HOME 24*

- 24 HOURS TO BUILD A HOUSE -

Prof. Dr.-Ing./Univ. Tokio Thomas Bock, Dipl.-Ing. Architect Frank O. Prochiner

Technical University Munich

Chair for Building Realisation andInformatics

Arcisstrasse 21, D-80333 Munich, Germany

Fon +49 89 289 22100

Fax +49 89 289 22102

e-mail: frank.prochiner@bri.arch.tu-muenchen.de

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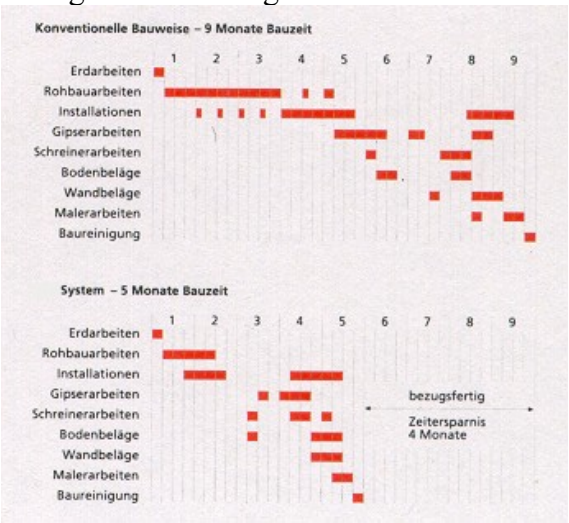
Home 24

Home 24 - this could be the future name of buildings which can be moved into only 24 hours after the beginning of their construction. Time is money, all the more as about 2/3 of the total costs of a building are apportioned to the costs of construction. Consequently, the most promising way to reduce these costs is to develop and optimise planning, manufacturing, logistics, and construction in a comprehensive process.

In order to reach this goal the Chair for Building Realisation and Informatics at the TU Munich is engaged in research in an interdisciplinary team in the fields of research and economy.

The project entitled "Installation and Dismantling in Wood Construction via Quick-action Fasteners" is a prelude to follow-up projects which are to be combined in a co-operative approach.

The most promising potential for cutting down costs lies in reaching a maximum degree of prefabrication by integrating different crafts. This could considerably reduce the time necessary for interior finishing and completion. For this reason parallel processes must replace sequential processes during manufacturing and construction.



Cutting building time by parallel craft integration. Conventional building above, systems building below.

Cutting costs

Some 20 % of net building costs go on housing technology.

Installation work has been considered without craft costs, as electricity and heating mains as well as freshwater and wastewater pipes are subject to the similar regimes.

All these crafts make use of sequential fabrication. First comes the installation basics and then the finishing, i.e. the plastering and flooring. Yet the latter make up the third largest cost factor – after basic construction and comprehensive interior finishing.

In complex installations the costs can certainly run higher and are, generally speaking, wage-intensive. And yet there is no easy road to automating the construction site, as installation work on the latter involves much moving around. Then again, many installation strands need to be "intelligently" woven together. To achieve this, even industrial prefabrication is unable to do without human judgement.

Integrated planning

The best option would seem to be prefabrication of sanitary installations – semi-automated, prefabricated pre-wall installations that are assembled on the construction site. Such units will in future be further developed for broad-based use, with cells ready made for installation simply brought to the site for assembly there as spatial cells.

But if this is to happen, it will be necessary to precisely define, at the planning stage, just where such cells are to be positioned, analogous to the spatial cells for ready-made baths. This yields the shortest pathways and cuts assembly time.

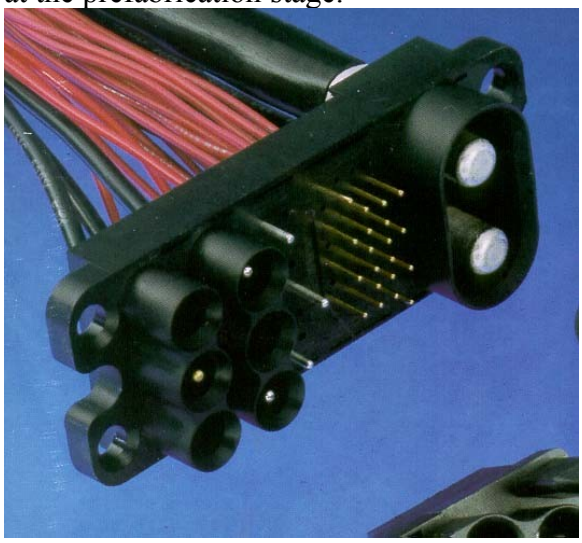
Automated fabrication

As housing construction standards are often similar, modern CAD-CAM systems can flexibly prefabricate such units on a semi-automated basis. Such installation cells might even contain, extraneously assembled, plug-in interfaces in both walls and ceilings.

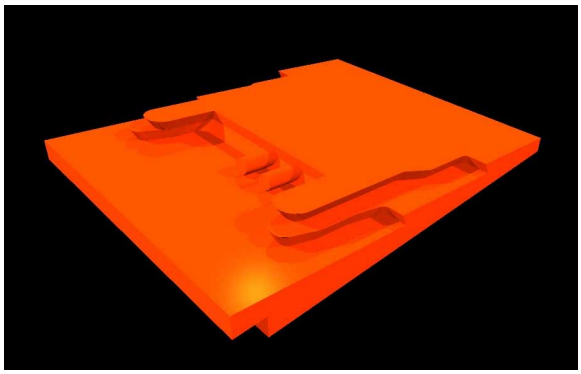
With regard to wall fittings, the installation task should no longer be seen as a thing apart – it can be offered as part of the overall wall system. Thus further systems solutions are called for, whereby fittings can be blended destruction-proof into the automation-produced wall panels.

Cutting building time by integrated craftwork

A further step would be for all electric cables to be integrated into the wall panels, with individual cables being hooked up via plug-in ultrarapid links. In this way, the entire electronic installation can be integrated at the prefabrication stage.



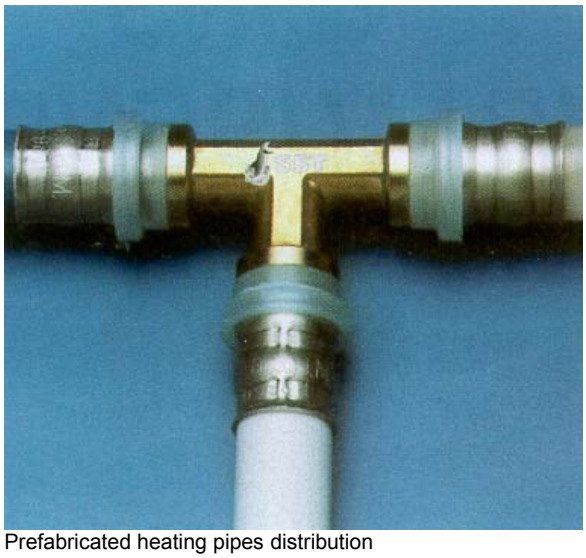
Ultrarapid electronic component in vehicle construction



Fast connector System for the integration of water and electrical supply, developed and patented by the TU-Munich

A stage further and these functions can be handled by robots in a single assembly unit. One developmental stage more and the same functions can be combined with the sanitary installations. Also feasible is for the heating mains [pipes?] to be relocated to the prefabrication stage. Relocation to the prefabrication stage requires a considerably greater scale of advance planning than conventional installation does. As a result of the seamless integration of these systems, the flush-fitting [maßgenaueren? more accurately crafted?]wall panels are of higher quality than conventionally fabricated walls. The risk of erroneous assembly is reduced and building time cut, since follow-up interior finishing can be commenced earlier. Mechanical fabrication permits wage costs to be further cut, thus yielding an additional cost edge.

The decisive theme for changing the current manufacturing and construction processes in wood construction is the connection of constructional elements at their mutual intersections. Connecting elements have to be examined with regard to positioning, adjustment, and fixation. Transition to automated manufacturing processes should be implemented in current processes of predominant manual installation and assembly, meaning in the fields of mechanical services and interior finishing. Development of plug-in systems of quick-action fasteners for structural components will result in new methods of installation and interior finishing



Prefabricated heating pipes distribution

Similar to developments in vehicle construction, prefabrication of systemic structural components for electrical and heating water installation will create new fields of work in the supply industry for wood construction.

The evolution of sub-contractors from component producers to systems suppliers

The overarching goal in this project is to develop a rapid-link system that not only provides higher-grade assembly time through more rapid mechanisation, but also permits significant cuts in overall construction time to be realised. The benchmark driving this goal is that no product should be developed that merely competes further with nuts-and-bolts assembly; rather significant cuts in time and outlay are to be achieved by an integrated approach.

Representatives of manufacturing industry confirm that almost every system seeking to compete with simple nuts-and-bolts assembly also faces a price squeeze from this quarter. This means that such a system has to absorb all extra costs that may be incurred through higher complexity alone as well as directly through faster times in component assembly (assuming parity of flexibility).

Since the advantages of such solutions only slightly feeds back on overall assembly costs, there seems little point in concentrating developmental efforts only on mechanical assembly of wall components.
Especially promising, because of the considerably longer consolidation times, would seem the integration of follow-on interior finishing (heating, electricity) after the building shell is in place. This furnishes firms with the additional option of lifting in-house productivity levels and of supplying construction sites with components exhibiting a higher degree of prefabrication.

These developments are to be continued in a cooperative project on the basis of this research project. The project entitled "Ways to an Economical Manufacturing of Wood Houses through Modern Manufacturing and Logistics Methods" too is to be sponsored by the Federal Ministry for Education and Research, which is to run for 3 years. The cooperative project consists of several sub-projects which are to be summarised by the three segments Customer Management, Product Management, and Production Management.
In cooperation with industrial contractors, the project "Automation and Manufacturing Concepts" conceives plants and procedures for a predominantly automated production on the basis of developments in the product segment. The way they function can be visualised by help of photo-realistic simulation software and is tested with regard to their capability to integrate into current production processes. Logistics and work material flow are optimised in a further simultaneous sub-project in cooperation with the Fraunhofer Institute for Production Engineering and Automation. Realisation of the research results in the building practice will be tested at the TU Munich by way of building a prototype together with partners of the building trade.

What we clearly have here is a sequence of many small steps which, for systemic reasons, have been skipped subsequently in final assembly, yet which may, in their aggregate, comprise a giant step towards cost-sensitive "final assembly".

Aside from the cost advantage that firms reap, which is naturally their primary concern, the enhanced quality levels achieved on construction sites represent no small gain.
Modified assembly methods – plus the assembly teams trained in these – can help translate higher-grade final assembly into an enhanced corporate image. As opposed to conventional construction sites, fabricants of ready-made housing can achieve superior levels of accuracy, cleanliness and rapidity.

The driving goal must therefore be not simply to cut building costs; it must also be to build simpler, better and faster.