

Finnish Developments towards Industrialised Residential Infill Systems

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ABSTRACT

In recent years there has been a growing interest in more adaptable housing in Finland. Today it is recognised that values and housing preferences are too varied to be met by universal fit-for-all solutions. There are developments going on in several directions; some of these developments involve high-density low-rise housing, some involve medium-rise housing with wooden load-bearing structures and an emphasis on ecology, and some are following the open building approach.

In this article I first briefly present the structural features that have become common in Finnish housing construction within the last thirty years. This will help to gain an understanding of the potential for open building in Finland. After that, I describe the common features of Finnish residential interiors and the interior product market, and present some interesting interior products that have recently become available. To end the article, I make brief remarks on the major factors that are driving the Finnish industries towards more open building friendly ideas and products.

KEY WORDS: industrialised housing & open building in Finland, adaptable interior systems & products

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Major development programmes for industrialised housing construction, common practices, and the emerging open building

During the last three decades, the use of various prefabricated parts has become very common in Finnish housing construction. The development programme of Suomen Betoniteollisuuden Keskusjärjestö SBK (The Central Organisation of the Finnish Concrete Industry) in 1968-70 had a major impact on the use of prefabricated parts. The so-called BES (concrete element system) recommendations for the open panel construction system were made in the programme. Based on modular dimensions, pre-cast reinforced concrete wall elements and hollow core floor slabs, BES quickly became very common in both residential and commercial construction. The BES development was quickly followed by PLS, an open flat-slab construction system development programme in 1971-72; however, PLS never became as common as BES in housing.

A further development of the BES programme was organised in 1986-90 by Tekes (the National Technology Agency of Finland) and VTT (the Technical Research Centre of Finland). The theme of the programme was “totally adaptable technology” and a system called TAT was developed as part of the programme. Its main idea was to handle technical subsystems as independent compatible modules or components, and to create a common set of concepts, a dimensioning system, a selection of component types, design instructions and model plans. The TAT principles have had some affect on residential construction, but have mainly been applied to office construction.

The first time a wider interest towards residential open building was recognised in Finland was in connection with the Milieu 2000 Technology Competition organised by Tekes, the Ministry of the Environment and the City of Helsinki in 1990-91. Four winning proposals of the competition were implemented in Herttoniemenranta, Helsinki in 1994-98. The development themes of the proposals included re-configurable building parts and equipment, and user participation.

During the last thirty-years, structural technology based on prefabrication has become dominant in Finnish housing. However, user demands have changed during the period and some structural solutions have proven to be unreliable. The main features of multifamily housing in Finland today are:

Structure and technology:

- the horizontal load bearing structure is usually made of hollow core slabs with a relatively long span

- facades [ES1] are often made of factory produced concrete elements (the skin, however, is usually of bricks laid in-situ due to the problems with the concrete facades of the pre-cast sandwich facade elements made in the 1970's)

User involvement:

- user participation has been relatively uncommon, but future first owners of newly built multifamily housing are becoming more demanding (today developers are forced to make many alterations to original apartment plans during construction of owner-occupied multifamily housing)

Fittings and amenities:

- apartments include saunas (until the 1980's, saunas in Finnish apartment buildings were shared, and private apartment saunas were uncommon; these days, private saunas are being built in even small one-room apartments)

Projects and actors aiming for adaptable housing

The implemented housing projects in Finland that include the main characteristics of the open building approach¹ are not yet very numerous. However, there are certain parties that are striving rather progressively towards open building with a more adaptable building technology², three examples of which are given below.

Building concept development: from Laivalahdenkaari 18 Housing to +Koti

VVO Laivalahdenkaari 18 is a 5-6-storey rental apartment building with 97 units located in Herttoniemenranta, Helsinki. It is designed by Kahri & Co., Architects, and finished in 1995. The original project included user participation and various adaptable components. The occupants had a selection of two to six-plan layouts [ES2] to choose from for their dwelling. They were also able to decide the material of the balcony railings, balcony glazing and the lower parts of the window openings. The choices were pre-priced, and their impact on the rent was calculated. Adaptable frames, variable panels and balcony systems, an individual heating and ventilation system for each apartment without radiators, and a de-mountable partition system were introduced in Laivalahdenkaari 18. The designer has continued developing the scheme (both in terms of the technology and the user participatory concept) with another developer; the scheme has been renamed as +Koti (+Home).

Competition for residential open building technology in Helsinki

The City of Helsinki and Tekes organised a technology and site-allocation competition for Arabianranta in 2000-01. The aim of the competition was to promote resident-oriented housing construction by applying the principles of open building. User-oriented operating models for the construction process, and new building systems and building products were the key development targets of the competition. Development groups with one of the

¹ The main characteristics referred to are "user as decision maker", "open spatial structure", "separation of support and infill systems", and "open building process". For the division of characteristics by Ulpu Tiuri, see Tiuri-Hedman 1998, p. 23.

² The major Finnish commercial developments and housing projects aiming for adaptability in the 1990's are described in "Developments Towards Open Building in Finland" written by Ulpu Tiuri and Markku Hedman.

partners acting as principal were entitled to take part. Four groups took part in the competition. "Sato-PlusKoti" of Sato developers and Kahri & Co., Architects, won the competition.

Progressive developer: Keski-Suomen YH-Rakennuttajat

Developers Keski-Suomen YH-Rakennuttajat have been applying several technical solutions in their projects to develop more flexible renovations and newly built housing. Individual mechanical engineering distribution boxes for each apartment, the placing of vertical ventilation ducts in the perimeter area of the apartments (integrated into façade walls or staircase structures), various solutions for wet spaces and several modifications of access floors are some applications developed in collaboration with certain manufacturers. In its projects, Keski-Suomen YH-Rakennuttajat has gradually introduced new technology over several years with the aim of increasing flexibility.

Common features of Finnish residential interiors and interior product market

Around the world, architecture is shaped by natural forces (geography and climate), cultural forces (housing traditions and local habits) and material forces (wealth, economy and resources). As Finland is one of the Scandinavian countries in the north of Europe with long cold winters, it is inevitable that heat and heating plays a major role in all construction. Most Finns feel that a dwelling is defective if it is not warm inside during wintertime. Similarly we feel that a house is imperfect if there is no sauna in it. We also tend to personalise our dwellings ourselves - do-it-yourself interior decoration is especially common.

To meet the needs of do-it-yourself interior construction, there are many do-it-yourself stores (rautakauppa in Finnish, literally translated as "iron store") in Finland. In these stores there is a large selection of surface materials of various types. Also the range of colours and tones for paints is very wide compared to those available in many other countries. The consumer may purchase materials, products, equipment and even small buildings such as garden cabins in rautakauppa. Kitchen cabinets are a common merchandise too - most kitchen manufacturers have either a nation-wide chain of representatives or have their products sold in various do-it-yourself stores.

Structurally, the residential interiors in Finland are usually built in a set way. Partitions, storage units and equipment are fixed and piping is often placed in situ within the reinforced concrete cast structural parts. Bathrooms and saunas are usually built fixed. However, a more sustainable technology relating to building services is becoming more and more common in Finland - for example, double piping made of polyethylene has become a common means of delivering heating and water supply, and an electricity system based on quick connectors is now on the market.

Adaptable interior products & concepts

In the following chapter there are some examples of adaptable Finnish interior products.

Bathroom units

Parmarine Oy, a manufacturer of bathroom units for the construction and shipbuilding industries, produces bathroom units with reinforced concrete floors and steel wall structures. The residential units, weighing 2.000 - 4.000 kg, are fully equipped rooms in which interior furnishing and mechanical and electrical service installations are made at the factory. The units are manufactured as ordered according to specific plans. In the 1980's, the company developed a panel bathroom type called "Entra 2000" that consists of floor, wall and ceiling panels. The type was delivered to the construction site as panels that can be brought into an apartment through the door opening.

Unit saunas

Unit saunas that can fit into small spaces are a new product group on the market. Apartment saunas became common in the 1980's in the newly built housing; these days it is relatively common to renovate old apartments and add a sauna if it can be made to fit into the overall room layout.

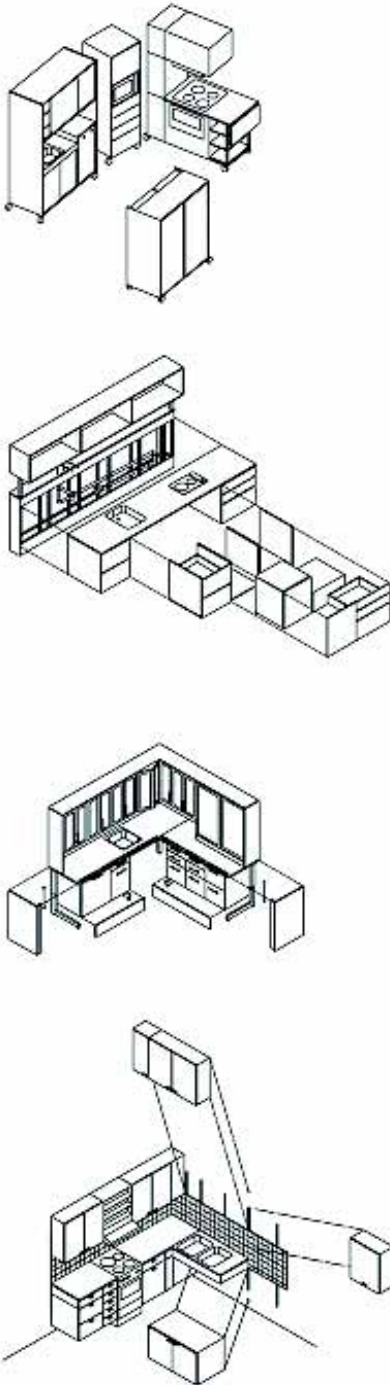
Half a dozen unit sauna manufacturers have entered the market with various solutions. The common denominator of these products is that they are delivered to site as ready-to-be-assembled sets, consisting of corner, wall and ceiling elements with a heater. They are assembled on top of a waterproof surface in the same manner as shower cubicles. Some manufacturers use a wooden structure with insulation, while others apply wooden panels to compound plastic materials with insulation. The units range from existenz minimum - Saunadusch Oy has a special, integrated, minisauna/shower cubicle with hinged sauna benches - to large custom made special deliveries. The design varies from traditional aesthetics to trendy geometric minimalism.

Adaptable kitchen sets

Commonly the kitchen manufacturers offer modular dimensioned cabinet frames and a large selection of materials, designs and colours are available for cabinet doors. The customer may choose a combination of modules and doors himself, or he may use design services available at most retailers. The outcome is customised, but not very adaptable during its use. The following kitchen sets are designed to have good adaptability.

A design based on independent movable units

A kitchen based on independent movable modules on wheels, designed by the interior architect Juha-Pekka Kinnunen, was presented at the Finnish Housing Fair of 2000 in Tuusula. The kitchen set consists of water, heat, cold and storage modules. A sink, a dishwasher and some storage space form the water module; a stove, a stove extractor fan and some cabinets make the warm module; a freezer and a refrigerator are combined to form the cold module. A microwave oven, for example, can be integrated into the storage modules. The module frames are made of steel and equipped with wheels. The surfaces



are made of high-pressure laminate or heat-treated birch, and there are quick connectors for electricity, water and drainage in the modules. The first version of the kitchen set was tailor-made for Villa 2000 House of the Housing Fair.

A design based on an installation wall and units integrated to a modular worktop

A kitchen design by the interior architect Esa Vesmanen based on an installation wall and units integrated to a modular worktop was first introduced in a design exhibition in May 2000. Its overall idea is based on its designer's studies and remarks on contemporary food culture. The installation wall with a steel structure - with surfaces of glass and subdued lighting inside the structure of the original version - semi-conceals the piping. The worktop is installed next to the installation wall. It contains built-in taps, a basin and a cooker. Various "space modules", for example, a two-sided refrigerator, home compost, recycling centre or dishwasher can be integrated under the worktop. The upper shelves in the original design are made of a lightweight veneer structure. The set can be installed as an independent space divider within a large living-dining-eating area or facing walls in a separate room. When installed as a space divider with a free-standing installation wall, the kitchen set can be easily updated with future technological innovations via the wall.

Height-adjustable kitchen cabinetry, adjustments as whole

The Keiski kitchen is an adjustable kitchen set designed by the interior architect Sirkka-Liisa Keiski. Aesthetically the kitchen matches the common taste, and functionally is especially designed to meet

the demands of the senior citizen and the disabled. It contains several special features. The kitchen can be integrated or free-standing. There is a steel pillar and pedestal mechanism that enables the kitchen set to be height-adjusted as one unit to a desktop height of 730 mm to 900 mm. The unit consists of lower cupboards, refrigerator and dishwasher that are hung from the worktop, and of upper cabinetry. The upper cabinetry is supported by plate walls installed on top of the worktop. The whole unit can be raised or lowered by sliding the pedestals within the steel pillar and locking it at the desired height. In L-shaped applications, some horizontally sliding lower cupboards are included to make legroom for wheelchair users who wish to use the worktop area. Handrails to help the disabled are integrated into the worktop in an aesthetically pleasing manner. The Keiski kitchen set is manufactured by Lahden Mittaovi Oy.

Height-adjustable kitchen cabinetry with independently adjustable modular frames

Some manufacturers offer height-adjustable cabinetry based on modular dimensioned frames and vertical installation mouldings. Upper cabinets, worktop and lower cabinets are installed independently into perforated metal mouldings that are screwed into the walls. The lower cabinets have adjustable pedestals and their plinth boards are renewed after height-installation. Modular metal cassettes with a tiled surface are used between the worktop and upper cabinets. The upper cabinets can be independently height-adjusted to a limit of 300 mm, and the worktop and lower cabinets to a limit of 200 mm. The modular cassettes can be removable, or dimensioned according to the highest and lowest cabinetry positions, to cover all of the wall area between the height-adjustment limits.

Conclusions: The main factors pushing towards an adaptable infill industry

The dwellers' needs and wishes in respect to their houses in contemporary society are becoming more and more difficult to predict and fulfil. Special dweller groups, be they cultural or demographic, have emerged, and they demand to be taken into account in housing design. Elderly citizens, with limitations to their bodily movements, need special functional solutions, for wet spaces, for example, which are not necessary for the younger age group. These various needs cannot be properly met with a good-for-an-average-family design mentality or by using only standardised equipment and spaces.

In Finland there is a tendency to build larger wet space areas with more water-using appliances within apartments. In many cases this tendency has caused problems with moisture. One way to reduce these problems is to use more factory-made integrated components in the wet areas; these would help improve technical quality by reducing the workers' need to improvise with various electrical and mechanical piping component joints on construction sites. If these integrated parts were designed with reversible joints³, they could be replaced and changed later on to meet the occupier's changing demands as to design or function.

In addition to some new functional needs and problems with moisture, the state support for open building developments via Tekes funding is one of the main driving forces towards industrial infill technology in Finland. The open building approach is recognised by Tekes by placing it as one of the key development issues.

In Finland there is advanced construction technology available at the support level of open building at present. At the level of residential infill, the situation is more controversial. It is interesting to note that adaptable interior systems did become relatively common in the 1990's in Finland - in the field of office development.⁴ However, systematic access floor structures, for example, suitable for residential use, entered the market as late as the year 2000. So far, the co-ordination of the parts and the demands for mechanical and engineering components and interior parts for adaptable buildings have been lacking. These demands will soon be met, when the second report of the "Infill Systems for Open Building in Housing" R&D project of the Department of Architecture in Helsinki University of Technology comes out at the end of 20015. In it, the recommendations for residential total infill systems and product concepts suitable for Finnish housing culture and the Finnish building industry will be given. It is very likely that new product and method development programmes will be started subsequently, based on the recommendations of the report.

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