OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

Distr.
LIMITED

ID/WG.122/20
28 March 1972

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Meeting on Prefabrication in
Africa and the Middle East

17 - 29 April 1972

Budapest, Hungary and Bucharest, Romania

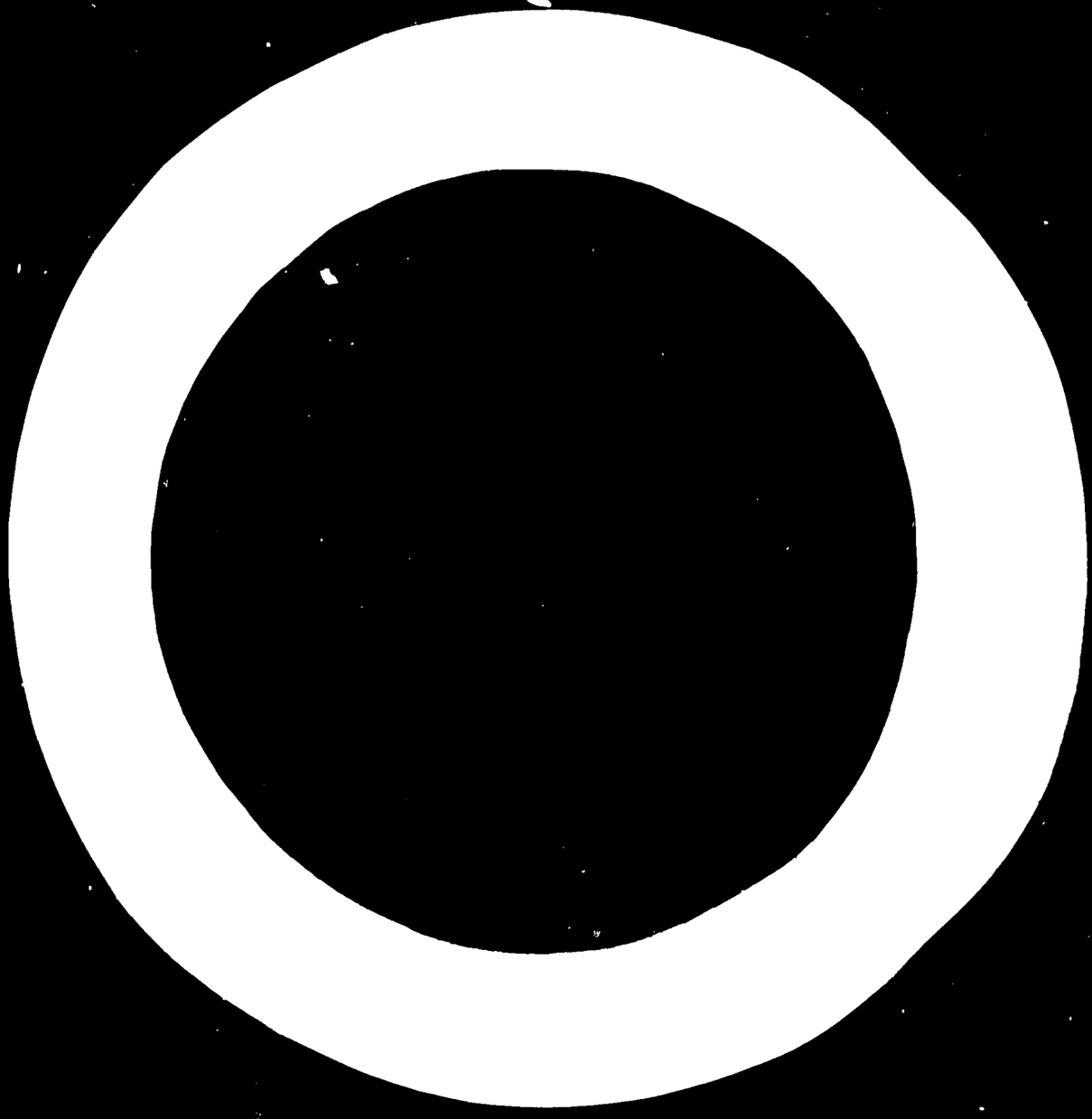
PREFABRICATION WITH GYPSUM [1]

by

M. Parkanyi
Kando Kalman v. 6
Budapest
Hungary

[1] The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

id.72-1884



1. Introductions. Ideas and their clarification.

This paper gives an extremely brief summary of a many years' research work, the aim of which was to elaborate a new, coherent, technological and economic approach to solving problems of mass-housing in developing countries.

As known to all, traditional building as a process is based on the axiom of tectonics. This simply means that you first put down something/ a piece of stone, a column, etc./ which is strong enough to support, and then, you place on it something, which is to be supported. Now, exactly the same principle is applied in the age of industrialized building, the only difference being that the supporting and supported elements are manufactured ones.

The axiom of tectonics, in other words: the principle of putting load-bearing elements above one another -- this is the essence of every tectonic structure be it traditional, or industrialised, up to this very day.

Traditional tectonic structures always put the emphasis on the individually workable, load-bearing elements; manufactured tectonic structures always put the emphasis on the usual manufacture of the frame, that is to say: on the usual manufacture of individually unworkable /finally shaped/ load-bearing elements, such as beams, blocks, panels, slabs, space-units, etc., and since all these elements are finally shaped, load-bearing elements, therefore, it is quite understandable, that the architectural variability / which can only be based on additivity/ goes on decreasing.

Now the question we reaised at the very beginning of our research was the following: Can we achieve a really fundamental change in the building industry through changing the principle of construction, or, in other words: is theaxiom of tectonics the only possible axiom of building, or can it be substituted for other rpinciples, and if yes, for what prinoiples, and how? -- and this how we finally came first, to invent the theory of non-tectonic structures, and then, to establish the first non-tectonic, industrialised system, the tissue-structural, cellular building method.

As opposed to any other manufactured tectonic system, which, as we have seen always put the emphasis of manufacture on the frame, the non-tectonic system puts the emphasis of manufacture on the surface, that is to say:

on the manufacture of the non-loadbearing surface elements, and instead of manufacturing heavy, loadbearing, tectonic beams, wall-, and floor-elements, we manufacture the light-weight, non-loadbearing, non-tectonic surface of the beams, walls, floors, etc.

In the non-tectonic system building becomes a complementary process in in which we combine the factory production of surface elements with an in-situ technology of pouring. First we always manufacture the elements of the surface / that is the surface of the wall, surface of the floor, etc./ and from these manufactured elements we actually assemble the surface of the load-bearing structure / that is the negative of the load-bearing structure/ through the additivity of these surface elements.

The building material is traditional, it is reinforced concrete and gypsum, but with this technology the weight of structure can be reduced extremely significantly, depending upon the type of building, from one-third to one-fifteenth. In order to achieve small weight and proper structural rigidity the cellular form of structure proved the most practical. When constructing the system we first manufactured the elements of the final surface, then, we preassembled the negative of the final, load-bearing structure on the building site, and then finally we elaborated the forwarding of the thin concrete to this surface. If the concrete meeting this surface required ribs, then we formed the negative of the rib within or, between the surface elements.

For the manufacture of the surface elements we, of course, chose a material of low specific gravity. Gypsum showed the most suitable, so we determined the form of the concrete by of the gypsum-elements. The concrete itself meets the gypsum in the phase of pouring, when, as a consequence of the moisture absorbing capacity of the gypsum, the concrete poured in, gets immediately stabilised. It freezes on the gypsum

Thus, in this structural system we determined the tissue of the concrete by the negative channel-system of the gypsum elements, and determined the form of the structure by the cells.

In the non-tectonic system the very surface element actually is a finally shaped, non-loadbearing, manufactured, non-tectonic brick, and as such, it is semantically meaningless. This means, that from an architectural point of view it is neutral, since-similarly to the traditional brick -- it is only part of the building, but not a determining part, consequently

it does not influence the final shape of the building. The aesthetic neutrality of non-tectonic bricks is based on the neutrality of the surface and this explains why in all these systems it is practically irrelevant whether we produce elements of wall, or elements of floor, the surface being the same in either case. Systems of non-tectonic bricks operate with open-systems.

We have already seen, that in non-tectonic systems the semantically meaningless surface elements are not bound to a particular building. This however means, that the building method actually transplants the well-known Gutenberg-principle to building industry simply by creating a new approach to fragmentation, which is the basis of any kind of mechanization.

Similarly to the letters of the phonetic alphabet -- or, more accurately said: similarly to the types of the printed alphabet -- which have no meaning whatever, yet allow any kind of texts to be printed, the elements of the non-tectonic system are no structures themselves, yet they render possible the assembly of any kind of structure required for housing, or communal buildings.

In the non-tectonic systems the elements -- i.e. the non-tectonic bricks -- constitute the letters of the structural system. This in other words means, that the role of the non-tectonic bricks in the non-tectonic building corresponds to the role of the movable types in the Gutenberg-principled printing and this explains why by analogy:

- we call the non-tectonic bricks the letters of the structural system.

In the non-tectonic building the non-tectonic bricks constitute a system, and this again explains, why again by analogy:

- we call the system of non-tectonic bricks the alphabet of the structural system, and

- we call the final product -- that is the building composed of the "letters of the alphabet" -- the typography of the structural system, and

- we call the very non-tectonic building Gutenberg-principled building and why, finally

- we call the manufacture of non-tectonic bricks blind manufacture. As opposed to the well-known housing factories, namely, in this kind of manufacture the factory does not see the final product, that is why the system is open.

In non-tectonic systems we combine the workability of structure/ which is a precondition for planning for change/ with the convertability of the manufacturing apparatus / which, in turn, is a precondition for producing

for change/. For this purpose we further developed modular coordination/ in which the reference is created between the modular elements and grids/ and elaborated the system of double-coordination / in which we established a double reference system on the one hand between the elements and grids, on the other hand, between the grids and the manufacturing apparatus/.

In the Gutenberg-principled building any modular dimension that occurs in the building can be expressed by the manufacturing apparatus. This is -- very briefly -- the essence of double coordination.

2. Conclusion. The possibilities inherent in the use of non-tectonic building methods in developing countries.

The application of non-tectonic systems to solving problems of mass housing may open now vistas for building in developing countries

1. because the materials applied are traditional hydraolic materials /i.e.: materials stabilised by water/. These natural or, artificial, stabilised, or reinforced silicate materials can be found anywhere; because they may eliminate the use of synthetics which have no real basis yet in these countries, and because they reduce the weight of structure very significantly. Our experiments clearly and scientifically proved that the tissue-structures represent the lightest weight construction manufacturable on silicate basis;

2. Because this very significant reduction of weight of building through reduction of material[X] radically changes first of all equipments of transportation and hoisting, absolutely eliminates the use of heavy trucks, trailers, cranes, etc., and therefore non-tectonic systems -- as opposed to any mechanization based industrialised system -- are not bound to built out infrastructure; then, it totally eliminates the long distance transportation of heavy elements with high degree of readiness. The non-tectonic systems put the emphasis of long distance transportation on the transportation of materials, and that of short-distance transportation on the light-weight surface elements which can quickly and easily be moved by no more than two or four men;

[X] by comparison:

weight of traditional wall:	400-500 kp/m^3
weight of large-sized wall panel:	450-550 kp/m^2
weight of traditional monolithic r.c. floor:	350-500 kp/m^2
weight of tissue structural wall, or floor:	60-80 kp/m^2 approx.

3. Because in the Gutenberg-principle building the very factory becomes transplantable, since the simple, light-weight apparatuses are constructed only of linear elements, which can be packed very favourably, thus when dismounted and when being transported they can not get distorted.

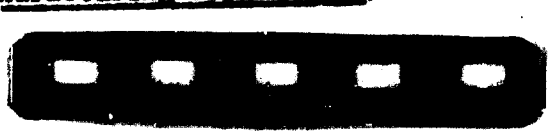
4. Because the Gutenberg-principled, non-tectonic systems are products of a complementary building method in so far as they combine the factory production of surface elements with an in-situ technology of pouring. The selection of complementary building methods is very important particularly in developing countries, because by making pouring one of the basis of the technology it becomes possible to combine an unusually high degree of mass-production of surface elements on an unusually high degree of precision even with handicraft forms of production, whilst using traditional materials.

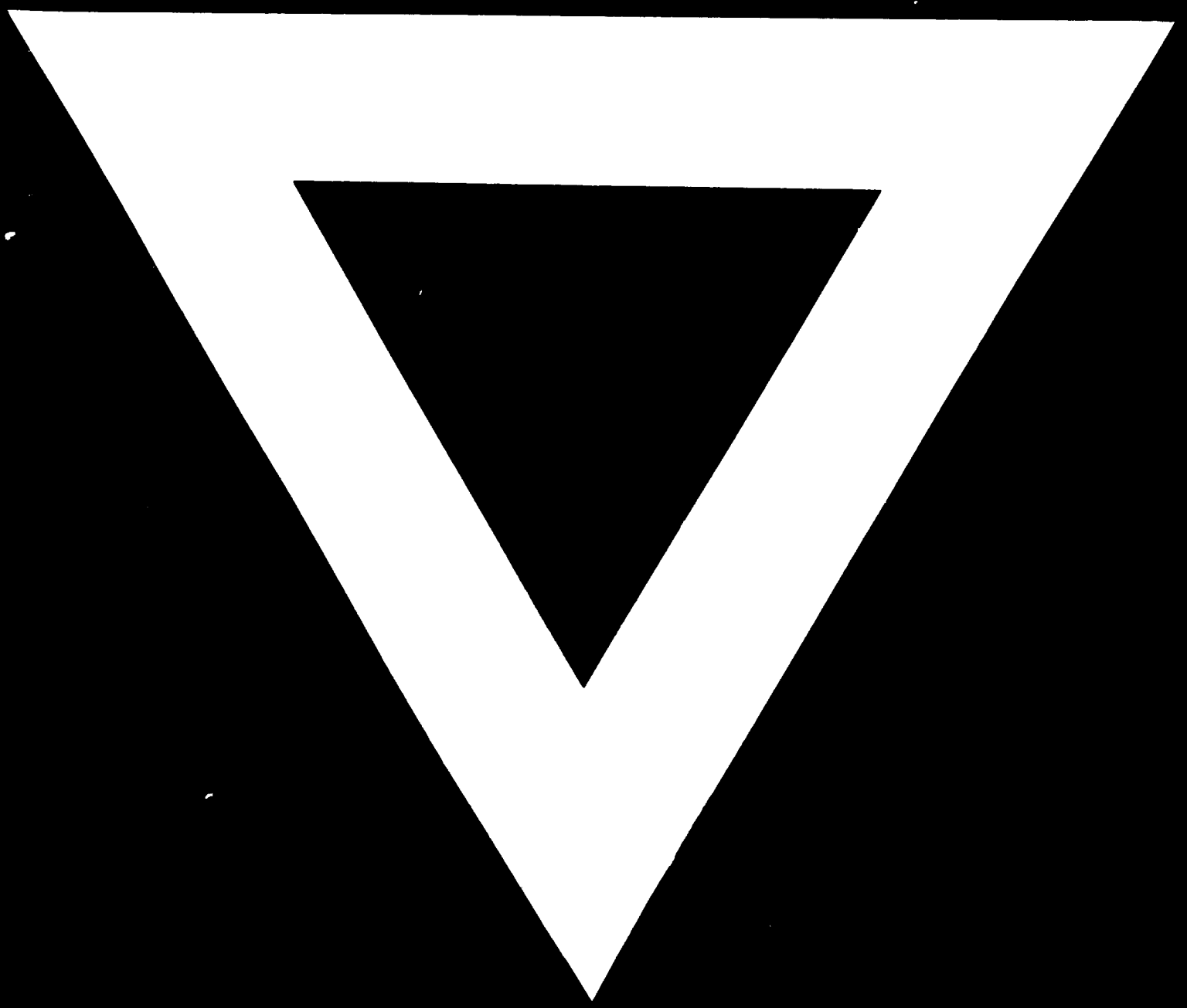
5. Because the technology itself is an extremely low-cost technology, which combines the technical advantages of capital-intensive technologies with the social-economic possibilities inherent in the use of labour-intensive technologies and thereby it offers a possible solution for eliminating the well-known inner contradiction of building in developing countries, since it may simultaneously satisfy requirements deriving from the unheard of housing shortage, need for industrialisation and extreme abundance of labor force.

6. Because it combines the additive principle of construction with monolithic structure and thereby its products -- the buildings -- are structurally rigid and earthquake-safe.

7. Because the factory production - i.e.: blind-manufacture - can be realised through elementary manufacturing apparatuses which require very low investment costs.

8. Finally, and this the most important: because it creates an open system industrialization and thereby -- both from social-economic and technological points of view -- it basically changes the whole structure of building industry. Instead of requiring huge planted factories -- the investment costs of which are extremely high, as known to all -- it bases the structure of industry on a system of elementary factories, micro building industrial units/ which can be scattered all over the country, and in which the production of non-tectonic bricks is founded on cheap, easily mass-producible, convertible transportable and transferrable elementary manufacturing apparatuses, which can even be operated by unskilled workers.





19.12.73