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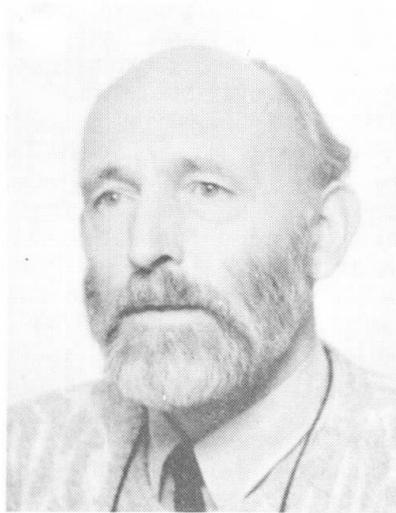
## A New Housing Concept

Nouvelle conception pour la production des maisons

Ein neues Konzept zur Wohnungsproduktion

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## SUMMARY

This paper presents a new concept in house production by industrialization of the house building process. The concept combines three essential points: Design-independent mass production; considerable influence of occupant's wishes on lay-out and finish in combination with industrialized production; optimal use of CAD-CAM in design, production and logistic management.

## RÉSUMÉ

Cet article présente une nouvelle conception pour la production de maisons par industrialisation du processus de construction de l'habitat. Le concept combine les trois points essentiels suivants: Projet indépendant des moyens de production; prise en compte de l'influence des souhaits exprimés par les habitants sur l'aménagement et les finitions en combinaison avec l'industrialisation; utilisation optimale de CAD-CAM pour le projet, la production et la logistique.

## ZUSAMMENFASSUNG

Dieser Beitrag beschreibt ein neues Konzept des Häuserbaues durch Industrialisierung des Bauvorganges. Das Konzept kombiniert die drei wesentlichen Punkte: entwurfsunabhängige Massenproduktion; wesentlicher Einfluss der Bewohnerwünsche bezüglich Grundrissgestaltung und Verarbeitung; optimale Verwendung von CAD-CAM in Entwurf, Produktion und Logistik.



## 1 INTRODUCTION

Traditional house building as well as that carried out by the mechanized building trade, has up till now, been characterized by a purely traditional organization. This is evident from the fact that in both cases

**"all houses are build according to a design made in advance".**

Where this concerned single homes for private persons there is nothing wrong. But when mechanized building nowadays put up for preference with one single design, the largest possible number of dwellings with the least possible variation, then there is something radically wrong. The result is then monotonous mass housing. Pressure by the community and the occupants has resulted in limiting the number of dwellings per design and per town district. Sometimes a certain variation in the site plans and finishing was brought about, but always at higher cost.

What is remarkable here is that the industrial production has at the same time been rendered powerless to participate in the house building process. This is just opposite of what would have been expected, in fact that giving preference to industrialization was the cause of suppression of the influence of the individual choice on design. But bypassing of the individual was neither the cause nor the effect of industrialization. This is clearly argued by Professor N.J.Habraken [1].

For good comprehension of what follows, we must first make a clear distinction between industrialization and prefabrication, both of which are essential to the rest of the argument. This distinction was made by Professor Habraken and for that reason a description as given in [2] will be used.

"For the past 25 years or more, a kind of confusion seems to have been plaguing discussions on innovation in housing design and production. These on technical innovation, for example, often confuse two distinct kinds of production.

When we discuss the production of houses, perhaps we can say that, when elements or parts used for building houses are made before the specific place where they will be positioned is known, (i.e. before there is a house design), we have what can be called industrialized production.

If on the other hand, when parts are made for building houses after the specific place where they will be used is known (after we have a design), then we call it prefabrication. Many things are prefabricated, on and off-site, using industrially produced parts, but only after a design has been made to guide their assembly.

Habraken made this distinction, which is held to be important to the health of a housing industry [3]. The reason the distinction is important is that the debate should be about what general parts should be industrially produced because, to be efficient, our industries need to know what to produce before house designs are made. Yet these parts need to be of a nature that they invite interpretation in diverse applications by different parties (flexibility). What general parts make sense?"

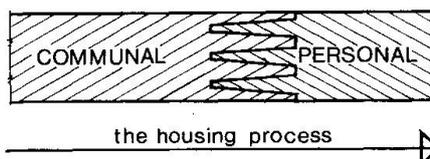
Therefore the goal of our research is an answer to this question, by:

**"Design independent mass production for the housing process"**

To make clear the way we tried to reach the right concept, we will follow Professor Habraken's line of thought beginning with his own statement:

"In order to solve the housing problem we must stop wanting to build dwellings".

For him a dwelling is not just something that can be designed or made; it is the result of a housing process. The last act in this process is that of the occupant who will live there.



Seen as a process the house is: . Terminus of a series of communal services.  
 . . Start of a personal enterprise.

Habraken therefore sees the process of housing in two spheres:

1. the SUPPORT → for which the community is responsible and the community decides
2. the INFILL → for which the inmates make their personal decisions.

Knowledge and agreement of the two spheres makes it possible to start good application of our technical ability. In opposite, the idea of converting a completely designed dwelling into an industrially produced dwelling led to a mental blockage. It has destroyed the clear purpose of building and has rendered industrial production powerless to participate in the housing process.

In my opinion the housing industry in Japan also suffers under this mental blockage. For the five biggest Japanese producers of prefabricated dwellings, which achieved an annual production of some hundreds of thousands of prefab dwellings, mostly worked on the basis of the modular, volume-enclosing element type consequently with big, completely-designed half or third parts of houses.

According to the director of Daiwa House Industry (28.000 houses per year): [4] "There are more than 5000 different types of parts. One unit of housing requires about 600 parts based on 150 varieties, which calls for small lot production of an extremely large range of items, even in comparison with such large scale enterprises as the automobile industry.

Recently, home buyers' demands have become highly diversified, so that standardised designs no longer satisfy their requirements. This trend has been gaining even greater momentum.....

..... Currently, the gradual increase in the market share of prefabricated housing is not so much due to the lower costs brought about by mass production, (mass production is out of the question, in fact there is only small-lot production (J.O. Bats)) as was originally intended, since cost does not differ significantly from conventional housebuilding methods, but rather uniformity of quality, high performance, financial and technical credibility of the manufacturers, accessibility of advice from highly trained and experienced technical personnel and excellent after sales service".

This quotation makes it clear that to try and start a housebuilding industry based on standardized design does not work well, neither for the occupants who don't have any possibility for a personal say, nor for the industry so long as this leads to small-lot production. Which is the same as has been said above by: rendered the industrial production powerless to participate in the housing process.

The new concept presented is this contribution couples, a high degree of influence by the occupant to industrial production.

Contrary to the superficial opinion generally held, the following statement holds:

**"Industrialization in the building process nowadays is the only way to reintroduce the influence of the individual.**

Habraken intended the mechanized building trade to build supports, while the infill is to be produced by industry. We aim at a more complete industrialization of the housebuilding process by industrializing the support as well as the infill.

## 2 THE SUPPORT

Conclusions of a literature study, [5] made earlier, are that "the general parts" have to be developed with due observance of the following conditions.

- a. The design must be based on the S.A.R.<sup>(1)</sup> method of designing and on modular coordination.
- b. The components must be comparatively small.
- c. The components must be demountable.
- d. The components must be as "simple" as possible.
- e. The network of lines and pipes must be very much independent of the other construction components.
- f. Free choice to position the stairs must be given.

(1) S.A.R.: Stichting Architecten Research (Foundation for architectural Research)



This has resulted in a steel bearing structure of cold-formed steel-sheet, which can be considered as the basic part of a steel support for application in housebuilding [6]

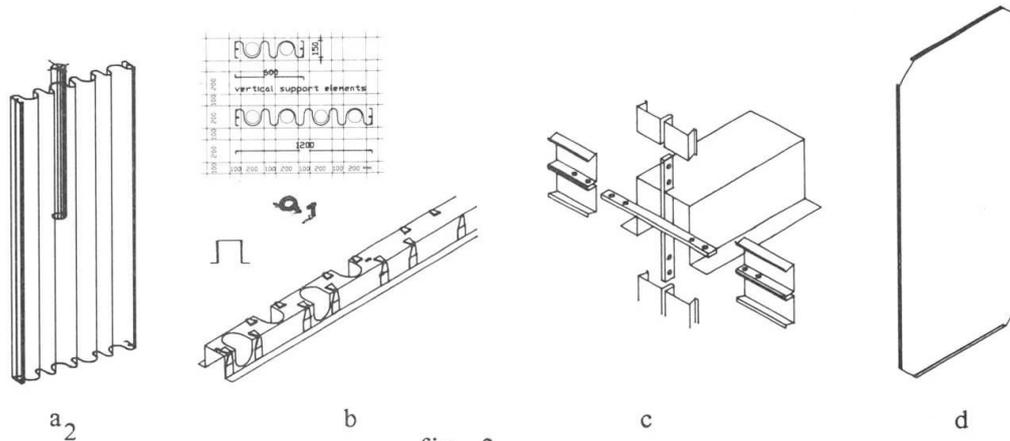


fig. 2

The core of the bearing system is the element given in figure 2a<sub>2</sub>. These elements are used both in the horizontal as well as in vertical direction in two widths: 600 mm and 1200 mm. (fig. 2a<sub>1</sub>). Steel bearing elements of this kind, together with a so-called "hat profile" (fig. 2b) form the "bearing structure" of the support. The "hat profile" allows the positioning and connection of the horizontal and vertical elements of the bearing structure. Therefore, small parts are spotwelded on the outer and upper sides of the "hat". For securing the horizontal and vertical coherence, coupling strips are needed as given in fig. 2c. The "house of cards" still requires stability provisions in the form of steel-sheet shear walls in the transversal direction. These walls are suitably placed parallel to the front and back faces of the building. (fig. 2d).

To form a support by using the steel bearing system, the permanent parts of the lines and pipes have to be installed at first followed by the subsystems for the floating floor (a), prepositioned wallpanel (b) and the ceiling (c) as shown in fig. 3 and 4.

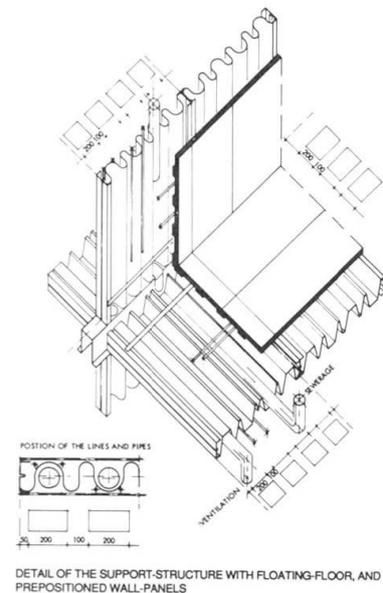
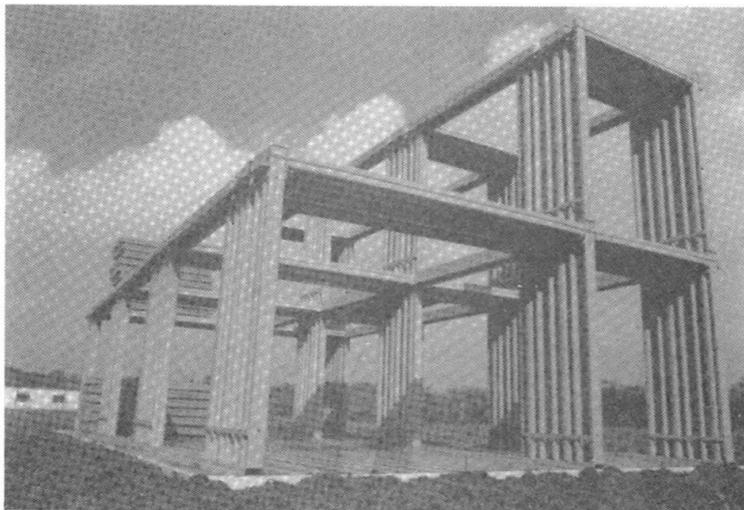


Fig. 3

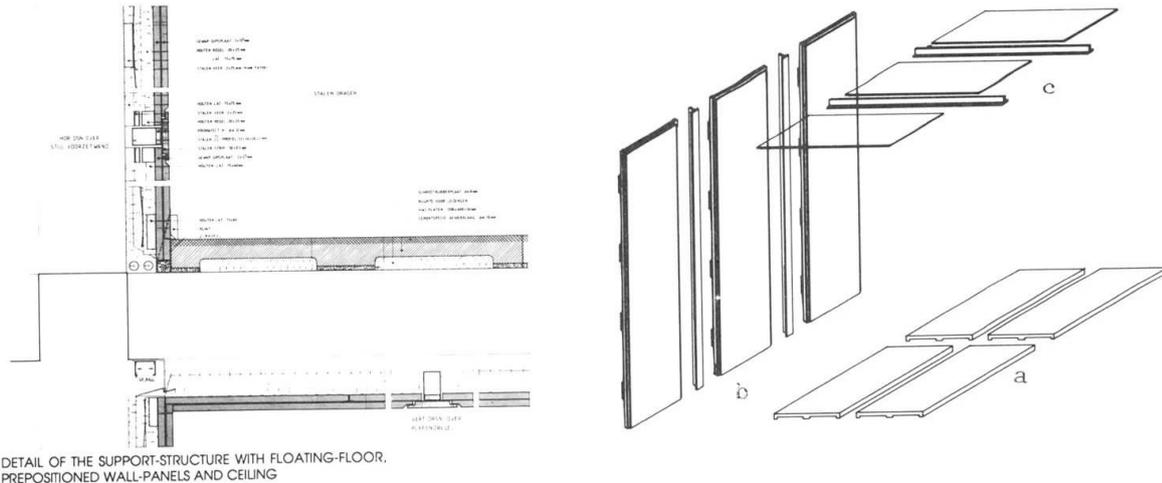


fig. 4

With the so obtained support system, consisting of 4 subsystems each with very few different elements, it is possible to build up a wide scale of different supports for all types of dwellings.

When we take the line that, where necessary with slight adaptations, outside and partition wall systems are available this gives great flexibility to each occupant, who can, for any support, decide upon position of partition walls, sanitary cells, kitchen location and equipment and have a voice at the design stage as to the position of the dividing walls.

We have thus achieved wide possibilities for action by the individual by means of an industrialized concept for the support as well as for the infill.

### 3 CONCLUSIONS

The very small number of different elements gives, contrary to the situation in Japan, a good opportunity for mass production even for a fairly small number of dwellings.

The foregoing, together with the examples, clearly show that the power of the new building concept lies in a strong rationalization of the house-building process. This gives optimal opportunity for using CAD-CAM for design, production and logistic management in combination with a maximum of freedom in the lay-out of the dwellings during construction (flexibility) as well as afterwards (variability).

With regard to the European Common Market in 1992, this makes it possible to build the locally desired houses in all countries of Europe with the same elements. The method of production gives an optimum chance of combining constant quality and moderate price with high productivity. Good quality and high productivity, however, often have been thought to be a contradiction in terms, but in Japan these two factors have had a high correlation. One can thus say, quality is the easiest way to improve productivity, which is essential for survival.

The Japanese quality control, combined with the innovative potentiation of this new concept on industrialization with a simple method of inspection, maintenance, repair, rehabilitation and alteration during lifetime, give unlimited possibilities.

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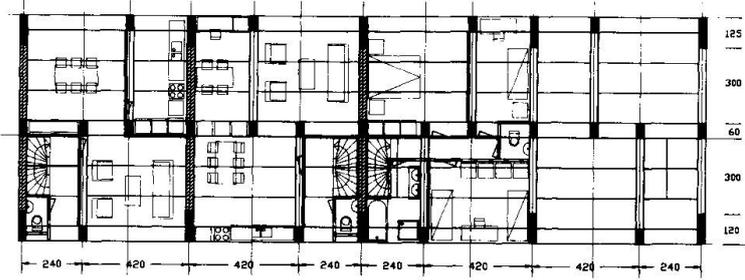
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4 EXAMPLE

Page 5 gives an exemple of popular type of Dutch dwellings.

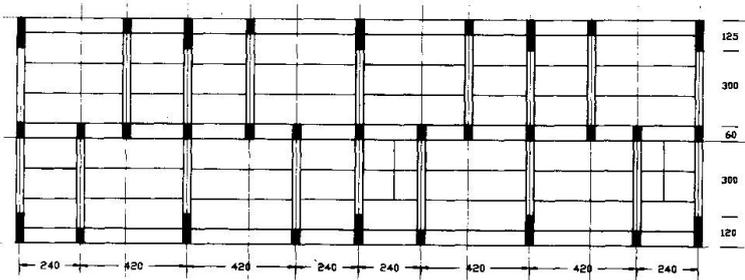
Example of different possibilities by the same support.



ground floor

upper floor

SUPPORT



INFILL  
thereabout-occupants  
makes their own  
decisions.

