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## Our Research Expertise

### Robot Oriented Design & Management



### Building Component Manufacturing (BCM)



### Large Scale Prefabrication (LSP)



### Site Logistics and Single Task Construction Robots (STCRs)



## Our Vision

Automated manufacturing technology that accompanies a shift from an arts and crafts based industry to an industry based on systematization and machine technology needs to be able to not only improve or double productivity, but to multiply performance (e.g. reduction of construction time to 1/10<sup>th</sup> compared to conventional construction, zero-waste, and defect free products). We envision a construction industry which is able to produce or change

### Automated/Robotic On-site Factories



### Hummanoids & Exoskeleton Technology in Construction



### Automated Deconstruction, Re-Customization & Recycling



### Automation & Robotics in extreme Environments



buildings according to customer demands with minimal delay in a near real time manner. Individual subsystems of the on-site factory, as well as sensor systems necessary to guide automated logistics and positioning operations on-site, can be integrated as building technology into the building and re-activated for change, recustomization and deconstruction during the building's life cycle. This idea we formalized into a life-cycle and building integrated manufacturing concept.

**TUM**  
Technische Universität München  
Fakultät für Architektur  
Lehrstuhl für Baurealisierung und Baurobotik

# Automated & Robotic Construction

Approach & Vision, Research Expertise, Selected Projects

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## Approach

Productivity and efficiency in the conventional labor based construction industry in Germany, Japan and the USA has been declining for about two decades. In comparison, productivity and efficiency in most other industries (e.g. in the manufacturing industry) has constantly been on the rise during that time period. The decline of productivity since the 1990s has coincided with a worldwide re-orientation in construction from technological based construction towards labor based management and organization oriented approaches.

As of today, major construction companies and many other practitioners and researchers have been seeking the solution for better productivity in construction, and even again increasingly in better management and organization of the conventional laborintensive construction method. However, this approach sharply contradicts the logic and possibility of industrial and technological advances in manufacturing and only generates marginal improvements. Therefore, our institute follows a radically different approach by focusing on the deployment of automation and robot technology on all levels in construction. We see the construction industry as a manufacturing industry that can produce products with highest efficiency on bases of the best available technologies.

Novel manufacturing technologies in construction and in particular radical solutions require drastic and co-adapted change of manufacturing, technology, organization, products and associated business models in construction. Although the necessary changes and resources are enormous, they can be accomplished on basis of so far developed technologies. The overcoming of associated challenges can eventually turn the construction industry into an incubator for future manufacturing technology.

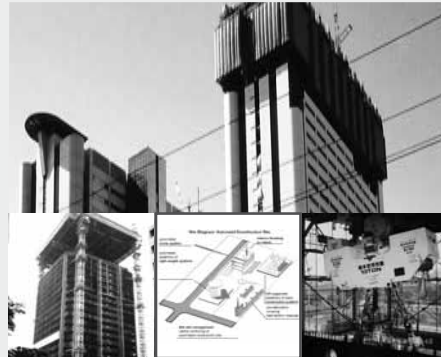
## Our Research Facilities

### Construction Robotics Laboratory



Since 1990, a multitude of automated high-rise sites have been operated by various Japanese companies in Asia. Also in European construction firms, flexible site-automation systems have been adopted nowadays. Most of these achievements have been obtained by highly experimental research approaches. Therefore the Construction Robotics Laboratory and the Teleconstruction Site in Garching are designed as an experimenting laboratory, i. e. an „Incubator“. Incubators are used in innovation science and the R&D-industry to specifically generate inventions or to systemize the invention process.

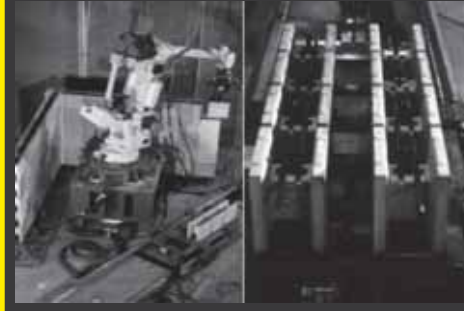
### Teleconstruction Site



Tele Construction Experimenting Site is an experimenting site located at Garching Campus, used for multiple purposes. The site is open for students and researchers to implement mock ups, experimental buildings, tele-construction experiments, distinguish and apply various demonstrator/prototype evaluation methods, use evaluation feedbacks for further development of the project in subsequent evaluation-development cycles.

## Selected Projects

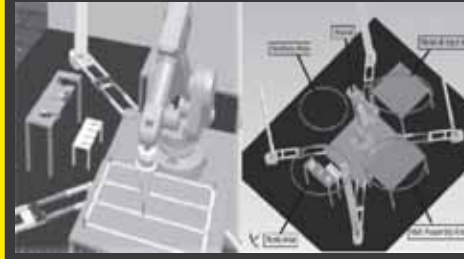
### R&D: SMAS (Solid Material Assembling System)



### R&D: ROCCO (Robot Construction System for Computer Intergrated Construction)



### R&D: ManuBuild - Open Building Manufacturing



### Strategic Consultancy: Sekisui Chemical Corporation, Housing Division (Sekisui Heim), Japan



### Technological Consultancy: Robotic and Crane based Automatic Construction System (RCACS), Korea



### Empiric Studies: Automated Deconstruction & Renovation



### R&D: SMARTSITE – Smart and Autonomous Construction Equipment.



### Future Concepts Development: Real-Time Construction

