

La construction offsite / hors chantier

rêves et réalités de la personnalisation de masse

**construction
industrialisée**

bâtiment usiné

**construction
modulaire**

préassemblage

**architecture
préfabriquée**

offsite / hors chantier

préfabrication

**modulaire
volumétrique**

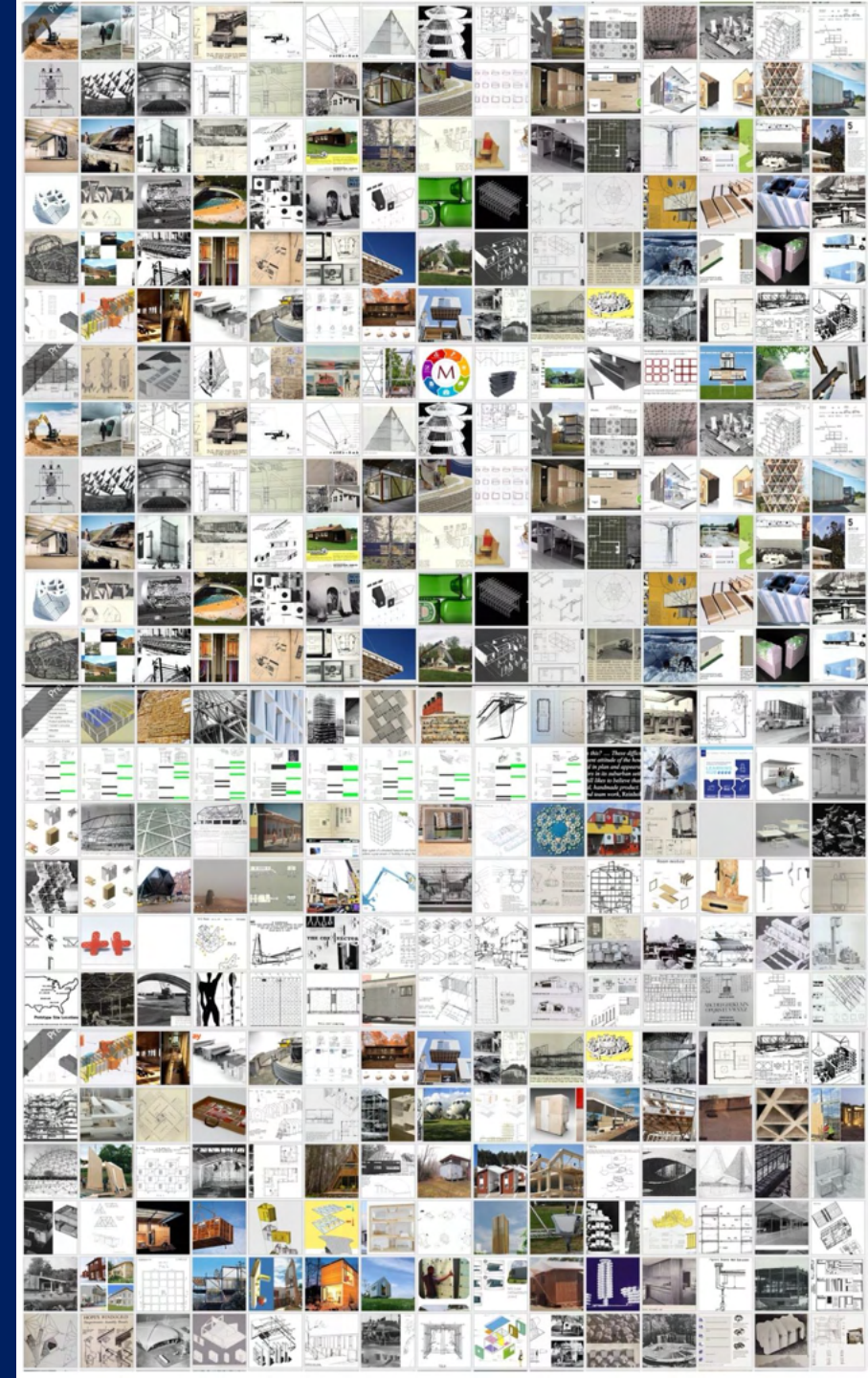
**systèmes de
construction
manufacturés**

**panneaux de mur
préfabriqués**

**DfMA appliqué aux
bâtiments**

Inventaire 1

- 1200 systèmes
- 200 ans
- 50 pays



Prefabrication experiments - 439 - Catalogues and styles

A spinoff of the spawning 20th century automobile industry, early mobile home manufacturing deployed mass production principles to build affordable dwellings. These principles are well documented; building a lightweight timber structure over a steel platform, wheeled out of the factory, delivered and installed on any site. The pre-cut kit house also used mass produced timber frames but from a different value proposition in as much as its design process offered increased options; pieces could be shaped and packaged for multiple configurations less affected by transport criteria.

Both models of twentieth century prefabrication used plan books to organize procurement. Clients could choose from designs articulated to harmonized modular strategies and supply chains. The Sears catalogue of houses is probably the most famous and inspired other companies like Canadian icon Eaton to offer their own version. The number of designs was staggering when analyzed in relation to what architects often decry as standardized prefab.

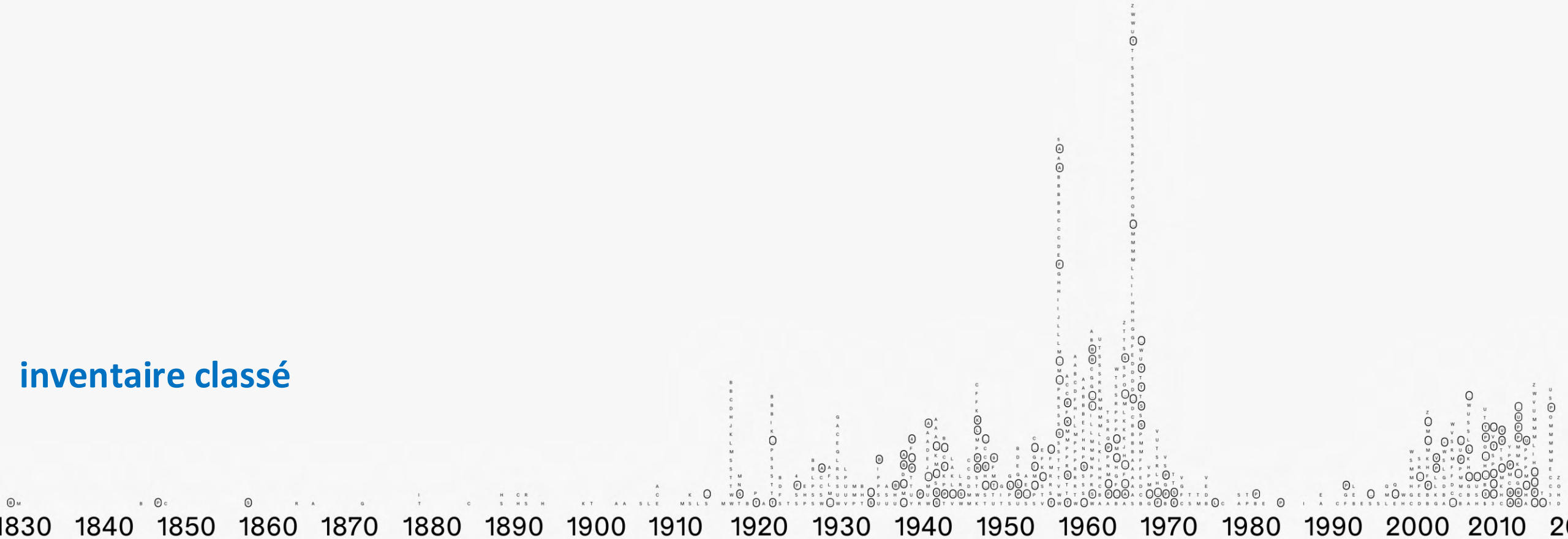
The conceptual distance between how industry and architects interpret the catalogue endures as an interesting dilemma for manufacturers. While architects have often argued against style to inform patterns and pastiche architectural compositions, their proposals remain relatively similar in terms of fundamentals differing only in aesthetic orientations. Resolution 4 architecture's took on the modular catalogue «The Modern Modular» with what at first glance seems like a third option: A library of spatial components and modular variability anchored to an objective of spatial and production rationalization. However, the aesthetic remains manifestly modern defined by clean and minimal lines.

Is architectural variability truly about singularity or is it about style. The Eaton catalogue contained traditional designs outlined by similar detailing and volumes, while Res4's architectural approach more closely mimics a type of pattern language leading to houses that all look the same, hardly singular. Industry's take on the pre-cut house was in a sense at once rational and varied. Contemporary architects argue that prefab should be organized around similar components, nonetheless, mostly tainted by modernist attitudes. This aesthetic and disciplinary-informed gap between architectural sophistication and generally palatable designs continues to hinder prefab's streamlined application.

Une histoire de deux champs



inventaire classé



1830 1840 1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020

Mechanization / Mécanisation

Mass production / Production de masse

Automation / Automatisation

Digital

All

Production par lot

Préfabriqués do-it-yourself

Plateformes de conception

Noyaux de service

Mécanisation

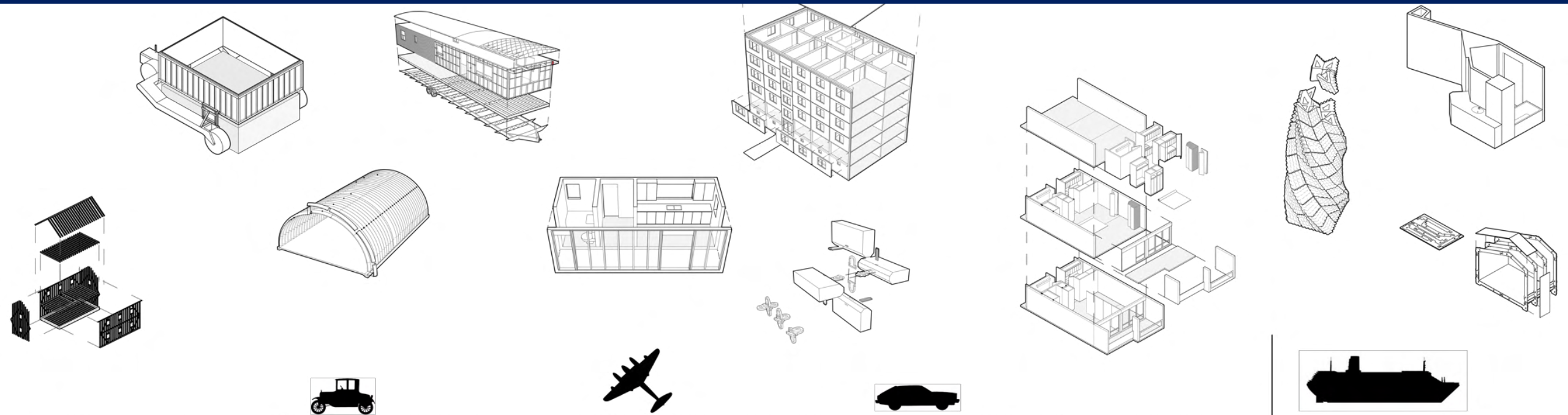
Connecteurs universels

Objets ready-made

Mégastructures

Ma

Tous les pays



Ford _ mass production

Wartime influence

Toyota _ lean production

Fincantieri _ DFMA + IPD

industrialized building systems

manufactured building
off-site construction

modular construction

DfMA platform

1850

1900

c. 1930

c. 1951

c. 1969

2000

c. 2019

c. 1851
Crystal Palace
Joseph Paxton
UK

prefabrication

Bemis
dimensional
coordination

The
Prefabrication of
Houses
Kelley

Operation
Breakthrough
coordination
modulaire

c. 2004
Refabricating
Architecture
Kieran and
Timberlake

Project FROG
Flexible
Response for
Ongoing Growth

les histoires

Rollohome

- Elmer Frey (8', 10', 12')
- singlewide à doublewide

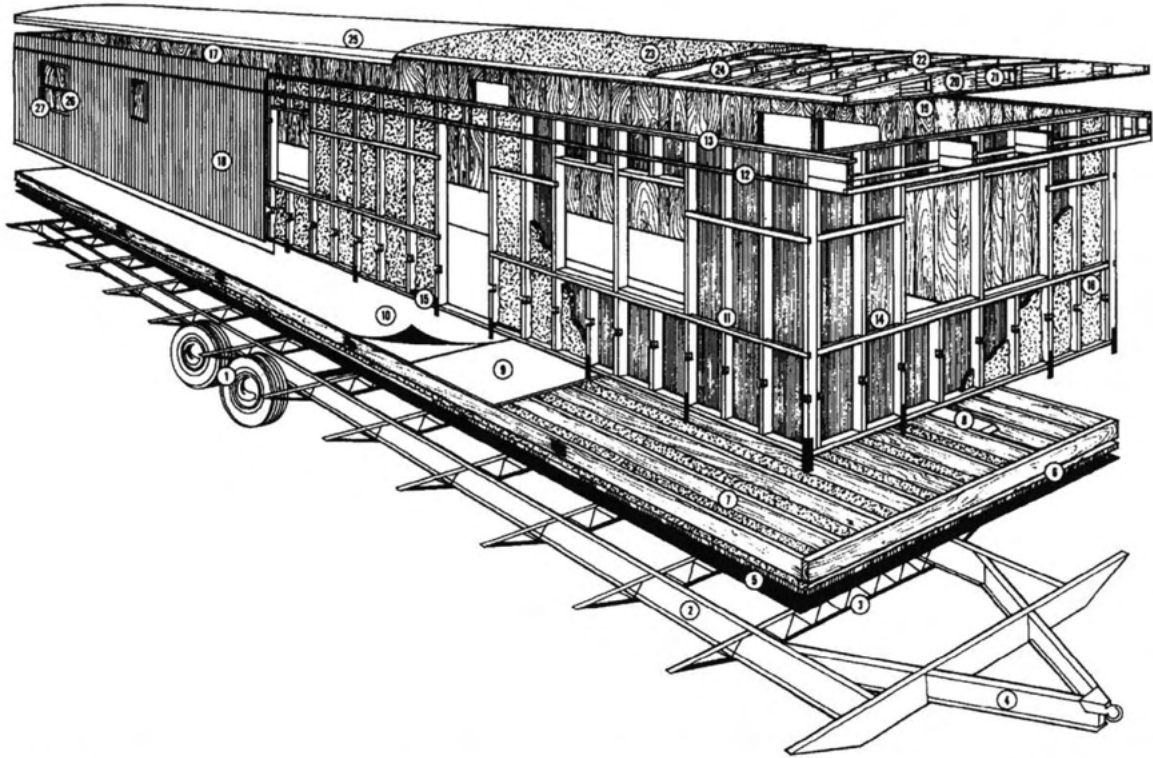


Figure 5.1. Exploded view of a mobile home.

- The Chassis**
1. Chassis—heavy-duty axle, leaf springs, and tires comprise the running gear.
 2. Frame—"I" beam—heavy-duty steel welded frames. 8", 10", or 12" "I" beams depending on length of frame.
 3. Rigid steel outriggers and center cross members.
 4. Hitch—sturdy "I" beam hitch members—optionally removable for cleaner appearance.
- The Floor System**
5. Bottom board—tightly sealed on bottom of floor.
 6. Floor insulation—all-weather insulation for temperature control, blanket fiberglass installed under entire floor for complete weatherproofing.
 7. Floor joists.
 8. Heat duct—aluminum-framed duct.
 9. 5/8" decking particle board glued and fastened to floor joists.
 10. Roll goods—cushioned vinyl floor in non-carpeted areas.
- The Wall System**
11. 2" x 4" studs.
 12. Dadoed belt rails for unitized sidewall construction.
 13. 1" x 4" top and bottom plate.
 14. Interior paneling—prefinished fire rated interior paneling glued and stapled to sidewall studs for unitized construction.
 15. 16. Sidewall insulation—heavy-density fiberglass insulation.
 17. Trim to harmonize with exterior decor.
 18. Rigid exterior metal is prefinished aluminum with baked-on enamel finish.
- The Roof/Ceiling System**
19. Decorative ceiling board.
 20. Gusseted truss-type rafters for extra roof strength.
 21. Blanket fiberglass insulation between rafters.
 22. Steel straps full length of roof over rafters support insulation and galvanized roof between rafters.
 23. Thick fiberglass roll insulation over rafters.
 24. Vapor barrier on warm side of roof to prevent condensation buildup.
 25. Galvanized steel one-piece roof.
- Windows and Doors**
26. Large aluminum-framed windows with screens and optional storm windows.
 27. Egress windows for emergency exit from every sleeping room.
- Mechanical Service Systems**
28. Electrical, plumbing, heating, and construction conform to or exceed the Federal Mobile Home Construction and Safety Standards.

Misawa wall units

- le centre de recherche industrielle
- l'investissement japonais

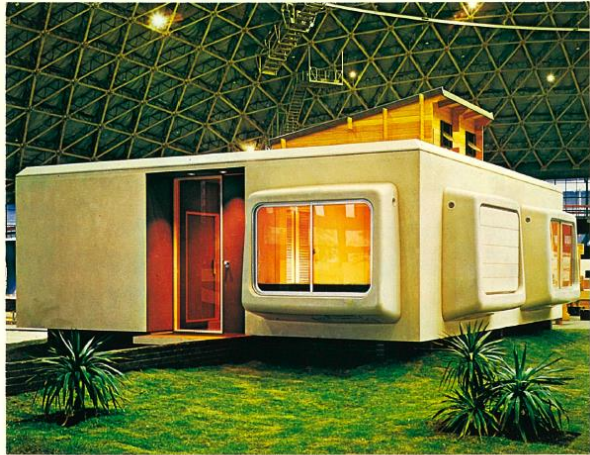


写真2: "MW-1"の全景写真 photo2: exterior of "Wall Units" MW-1



写真3: キッチンユニット photo3: Culinary Unit



写真4: 音響機器ユニット photo4: Audio-Electronic Unit

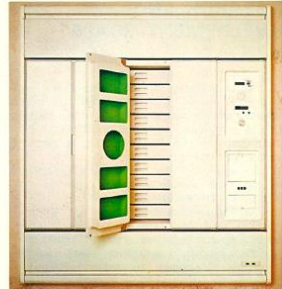


写真5: ドレッシングユニット photo5: Dressing Unit

今後の展開

今後は(1)ホーム・メカの大型化 (2)高性能化 (3)材料全般の検討 (4)量産条件の整理

FUTURE DEVELOPMENT

Due to the interchangeability and design flexibility of the "Wall Units" there is great potential for future development and refinement in the system. In fact, this potential is great even beyond our own hopes and expectations, so we must take positive steps towards plumbing this potential. To this end, we are presently formulating plans to:

について一層、研究を進めてまいります。住宅関係の新技術開発は開発投資効果の点で、又総合的角度からの評価に立てる点で、プレハブ産業が優位にあることが明白である以上、より優れた住宅を供給するための新技術の開発に大きな責任を感じ、完成に

- (1) Expand the size of the "Wall Units."
 - (2) Strive for an even higher degree of performance.
 - (3) Investigate and utilize new materials and component parts.
 - (4) Refine the arrangement and performance of the mass production process.
- From the point of view of technical and financial development, the prefabricated housing industry is one of the most interesting and fastest growing today. As a member of this industry, we at Misawa Homes feel a great responsibility, and are extending the

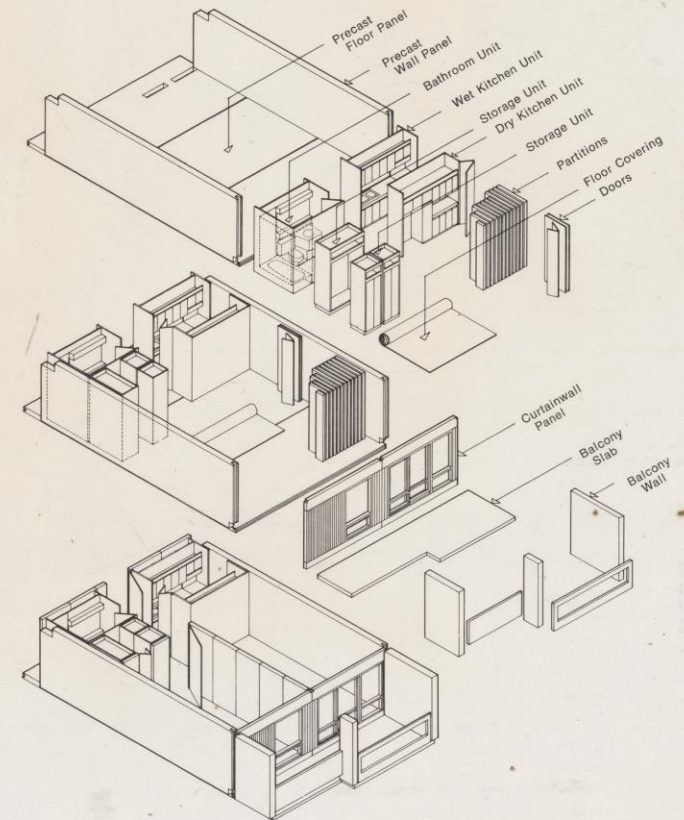
向ってより一層の努力をする予定であります。このプロジェクトは、製造面を中心に日立製作所の御協力をいただいたものであり、その御協力に対しこの紙面を借りて、厚く感謝の意を表します。

maximum effort, towards realizing the industry's potentials, and subsequently satisfying the consumers' demands for better housing products. We believe that this commitment on our part is clearly reflected in this announcement of the Misawa Homes "Wall Units". Finally, we wish to take this opportunity to express our sincere gratitude and appreciation to the management and staff of Hitachi Seisakusho, who contributed greatly to our efforts and concepts in their role as project coordinators.

The Descon/Concordia Building System

A performance criteria-open type, the Descon/Concordia building system calls for a rationalized assembly of interfaced off-the-shelf components or components fabricated by using existing processes. It is a system which is not limited to one source of supply and does not require extensive capital investment for plant. Hence it is ideally suited to local fabrication and to development by small entrepreneurs.

Major components of the building system include Structure, Plumbing, HVAC, Weatherscreen, Kitchen, Bathroom, Storage Wall, Partition and Door sub-assemblies.



Descon / Concordia

- Operation Breakthrough (1969)
- le processus et le produit

Inventaire 2

Boxes, panels and pieces

catégories (Dietz and Cutler, 1972)

Add layer + Share Preview

Liste Manufacturiers_2019-22-08...

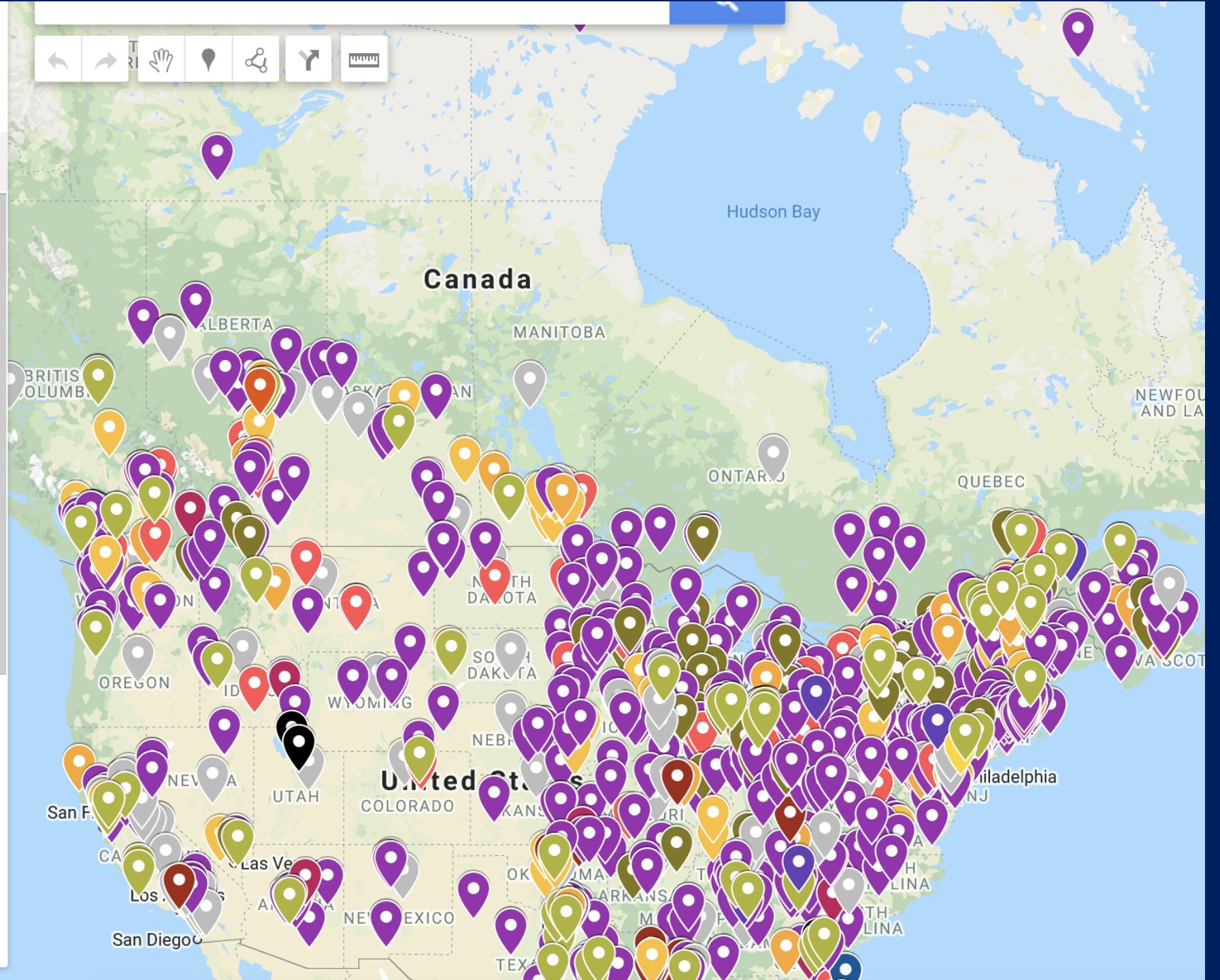
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- Volumetric (759)
- Panels (92)
- Kits (91)
- Manufactured (68)
- Volumetric + Panels (55)
- Kits + Panels (46)
- Kits + Volumetric (21)
- Kits + Volumetric + Panels (21)
- Volumetric + Manufactured (4)
- Other / No value (130)

AJOUT 21-09-19.xlsx

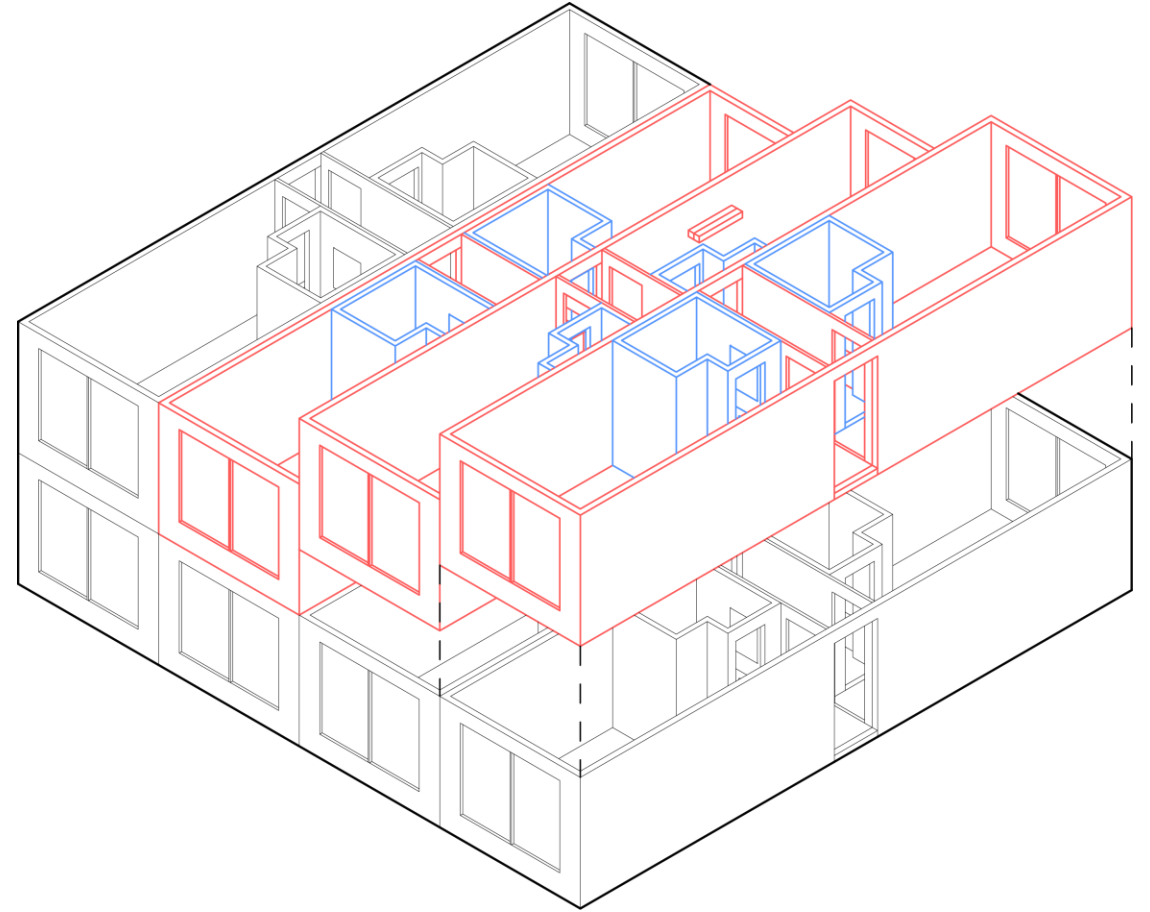
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modulaire volumétrique (grands volumes) boxes

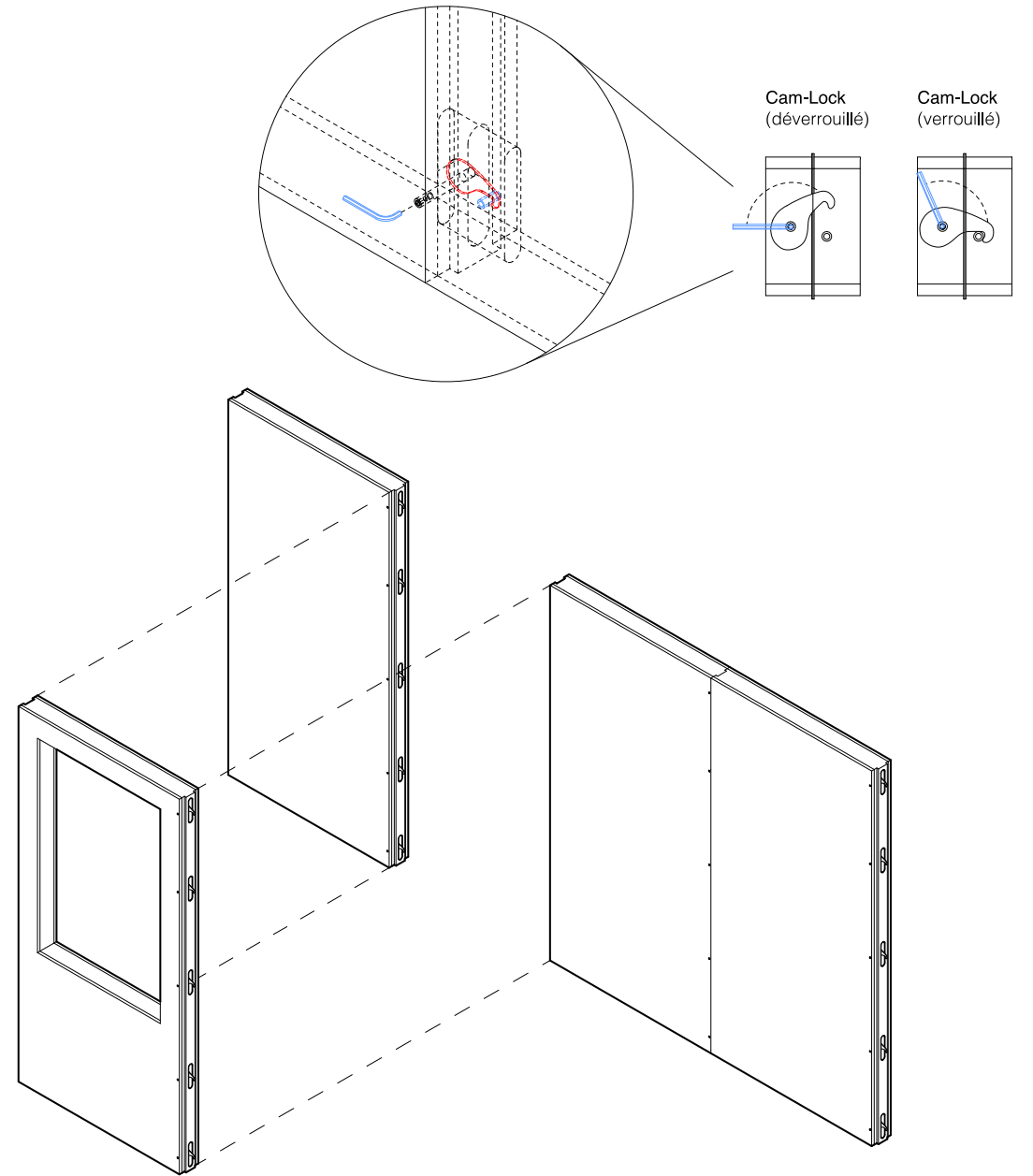
MODZ4-base4:

<https://www.base-4.com/modz4/>



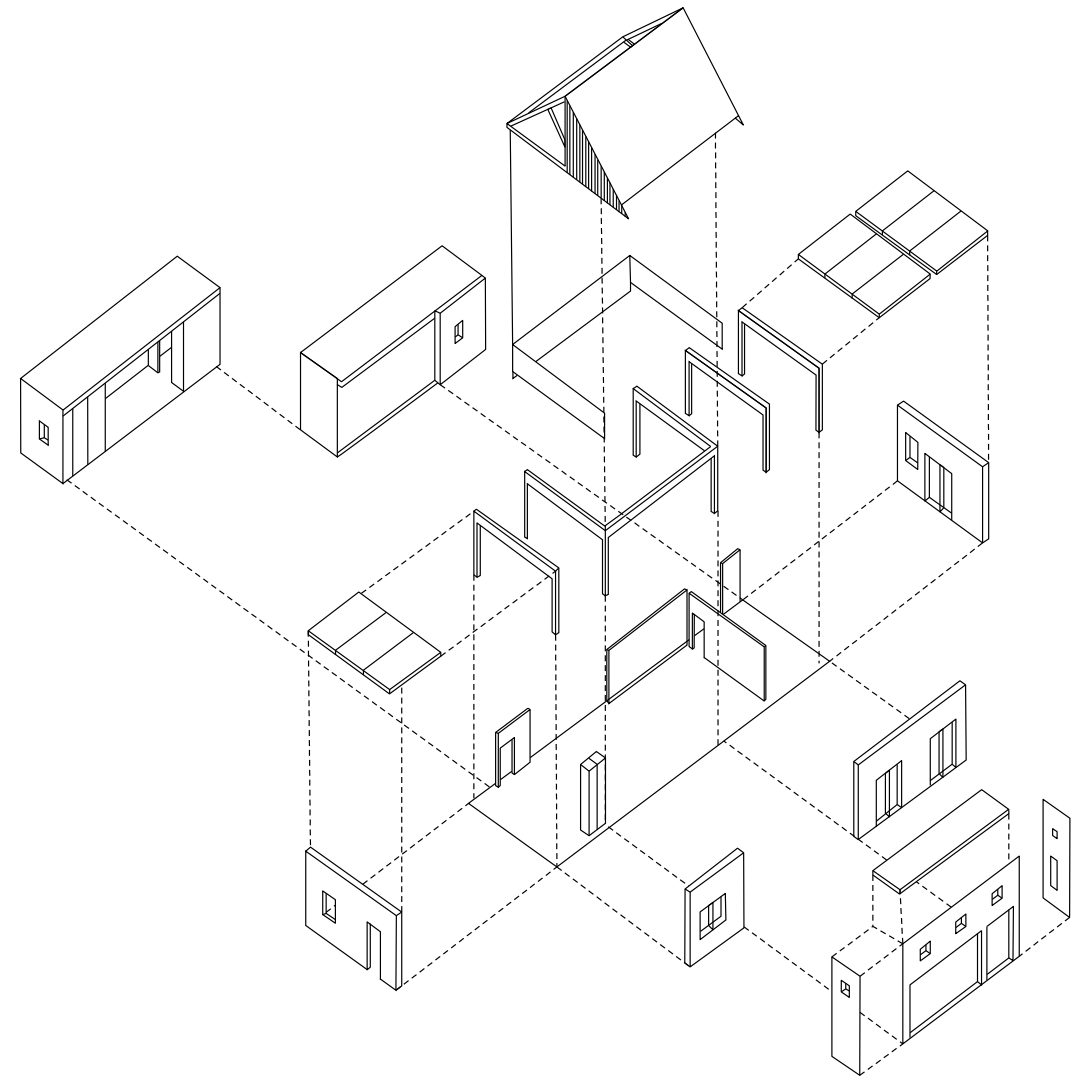
systèmes à panneaux (panels)

Murus panels:
<https://murus.com>

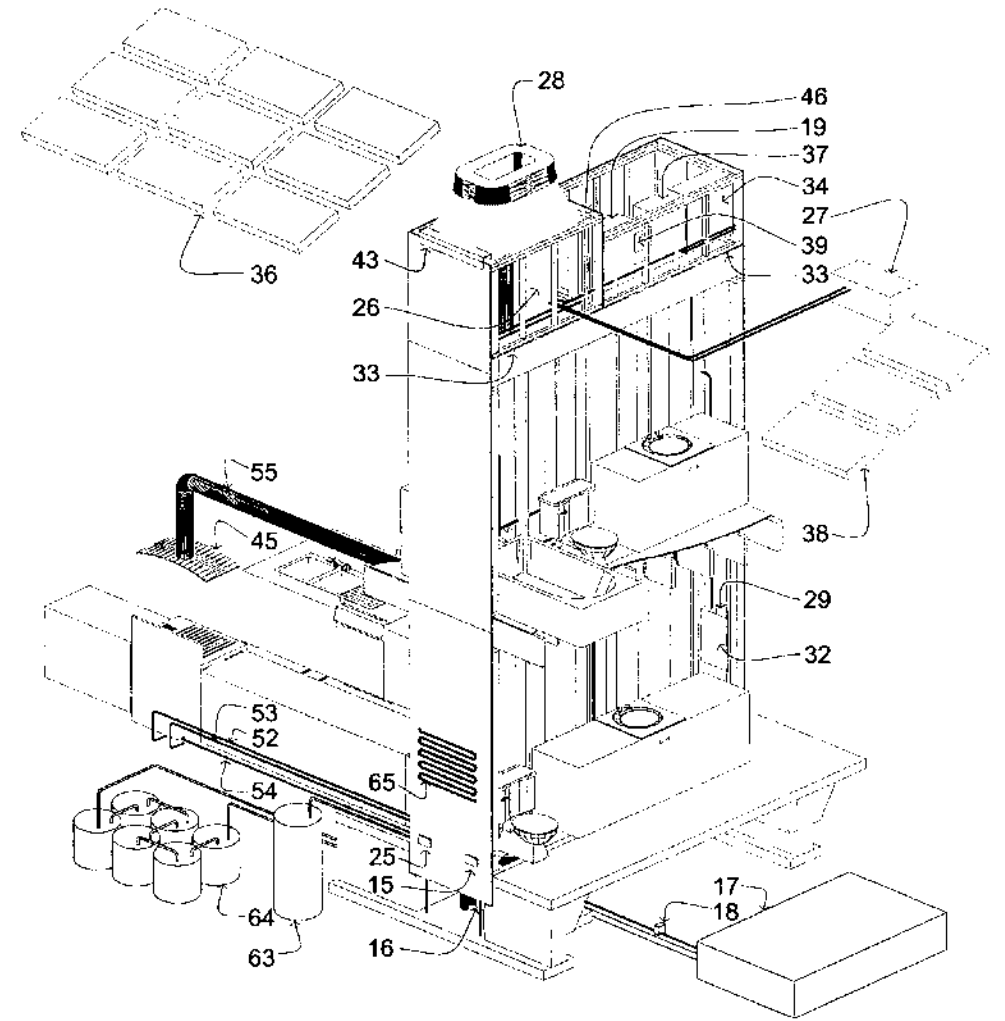


«kits de construction» (pieces)

Bensonwood Homes:
<https://bensonwood.com>



noyaux de services – coordination systémique



Axes de personnalisation

catalogue

modularité

configurateurs

plateformes DFMA

fabrication numérique

near site prefabrication

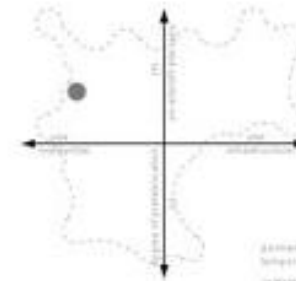
multitrade prefab

préfab spécifique aux projets

Stelco Catalogue Housing

Barton Myers Associates | 1969 | Steel housing prototype

Prefab Score  77



Methodology: Using a structure of steel columns, modules based on a 3-foot-square dimension could be filled in.

Units of Prefabrication: Steel column sections, sandwich panels of prefinished steel and catalogue ordered parts.

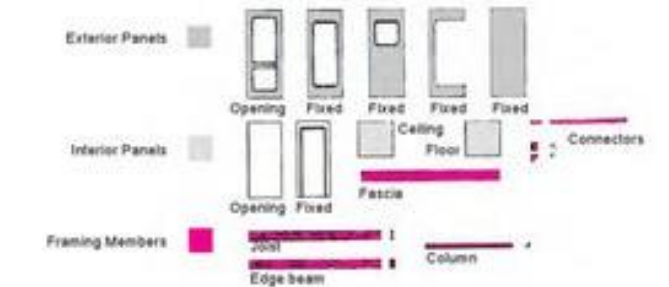
Structure: Steel column sections, hollow tube beams, and a number of different sandwich panels with a urethane core for horizontal and vertical surfaces.

Delivery: Catalogue ordered parts could be assembled by two unskilled persons in just an hour per square frame.

Axonomic View of Cluster



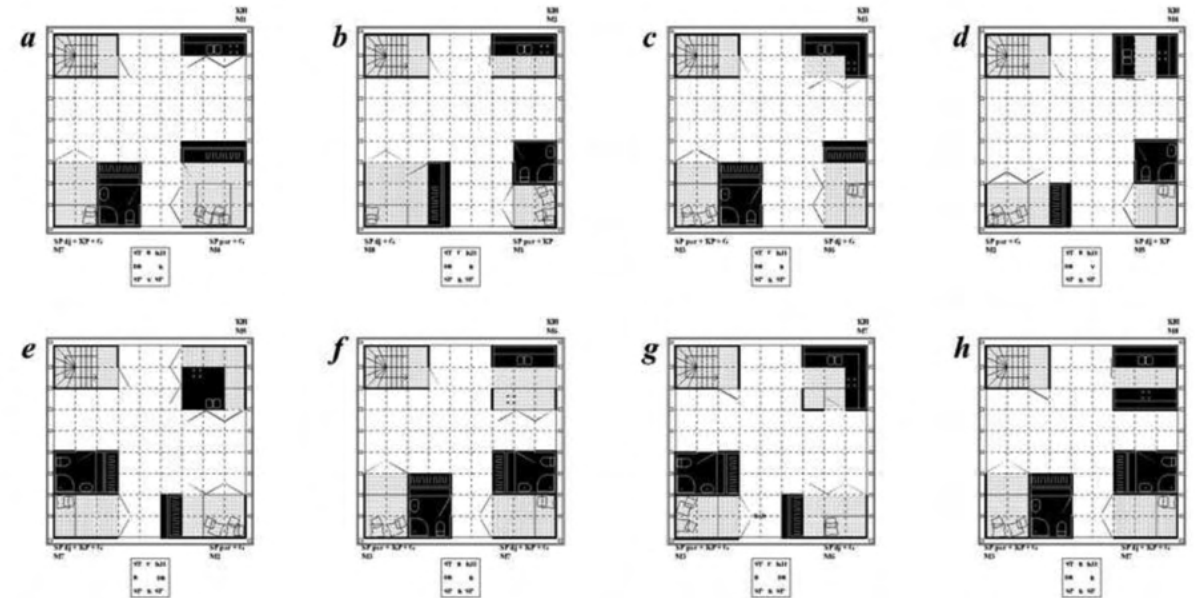
Unit Components



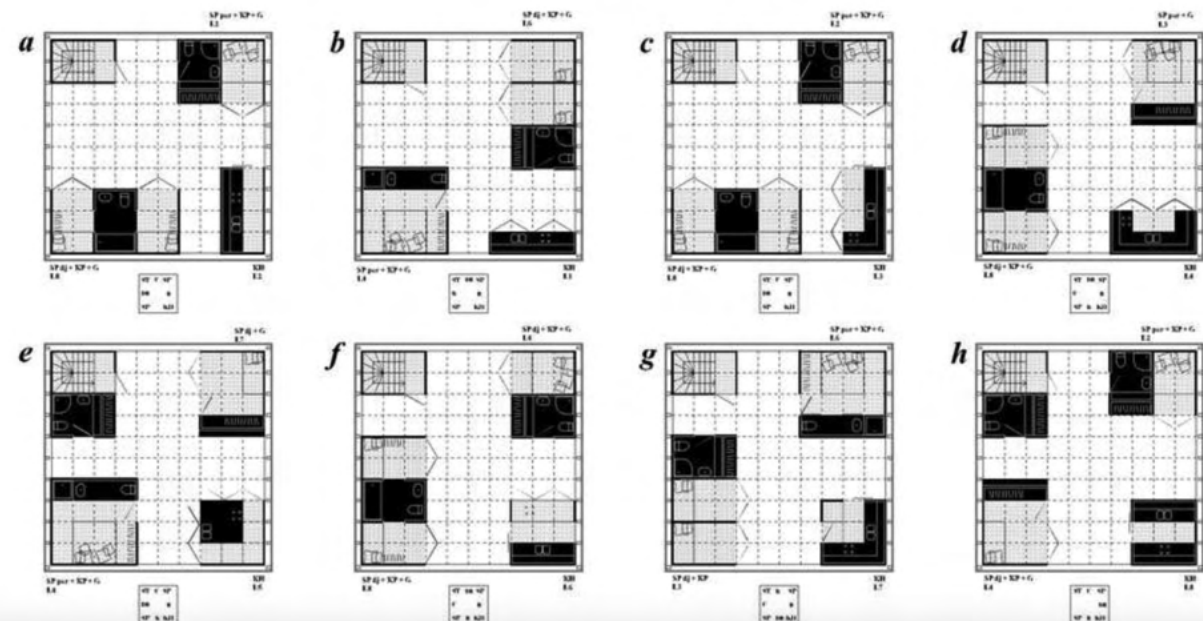
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M / 9m x 9m



L / 10m x 10m



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Generative Design Tool for Modular Buildings

How can we leverage generative design to accelerate test-fitting processes for modular buildings?

WHAT WE DID

We created a rapid test-fit toolkit to help designers generate multiple hotel configurations quickly and dynamically in the early stages of the design process.

We first identified critical variables and parameters across modular projects, and then summarized their design rules. Our toolkit is informed by the tools and methods applied to current modular projects—their key elements, requirements, and layouts in response to varying site conditions. We translated these design constraints into a visual programming language including modular unit dimensions, corridor widths, core dimensions, and site setbacks. Then we established a series of inputs that correspond to those design constraints. Finally, we tested, debugged, and created our user interface.

THE CONTEXT

Modular construction has enormous market potential, creating value in three main ways: increasing speed to market, streamlining labor, and empowering craft. We are focused first on residential and hospitality property use cases, as they stand to benefit most from the repetition of modular units. Residential and hotel buildings are a perfect fit for preconstructed modules—which can be small and identical units that enable quick design alternatives if needed. However, the efficiency of modular design technology solutions still lags; our toolkit aims to generate modular solutions faster and more easily than other tools currently on the market. Through our custom interface, users can rapidly generate and then compare schemes by inputting key parameters and design objectives.

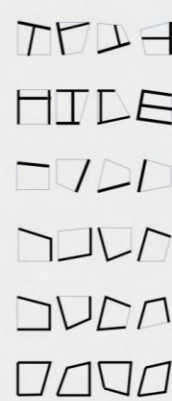
LEARNINGS FROM CURRENT HOTEL CLIENT



We see the possibilities of alphabetic letters



Derivatives of letter prototypes



MODULAR HOTEL GENERATOR

SITE

Select Site Properties

Site Setback West: 5

Site Setback South: 5

Site Setback East: 5

Site Setback North: 5



SHARED

Unit Width: 12

Unit Depth: 22

Corridor Width: 5

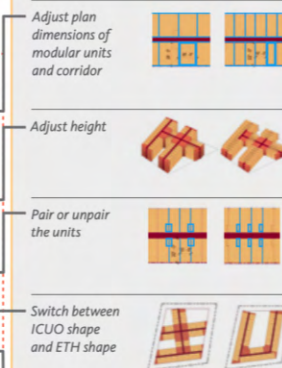
Total Height: 20

Floor-to-Floor Height: 10

Paired: Yes

Letter Prototype Switch: Check for ETH Shape | Uncheck for ILCO Shape

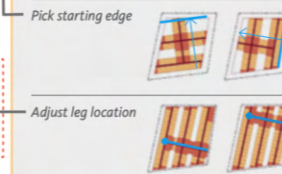
Starting Edge Selection: 0



ETH SHAPE

ETH Only | Courtyard Width: 20

ETH Only | Connecting Leg Location on Starting Edge: 0.3

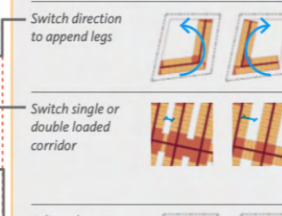


ILCO SHAPE

ILCO Only | Direction: Clockwise

(ILCO Only 0=Single Loaded Inside 1=Single Loaded Outside 2=Double Loaded)

ILCO Only | # of Legs (less than the # of centerline segments): 1



Cancel Set Values

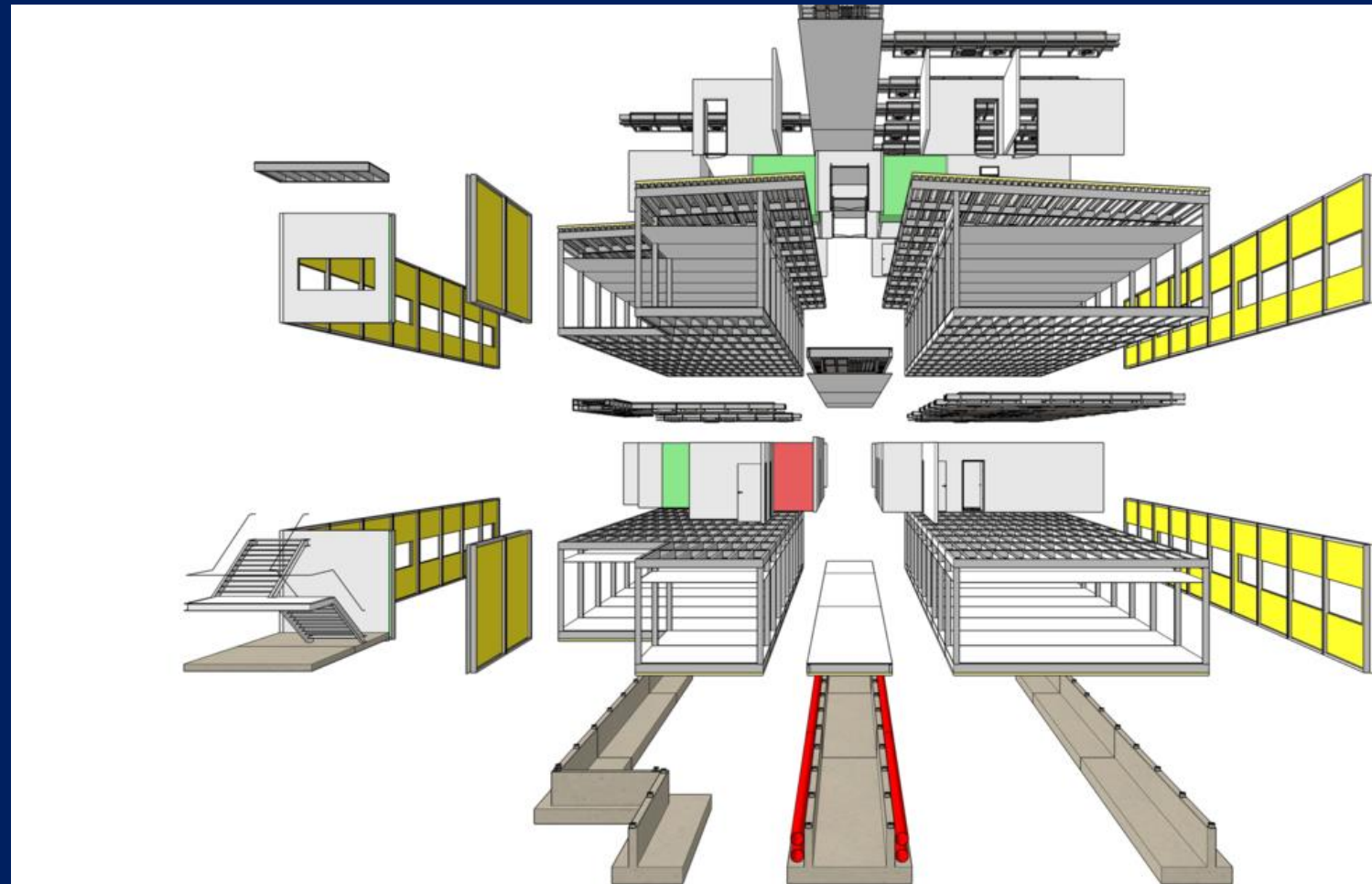
THE RESULTS

We created an “alphabetical approach” to hotel layouts. After studying ongoing modular projects, we developed an approach inspired by the abstraction of letters—I, L, U, O, E, T, and H—which is representative of the range of typical hotel layouts. After we developed our core algorithm around our alphabetical approach, we utilized visual programming (Dynamo) and coding (Python) to establish constraints, and interpret and stabilize the geometrical and mathematical relationships.

For the user, we developed an input and output interface. We set out to create a seamless and adaptable workflow between Dynamo and Revit. The input interface is customizable, or non-automated. Users set up variables by click and slide functions, including features such as adjust site setback, adjust dimensions of modular units, adjust level-to-level height, pair or unpair shaft locations, and switch letter prototypes. The output interface visualizes parameters. It also uses a click and slide feature, with the intention to experiment with different configurations. Users can then compare data metrics and variance among each model.

Axes de personnalisation

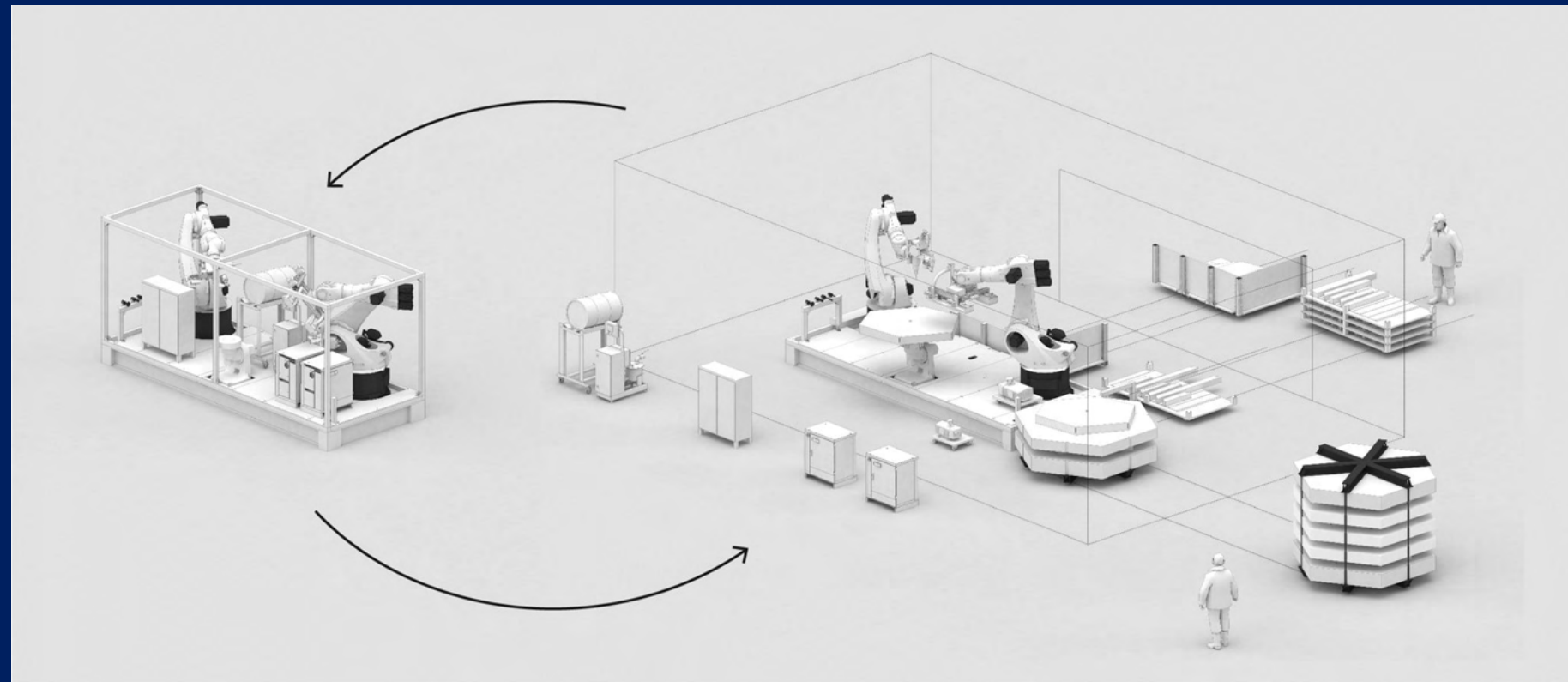
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multitrade prefab
prefab spécifique aux projets



Axes de personnalisation

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Flexible and transportable robotic timber construction platform – TIM

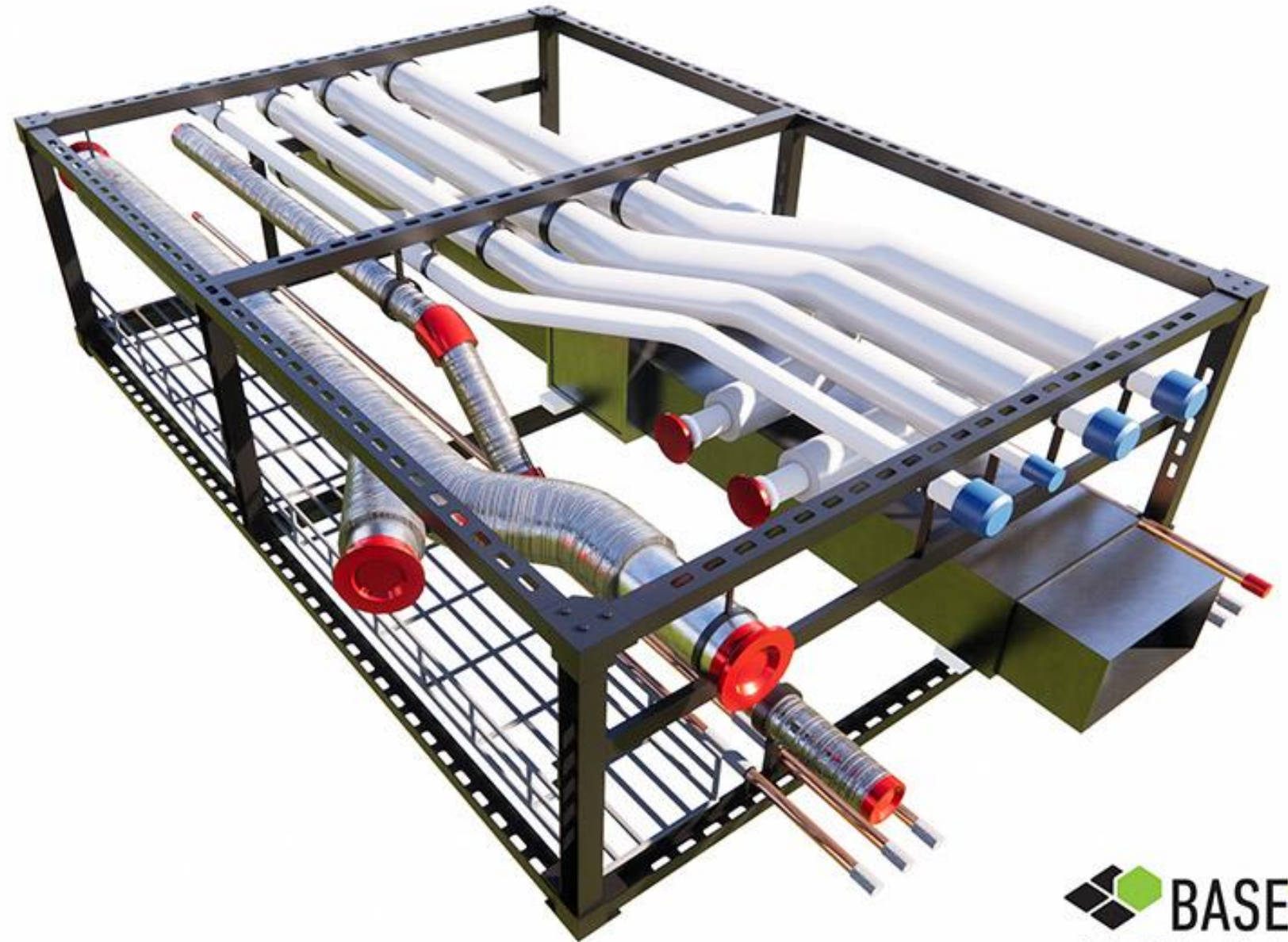


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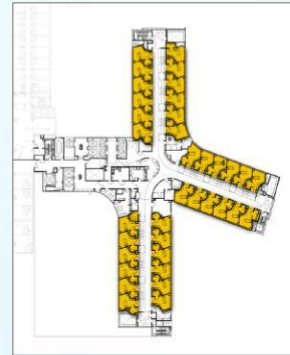
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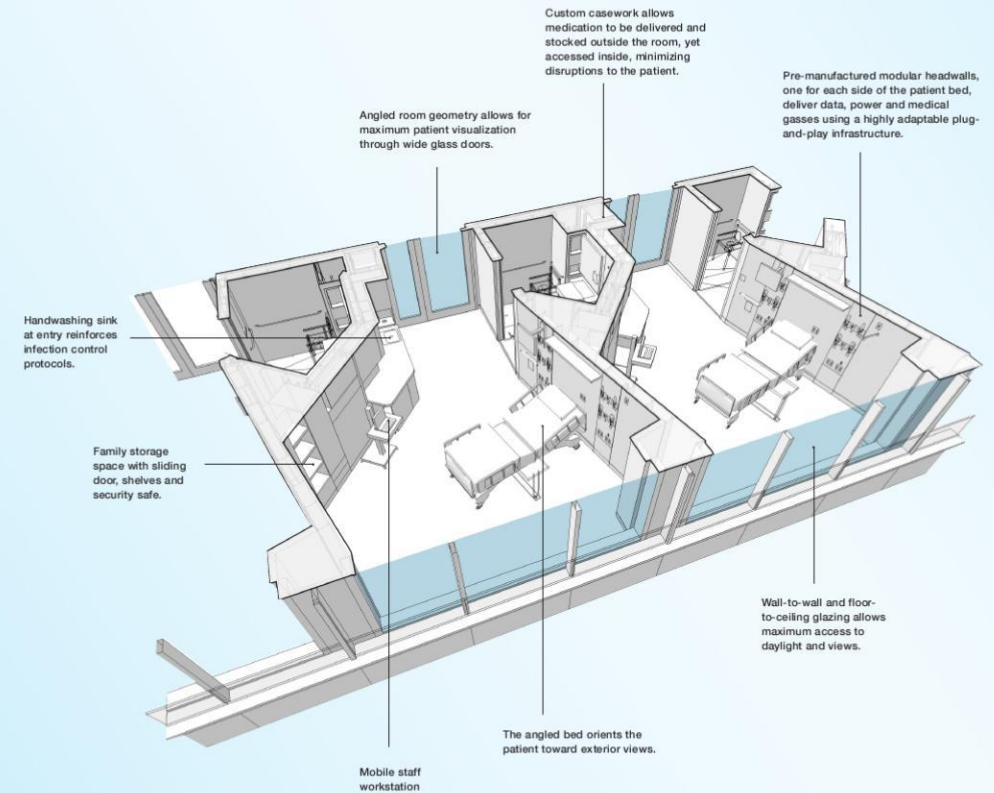
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STANDARDIZED PATIENT ROOMS

The MVH bed tower contains 178 identical private rooms on five identical floors. This degree of standardization provides the flexibility to shift functions from floor to floor and reduces the need for patient transfers. Each room is same-handed to ensure patient safety and to streamline staff movements throughout the day.



Inventaire 3 La question de la répétabilité

(Bryden Wood, 2018)

Rationalisation

By reviewing previous and proposed solutions, a range of analytical tools will be applied to group similar elements. These can then be tested to ascertain whether the degree of variation within the group (i.e. the range of different solutions to the same problem or brief) is necessary or whether a common solution could be adopted.

Standardisation

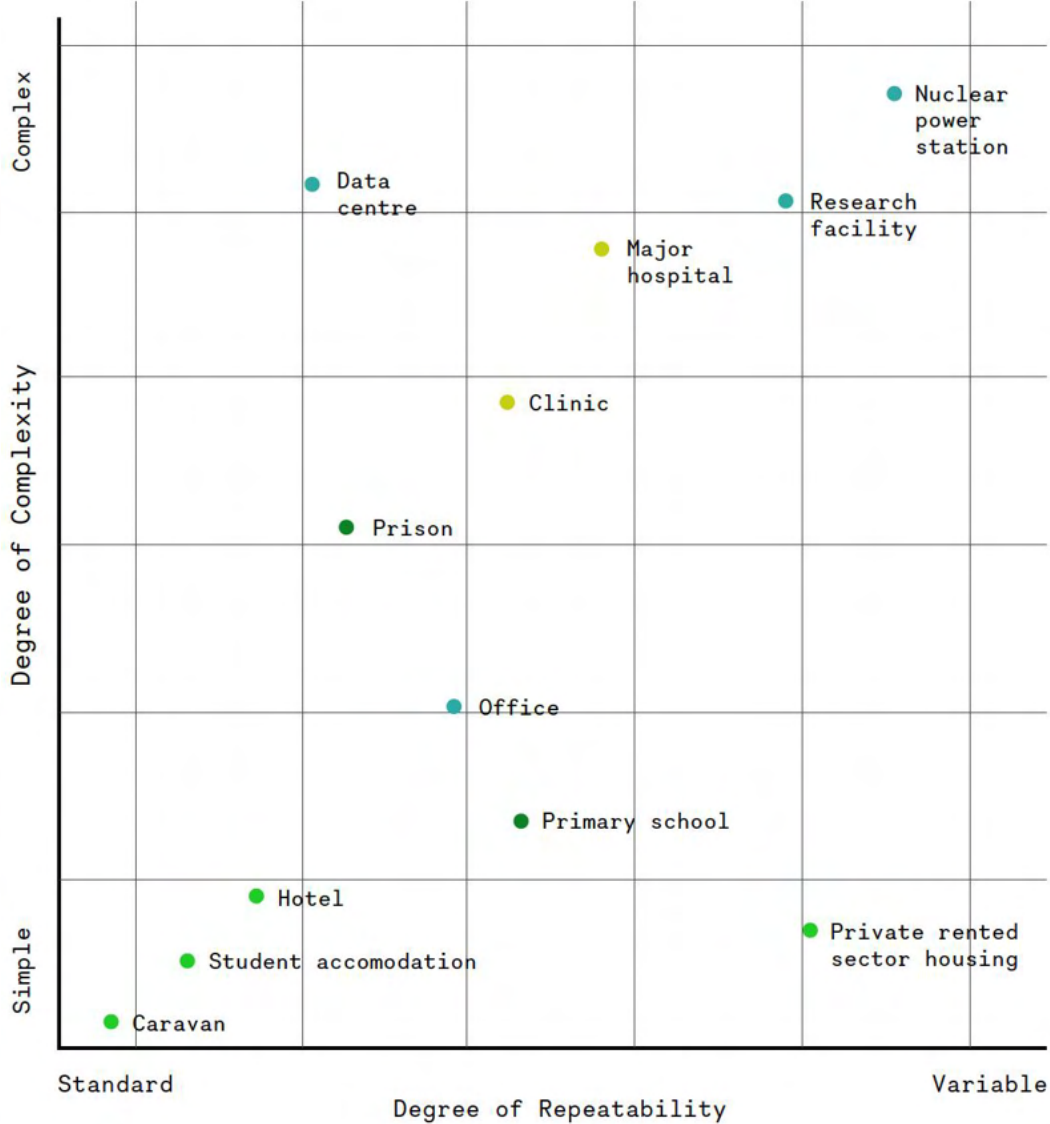
The rationalisation process will yield a number of common solutions with a high rate of occurrence. These will provide significant benefits in terms of speed of design, ease of construction, opportunities for standard working etc.

These standard elements can then be refined with stakeholders and, where appropriate, the likely supply chain to develop consistent and reliable layouts, interfaces, details and materials specification to ensure regulatory conformity, long life and minimum defects.

Optimisation

Further benefits may be realised by continuing to refine certain components – highly repeatable elements that will justify significant time and effort in refining the design. The cost of the product can further be reduced by optimising the use of materials (specification, thickness etc.) to meet the requirements for robustness and durability without being overspecified.

This approach is particularly beneficial where it facilitates programme-wide procurement with associated benefits of mass production and manufacture at an industrial scale.



- Residential
- Offices
- Health
- School