 1
D - 64287 Darmstadt
Tel + 49 (0)6151 16 2102
Fax + 49 (0)6151 16 2302
h.matcha@techno-tud.de
www.architektur.tu-darmstadt.de/techno

Project Team

Dipl.-Ing. Heike Matcha (Project Management)
Dipl.-Ing. Gero Quasten
Cand.-Inform. Hossein Rabighomi

Sponsor

Bundesamt für Bauwesen und Raumordnung

File Reference

Z 6 – 10.08.18.7- 07.7

Cooperation Partner

Housing Company THS Consulting GmbH, Gelsenkirchen
Autodesk, Munich with Software Revit Architecture

Project Duration

01.10.2007 - 30.04.2009

ISBN

978-3-88536-102-2

