

# La construction **offsite / hors chantier**

**rêves et réalités de la personnalisation de masse**

construction  
industrialisée

bâtiment usiné

construction  
modulaire

préassemblage

architecture  
préfabriquée

# La construction **offsite / hors chantier**

rêves et réalités de la personnalisation de masse

préfabrication

modulaire  
volumétrique

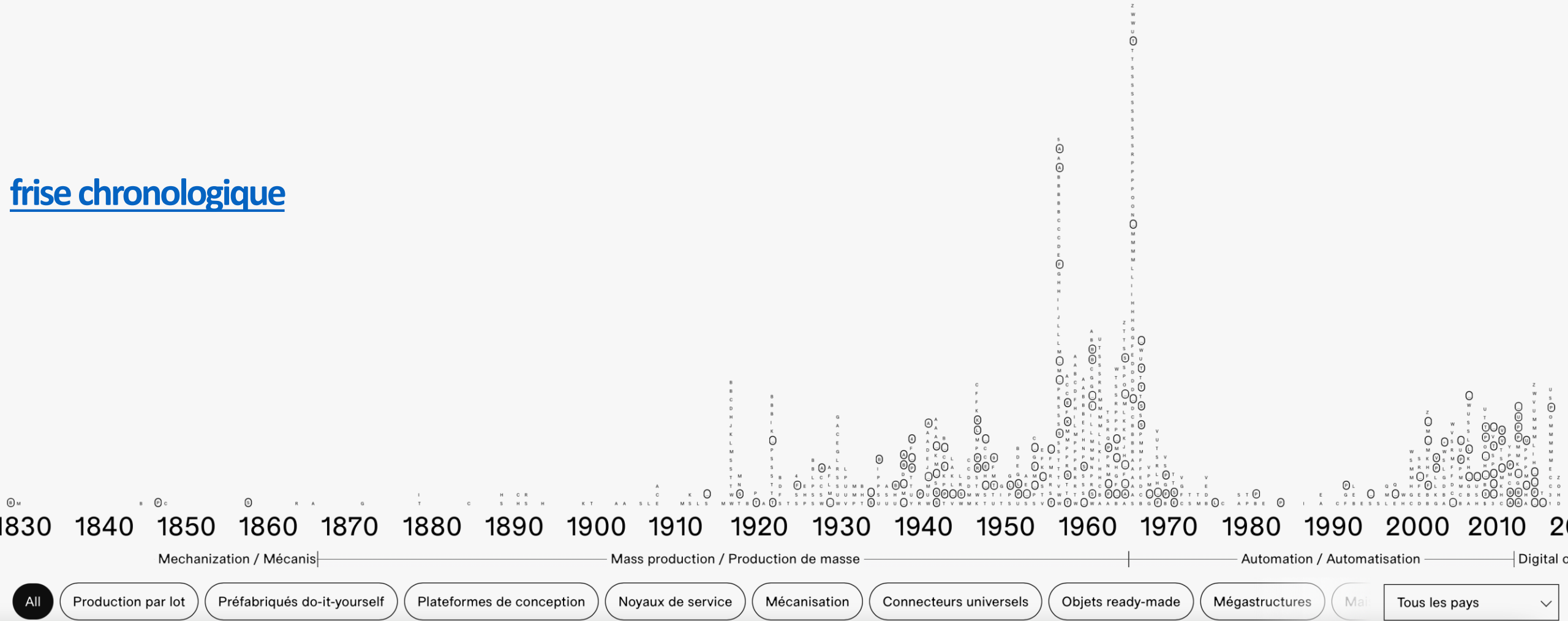
systèmes de  
construction  
manufacturés

panneaux de mur  
préfabriqués

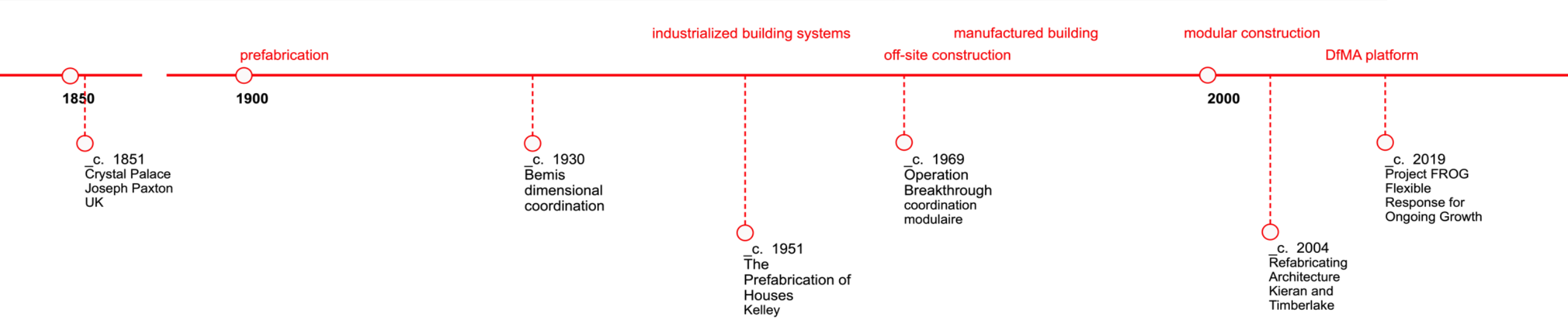
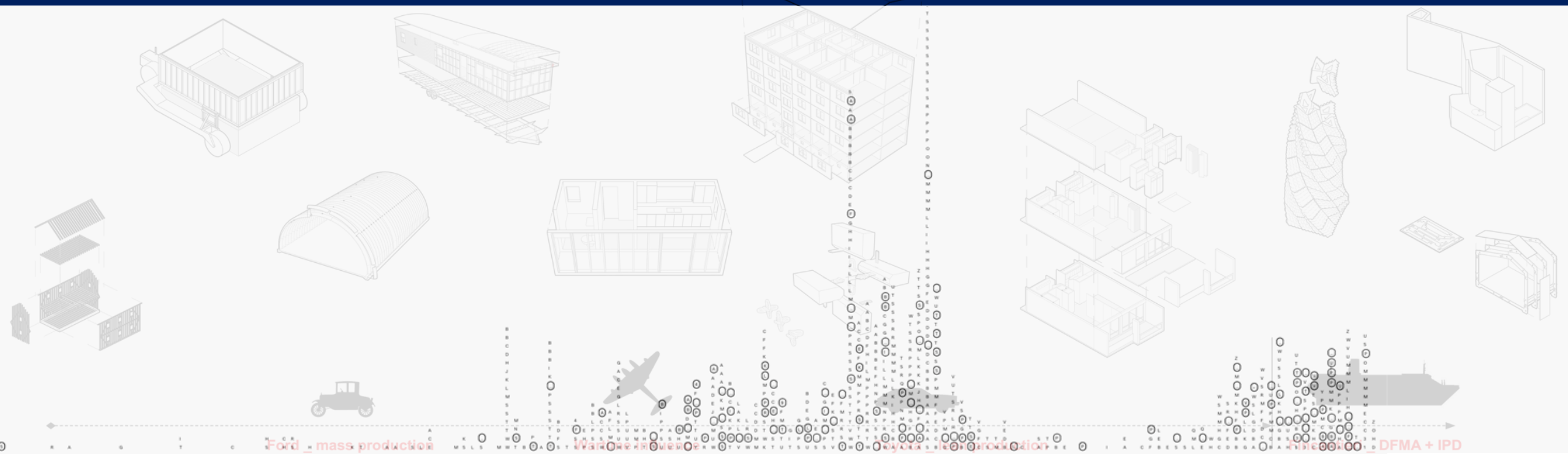
DfMA appliqué aux  
bâtiments

# la plus vieille nouvelle idée en architecture, portée par des moments de crise

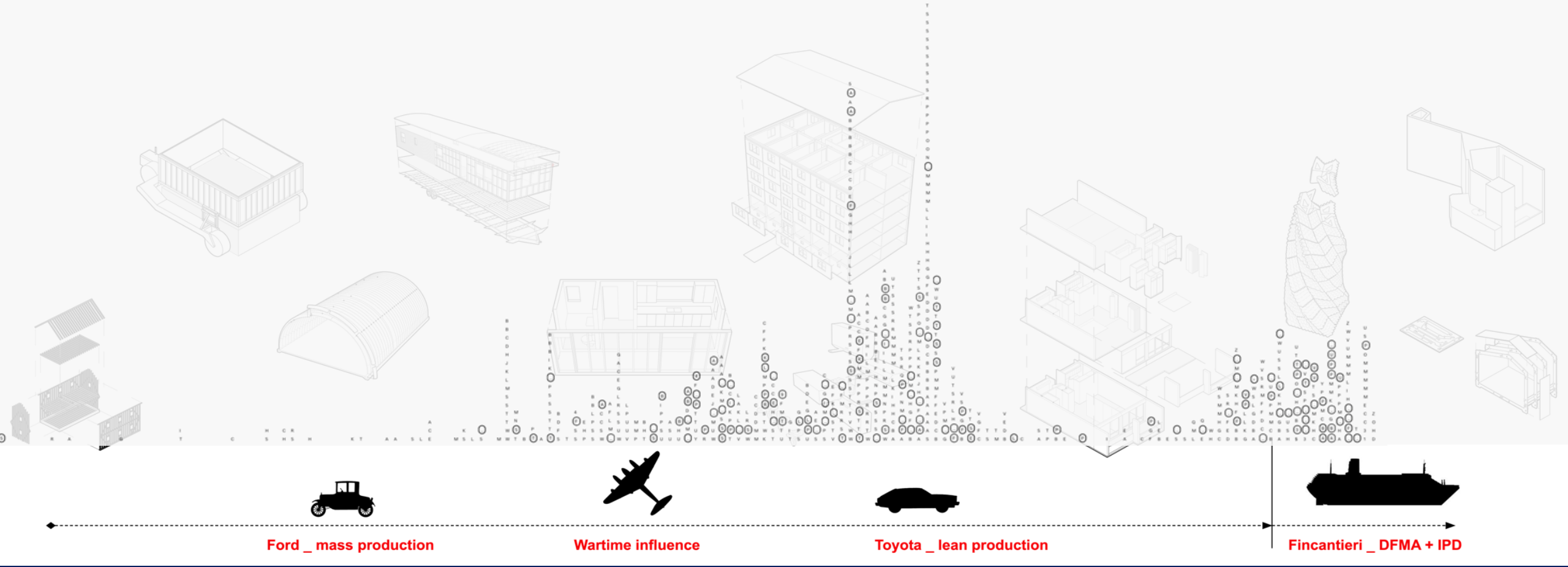
## frise chronologique



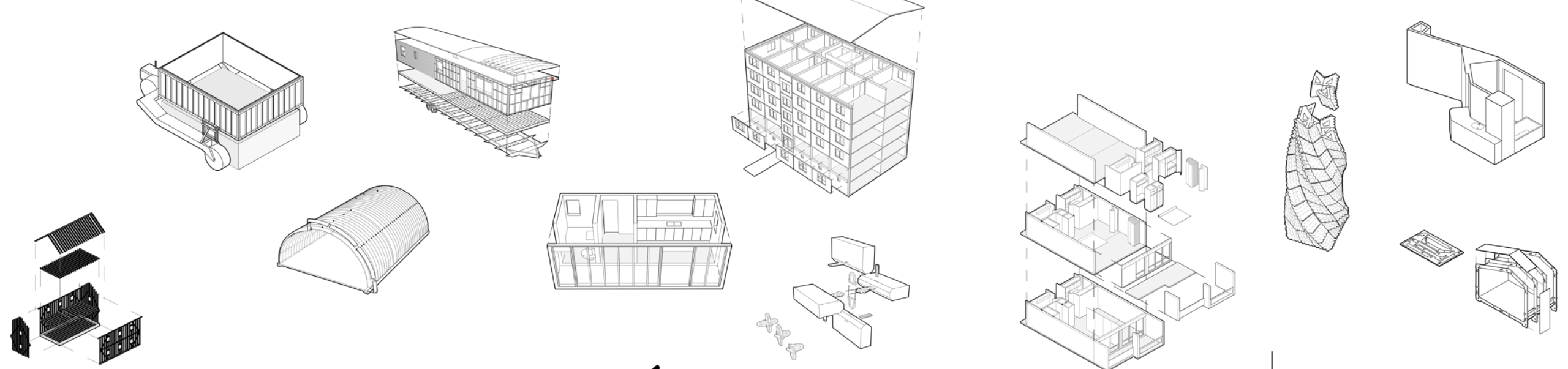
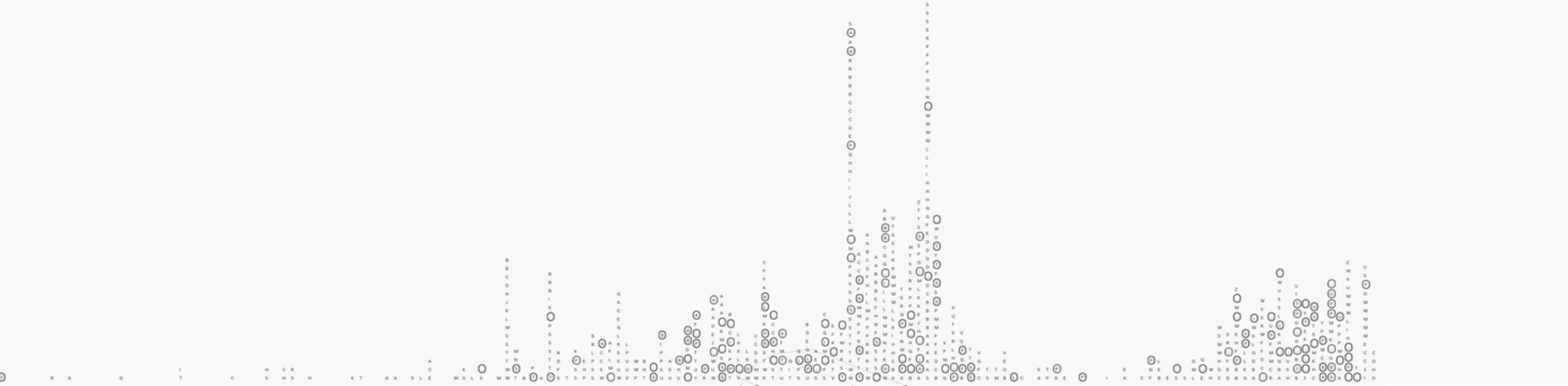
# la plus vieille nouvelle idée en architecture, les grandes crises



# la plus vieille nouvelle idée en architecture, les avancés des méthodes manufacturières



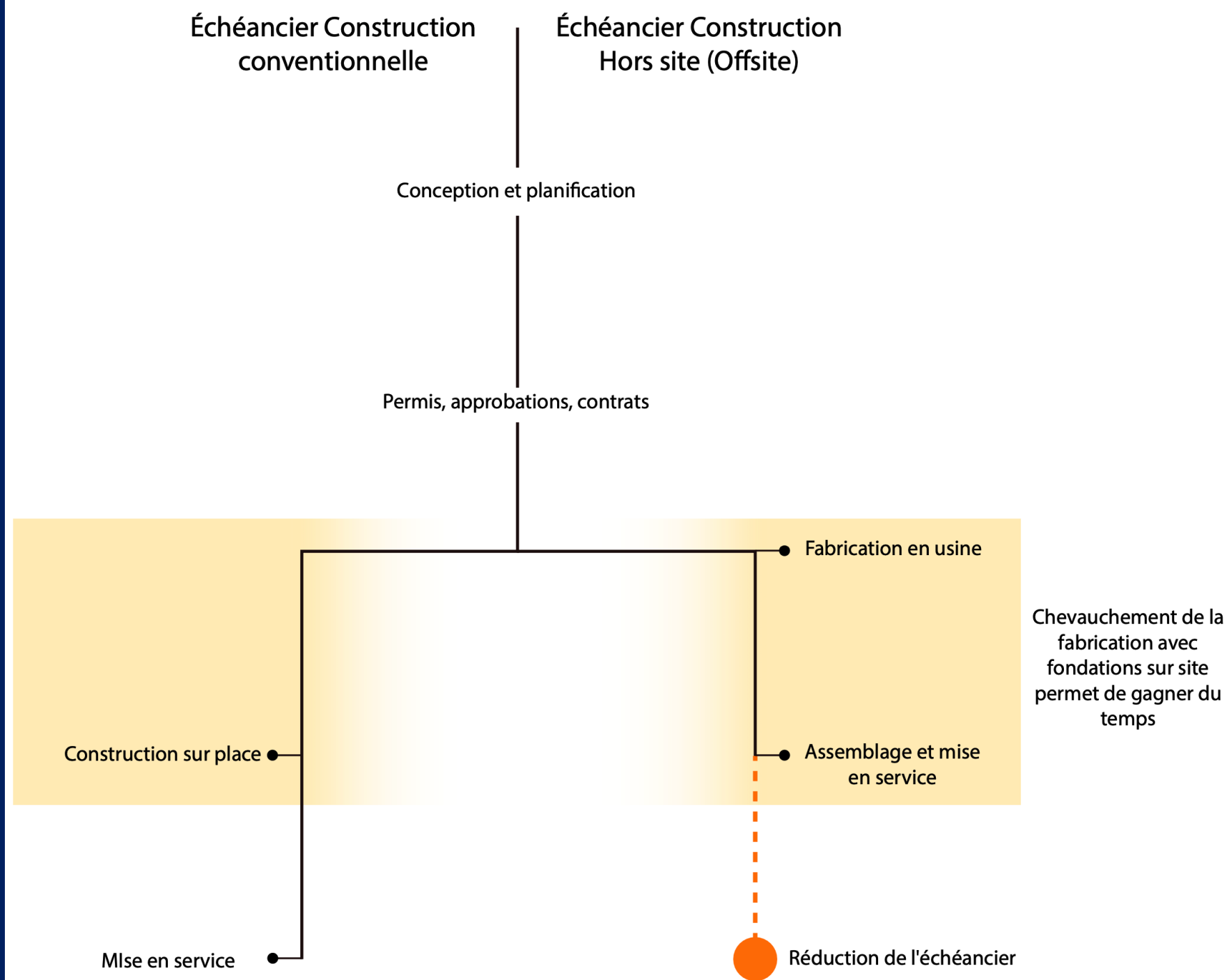
# la plus vieille nouvelle idée en architecture, une nouvelle ère (de la production vers la personnalisation de masse)



# l'avantage le plus cité

## Échéancier

- + réduction des déchets
- + empreinte écologique plus faible
- + augmentation de la productivité
- +



# l'industrie actuelle – modulaire volumétrique

LISTE MANU. (2019-10-22)

242 views

All changes saved in Drive

Add layer Share Preview

Liste Manufacturiers\_2019-22-08...

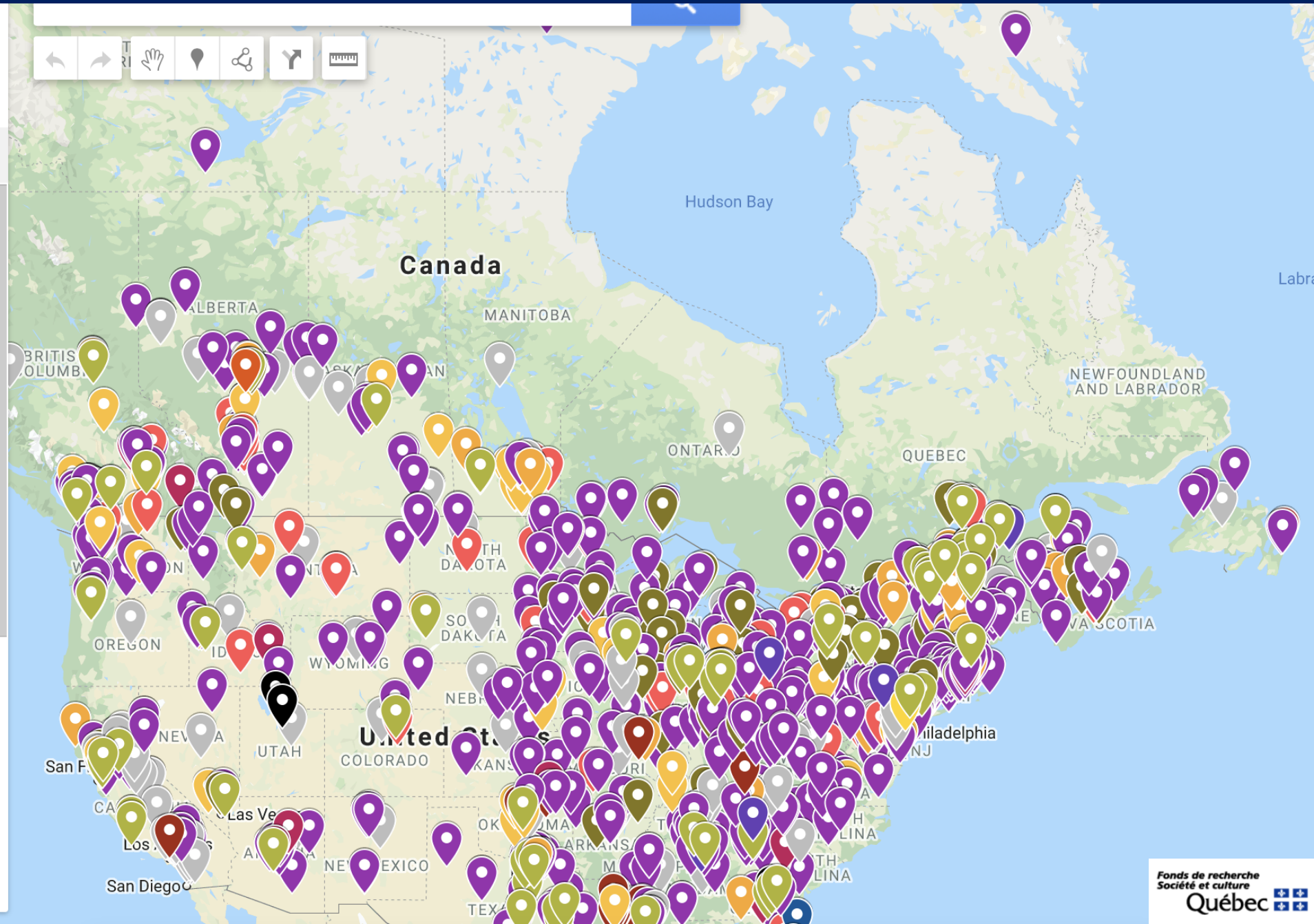
Styled by SYSTÈMES / SYSTEMS

12 rows couldn't be shown on the map.  
Fix errors highlighted red in the data  
table. [Open data table](#) [Dismiss](#)

- 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

Styled by SYSTÈMES / SYSTEMS





# les trois grandes approches

boxes – (modulaire volumétrique)

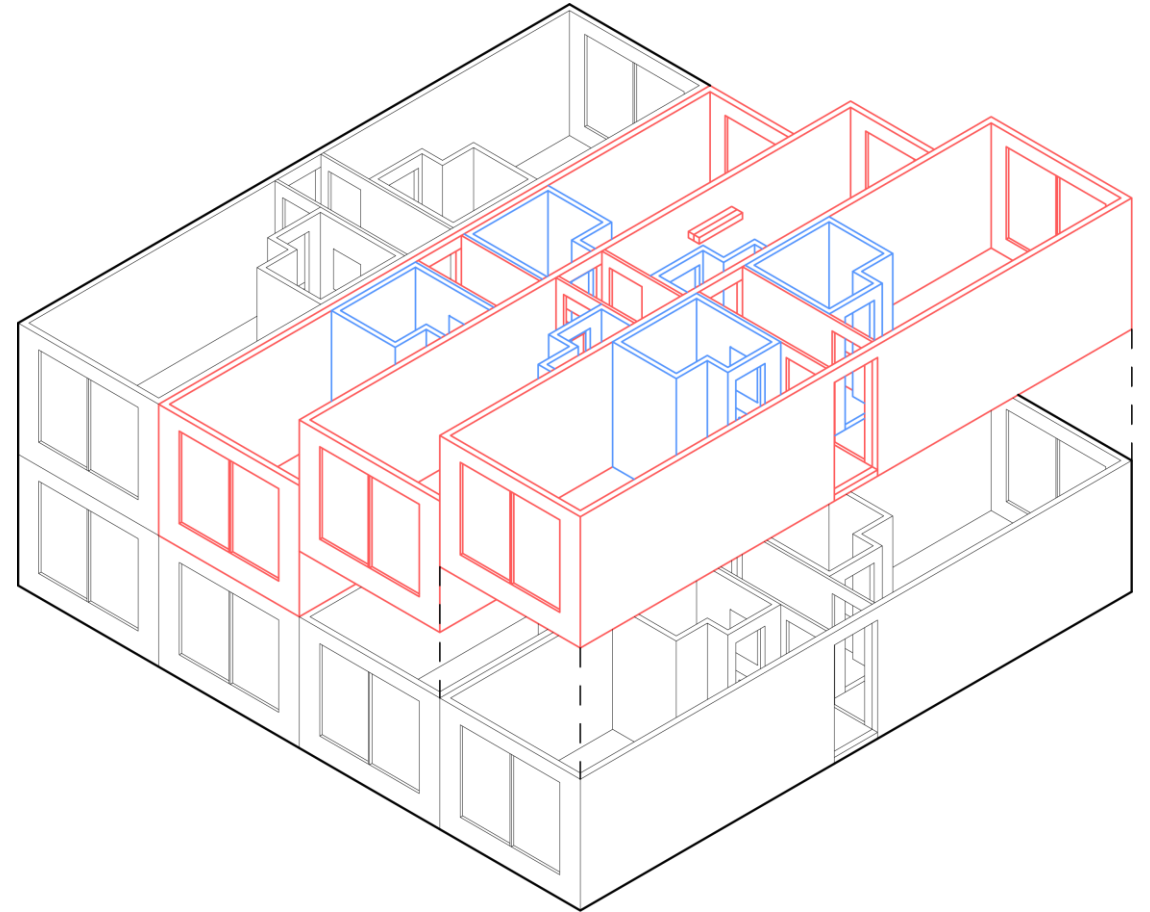
panels – (systèmes à panneaux)

pieces – («kits» de construction)

# modulaire volumétrique (grands volumes) boxes

**MODZ4-base4:**

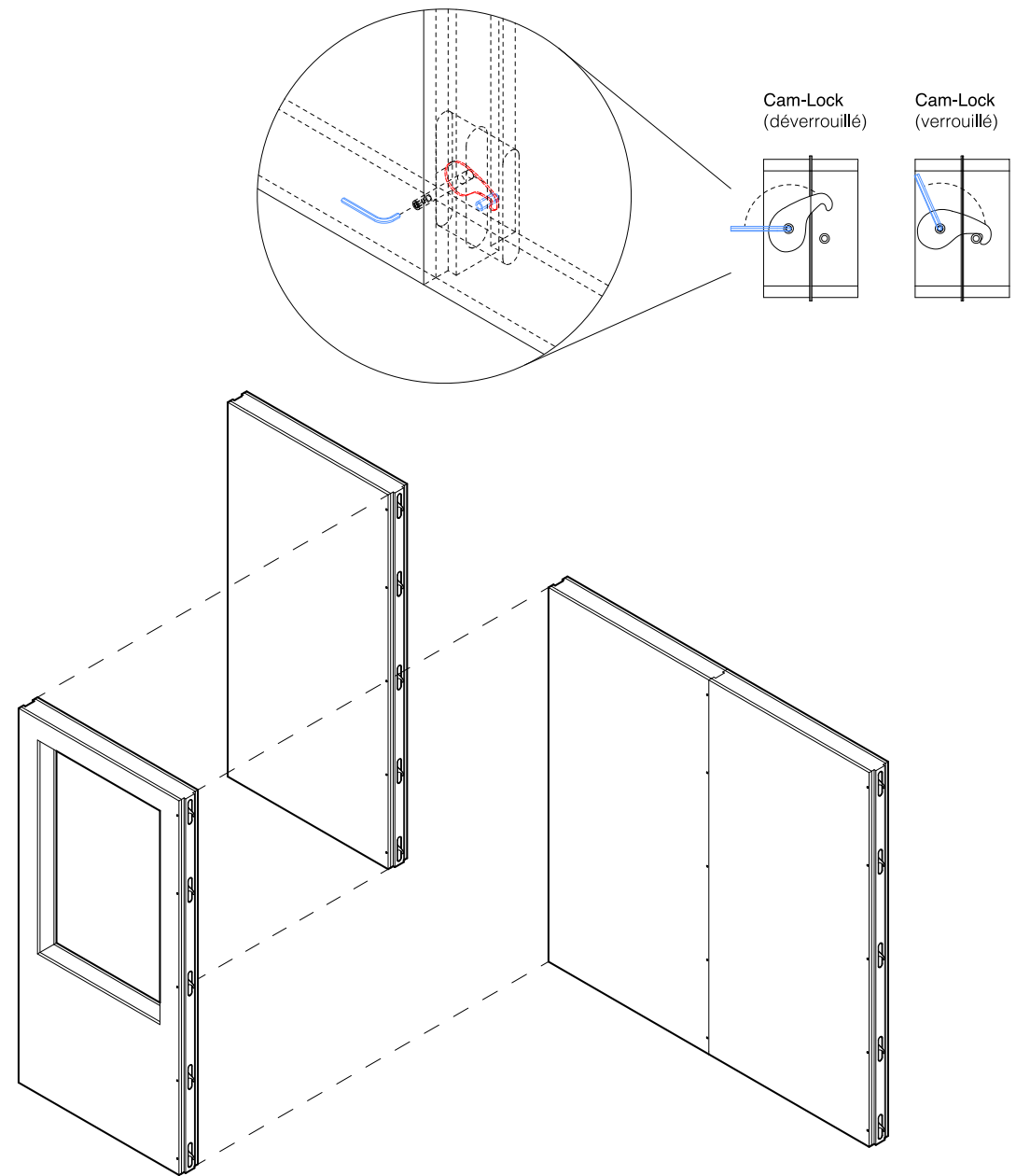
<https://www.base-4.com/modz4/>



# systèmes à panneaux

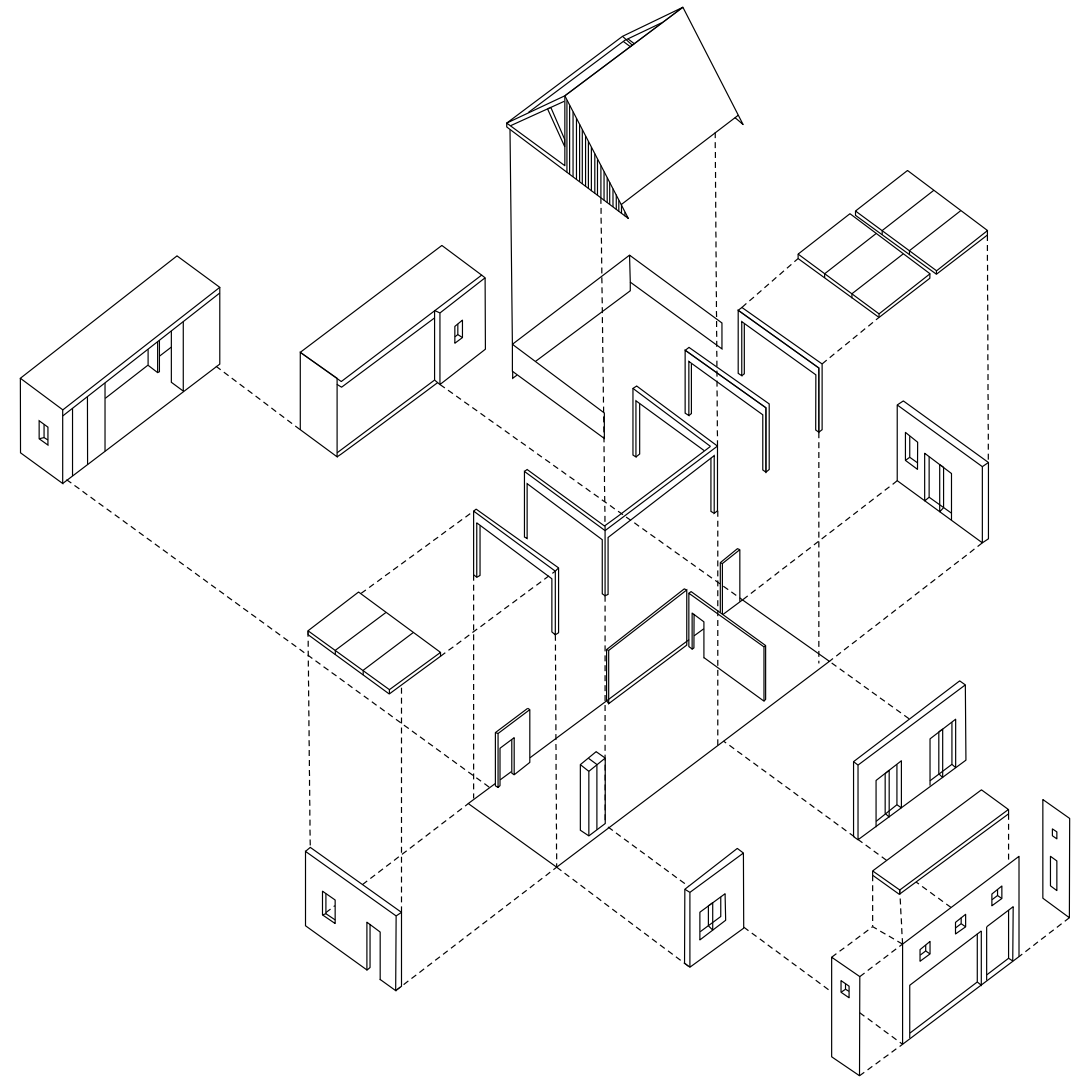
Murus panels:

<https://murus.com>

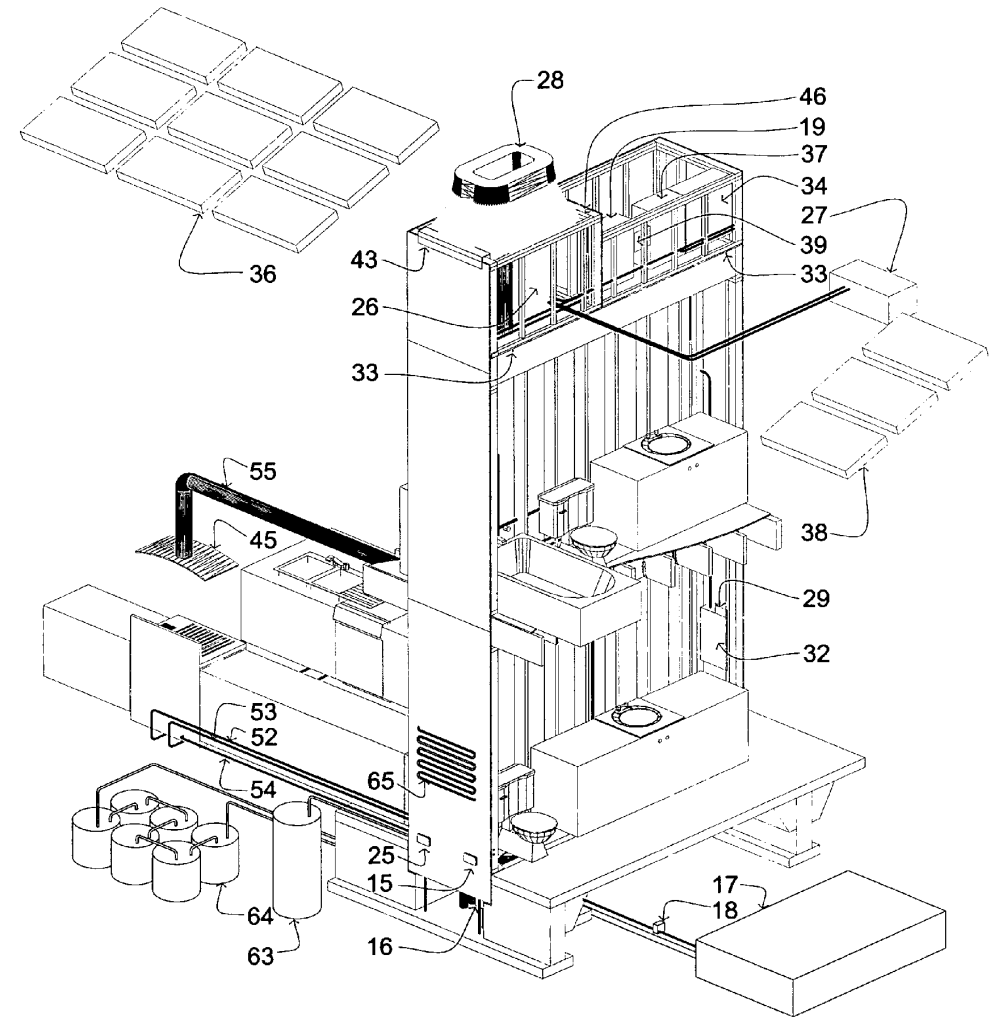


«kits de construction»

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



# noyaux de services – coordination systémique



# Axes de personnalisation

catalogue

modularité

configurateurs

plateformes DFMA

fabrication numérique

near site prefabrication

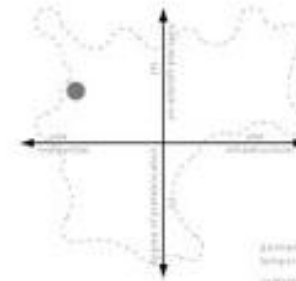
multitrade prefab

préfab spécifique aux projets

## Stelco Catalogue Housing

Barton Myers Associates | 1969 | Steel housing prototype

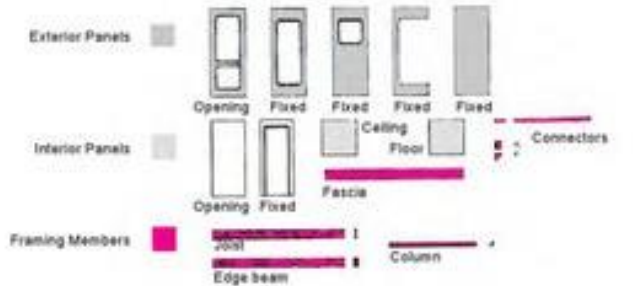
Prefab Score  77



Axometric View of Cluster



Unit Components



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.

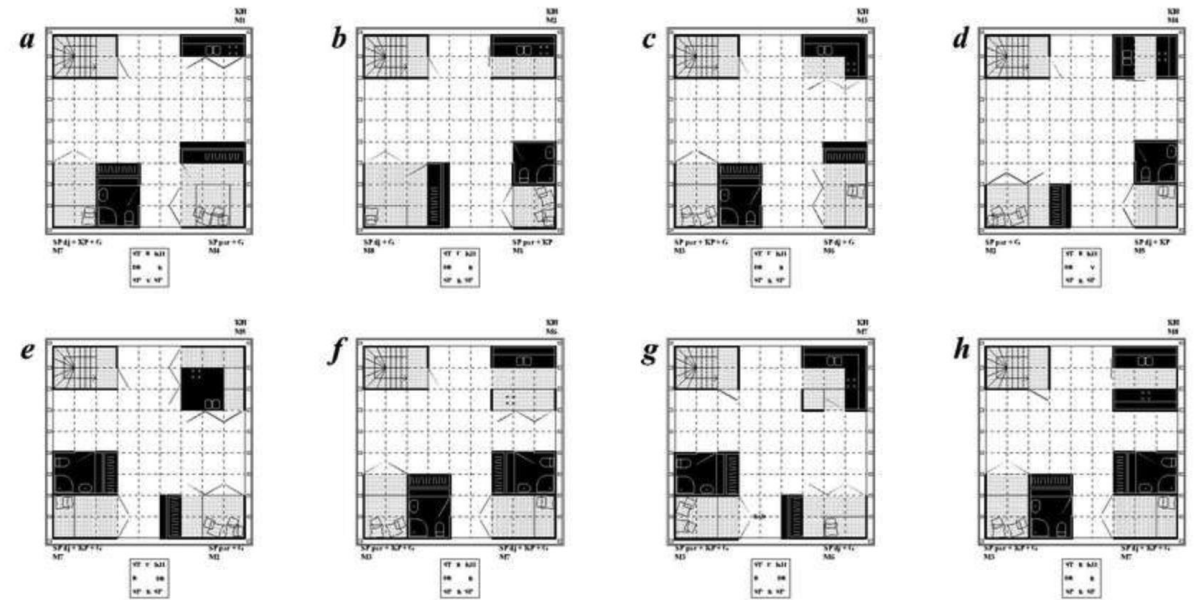
Delivery: Catalogue ordered parts could be assembled by two unskilled persons in just an hour per square frame.



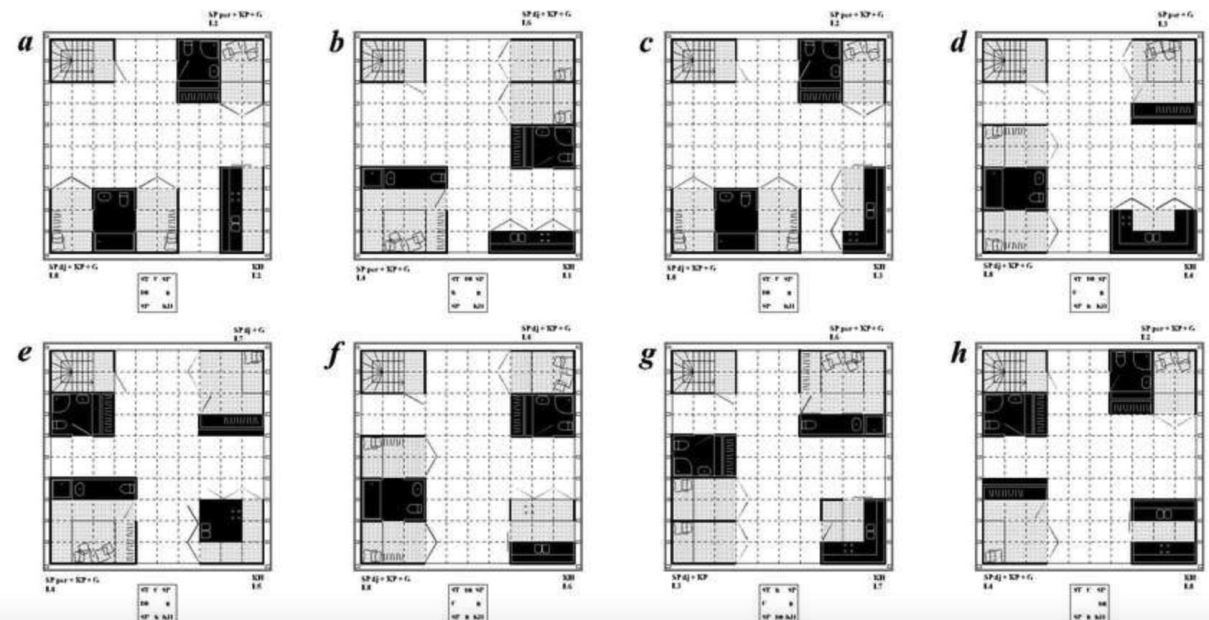
# Axes de personnalisation

catalogue  
modularité  
configurateurs  
plateformes DFMA  
fabrication numérique  
near site prefabrication  
multitrade prefab  
préfab spécifique aux projets

*M / 9m x 9m*



*L / 10m x 10m*



# Axes de personnalisation

catalogue  
modularité  
configurateurs  
plateformes DFMA  
fabrication numérique  
near site prefabrication  
multitrade prefab  
préfab spécifique aux projets

## 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

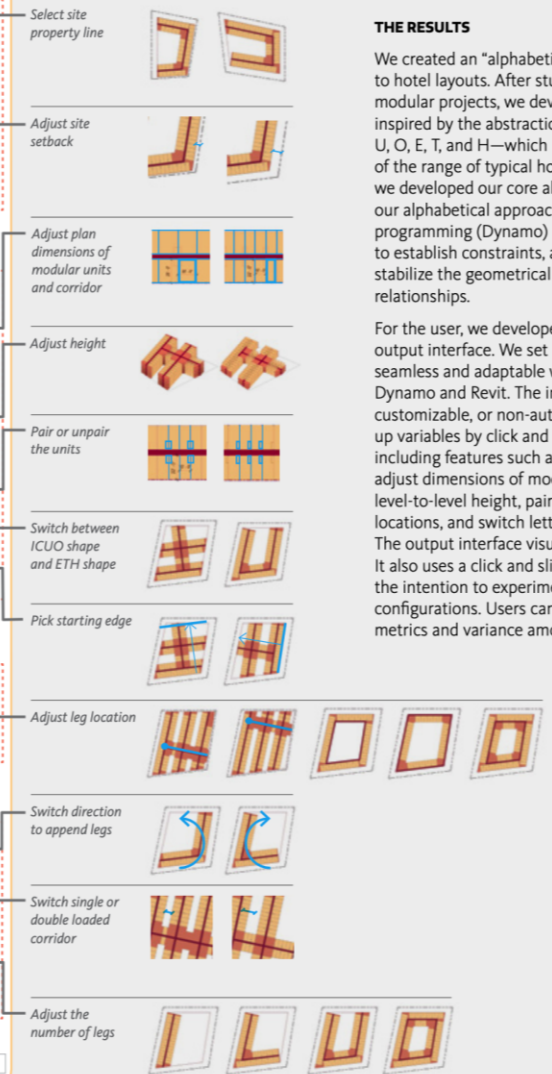
#### ILCO SHAPE

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

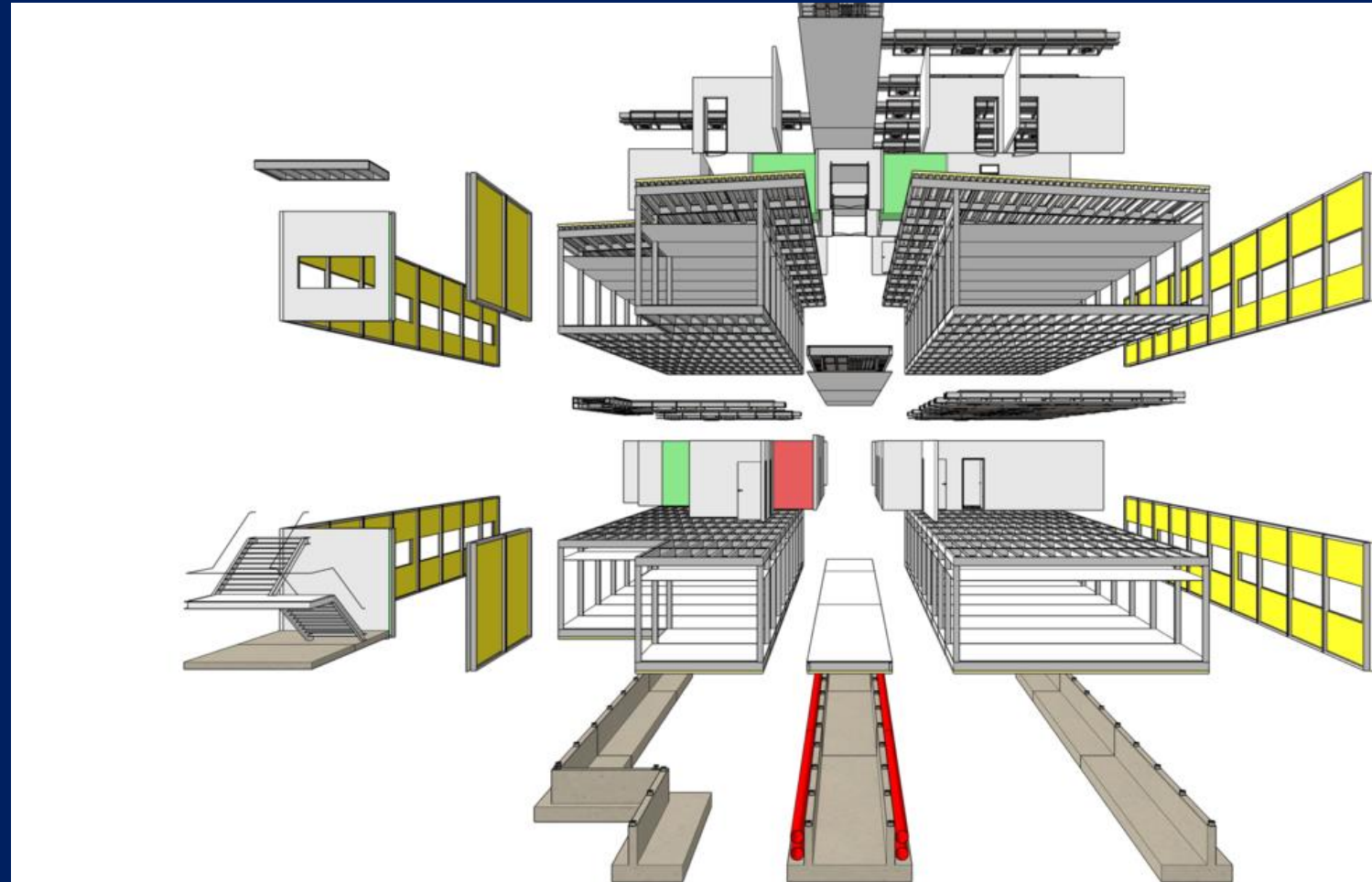
We created an “alphabetical approach” to hotel layouts. After studying ongoing modular projects, we developed an approach inspired by the abstraction of letters—I, L, U, O, E, T, and H—which is representative of the range of typical hotel layouts. After we developed our core algorithm around our alphabetical 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

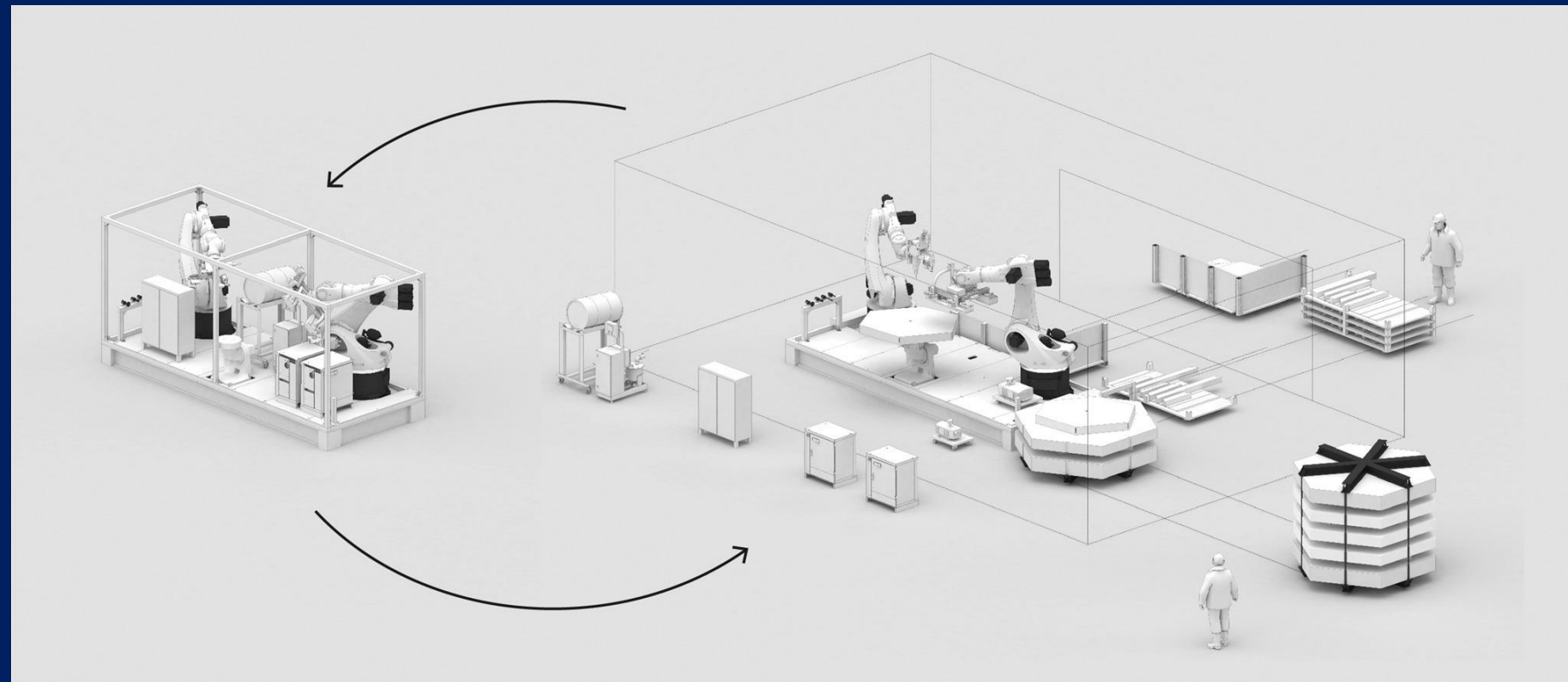
catalogue  
modularité  
configurateurs  
**plateformes DFMA**  
fabrication numérique  
near site prefabrication  
multitrade prefab  
prefab spécifique aux projets



# Axes de personnalisation

catalogue  
modularité  
configurateurs  
plateformes DFMA  
**fabrication numérique**  
near site prefabrication  
multitrade prefab  
préfab spécifique aux projets

## Flexible and transportable robotic timber construction platform – TIM

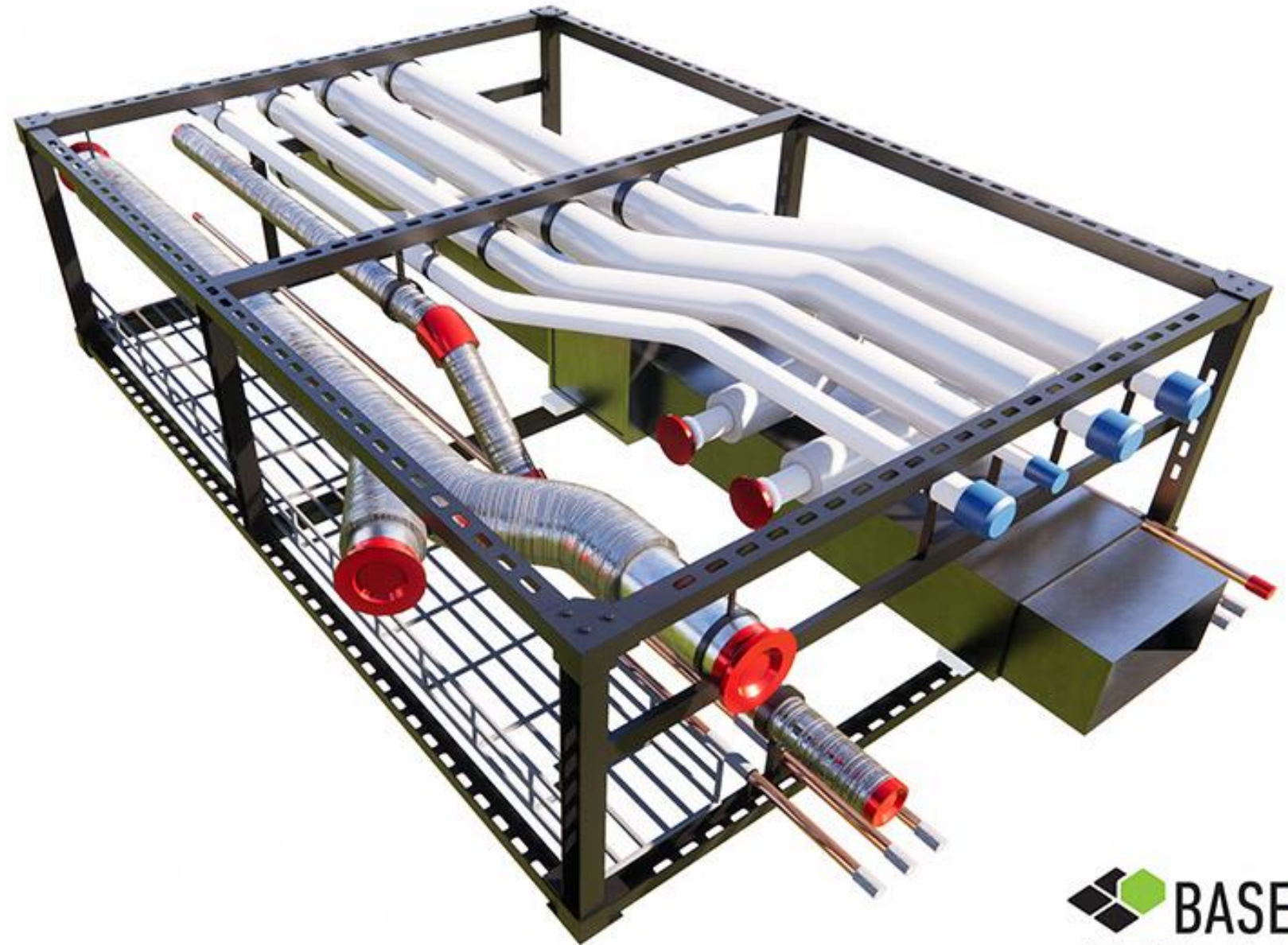


# Axes de personnalisation

catalogue  
modularité  
configurateurs  
plateformes DFMA  
fabrication numérique  
**near site prefabrication**  
multitrade prefab  
préfab spécifique aux projets

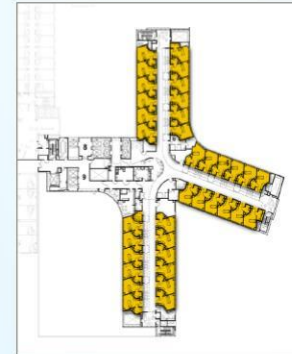


catalogue  
modularité  
configurateurs  
plateformes DFMA  
fabrication numérique  
near site prefabrication  
**multitrade prefab**  
préfab spécifique aux projets



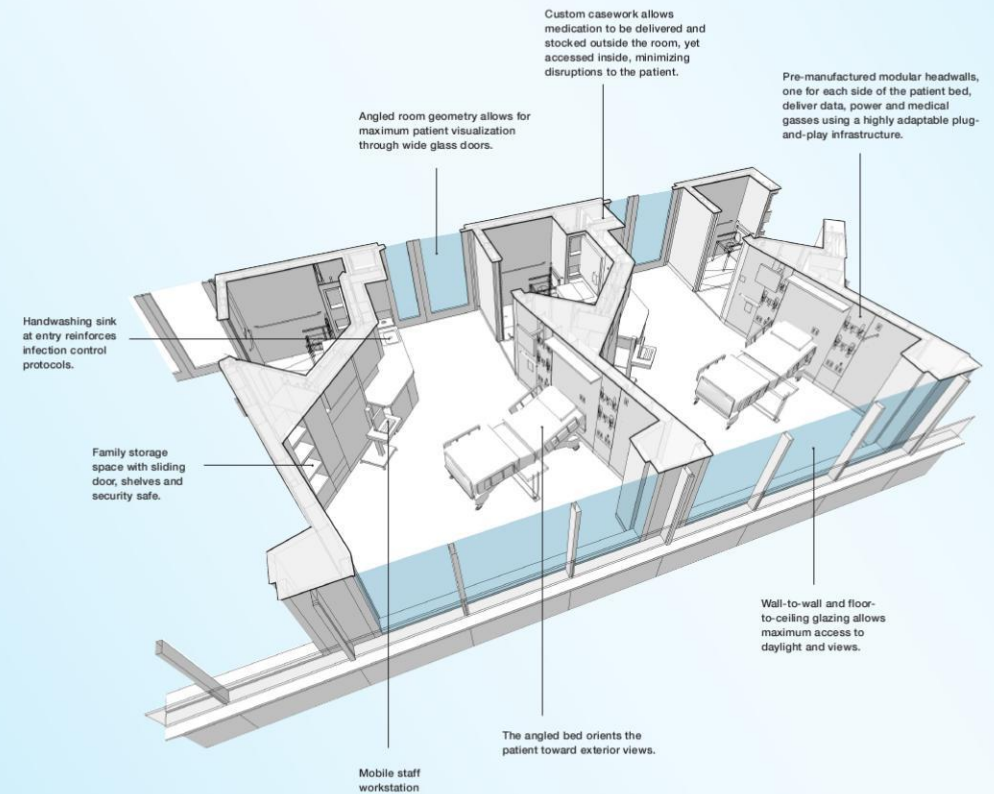
# Axes de personnalisation

catalogue  
modularité  
configurateurs  
plateformes DFMA  
fabrication numérique  
near site prefabrication  
multitrade prefab  
préfab spécifique aux projets



## 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.



# Rationalisation, standardisation, optimisation conception versus production

## 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

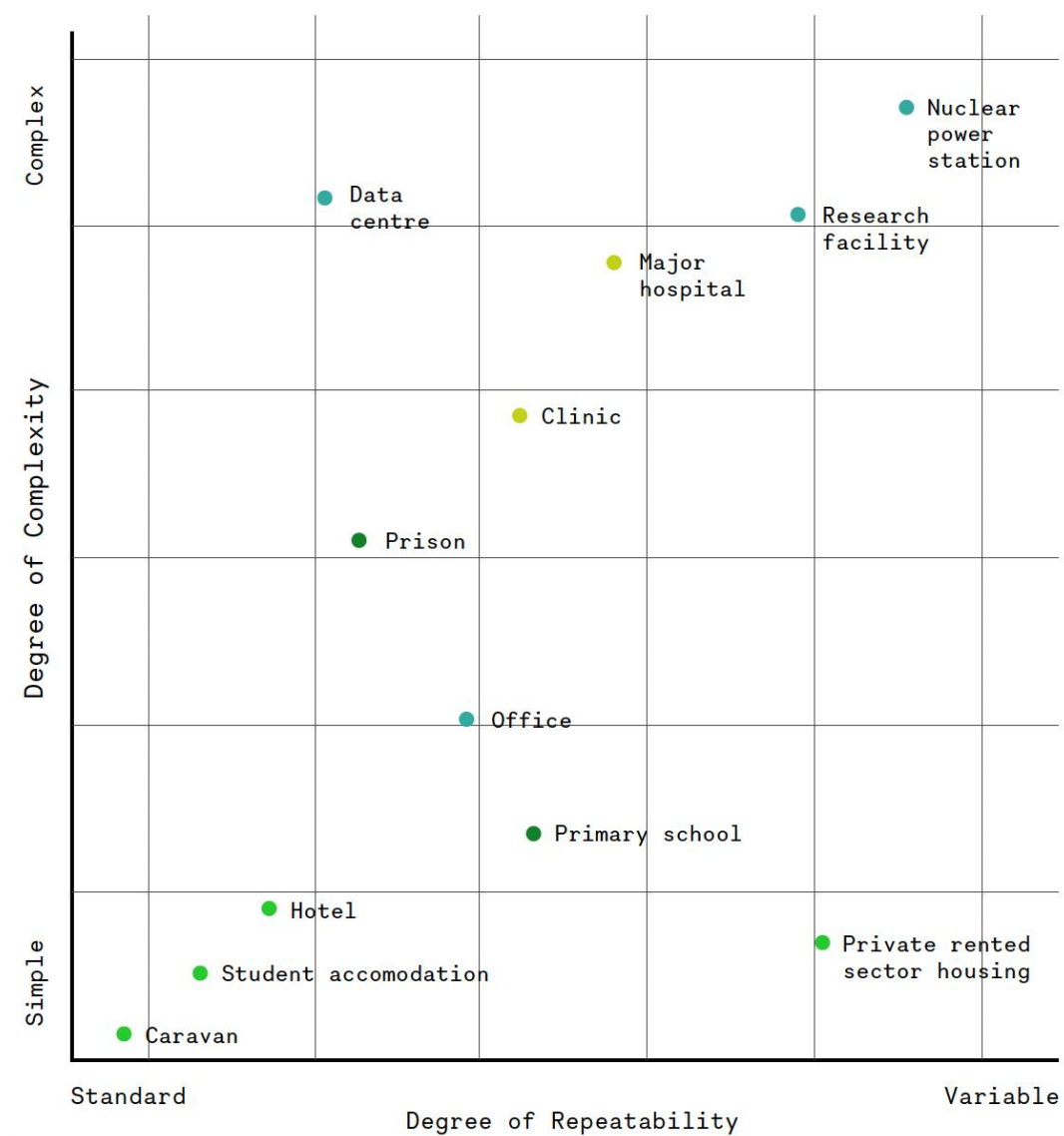
The rationalisation process will yield a number of common solutions with a high rate of occurrence. These will provide significant benefits in terms of speed of design, ease of construction, opportunities for standard working etc.

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

Vers des méthodes manufacturières, les jumeaux digitales, l'intégration systémique, la décarbonation et la circularité

