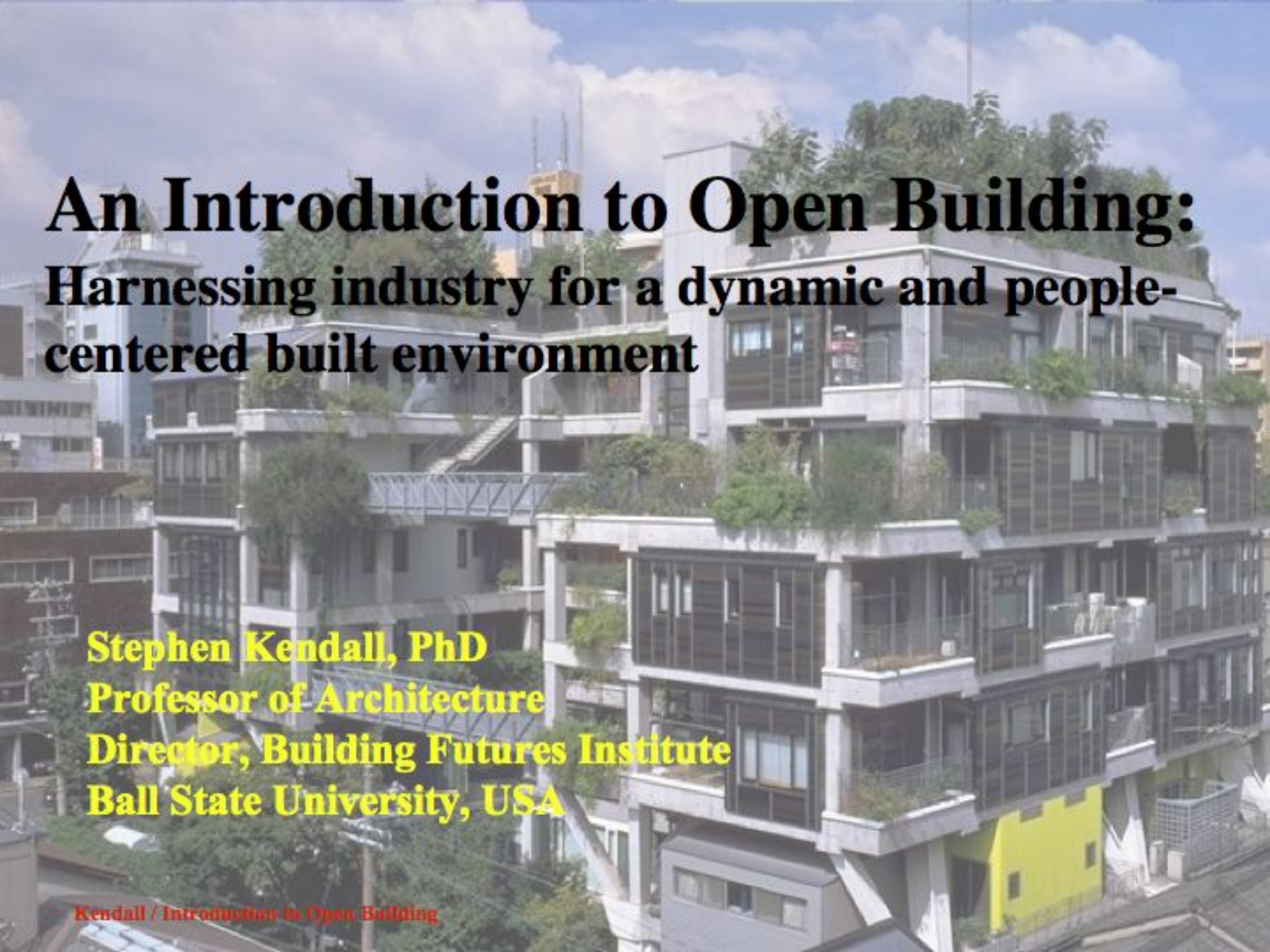
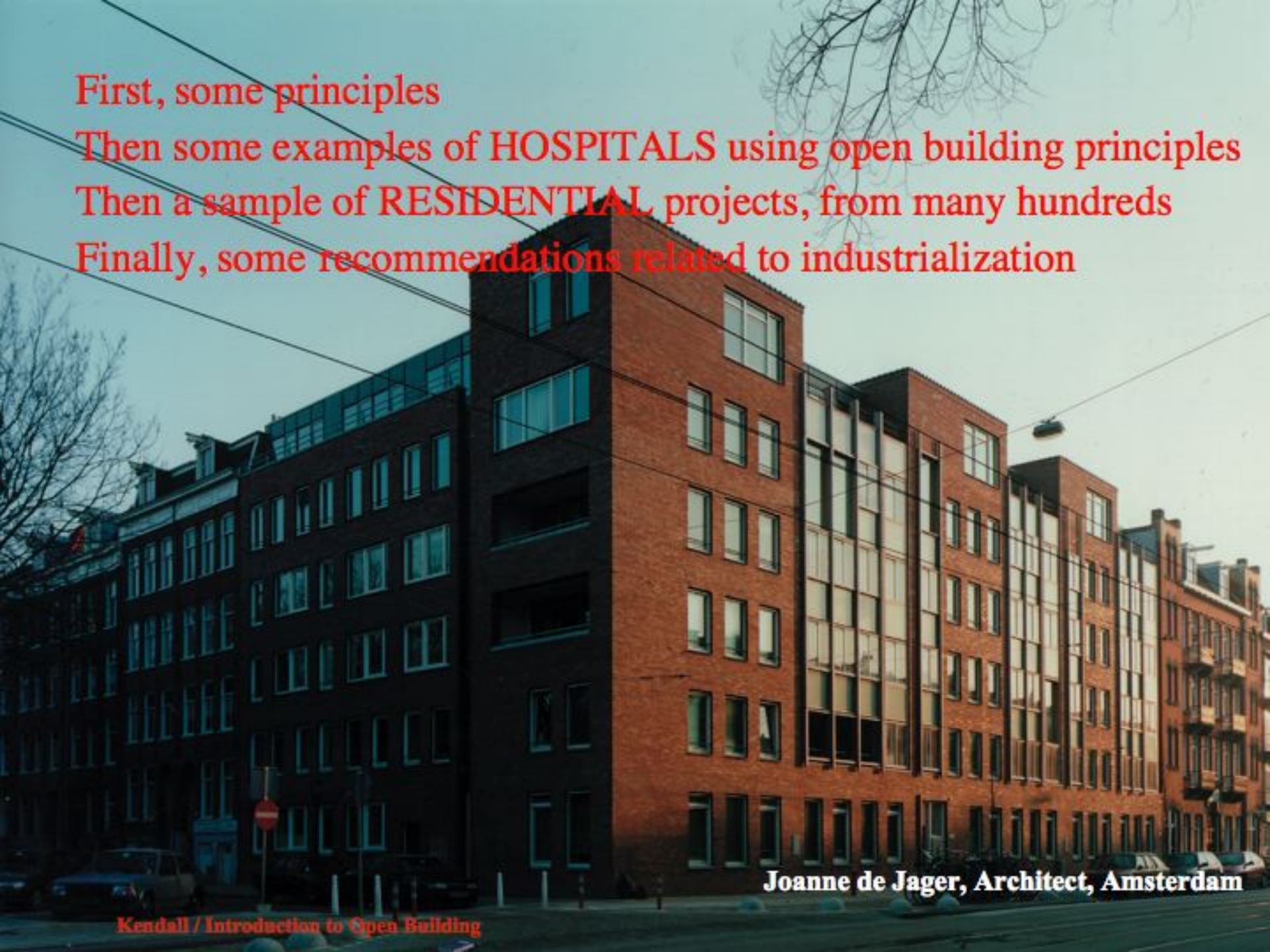


An Introduction to Open Building:
Harnessing industry for a dynamic and people-centered built environment

Stephen Kendall, PhD
Professor of Architecture
Director, Building Futures Institute
Ball State University, USA

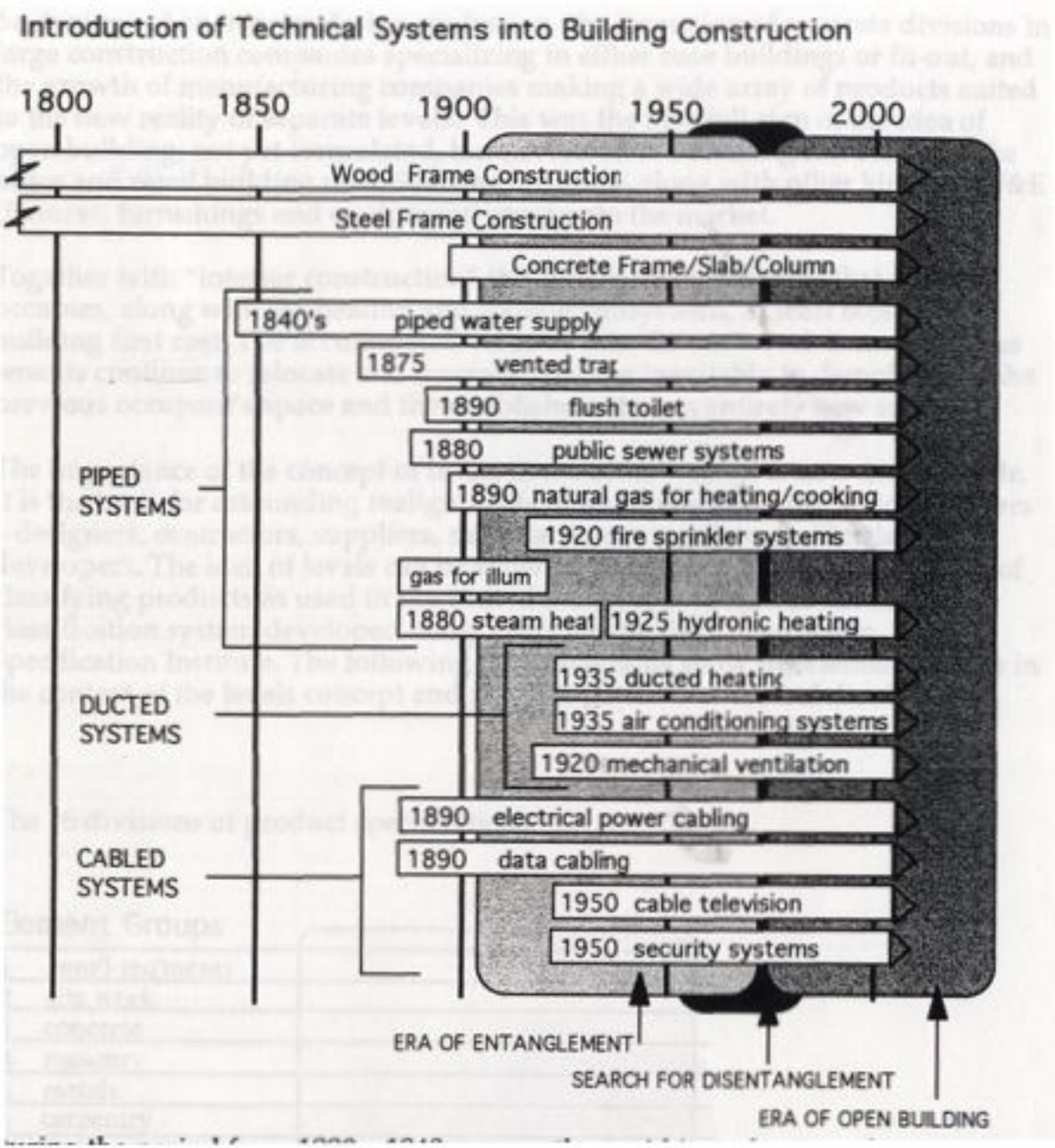
First, some principles
Then some examples of HOSPITALS using open building principles
Then a sample of RESIDENTIAL projects, from many hundreds
Finally, some recommendations related to industrialization



What is Open Building?

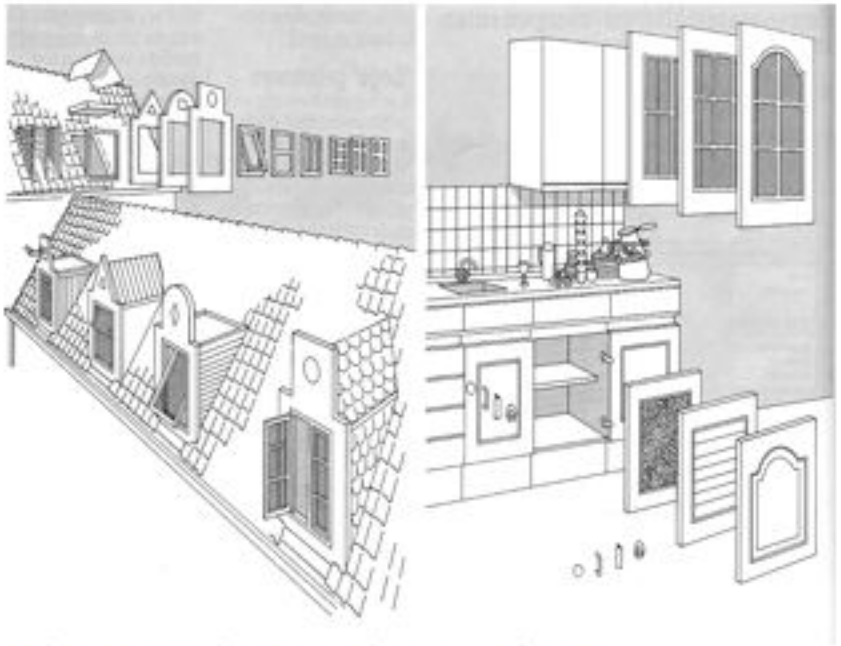
A technical way of explaining..

…buildings are composed of many thousands of parts…



Avoiding the entanglement in this picture is important

Interface conditions should allow alternative products to replace one another…



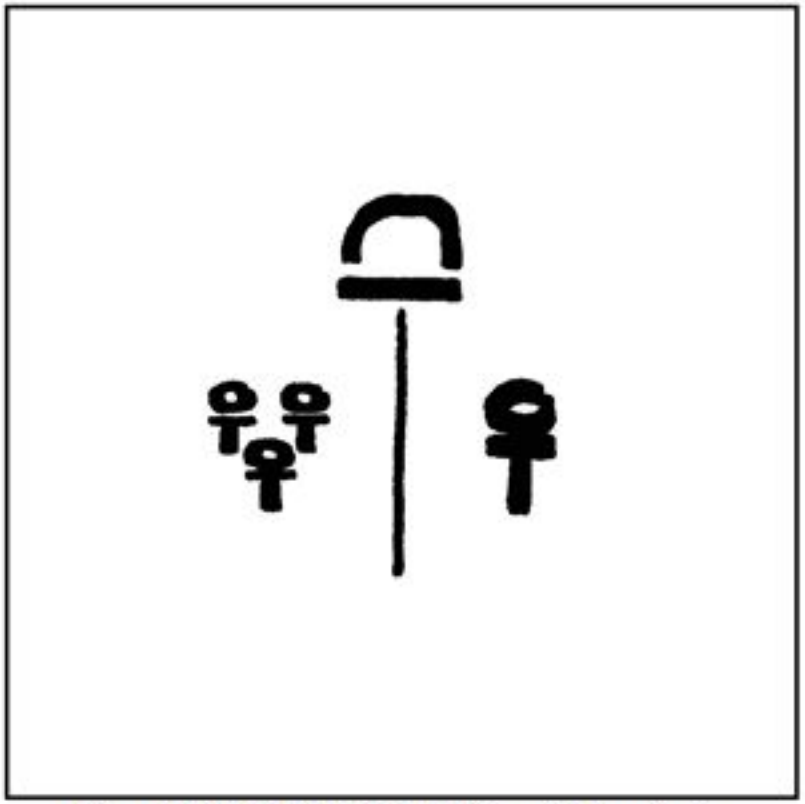
This is the technical or "flexibility" aspect of open building…

The second point concerns distribution of responsibility…

***CONTROL** is always distributed…*
…but who controls which parts?

***INDIVIDUAL USERS** must be able to exercise control… but of what parts and spaces?*

***COMMUNITY** is responsible for…..what parts and spaces?*



From HABRAKEN: "ABC's of Housing"

Control also has a lot to do with the control of space…

…territorial control….

This is important to human beings' sense of belonging and personal responsibility..

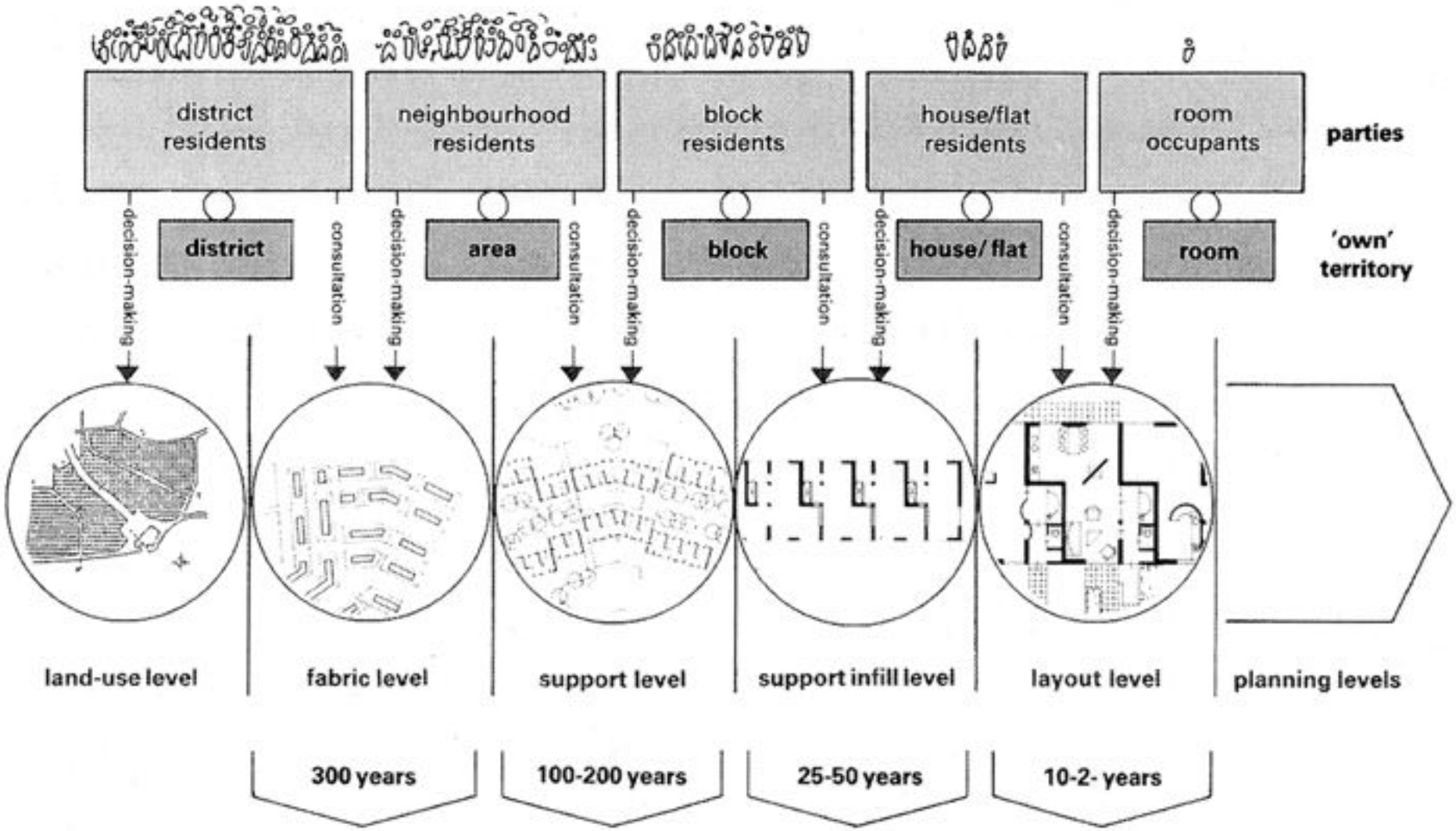
Open building is also about

PERMANENCE and CHANGE

- The city is permanent to the neighborhood
- The neighborhood is permanent to the building
- The building is permanent to the room
- The room is permanent to the furniture…

…the built environment is never finished….

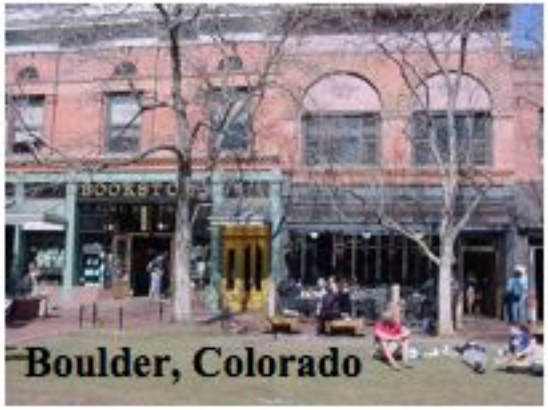
Open building distinguishes "LEVELS" of intervention



Source: OBOM/TU DELFT

For example

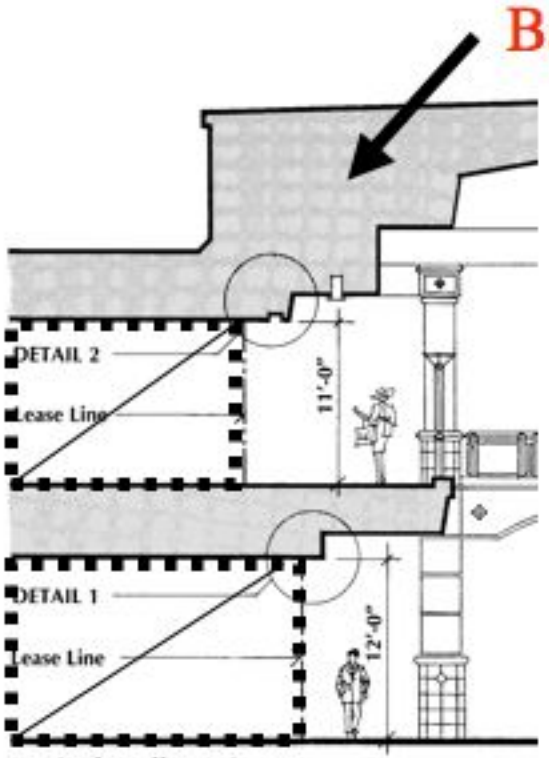
- ***Shopping centers have always balanced permanence and change and distributed design.***
- ***The base building is designed by one firm***
- ***Shops are designed by specialized interior designers***
- ***And are installed by specialized fit-out contractors***



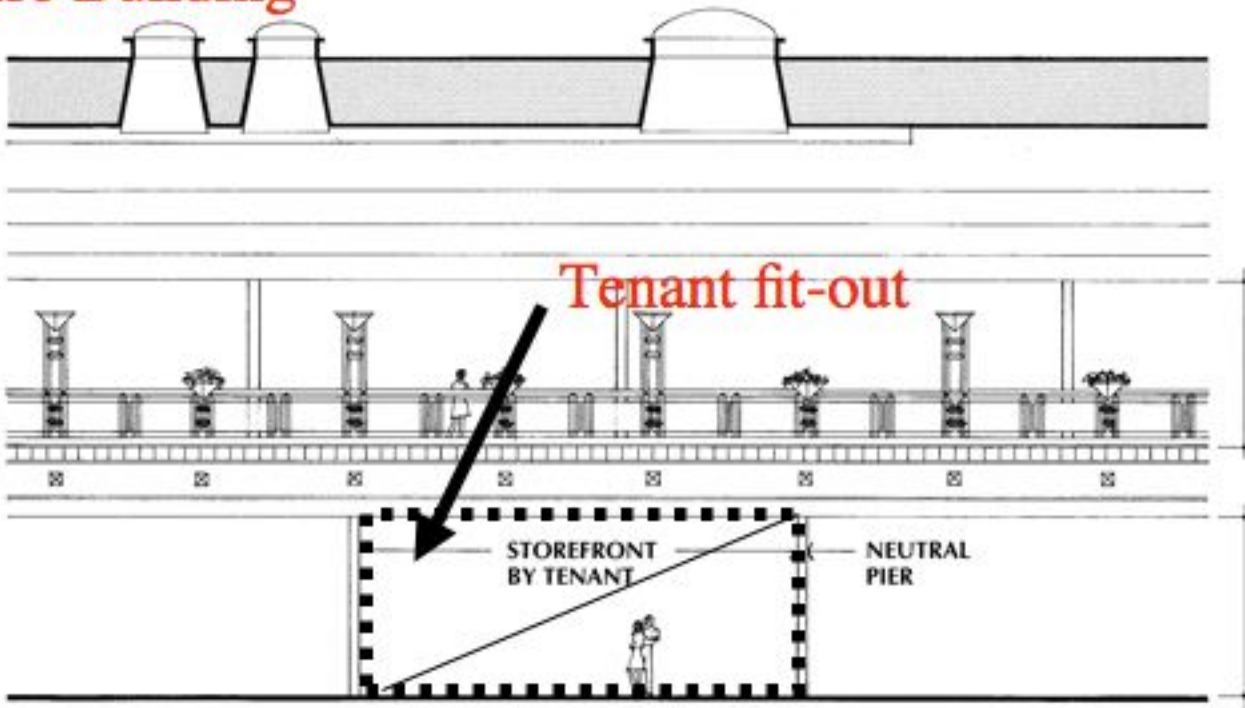
Boulder, Colorado

GUM Department Store, Moscow

Shopping centers are handled in very conventional ways…



Typical Mall Section



Typical Mall Elevation

Modern office buildings, designed by the best architects……

- are built for "churn"….
- Inside, tenants have their leased spaces designed by their own architects…
- and finished by specialized fit-out contractors


Tokyo

Hospitals on the Time-Axis

100 years

25 years

5 years

Long Lifetime

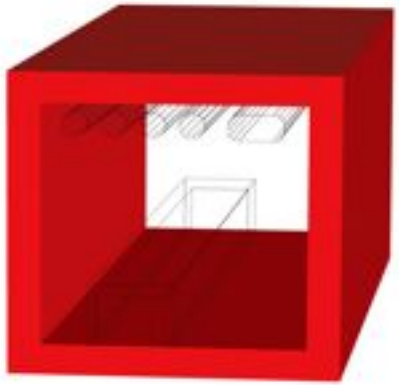
(50 -100 years)

UNCHANGABLE

Site development

Supporting structure

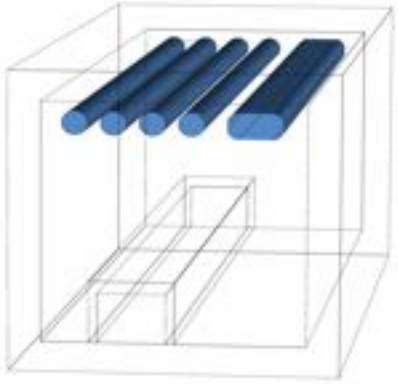
Building envelope



Medium Lifetime
(15 - 50 years)

ADJUSTABLE

Inner walls, ceilings and floors, fixed installations (extensions)

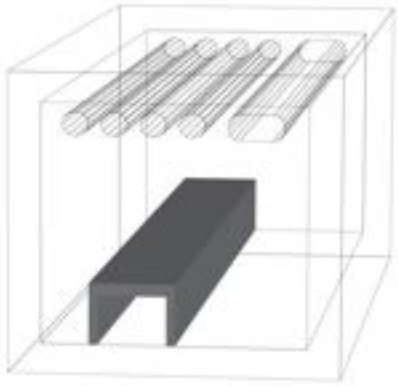


Short Lifetime

(5 -15 years)

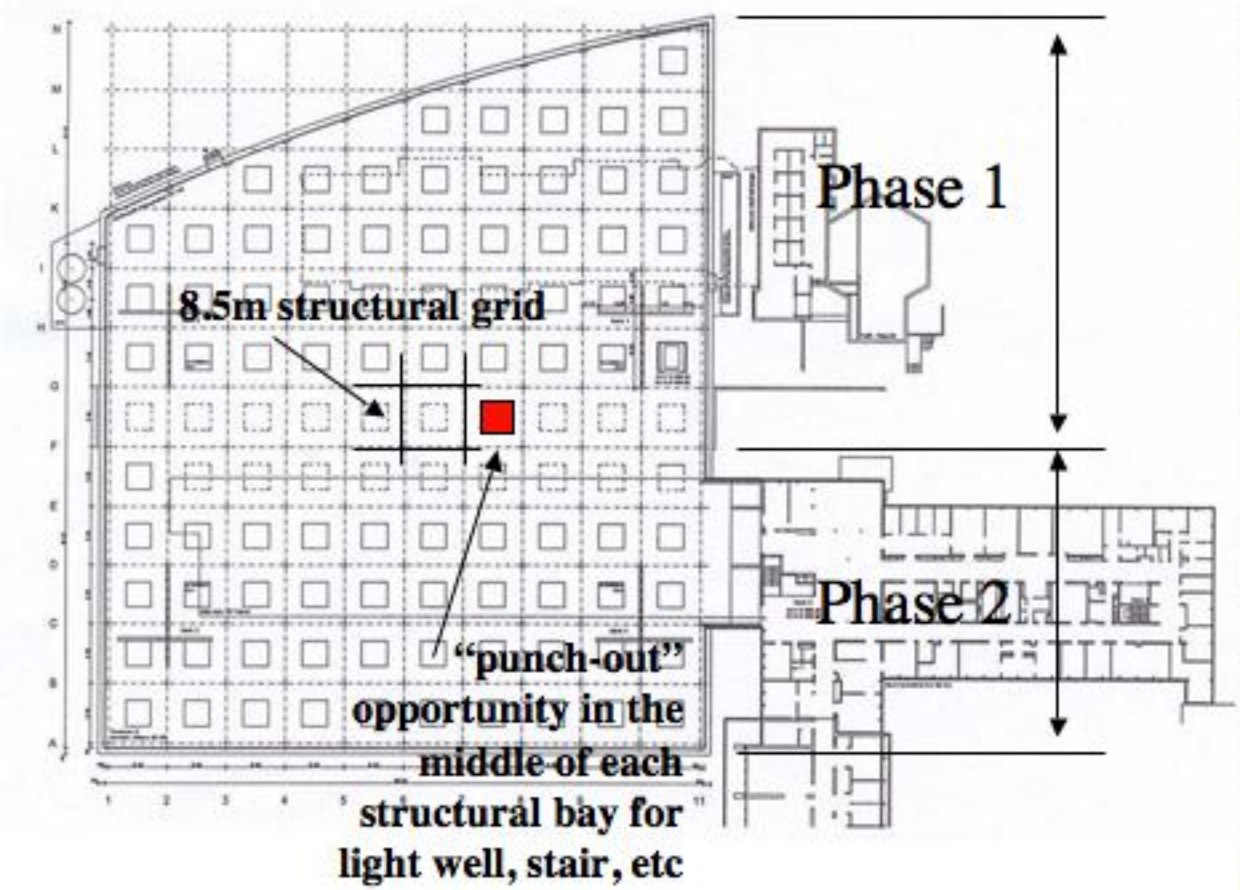
CHANGABLE

Devices, equipment, furnishings



The Inspital (INO) Project

Bern, Switzerland



Roof of Phase 1

Inside Phase 1 Primary System

The INO Hospital

Bern, Switzerland

Two alternative layouts of a surgery suite in the base building…

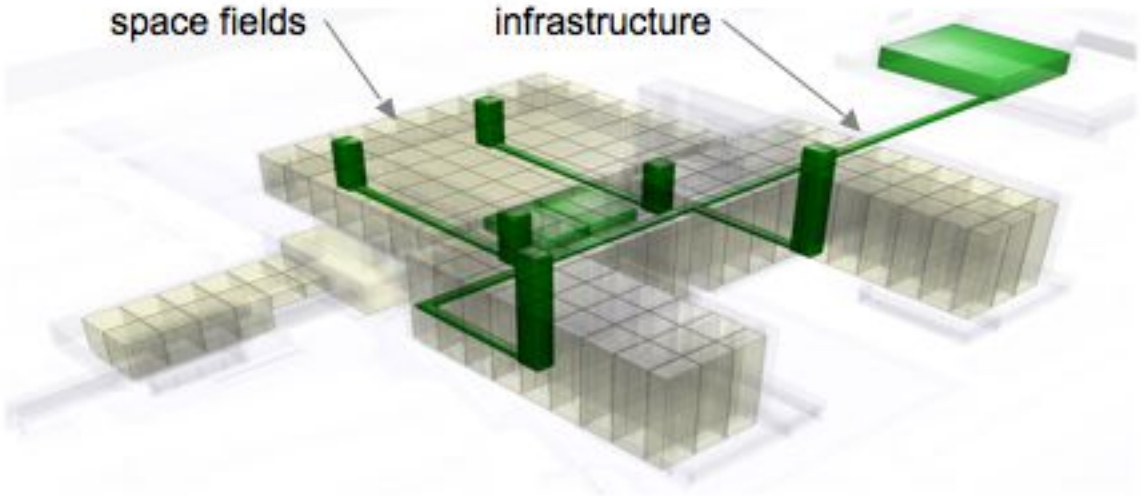
Gonda Building / Mayo Clinic

Architects: Ellerbe Becket

A variety of layouts is possible

Banner Estrella / Phoenix

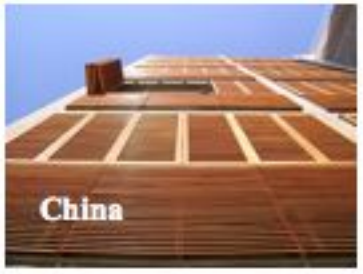
NBBJ Architects

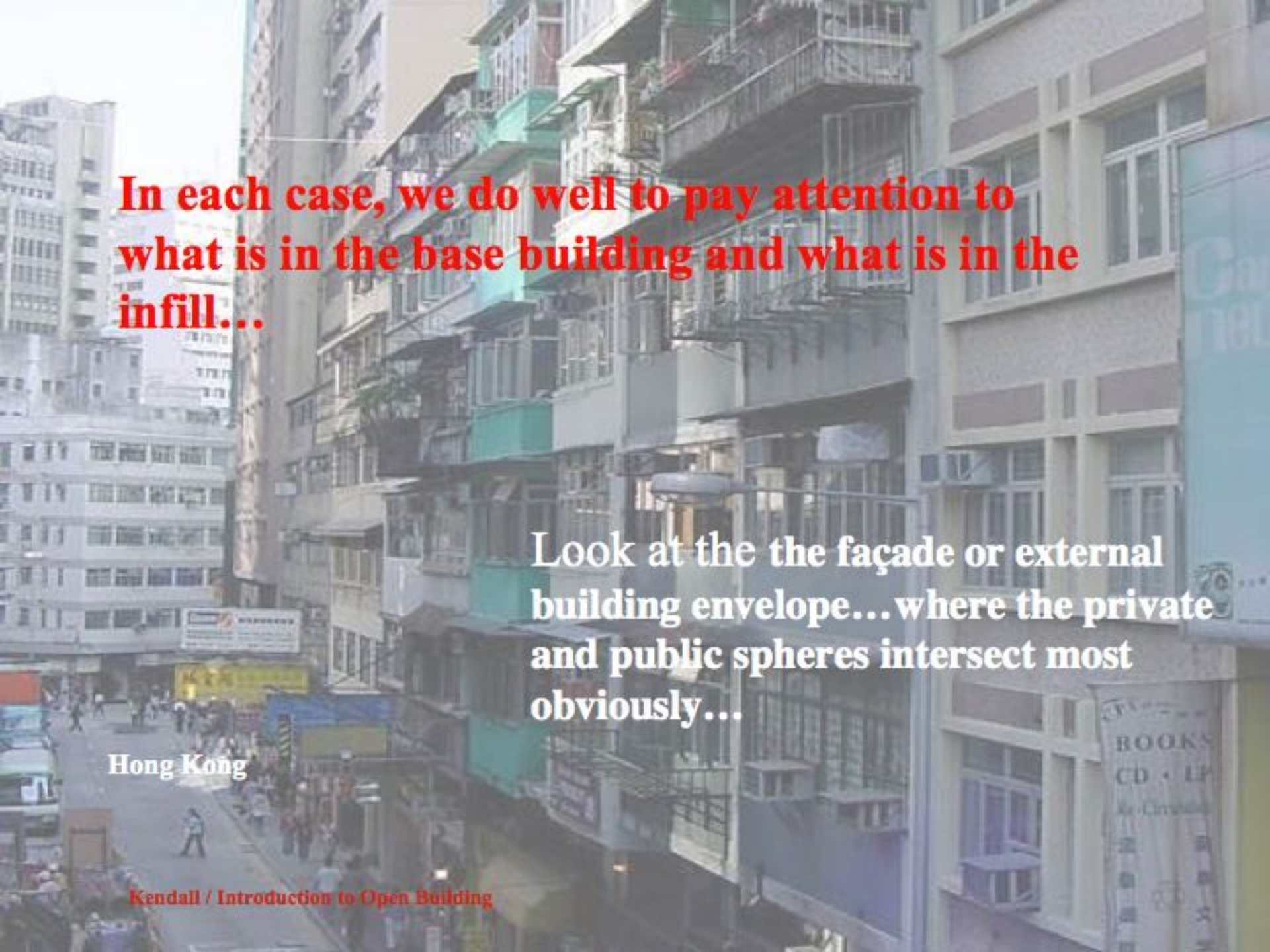


Permanent infrastructure relative to space fields

But what about residential building?

CASES OF RESIDENTIAL OPEN BUILDING ...among many hundreds...



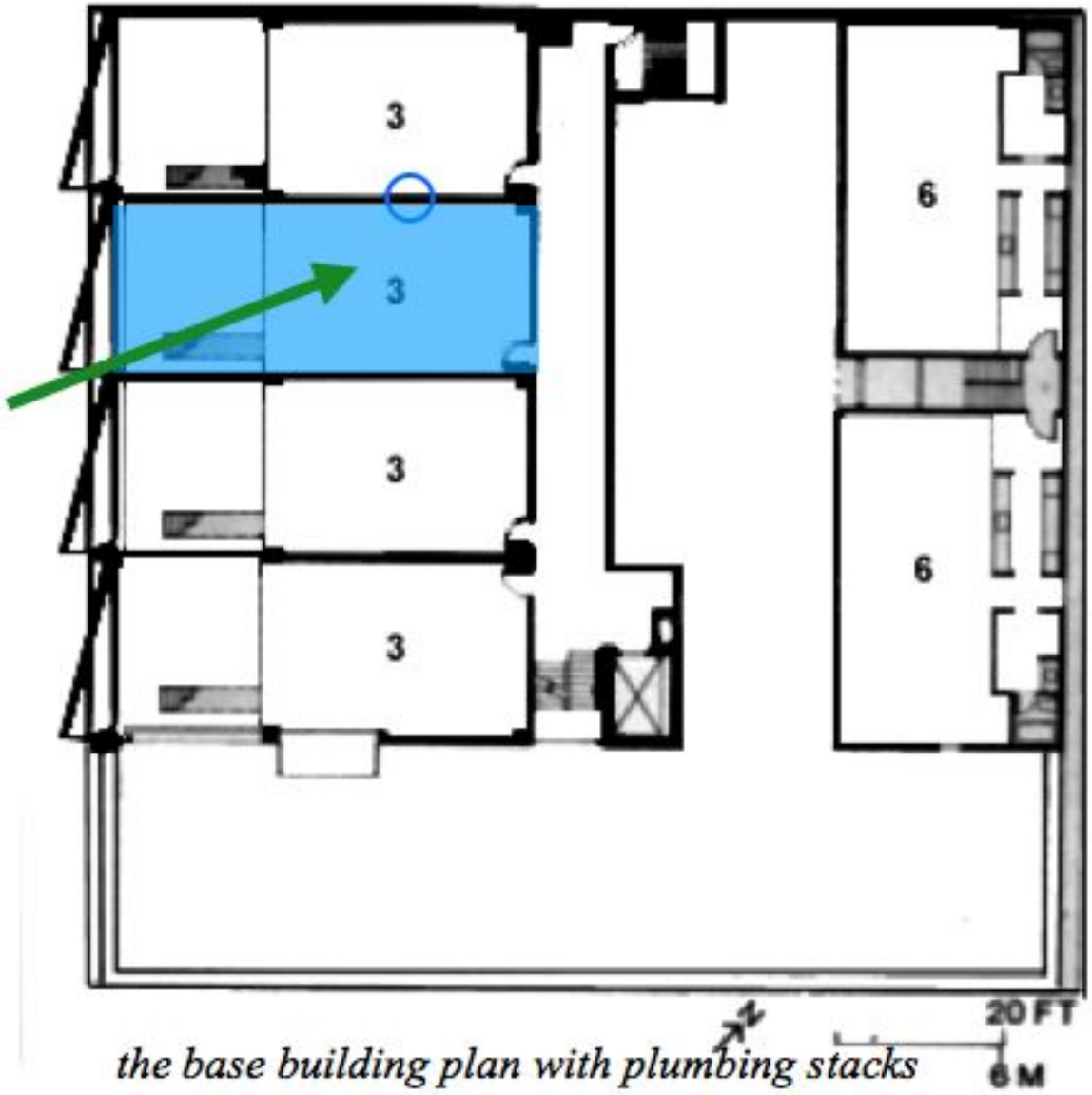

In each case, we do well to pay attention to what is in the base building and what is in the infill…
Look at the the façade or external building envelope…where the private and public spheres intersect most obviously…
Hong Kong
Kendall / Introduction to Open Building

The Banner Building

In Seattle, Washington, a developer hired an architect to design an open building for sale.

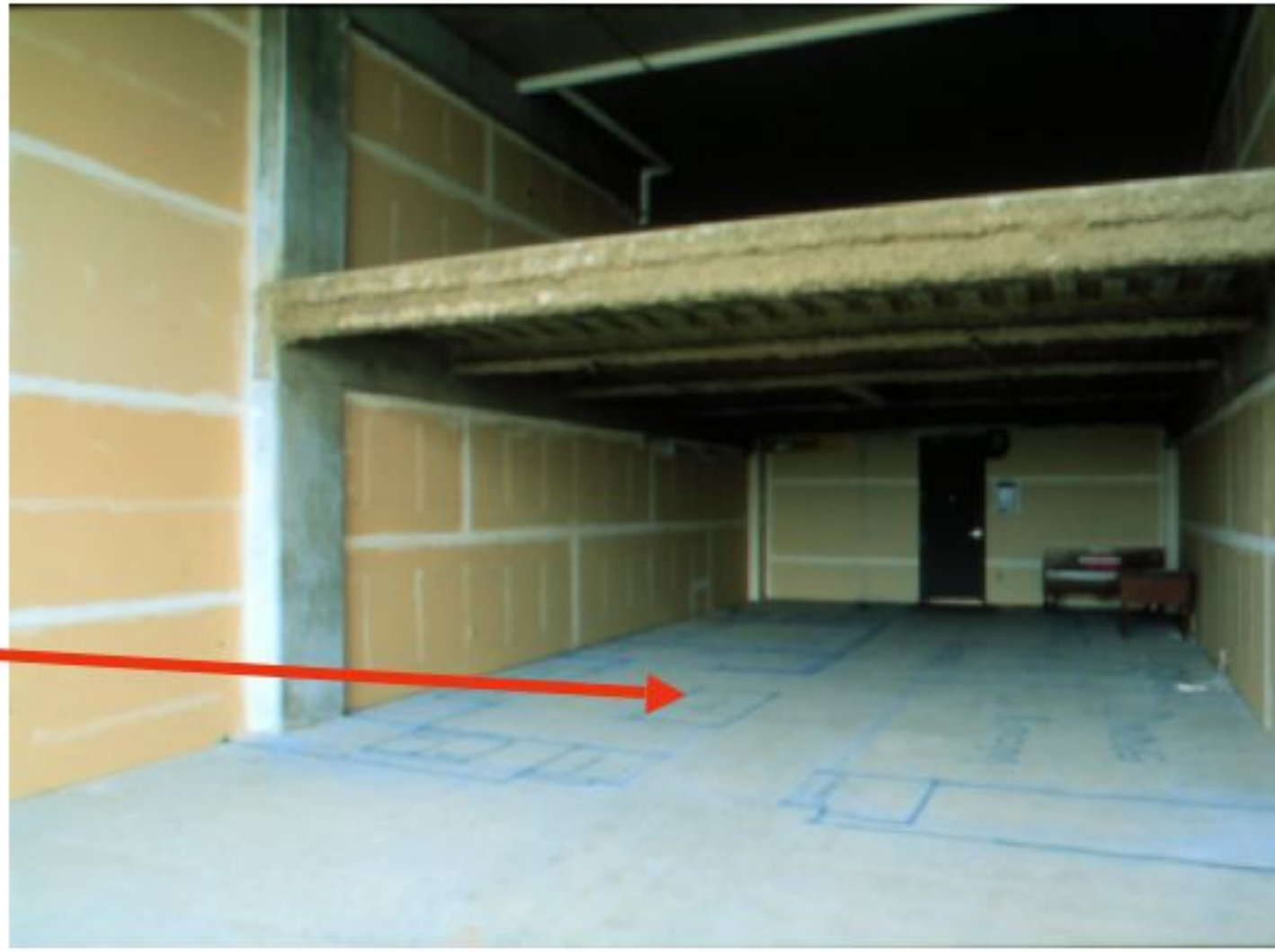
The Banner Building

Each of the 16 units in the building is sold empty…its interior is designed by an architect or interior designer selected by the occupant…



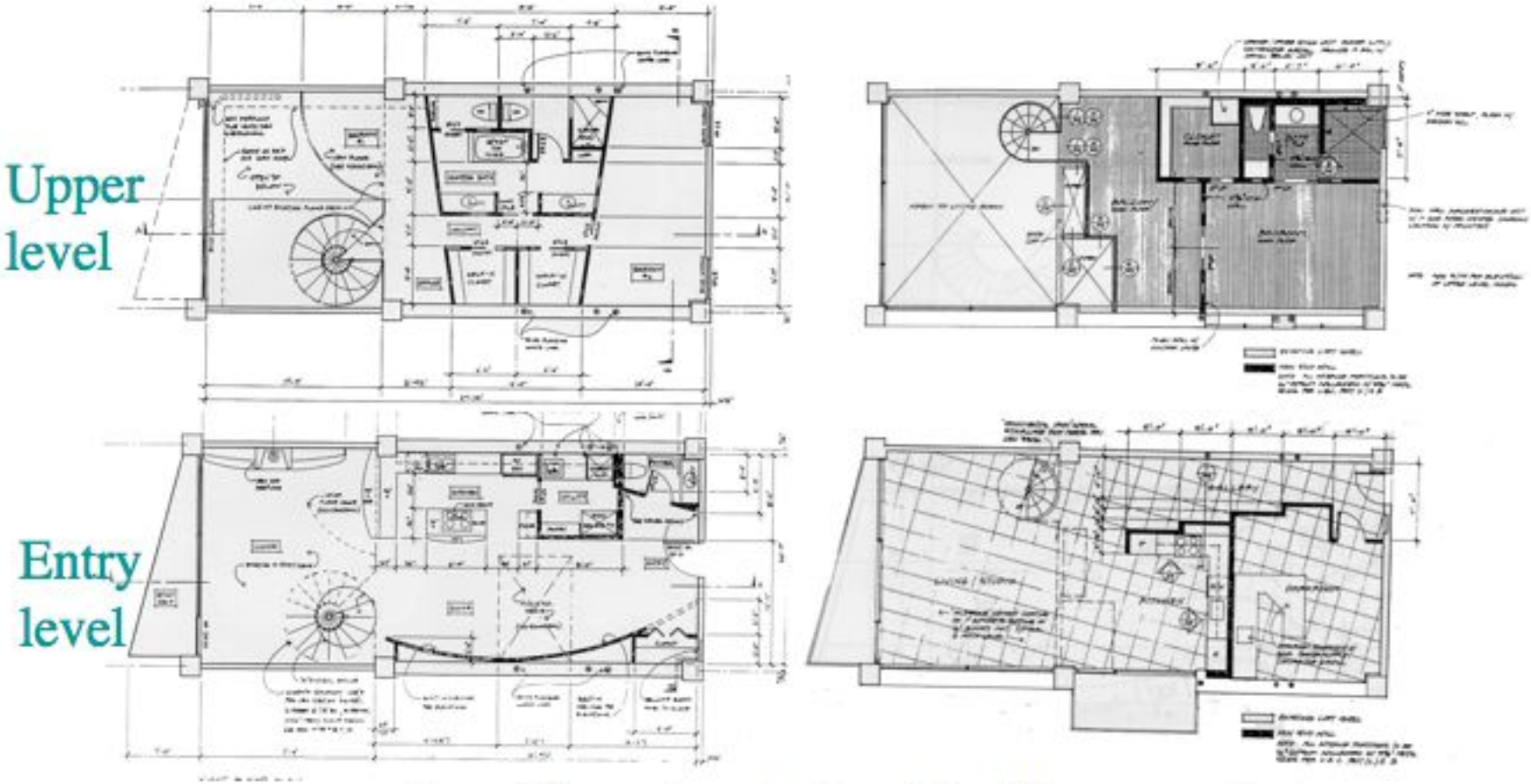
the base building plan with plumbing stacks

The Banner Building



the empty interior with the layout drawn on the floor…

The Banner Building



two of the custom designed dwellings


The Netherlands
one of the leading incubators

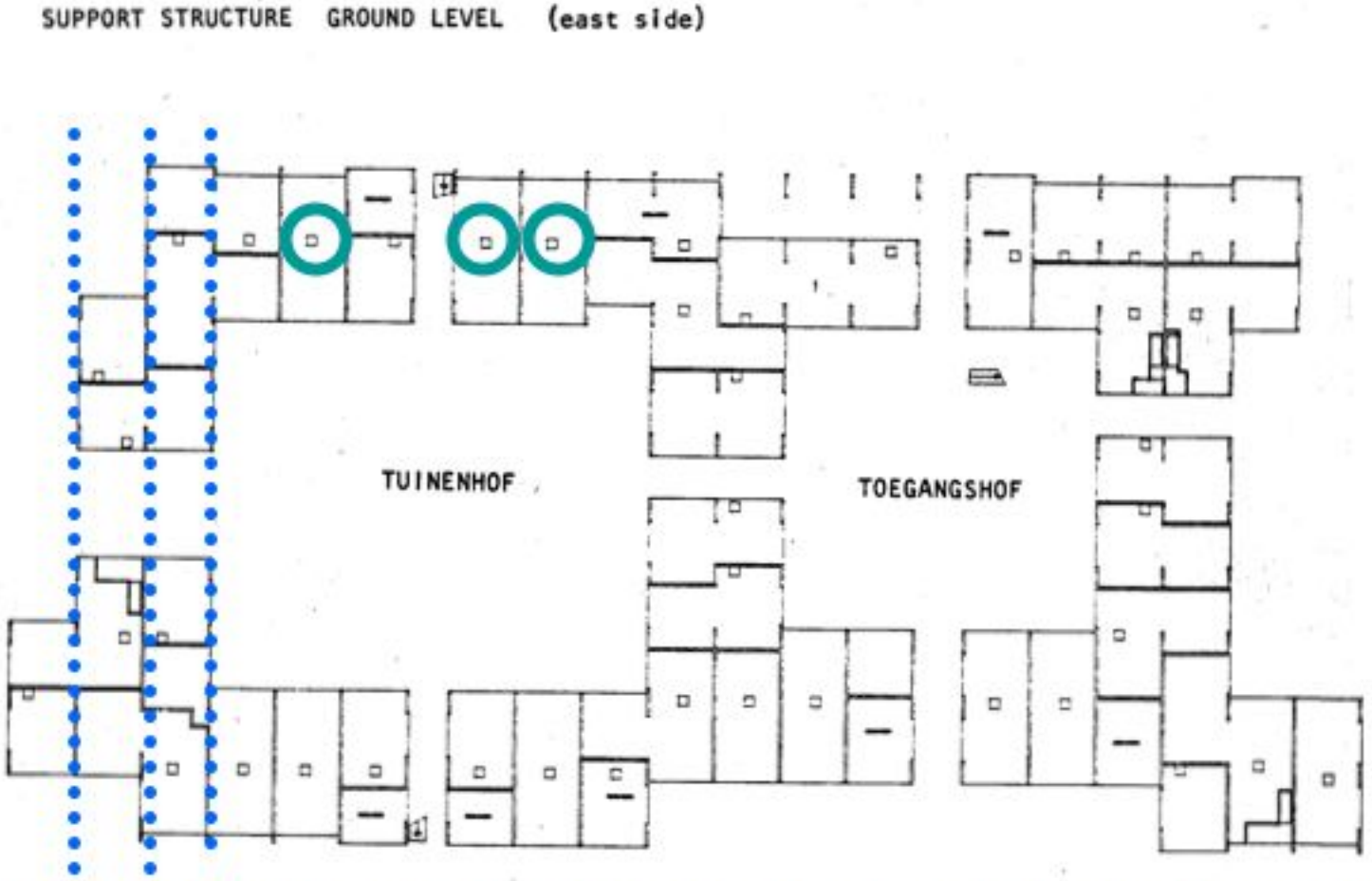
Papendrecht Molenvliet

One of the first large housing projects of this kind was built in Papendrecht, near Rotterdam. It was built in 1977…..

Papendrecht, Molenvliet

123 dwelling units, several offices and shops, and a kindergarten

Papendrecht
Molenvliet



a drawing showing the regularity of the base building and the plumbing stacks

Papendrecht
Molenvliet

Tunnel form construction of the base building… and prefabricated façade panels

Papendrecht
Molenvliet

the wide variety of dwellings ... no two are alike

Papendrecht, Molenvliet

Patrimoniums Woningen

The project in Voorburg is a good example of open building for rehabilitation……of a 1960's era neighborhood

Patrimoniums Woningen

Layout menu

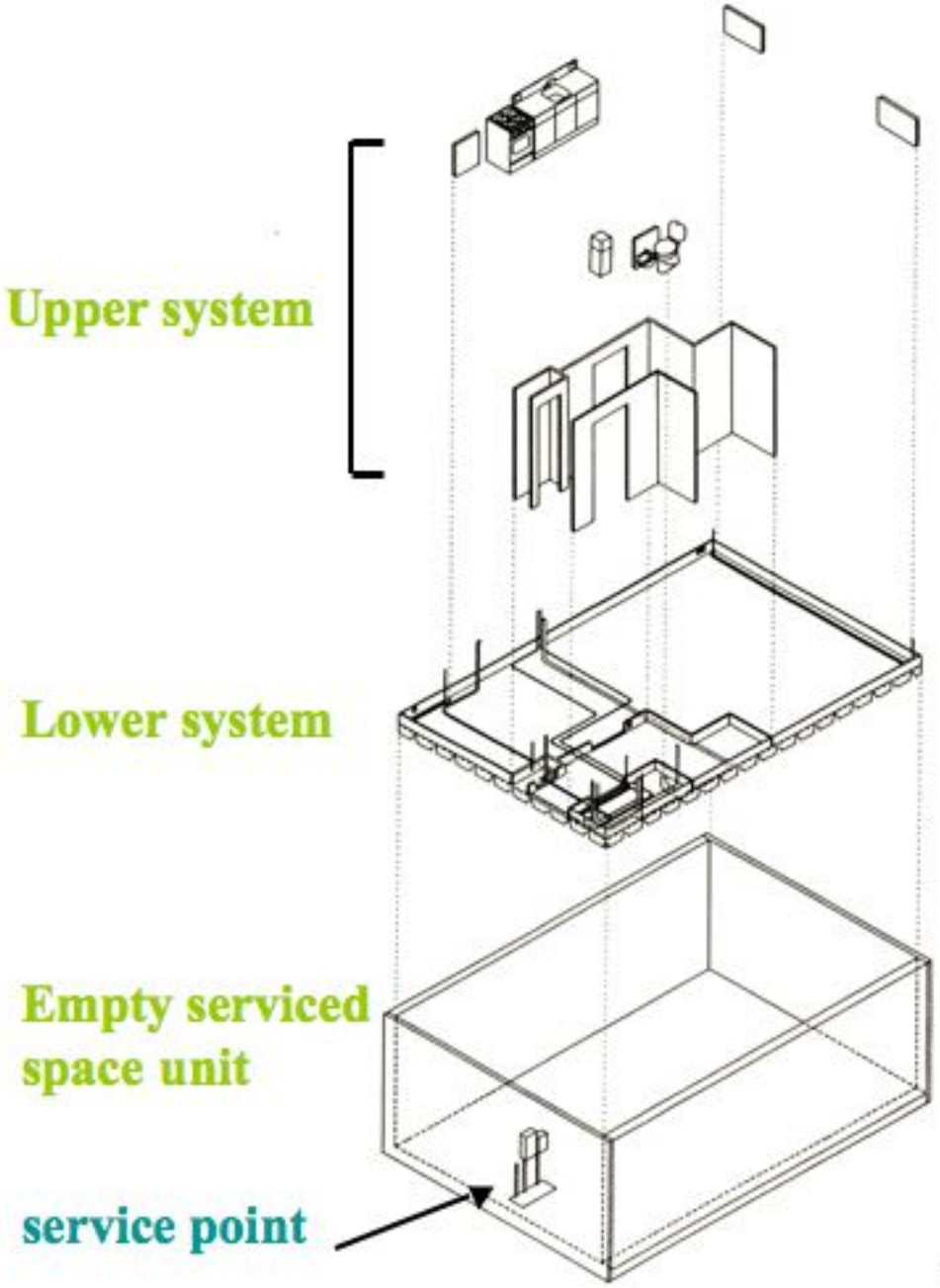
kitchen **bathroom** **Service points**

original floor plan *empty unit*

What two occupants actually selected for their own units.....

Patrimonium Woningen

Matura Infill Systems, a company specializing in delivering customized interiors in a JIT fashion.....



Patrimoniums Woningen

the tenants in their future home, making decisions

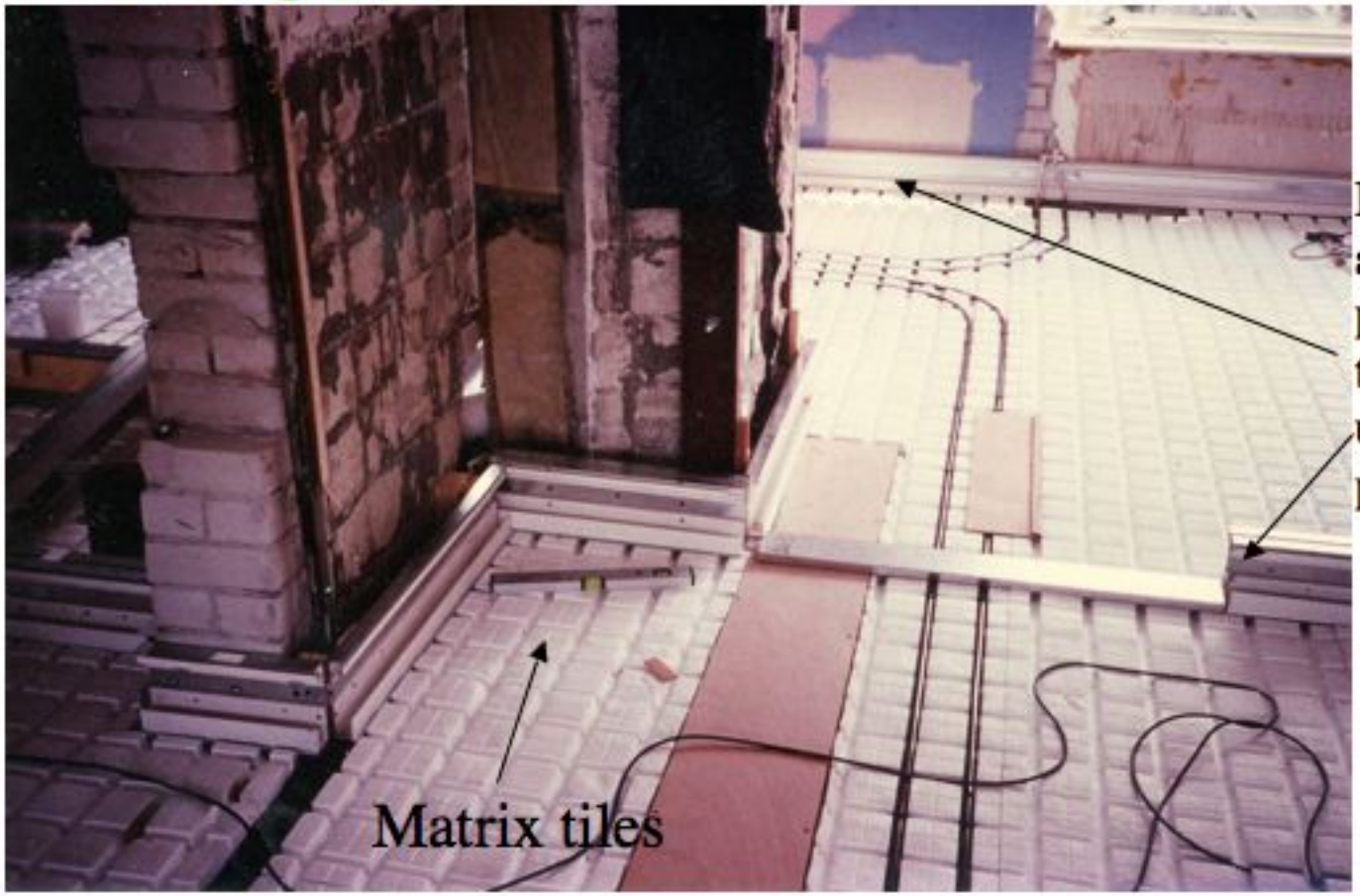
Patrimoniums Woningen

the Matura fabrication and distribution facility

Patrimoniums Woningen

Matura containers being delivered to the site, with everything for one dwelling unit's fit-out, including the worker's on-site work room....

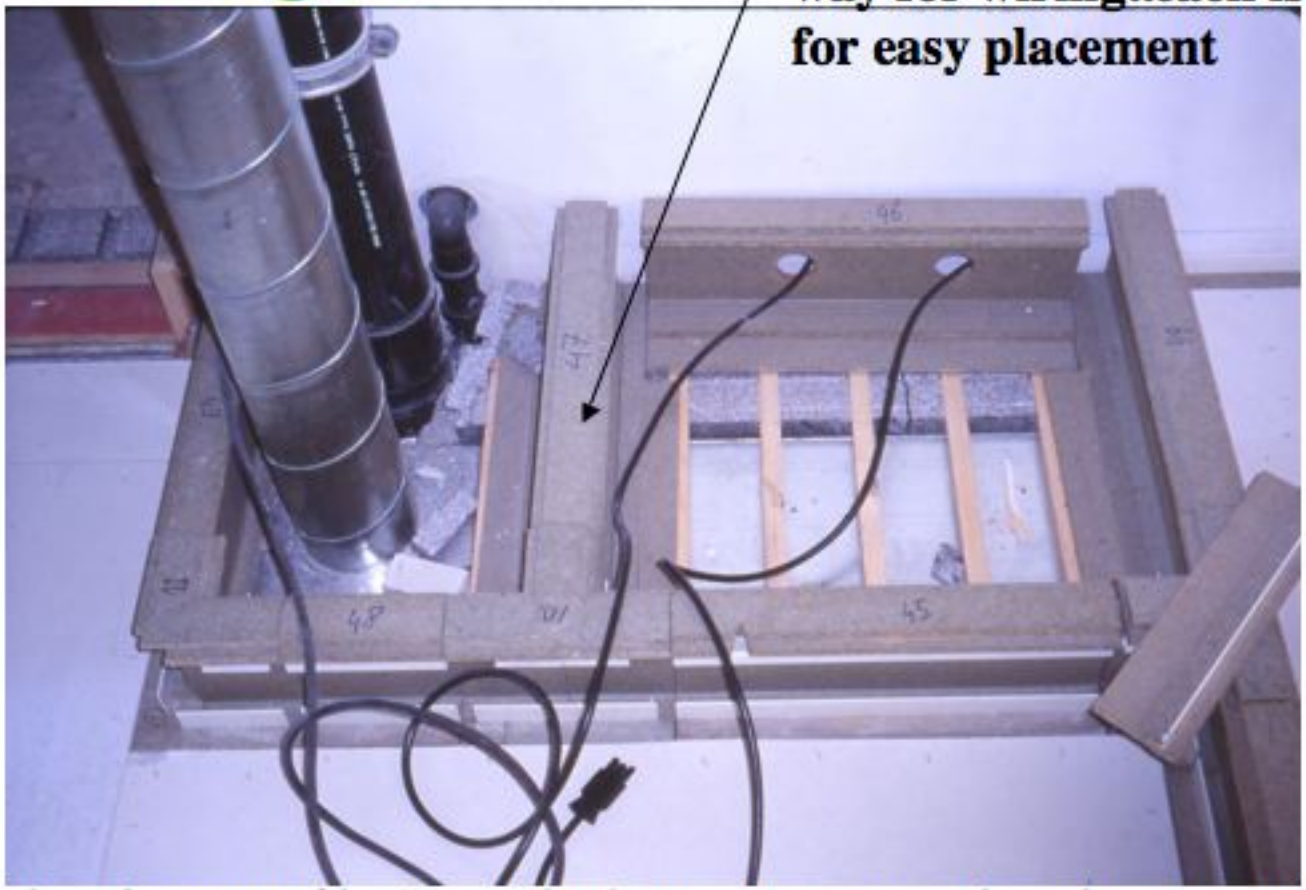
Patrimoniums Woningen



"matrix tiles" for managing the distribution of piping, as well as to accurately and quickly position the "base profiles" for partitions...

Patrimoniums Woningen

Base profiles also provide a race-way for wiring..each is numbered for easy placement



the "base profiles" on which partitions are placed are precut to exact lengths. WIELAND pre-terminated cabling runs in the base profiles….

Patrimoniums Woningen

Matrix tiles are covered, ready for final floor finishes; door frames are hung; partitions painted…

Patrimoniums Woningen

one finished dwelling, a month after the old unit was vacated…

Patrimoniums Woningen

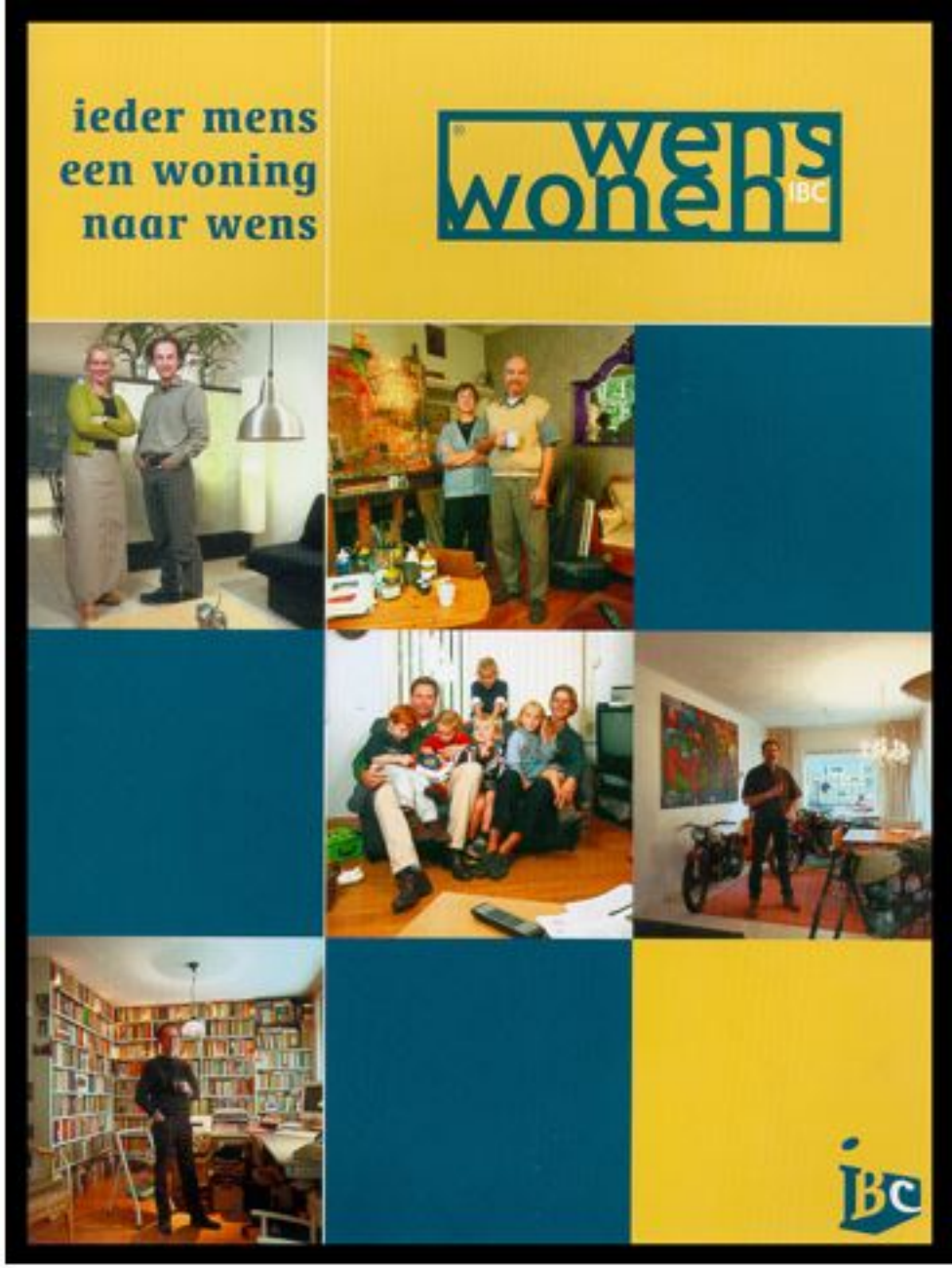
The base building was upgraded....

Patrimoniums Woningen

The building continues to undergo gradual improvement.

Wenswonen

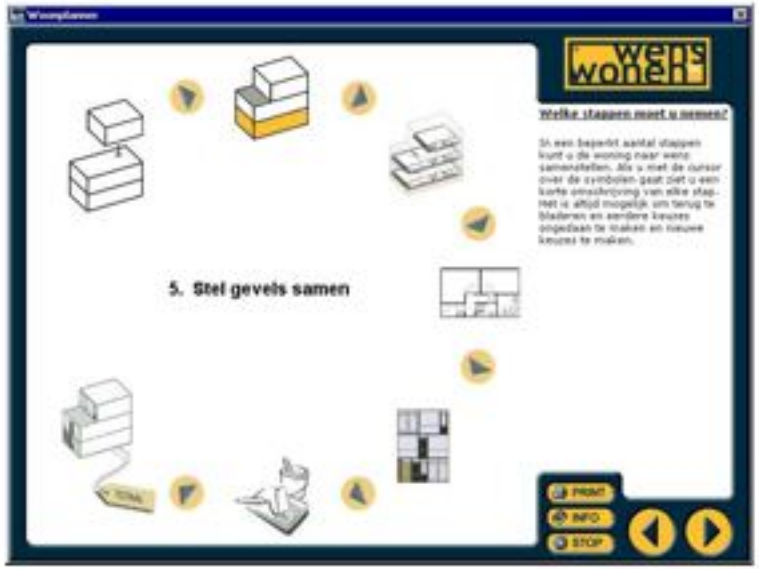
This project was completed in 2002. It's a good example of a private development company wanting to do an open building project.

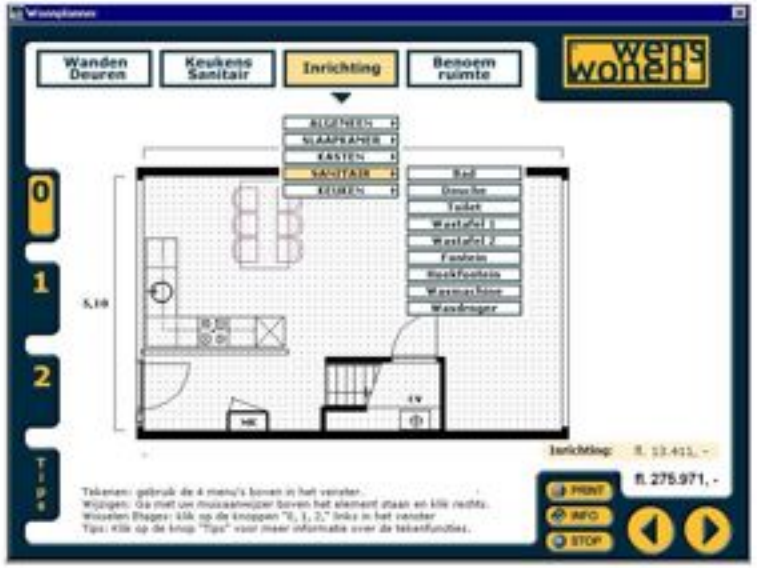


Wenswonen

…a townhouse development….buyers can choose the volume, façade, floor plans, equipment and finishes of their dwelling.

A custom-designed software system supports this. At each step, the buyer knows the cost.





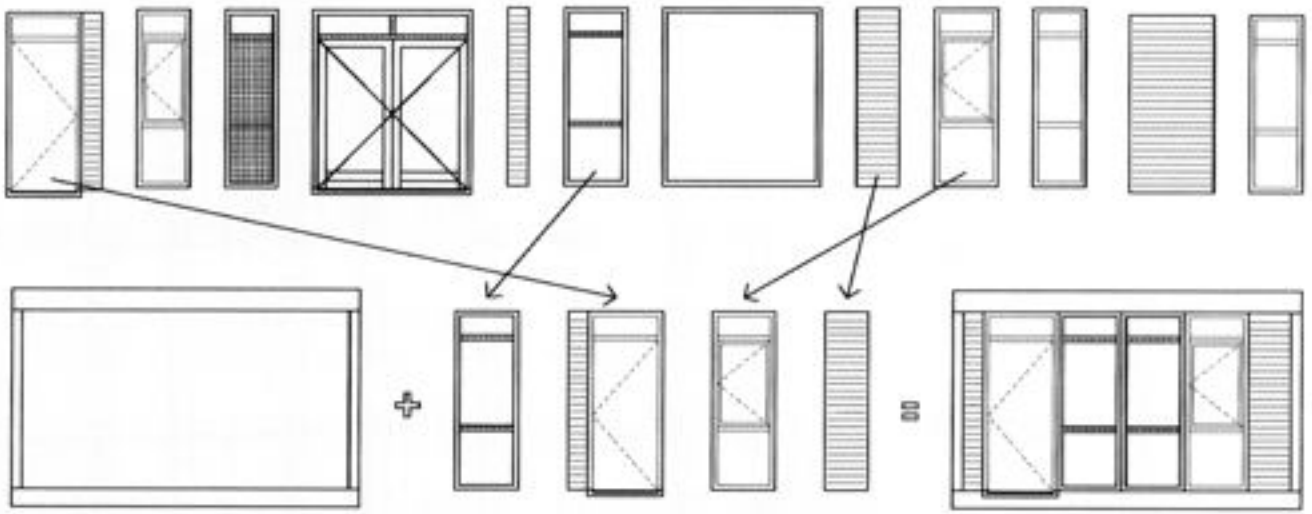
Wenswonen

Decisions about dwelling volume include the possibility of adding a room at the back….

Wenswonen

The architects also designed a “library” of façade elements.

Buyers could make their façade design suited to their chosen floor plan…



Variatiemogelijkheden in de gevelindeling

Wenswonen

MULTIFUNK, Amsterdam

MULTIFUNK, Amsterdam

The developer wanted a multi-functional building…

MULTIFUNK, Amsterdam

Already, the building's "openness" has proved useful, allowing changes of function without delays or extra costs.

MULTIFUNK, Amsterdam

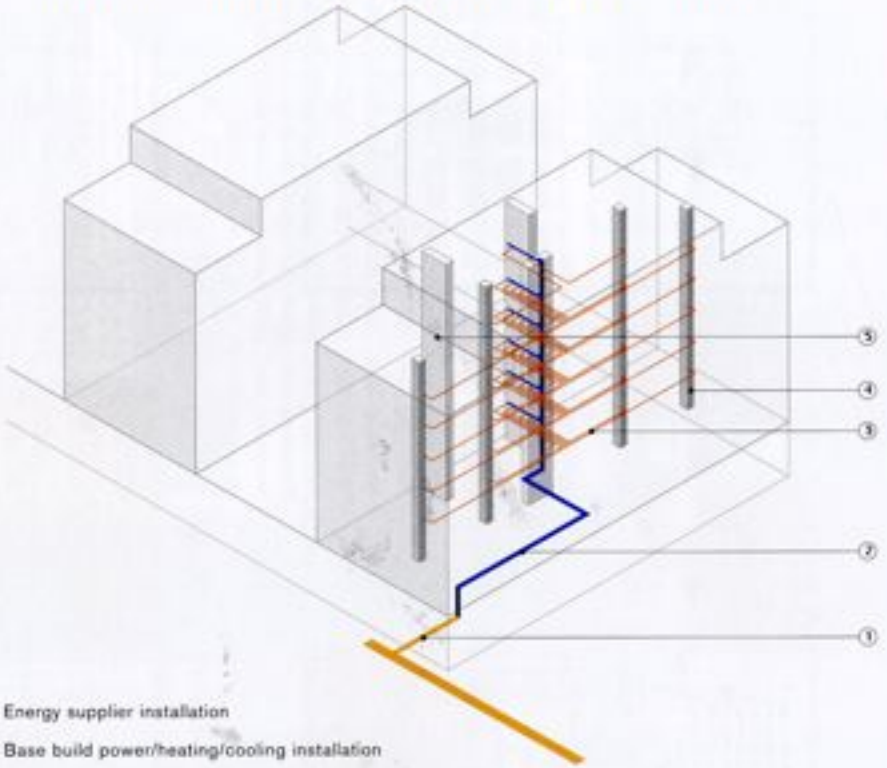
The developer is happy because the added capacity of the base building added less than 5% to the total cost of the project.

THE SOLIDS

Baumschlager and Eberle, Architects
Owner: Het Oosten
Development Company: Krystal

THE SOLIDS

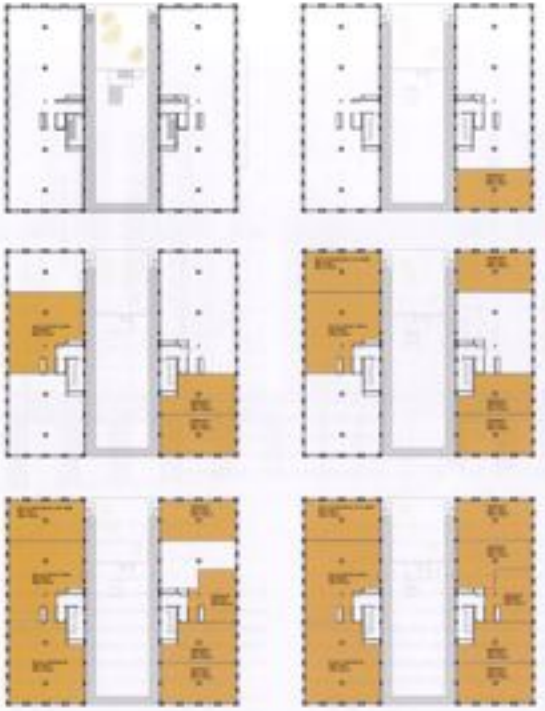
Diagram of base building installation services



1. Energy supplier installation
2. Base build power/heating/cooling installation
3. Power/heating/cooling distribution to individual units
4. Vertical shafts for sewage and cool water supply
5. Vertical shafts with excess space for future services

101

Several SOLIDS project are planned for construction in the coming year, in Amsterdam….users can lease as much space as they like for what use they choose…



Finland

Arabianranta, Helsinki

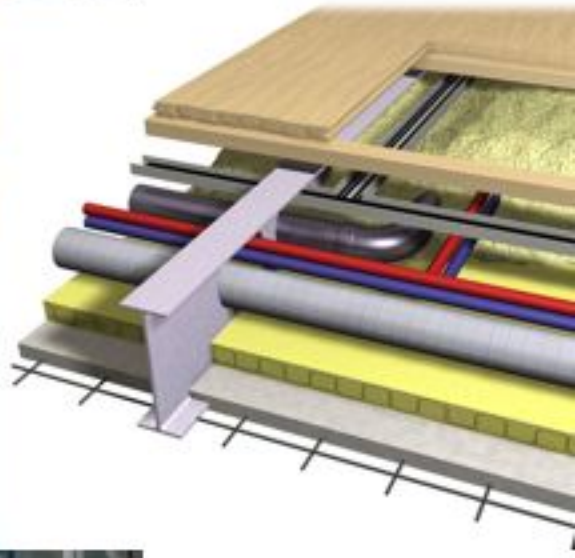
This is an early example of a PLUS HOME project

Arabianranta

Many unit size and layout variations are offered….

These “yellow” areas are where bathrooms can be located, near the public space and stairs.

Arabianranta

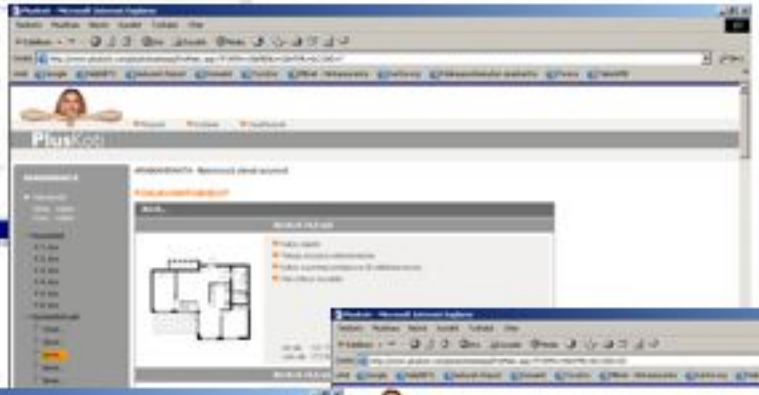


The floors are constructed to provide a large “wet zone”….

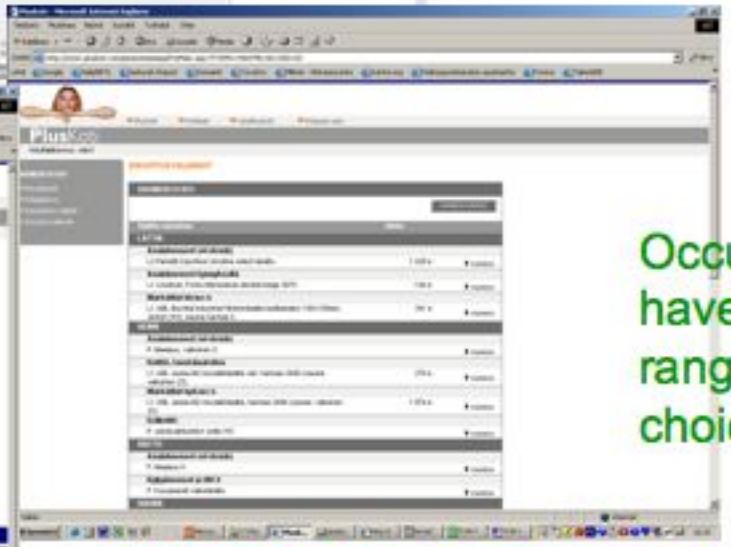
Occupant´s Internet Services

PlusHome - Concept with wide occupants choices

Occupant´s Internet front page with step-by-step guidance…



All Flat Types - Basic-Prices - Location info



Occupants have a wide range of choices

All-inclusive prices at once with individual choices

PlusHome Total IT process

Arabianranta / Helsinki / 2004

Customer service

Customer tailoring view to the project

Customer

3D model view to project

Design management

Architect

Tocoman Production Model Server

Project management

Real time Quantity information

Project manager

3D Model & quantity and cost view to the project

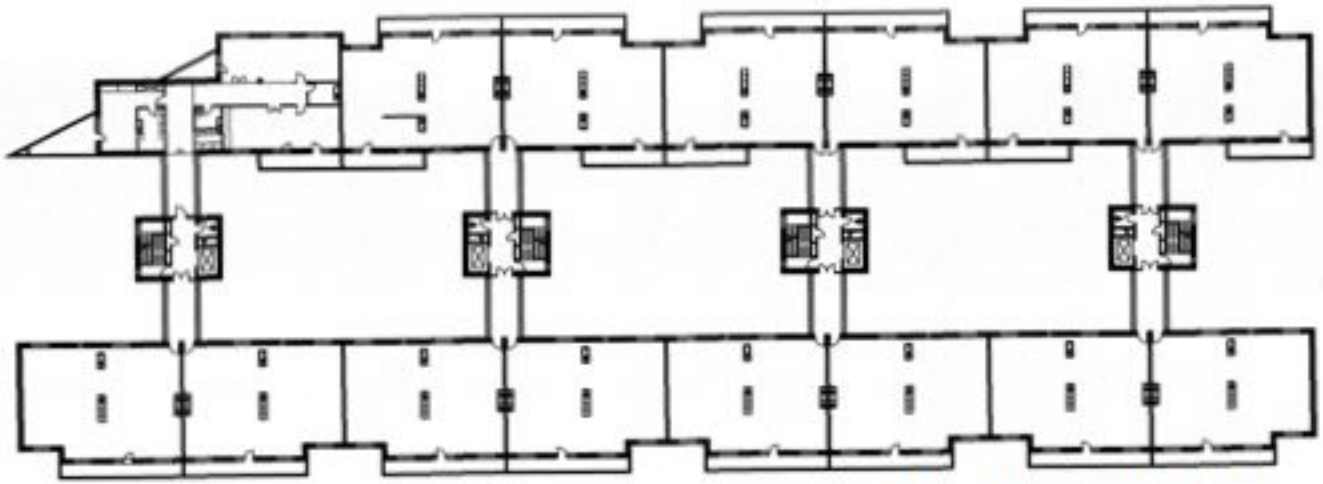
Quantity/ PDM& Cost Management

Quantity suveyor

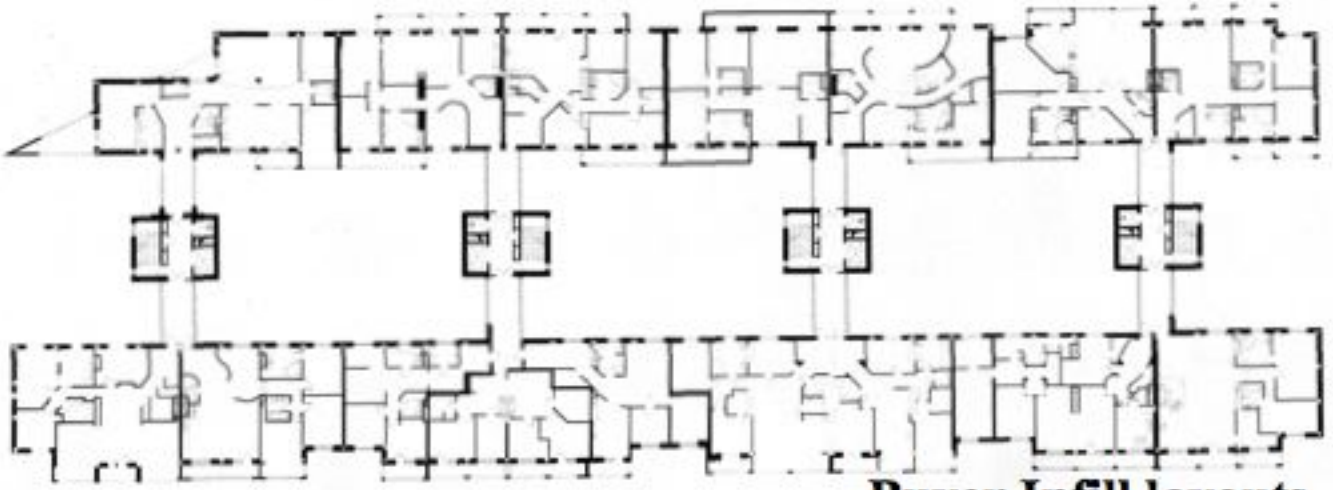
TOCOMAN

Russia

Catamaran House, Moscow



The Base Building



Buyer Infill layouts

Catamaran House, Moscow

Vladimir Plotkin, Reserve Architects

Catamaran House, Moscow

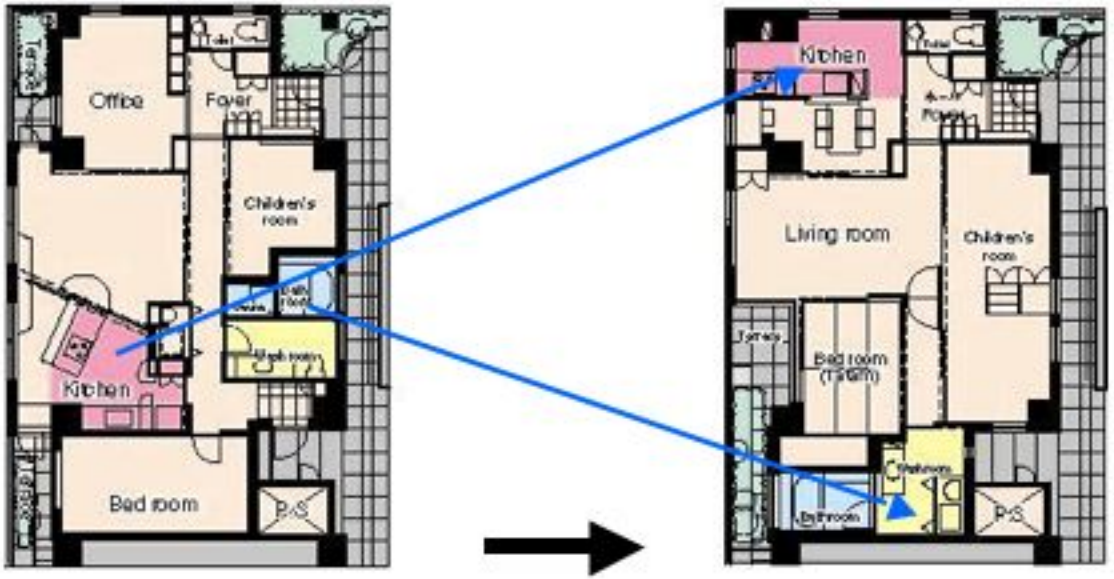
Hundreds of such "free plan" buildings are being constructed in Moscow…downtown and around the periphery…of high quality…


JAPAN
Japan is the other leading incubator of residential open building, with hundreds of realized projects…

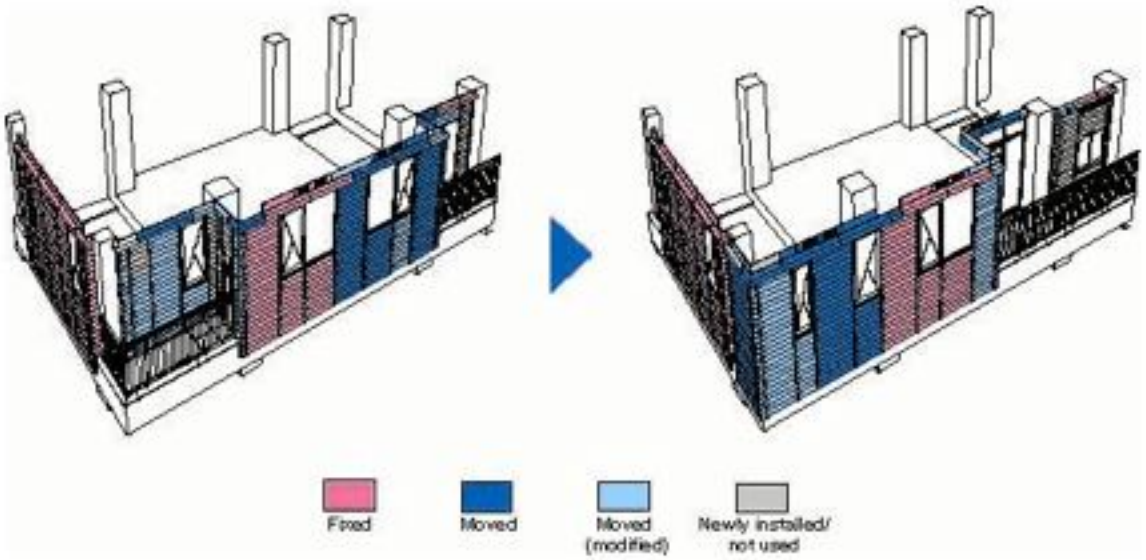
NEXT 21

- skeleton designed by one team;
- façade system by another team
- a modular coordination planning method by another team.

Next 21



Several dwelling units have been modified…



NEXT INFILL / Sekisui Heim

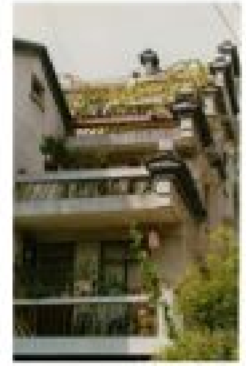
A new product entering the market for renovating the old housing stock..with a few new products, and many from the open market…

NEXT INFILL / Sekisui Heim

China

Support Housing in WUXI

Architect:
Bao Jiasheng
1988

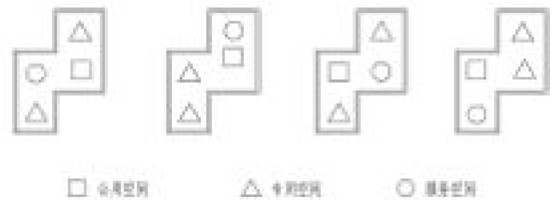


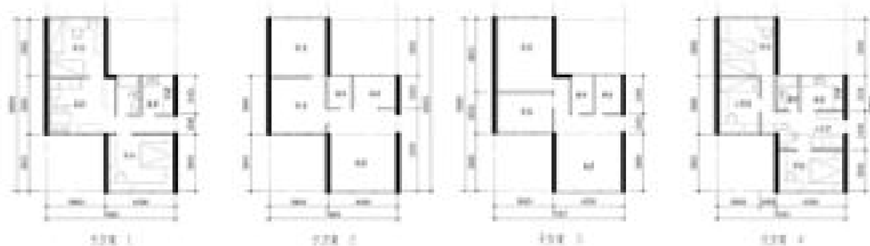
"Support" Housing

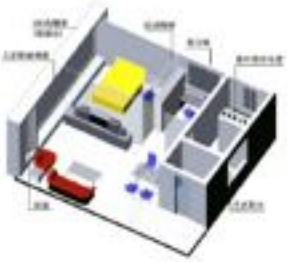
Wuxi, China, 1988
Bao Jiasheng

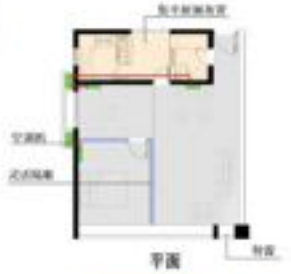
The design of the project targeted on three phases of construction: the construction of the structure, the production and detachable infill elements, and the interior layout by the residents using the infill elements. The three phases of construction were carried out by three bodies. The structure was built by a construction company. The infill elements were made by a special producer aimed at general market. The interior fittings were installed either by the residents themselves, or neighborhood ser-

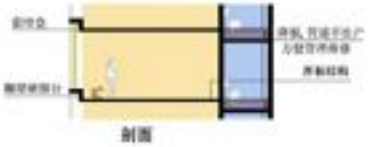
住宅的建設分三階段進行，第一步是設計建造支撐體；第二步是設計生產可分體；第三步是把住戶選定的可分體按照住戶的意願佈置安裝於他所選定的支撐體中，最後構成一個適用的完整的住宅。三個階段分別由三個不同的建築生產組織生產：支撐體由現行的建築公司來承包，可分體則由專門化的工廠進行商品化生產，最後的安裝工作則由住戶自己或由他委託的社會勞動服務組織來完成，支撐體











Chang Faming Hua Yuan
Cheng Estate

Shenzhen, China 2004
Yue Ziqing, Shan Hao, Ying Xiaochuan

There is a growing demand on small apartments in housing market of Shenzhen. The two tower buildings were specifically targeted on small home buyers, providing small one-room apartments and two-room apartments. However the architects intended to make a more varieties within constrains imposed by the developer. In each of the four wings on the floor plan there were a one-room apartment and a two-room apartment. The two apartments can be combined to make a larger apartment. They can be sold as separate two apartments or as one bigger apartment, to accommodate a variety of residents or changing of needs, from home office, family with two couples, to leasing on apartment and occupying the other under single ownership, etc. Thanks to the sheer-wall structure and thick floors to make a large, open and beam-free space, a variety of interior layout were achieved.

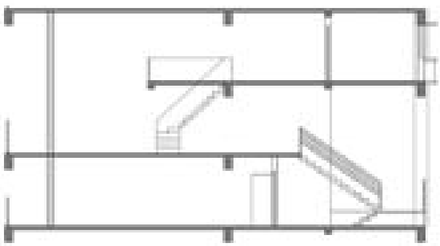
近幾年來，隨物產飆點由高收入階層往中低收入階層中小戶型住宅轉變，爲了適應市場需要，我們將一房和二房戶型集中在2幢18層塔樓內，呈風車型佈置，每個翼由二個小戶型組成，業主可以買一套或多套，獨立或者拼接使用，可自住、辦公、出租，能便於投資或售後出售，由於採用了剪力牆厚板結構，室內隔牆可任意佈置，同時可增大室內空間感覺，二種戶型本身平面方整並可以靈活變化，拼接後又有更大的適

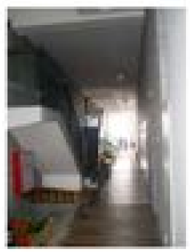
CHOICE	YES	NO
Dwelling size		
Complete floor plan		
Floor plan except bathroom		
Equipment (kitchen, bath, etc)		
Facade (major elements)		
Facade (minor elements)		

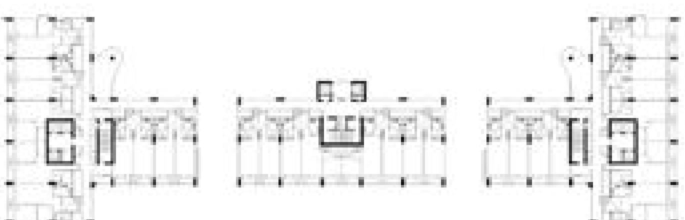
Chang Faming Hua Yuan

Cheng Estate, Shenzhen, China, 2004

Architect: Yue Ziqing, Shan Hao, Ying Xiachuan





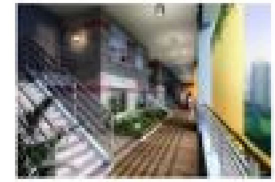


House-Golden Age,
private housing complex

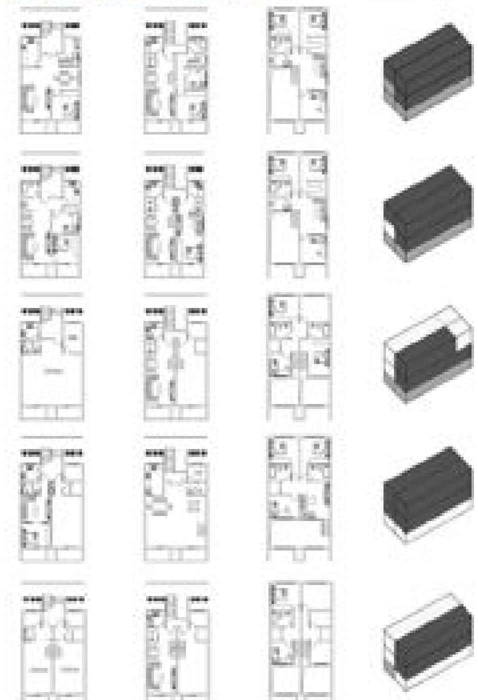
Chongqing, China 2006
Li Halle, Tang Ning

This massive housing complex built with 8 m × 8 m concrete framework structure consists of duplex apartments, multiple sky streets and sky gardens, which serves as neighborhood gathering spaces. Each sky street connecting the apartments on every three levels is 3.6m wide, with inner half of the width used as garden and buffer zone of kitchens on the street level. The apartments are varied not only in size, but also in type, because of flexibility implied in the building structure. The potential uses can have a choice from single story apartments, duplex apartments, and if needed, three story working apartments. In each type, a certain variety in layout and partition are also provided to accommodate diversity of accommodation. The partition walls were constructed with light-weight and hollow concrete blocks (700kg/cubic meter) in 200mm thickness.

[illegible]



CHOICE	YES	NO
Dwelling size		
Complete floor plan		
Floor plan except bathroom		
Equipment (kitchen, bath etc)		
Facade (major elements)		
Facade (minor elements)		

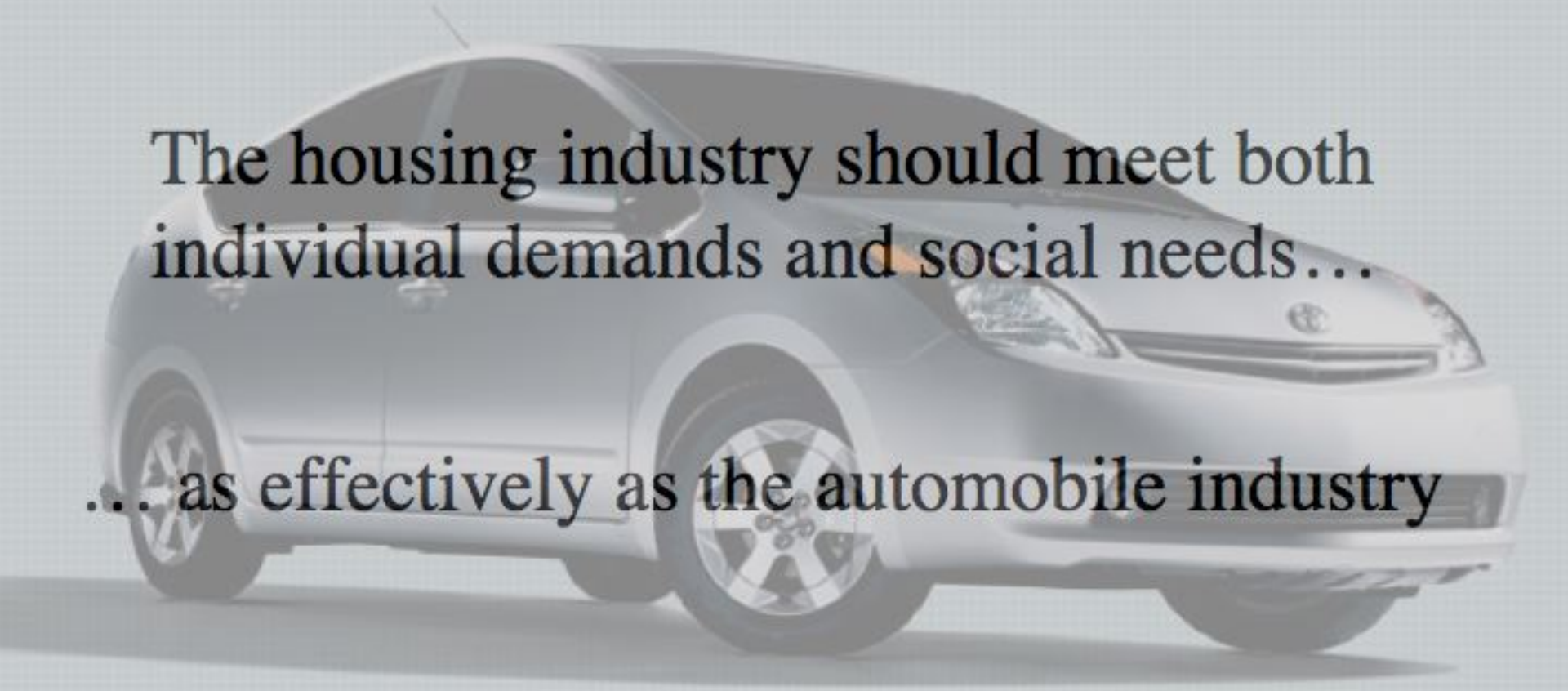


House Golden Age (private housing complex)
Chongqing, China, 2006
Architects: Li Halle, Tang Ning

In Summary

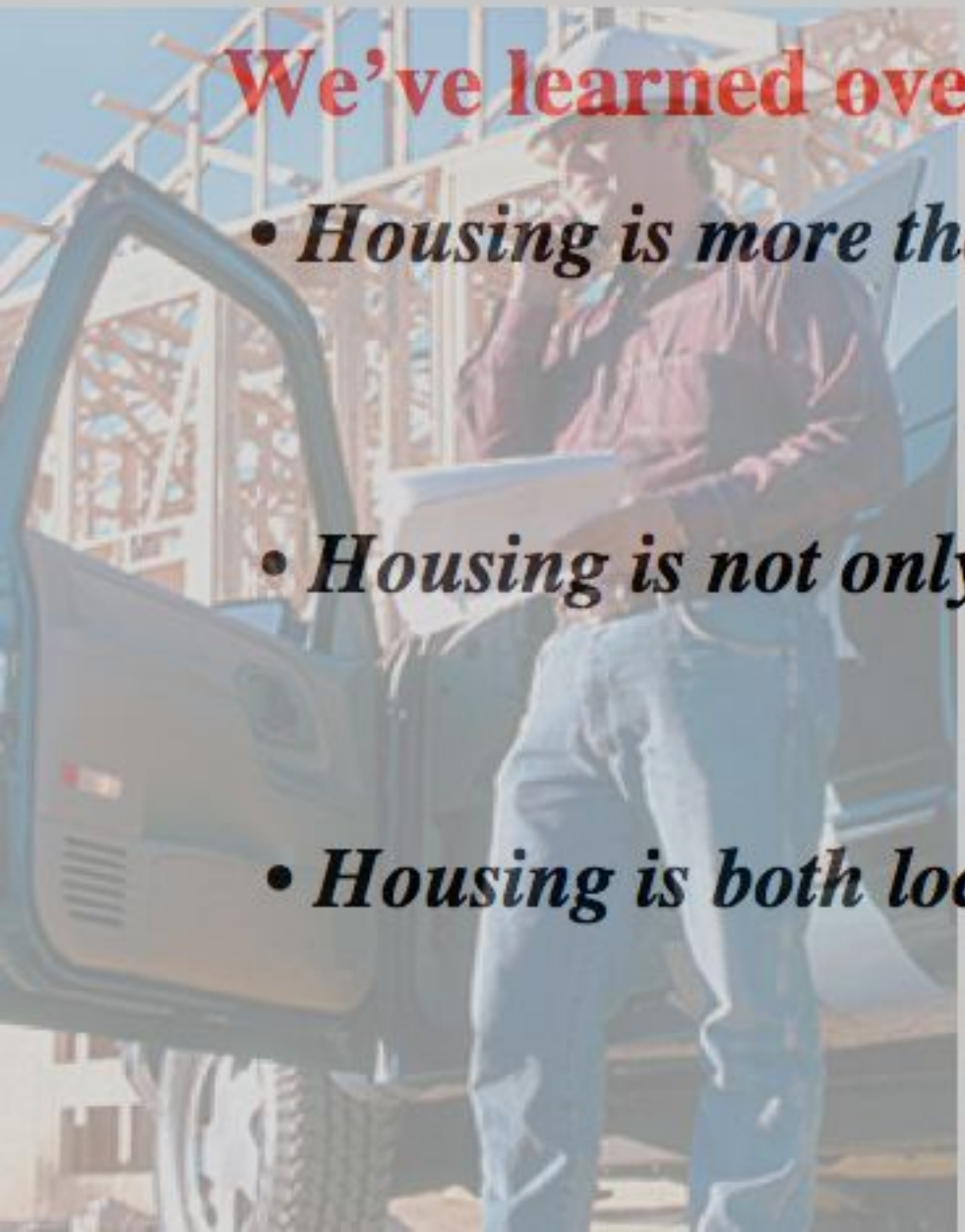
How I see the potential of industrial processes to support the kind of projects I've shown.

The main point I want to make is:



The housing industry should meet both individual demands and social needs…

… as effectively as the automobile industry



We've learned over the years that:

- *Housing is more than hardware.*
- *Housing is not only about engineering*
- *Housing is both local and international*

We've also learned that:

- *Consumers are key.*
- *We must build for both permanence and change.*
- *Housing must fit into its local context*

New directions for research….

We should re-focus on industrialization studies in

The layer of public oversight

The layer of consumer preferences

Housing needs these two areas of action….

Action must be taken in both…

Housing needs both coherence and variety….

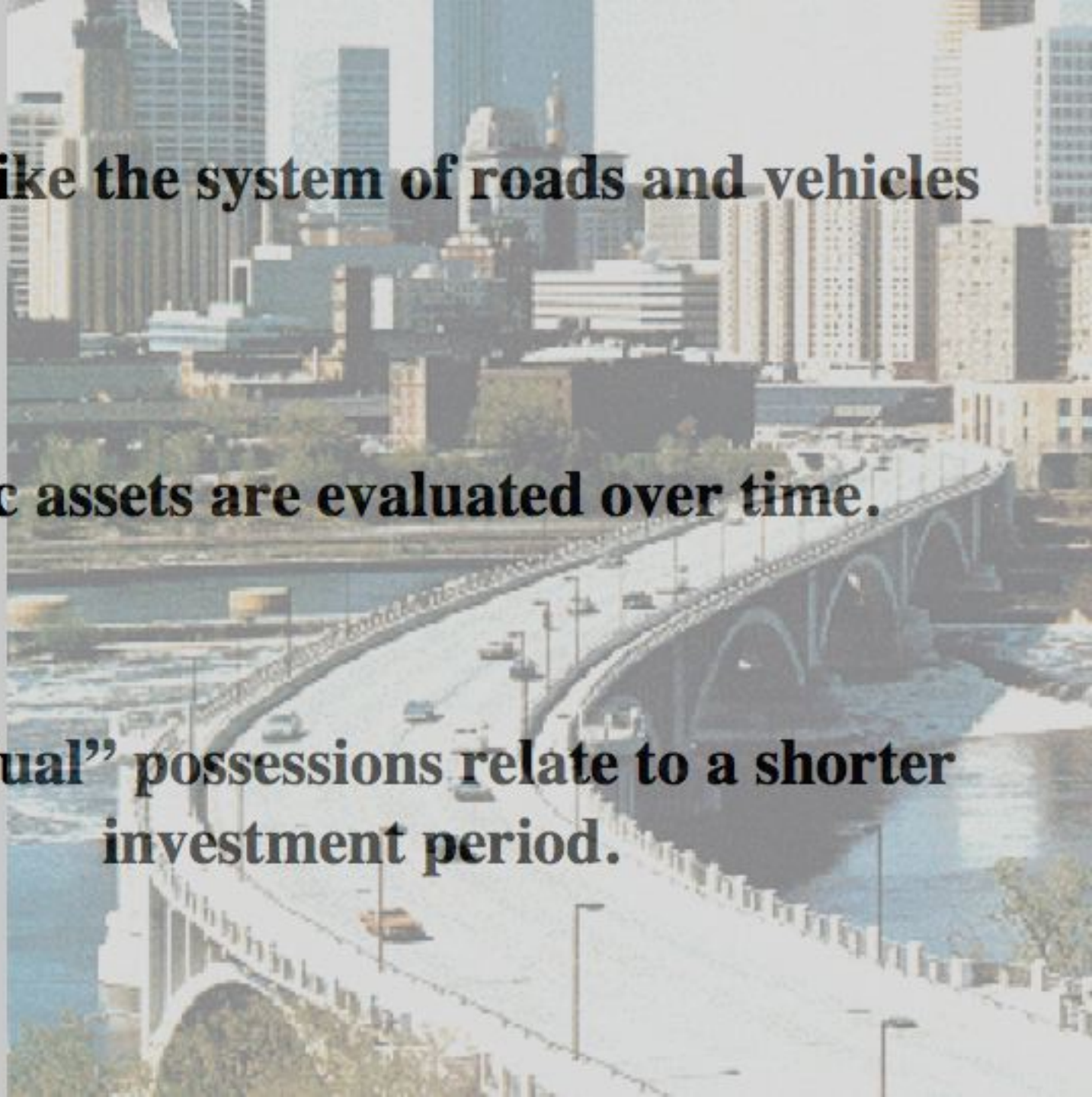
For optimum effectiveness these two arenas need to be clearly distinguished.

Then, they need to be supported by two distinct but closely related production processes.

These two processes represent two kinds of markets.

Studies of how these two markets work in housing is essential….

…to harness industrialization for housing, the two arenas must be "disentangled".



This is like the system of roads and vehicles

Public assets are evaluated over time.

“Individual” possessions relate to a shorter investment period.

We need research in new construction and industrial production methods in both:

the decision layer controlled by local political forces

and the decision layer supporting individual choices…

Political forces push us to long term interests and to meet "social" conditions.

This process cannot listen to individual preferences.

But it sets the constraints and the "capacity" for individual preferences to be expressed.

This can be called the BASE BUILDING or SERVICED SHELL of a house.

Consumer choice is interested in variety at a range of prices

Households want maximum freedom.

We can call this part of the house the

FIT-OUT or INFILL.

When the two markets are not clearly "disentangled" both are inhibited.

Entanglement hinders industrialization.

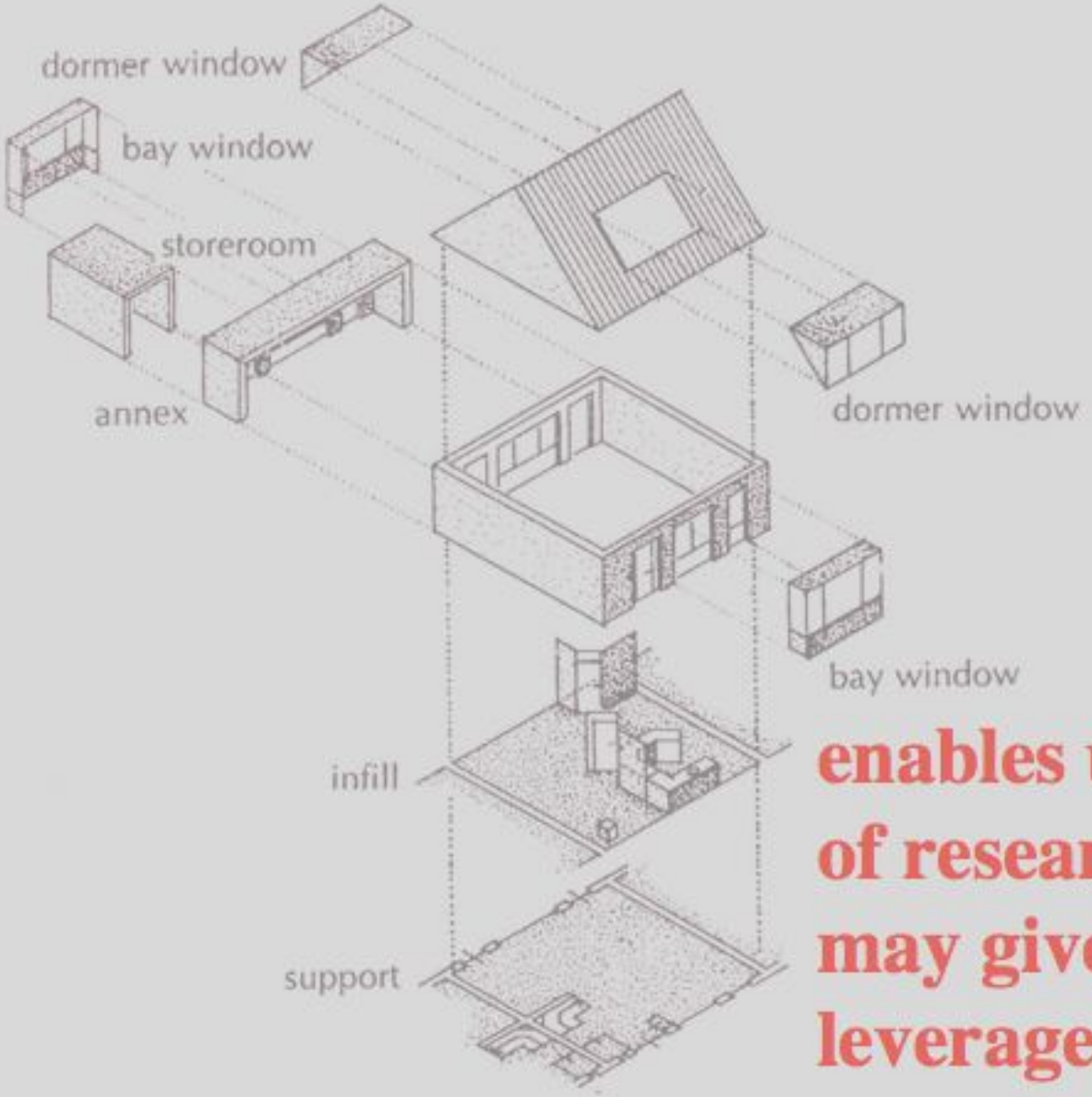
When housing production does not distinguish these two decision processes and their respective production and management operations, we cannot achieve optimum production effectiveness or drive industrialization forward.

This is my understanding of the literature in housing production, industrialization and innovation to date.

Housing research should focus on improved production and management methods….

First we have to distinguish a SHELL and an INFILL.

Then we can study technical interfaces and issues of coordination, logistics and approvals.



Disconnection support and infill

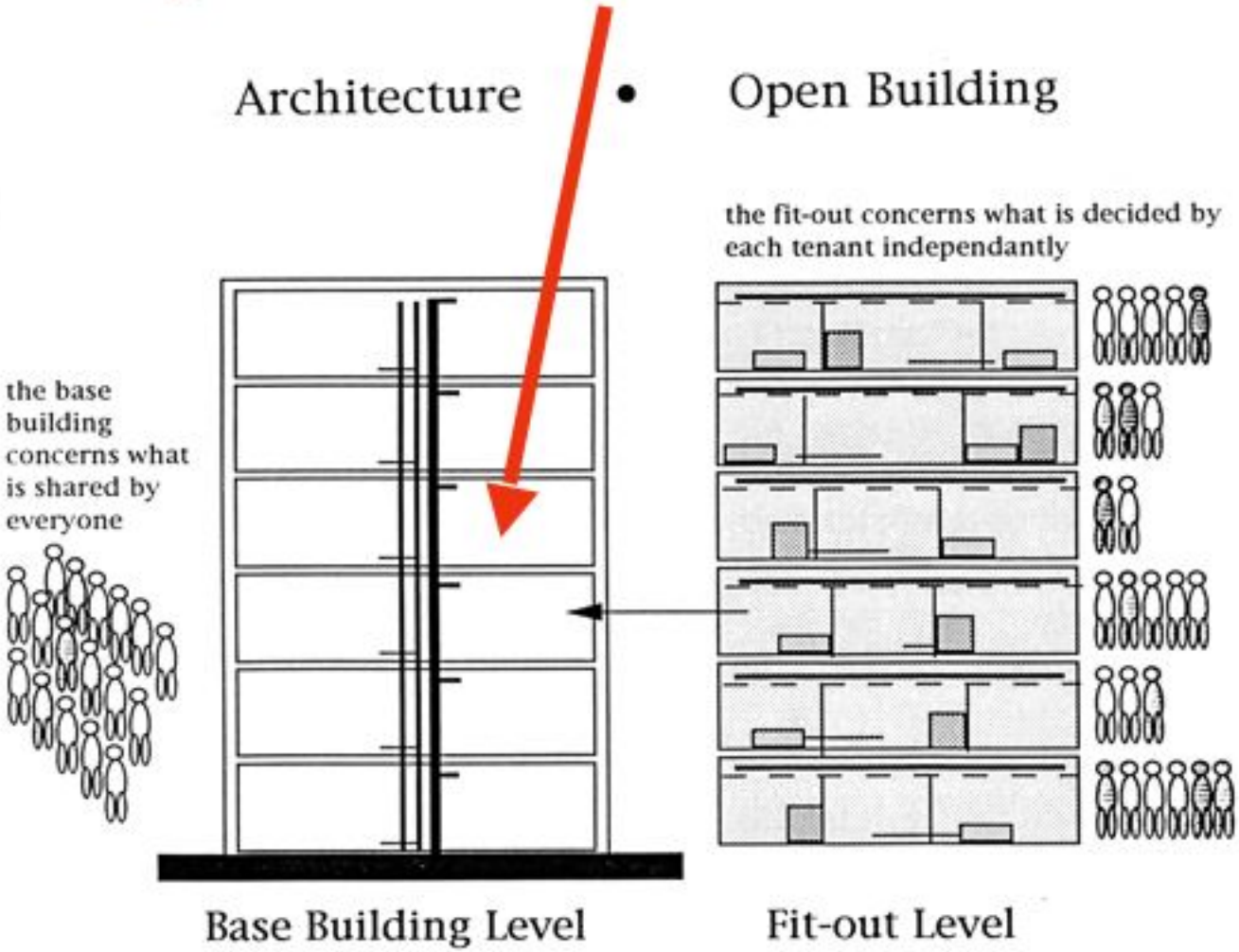
Seeing housing production in this new way – *operating in two arenas of action*

enables us to define a set of research questions that may give us new ways to leverage innovation.

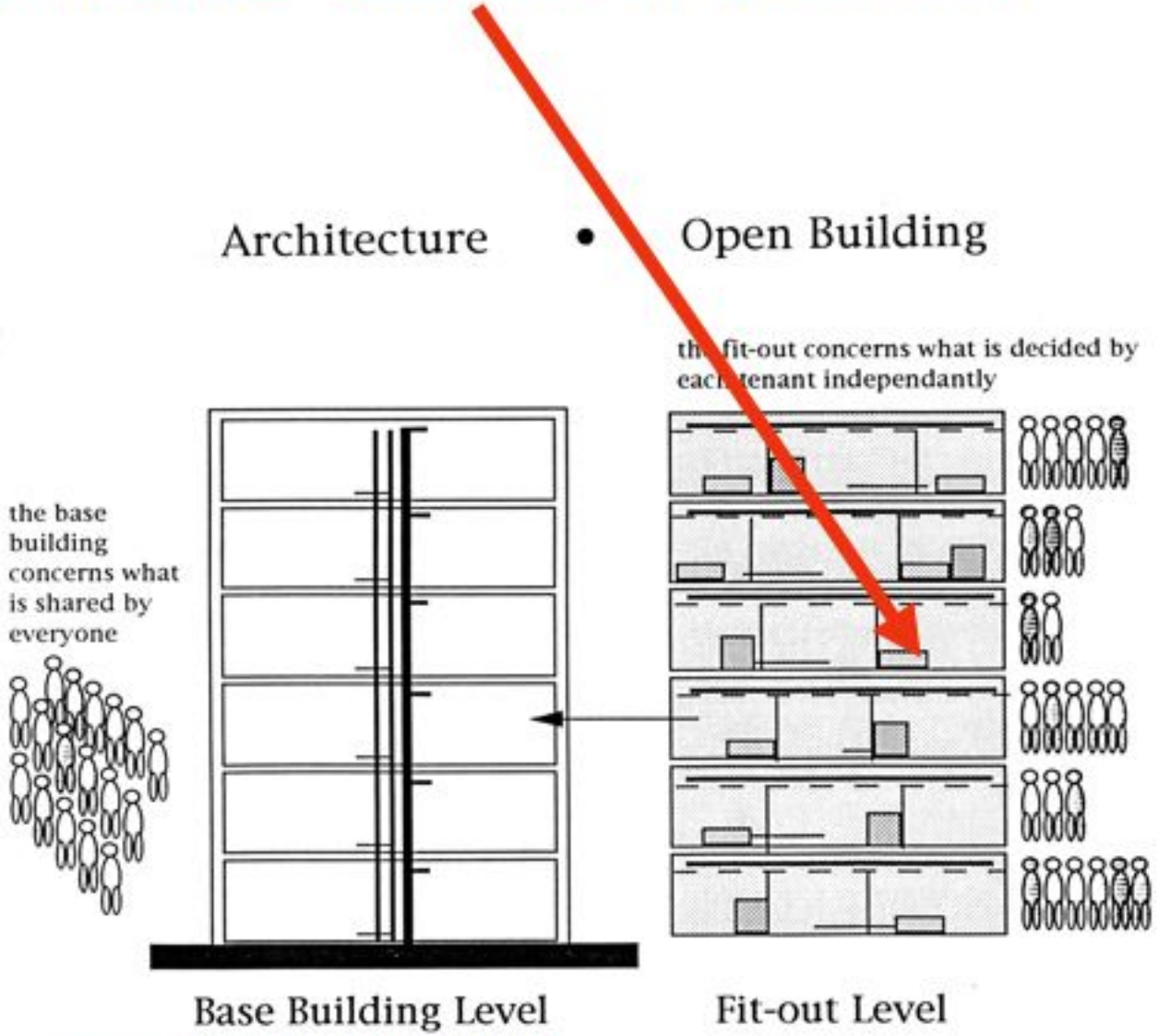
Let me summarize…

Improved ways of making BASE BUILDINGS are needed…

Is more research needed, better teaching in the university, improved development practices…?



How can the "infill level" be best served?



Is more research needed? If so, what has to be done, by whom?

I am convinced that a new INFILL INDUSTRY is needed






…harnessing building information modeling, advanced logistics and multi-skilled work teams…

The BUILDING FUTURES INSTITUTE:

www.bsu.edu/bfi

For up-to-date reports on residential open building and for reports on open building in hospital design.

And also see the website of the CIB W104 Open Building Implementation:
www.open-building.org


Thank you!