La construction industrialisée

opportunités d'intégration dans les projets

7 mai 2025

Collaboration | Lean Design & Lean Construction | Technologie

Bienvenue au café

COMMUNAUTÉ DE PRATIQUE
INNOVATION CONSTRUCTION

cpiconstruction.org

Nos plus sincères remerciements

GRIDD
Groupe de recherche en intégration et développement durable en environnement bâti

ÉTS
Le génie pour l'industrie
ÉCOLE DE TECHNOLOGIE SUPÉRIEURE
Université du Québec

Ordre du jour

Un café Lean est une rencontre structurée où les participants discutent d'un sujet en utilisant un processus simple et collaboratif.

- Mot de bienvenue
- Présentation sur le sujet du jour
- Discussion en équipe par table
- Discussion de groupe
- Plus/delta
- Prochaine activité

- Le café Lean est un format de rencontre qui permet de discuter des sujets en lien avec les attentes des participants dans un esprit participatif.

COMMUNAUTÉ DE PRATIQUE
INNOVATION CONSTRUCTION

Avant de débuter…

Qui est en est à sa première présence au Café?

Tour des participants en 5 secondes:

- Votre nom
- Entreprise
- Votre rôle
- Et êtes-vous:
  - Professeurs, chercheurs, étudiants
  - Donneur d'ordre
  - Professionnels et consultants
  - Entrepreneur général
  - Entrepreneur spécialisé
  - Fournisseurs

COMMUNAUTÉ DE PRATIQUE
INNOVATION CONSTRUCTION

La construction industrialisée

opportunités d'intégration dans les projets

07.05.2025 - CPIConstruction

ÉCOLE DE DESIGN 50

Mise en place d'un module, 4857 Broadway, NY
(Gluck + et Stack Modular)
collection Carlo Carbone

La recherche documentée
http://prefabricate.blogspot.com

prefabricate.blogspot.com

pre[FABRICA]tions

notes on mass housing, building systems, dwellings, types, offsite construction and industrialized building

Monday, April 7, 2025

Prefabrication experiments - 462 - Panelization principles

Panelization, assembling buildings with wall or floor factory produced panels, has succeeded more than other industrialized building strategies in becoming commonplace and widely used in construction projects. Framing on site is time consuming and generates large amounts of waste. Fabricating wall, floor or roof surface sub-assemblies in factories is an efficient way of erecting a building's structure without the more complex wrapping, transport, lifting and setting required in modular construction. Further, lightweight panel systems come with design freedom as their dimensions and parameters are less constrained by delivery prerequisites. The advantages of panelization also include their low impact on conventional construction culture; Specifically for open panels used for framing, their implications for systemic coordination are minimal.

Timber panels are straightforward construction elements organized as stressed skins, composites, or even as hollow box-beam formats. While they range in configuration, the building method remains a standard lightweight timber platform construction. Beyond their onsite flexibility, their manufacturability and relatively simple tooling has made panels effective: A framing table with an insulation or sheathing table in a shed, organized in a linear sequence where elements can be cut, framed and then finished at arms' length is a prevailing factory arrangement. As compared to modular volumetric which offers its own advantages in terms of offsite systemic integration, panel-making reduces the number of trades, systems, components and logistics required in a factory.

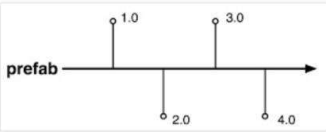
The single line setup with framing and sheathing tables is an affordable path for panel production: The drawing accompanying this post shows a cut-off saw that prepares timber stock according to design documents. The cut timber elements are then carried to framing tables with conveyors reducing human effort required to carry materials. Using non-automated tools reduces important upfront costs but limits factory output. Weinmann is a well-known manufacturer of panel-fabricating equipment that has developed completely automated lines for increasing output. With this type of relatively affordable democratization of computer-controlled tools, tables equipped with panel bridges to place, cut, nail, lift and perform any number of programmed tasks are becoming common.

"Much nonsense has been talked about prefabrication, chiefly because the meaning of the word has not always been fully understood. Prefabrication is a technique. It is not a type of house, not a cure-all for evils, nor a bogey with which to frighten old ladies and reactionary members of the building industry." Anthony, H. (1945) Houses: Permanence and Prefabrication. Pleiades Books Ltd. London.

SCIUS Advisory (our data contributed to this study)

- Prefab Construction Navigator

Timeline of prefabrication experiments



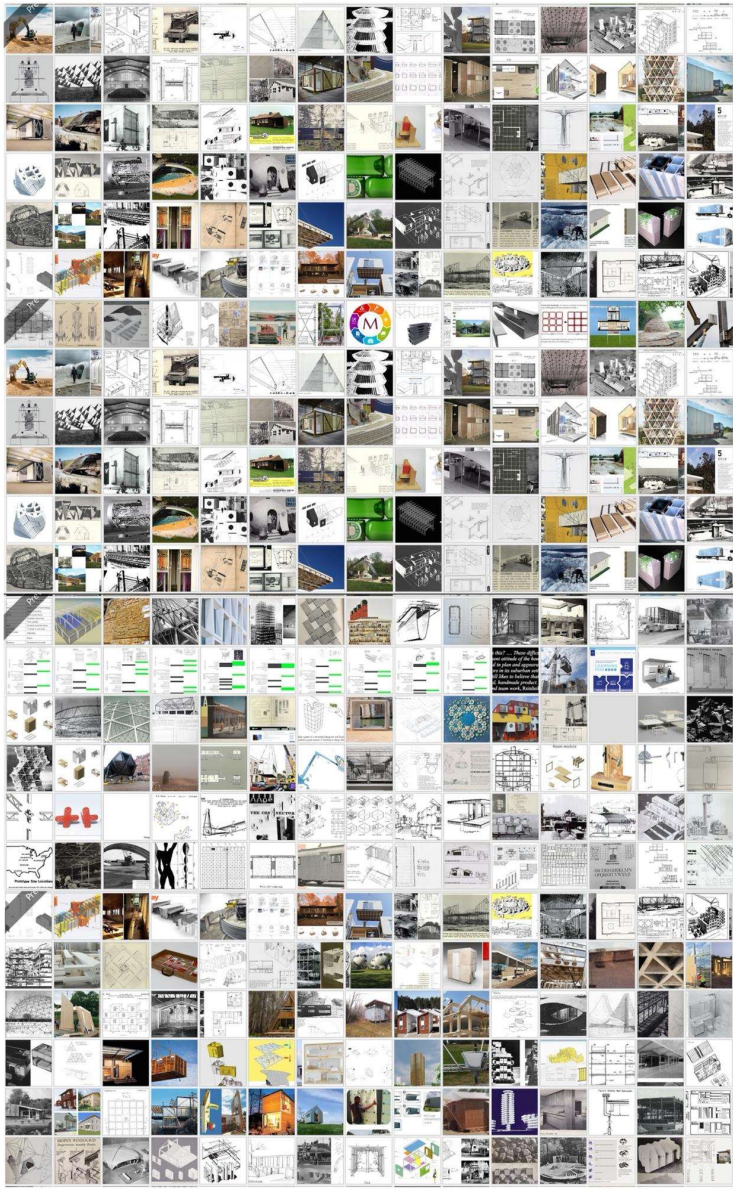
700 proposals / 50 countries / 4 industrial revolutions

Exhibition presented at the Centre de Design UQAM

Axes de recherche

laboratoire de recherche pre[FABRICA]tions

1- l'histoire – depuis 1851

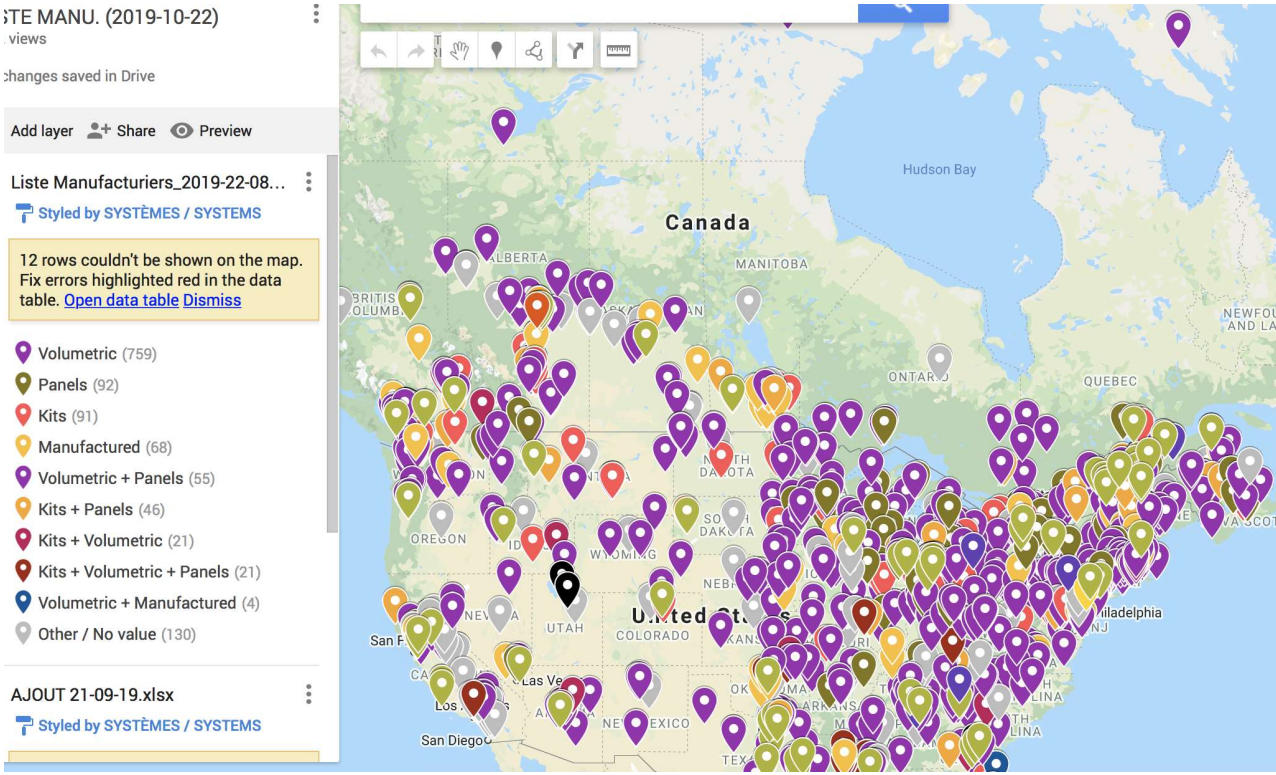


Schématisation de l'inventaire,
pre[FABRICA]tions

Axes de recherche

laboratoire de recherche pre[FABRICA]tions

2 – les pratiques en Amérique du Nord

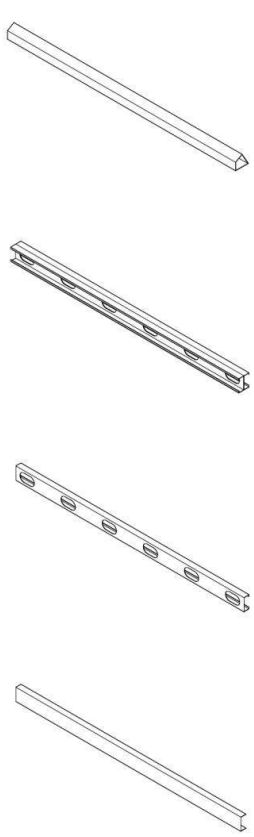


Cartographie du secteur,
pre[FABRICA]tions,
cartographie

Axes de recherche

laboratoire de recherche pre[FABRICA]tions

3 – l'expérimentation – conception de systèmes



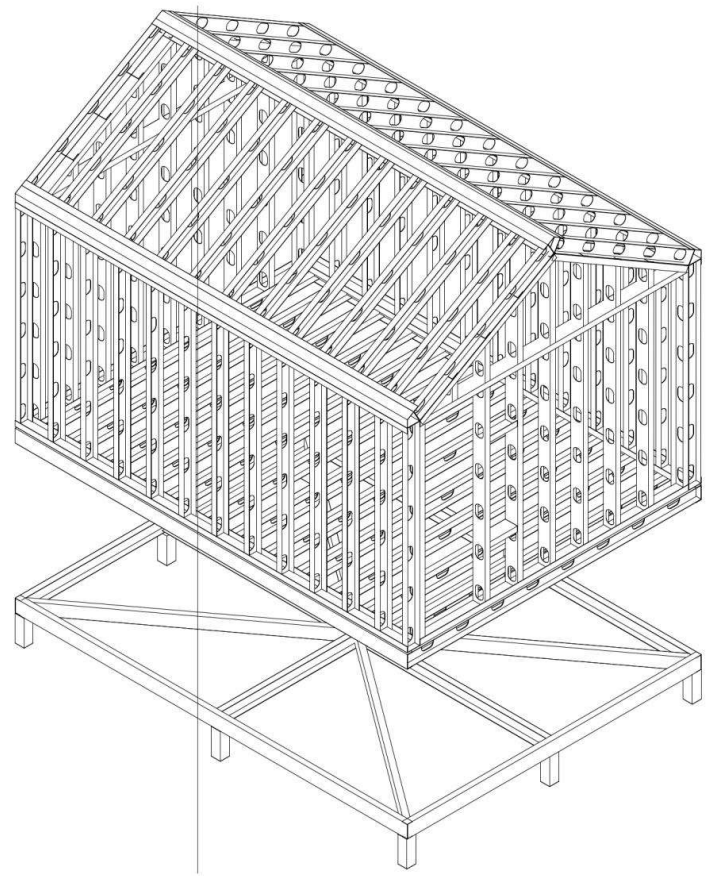


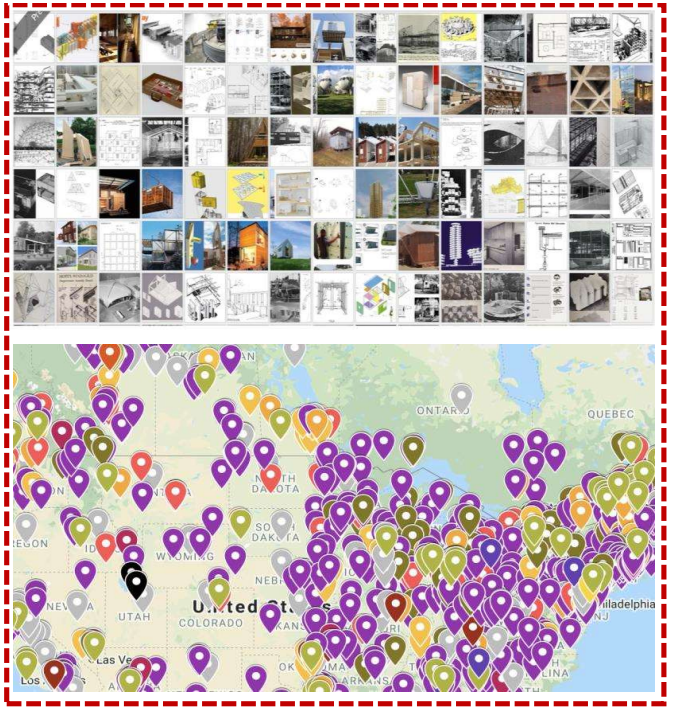
Figure 4 *Structural system axonometric*, Authors, 2025

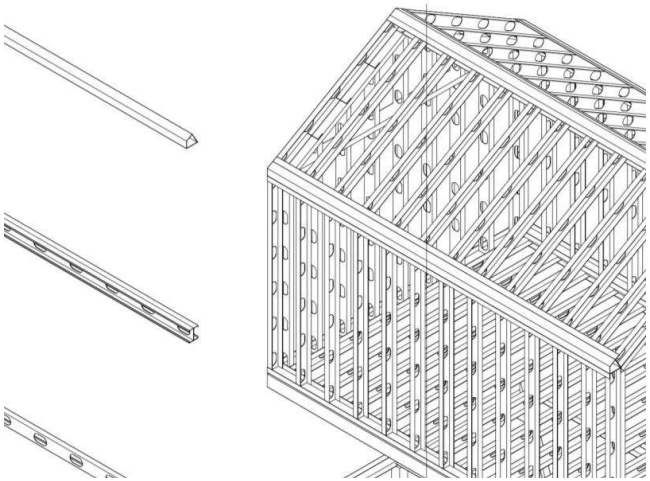
Axonométrie du système Arktikit, partenaires AluQuébec + RTMQ, pre [FABRICA] tions

Axes de recherche

laboratoire de recherche pre[FABRICA]tions

Le webinaire – 25.04.2025



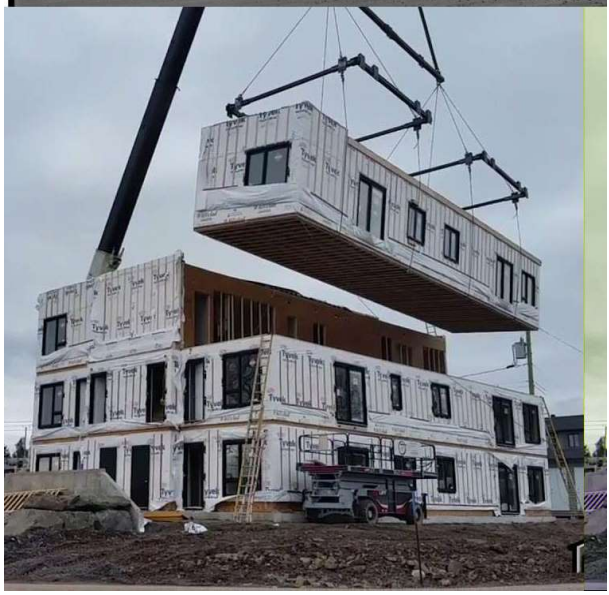


La construction industrialisée

définition

L'application des principes de l'industrialisation à la réalisation d'édifices pour rendre la production plus efficiente. Le gain de productivité est obtenu à l'aide des techniques de fabrication et d'assemblage du secteur manufacturier. Les avantages les plus souvent cités sont la construction dans un environnement contrôlé, le chevauchement des tâches sur et hors site, le contrôle de qualité plus facile en usine, la réduction des déchets et des environnements de travail en usine plus sécuritaires pour les travailleurs.

Rêves et réalités
au Québec

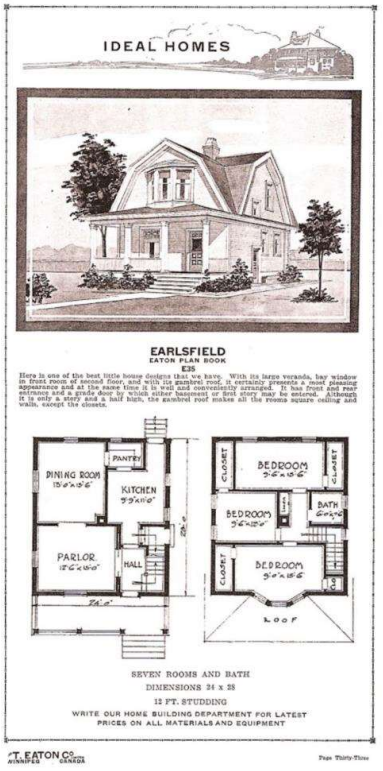


H. Habitat 67, Moshe Safdie,
collection Carlo Carbone

B. Mise en place d'un module, projet Saint-Nicolas,
https://www.maisonlaprise.com/

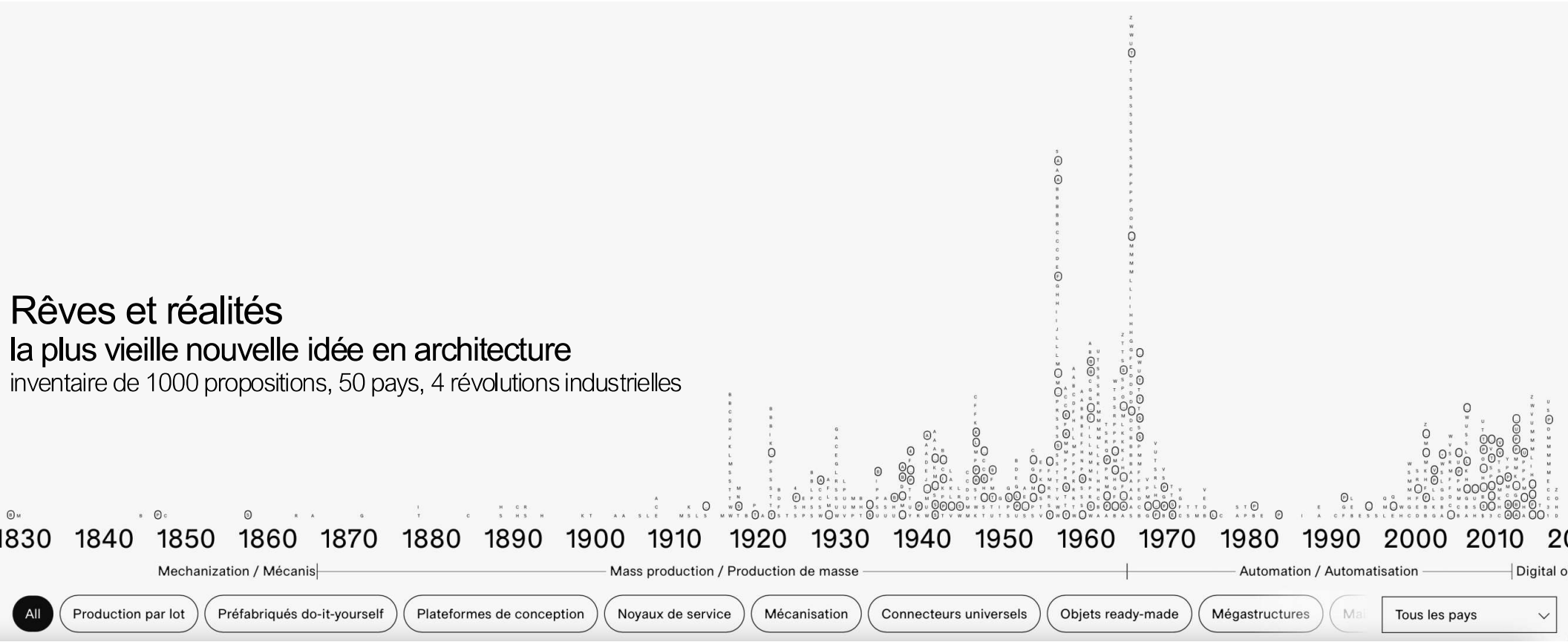
Rêves et réalités

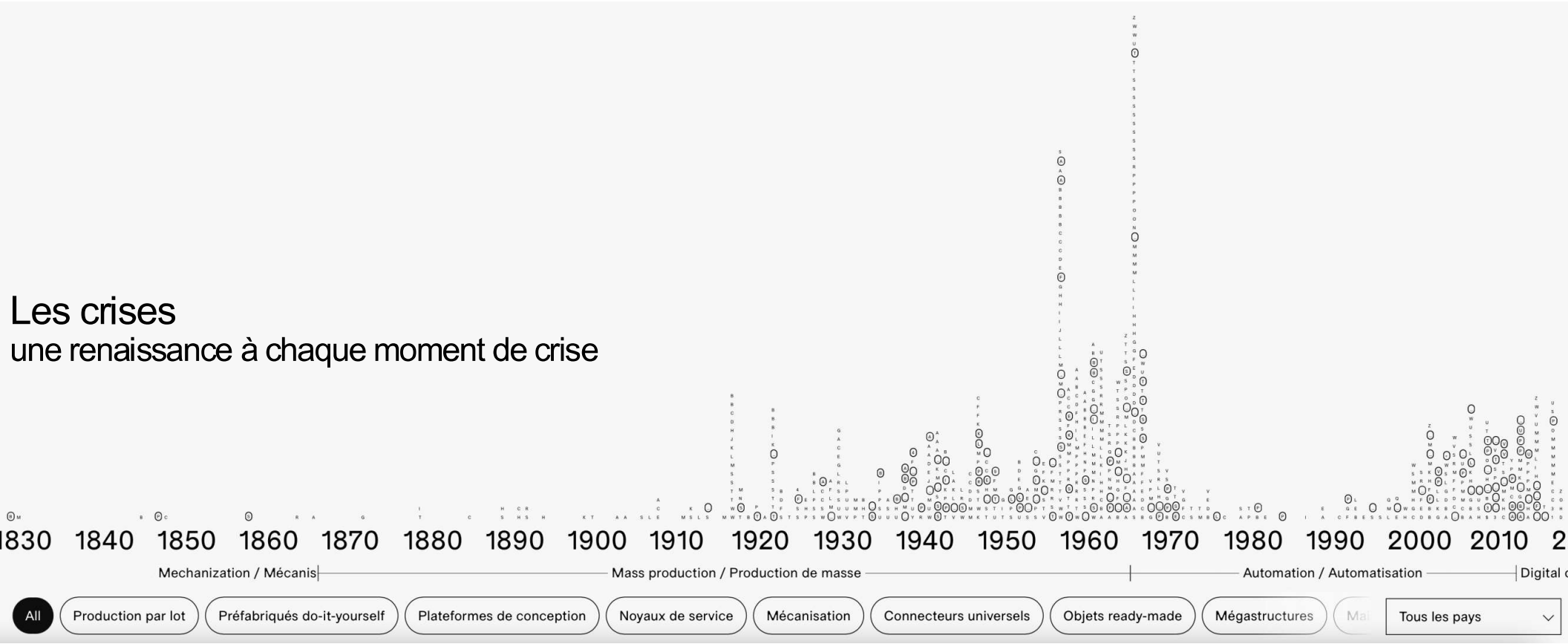
du catalogue à la personnalisation de masse

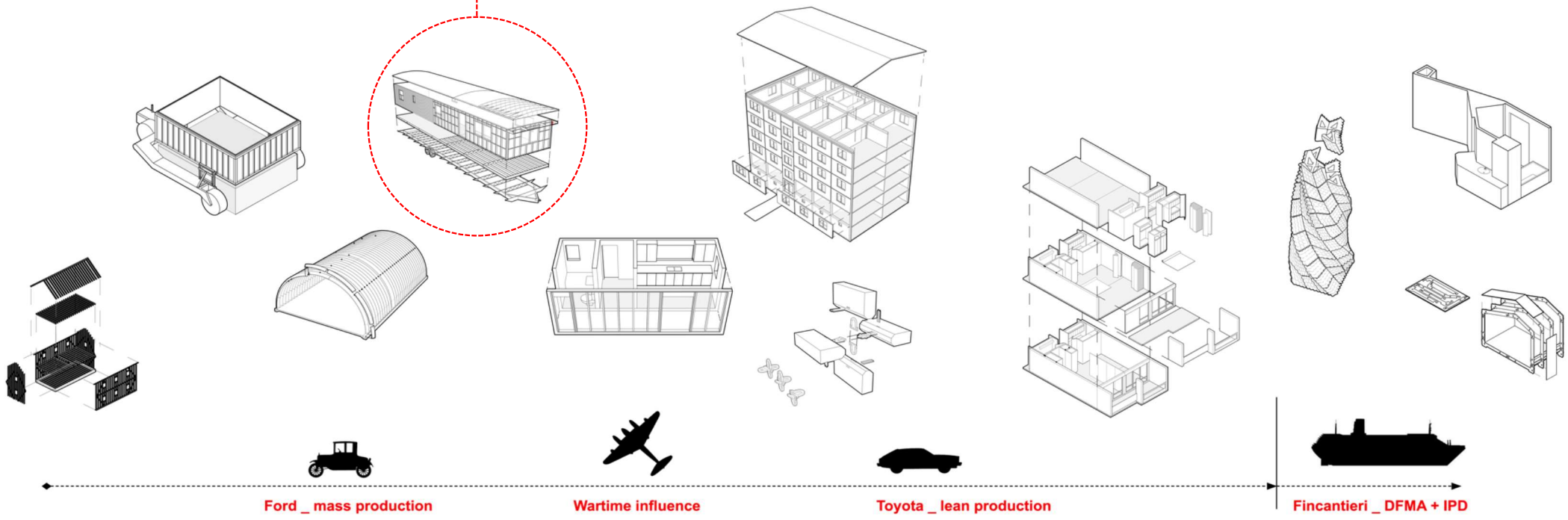


G. page de catalogue T. Eaton,
collection Carlo Carbone

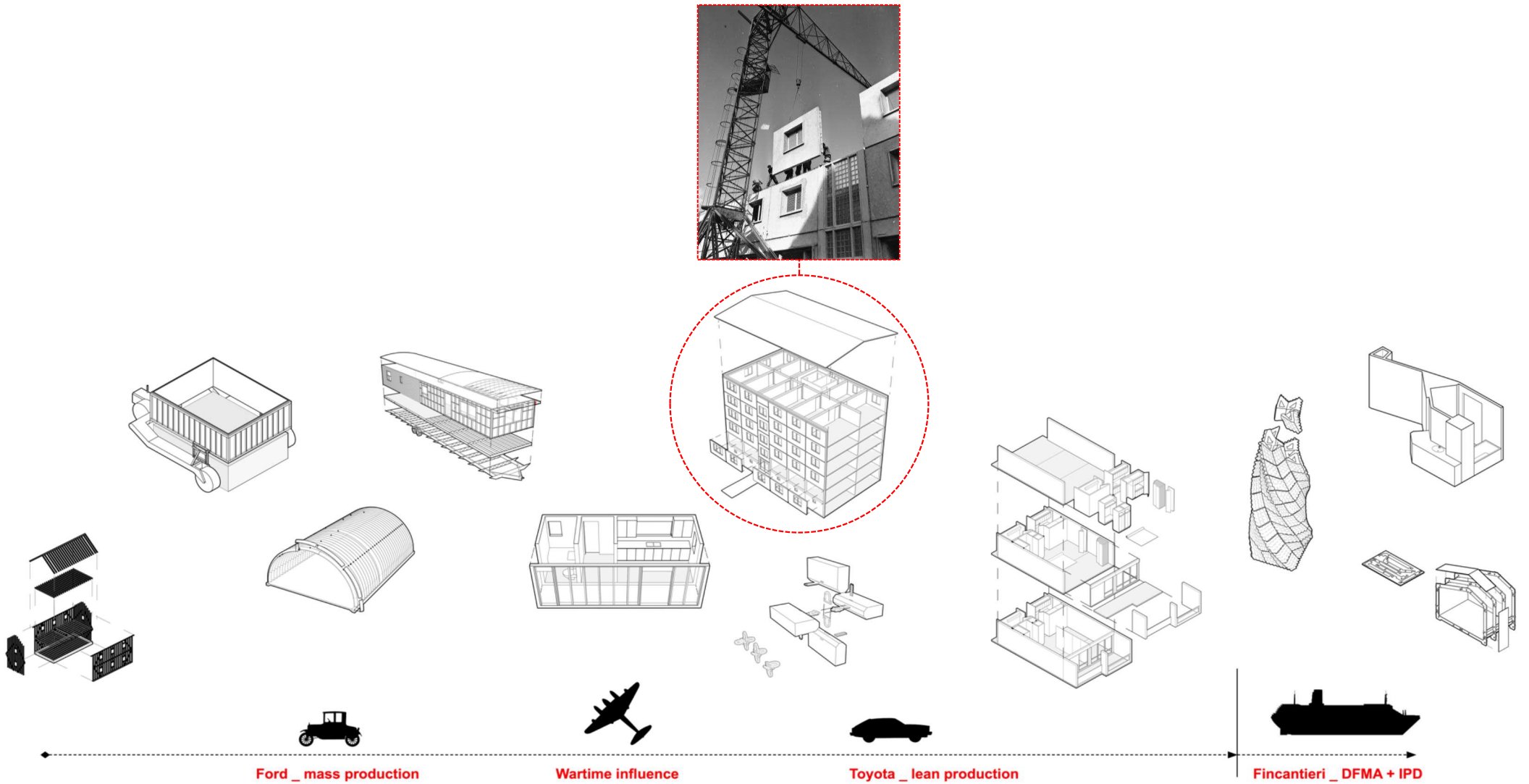
D. Modern modular, Resolution 4 architecture,
https://www.re4a.com/the-modern-modular



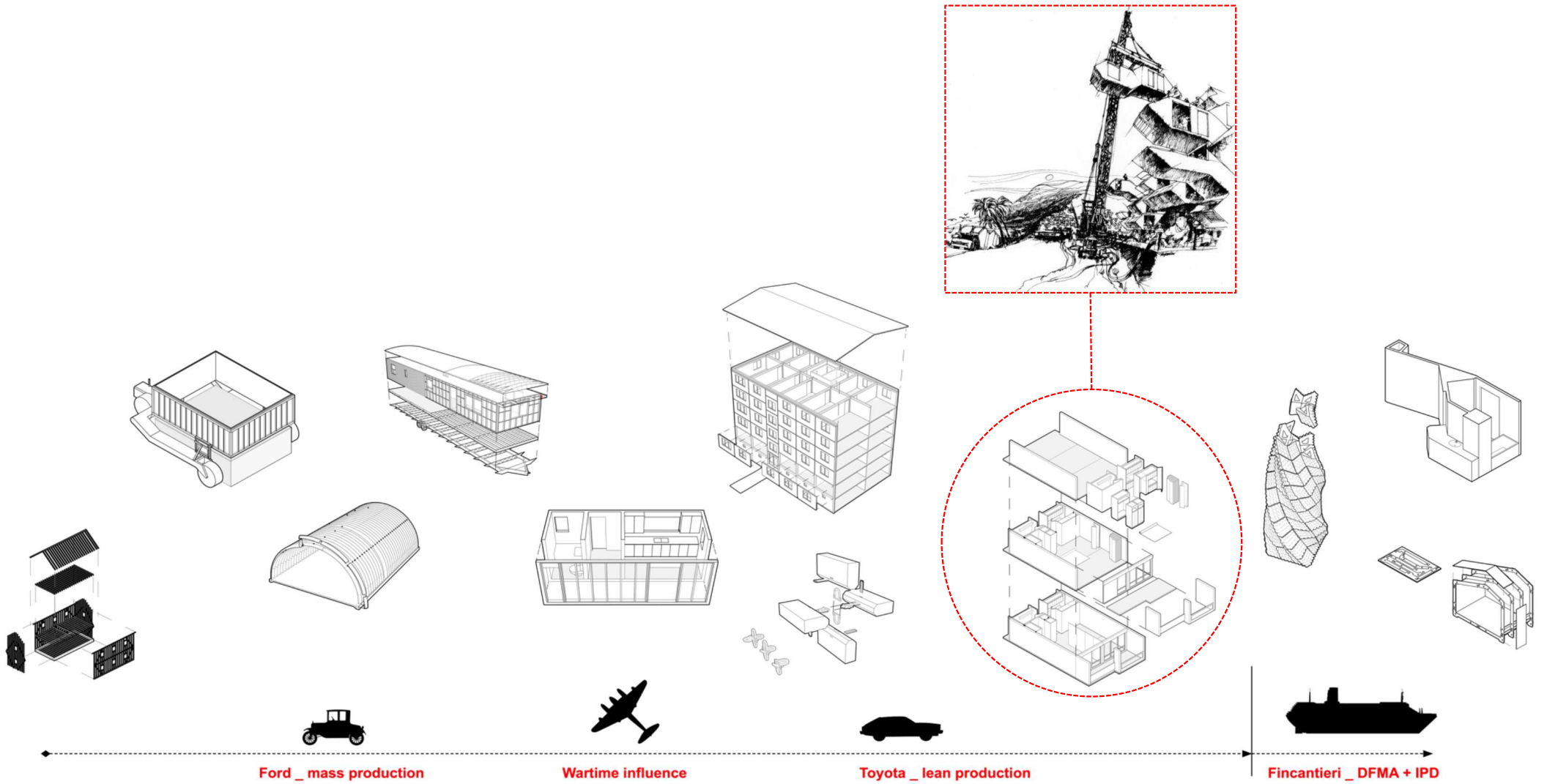




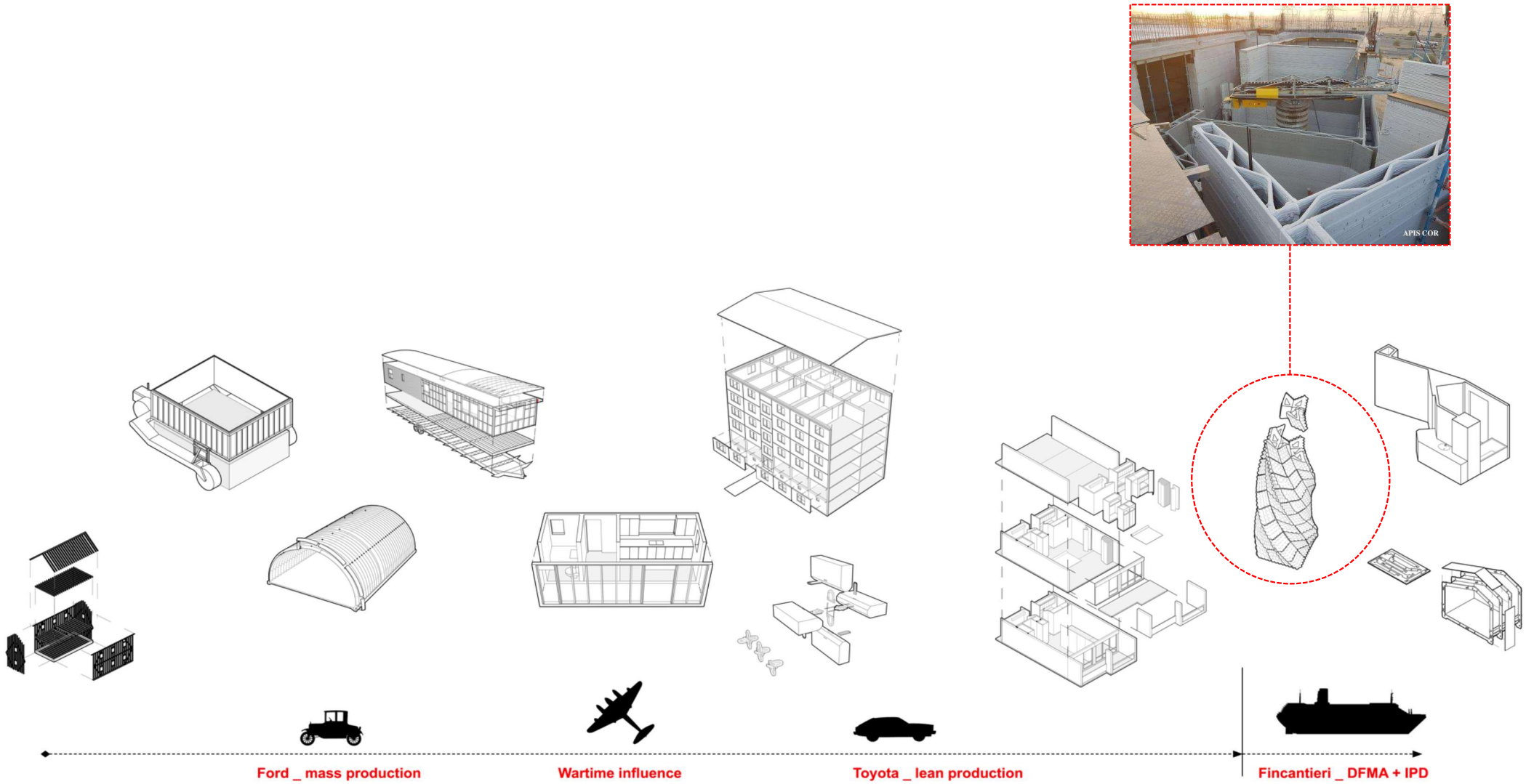
1.0 – production de masse



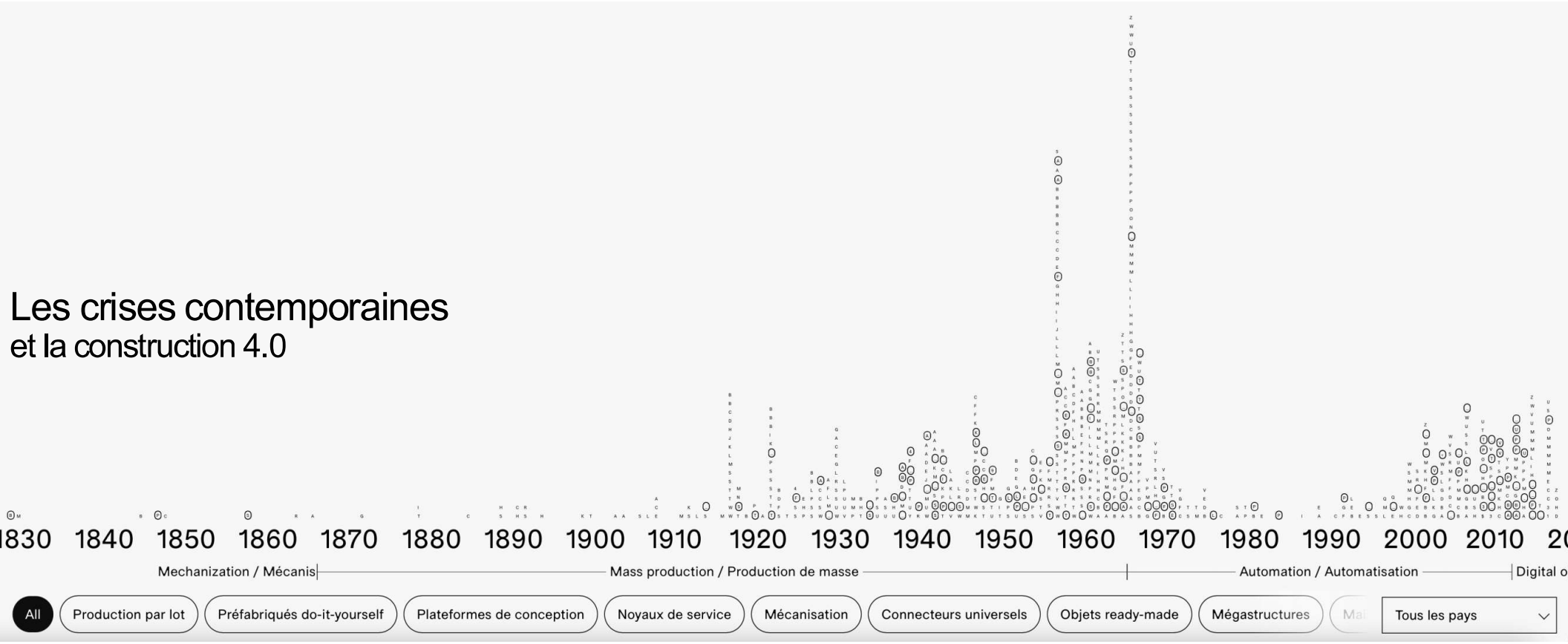
2.0 – influence militaire



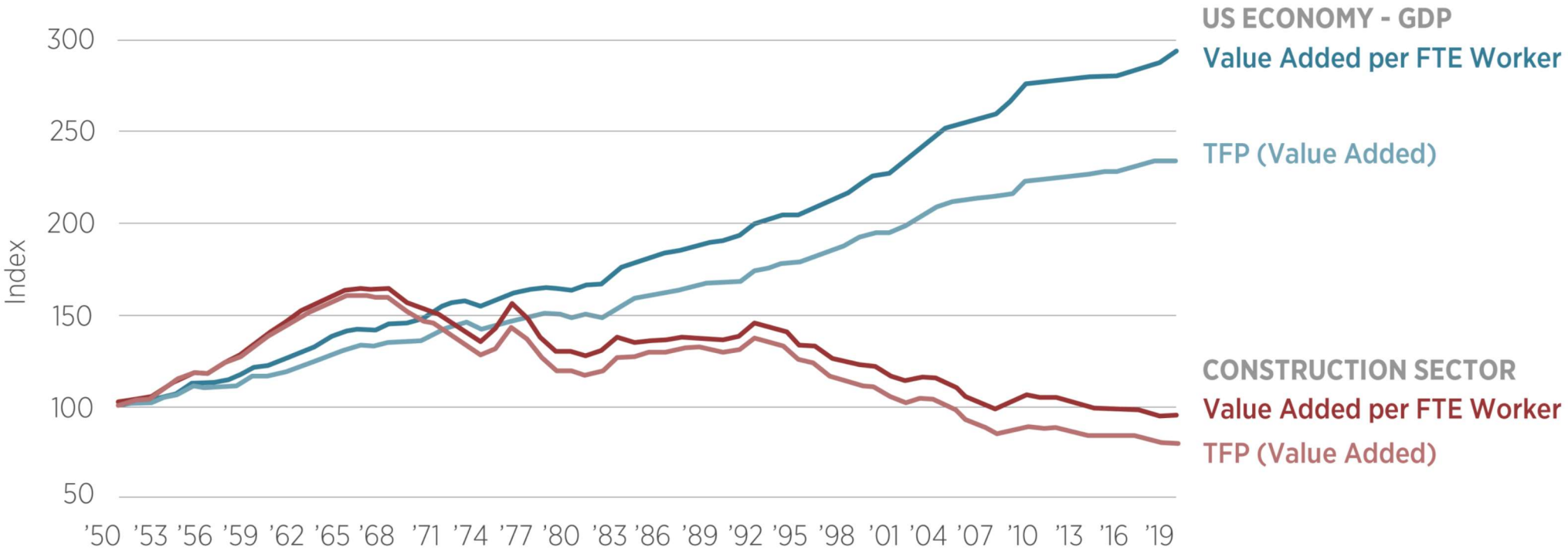
3.0 – production «Lean»



4.0 – fabrication numérique



Indexes of Value Added Per Full-Time-Equivalent (FTE) Worker and Total Factor Productivity (TFP), Overall US Economy and Construction Sector (BEA Data)



Note: This figure shows indexes of US construction sector labor productivity and total factor productivity (TFP) from 1950 to 2020. For comparison, it also plots the same indexes for the overall economy. Throughout the 1950s and well into the 1960s, both measures of construction sector productivity grew steadily. Indeed, they outpaced their whole-economy counterparts during that period. By 1970, however, the construction sector's labor productivity and TFP had both begun to fall. This downturn was not temporary; the decline has continued for the past half-century.

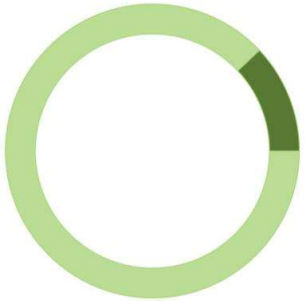
Becker Friedman Institute

Les pratiques

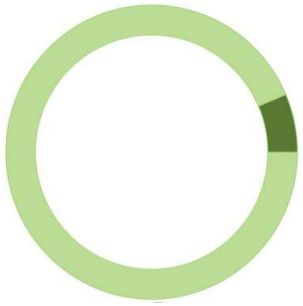
La construction industrialisée dans le secteur

un marché fragmenté

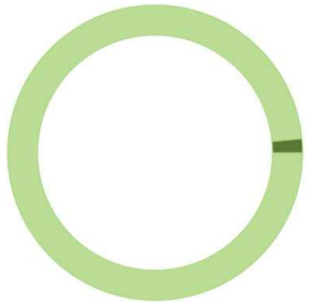
Maisons usinées [+/- 12%]



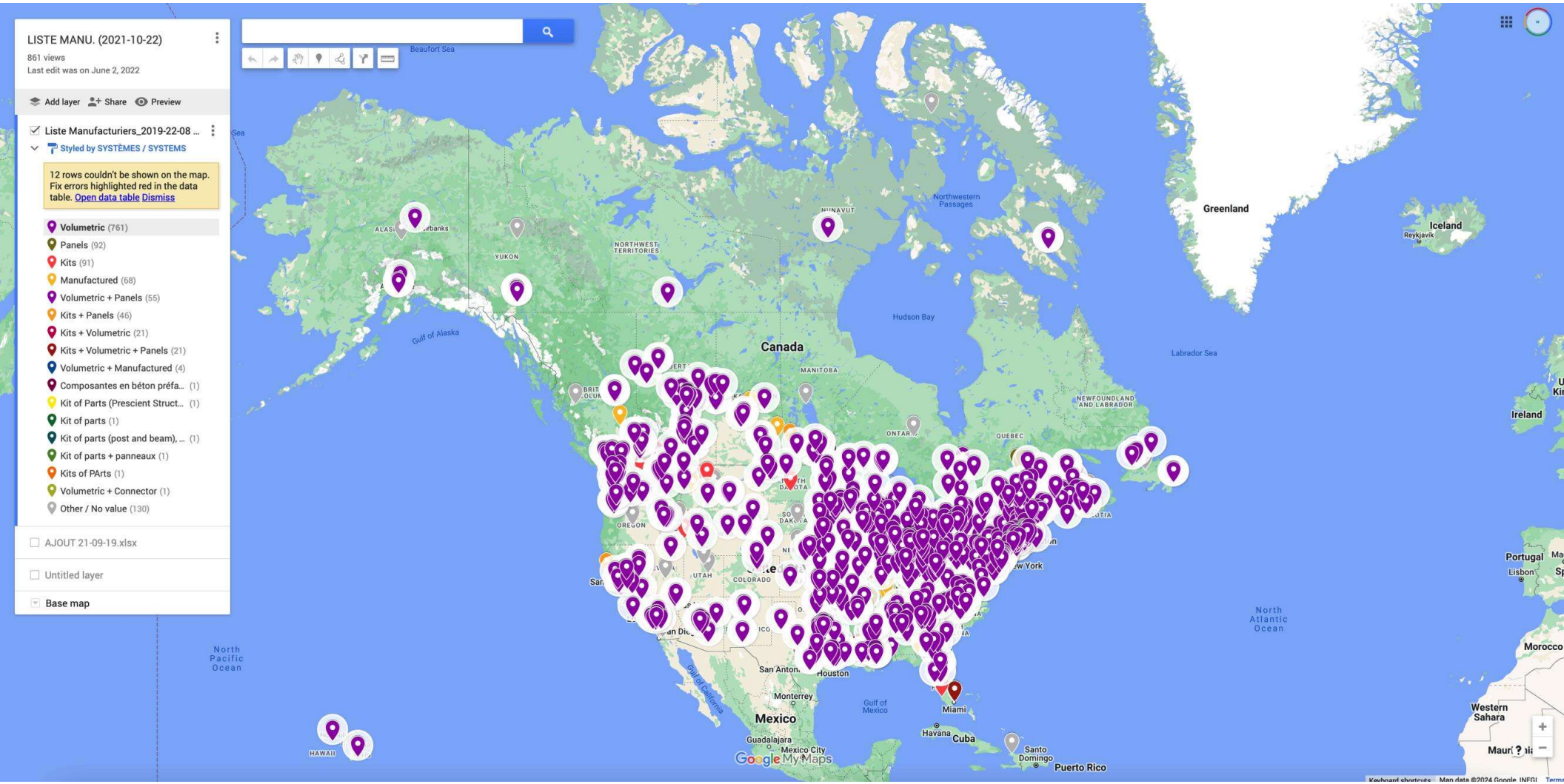
Construction modulaire volumétrique [+/- 6%]



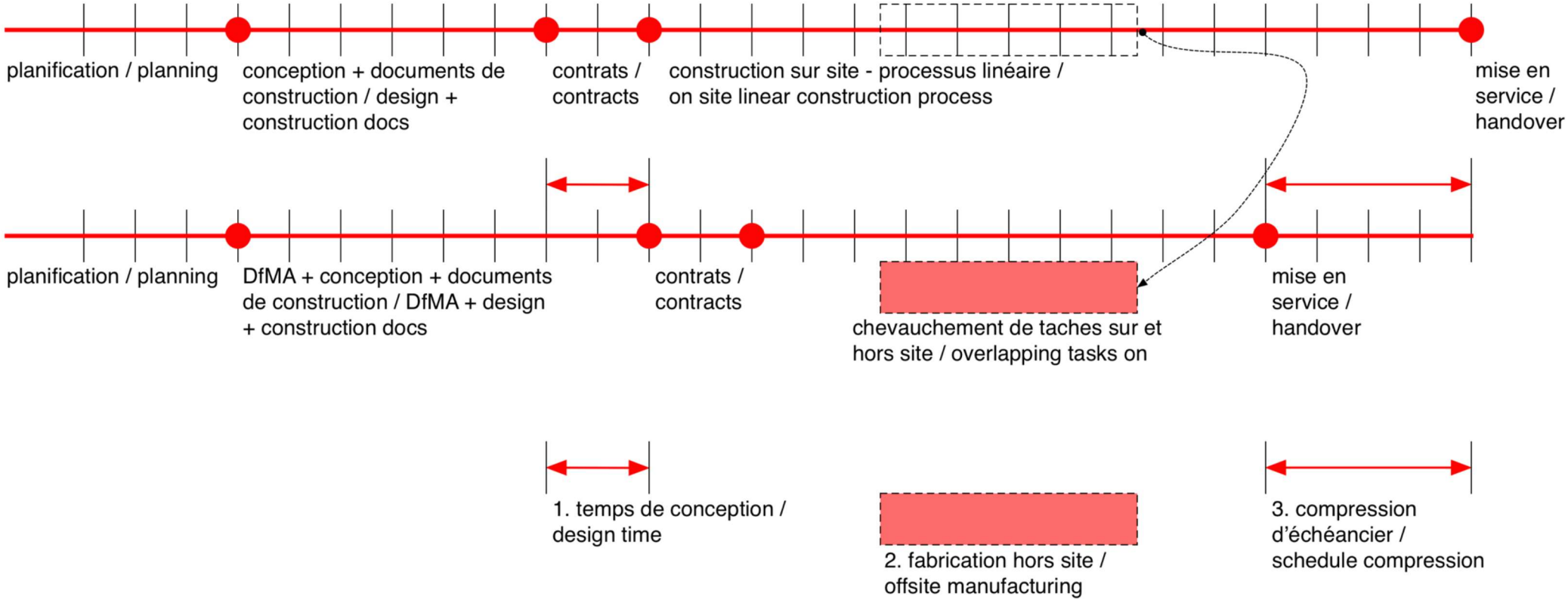
Maisons mobiles [+/- 1%]



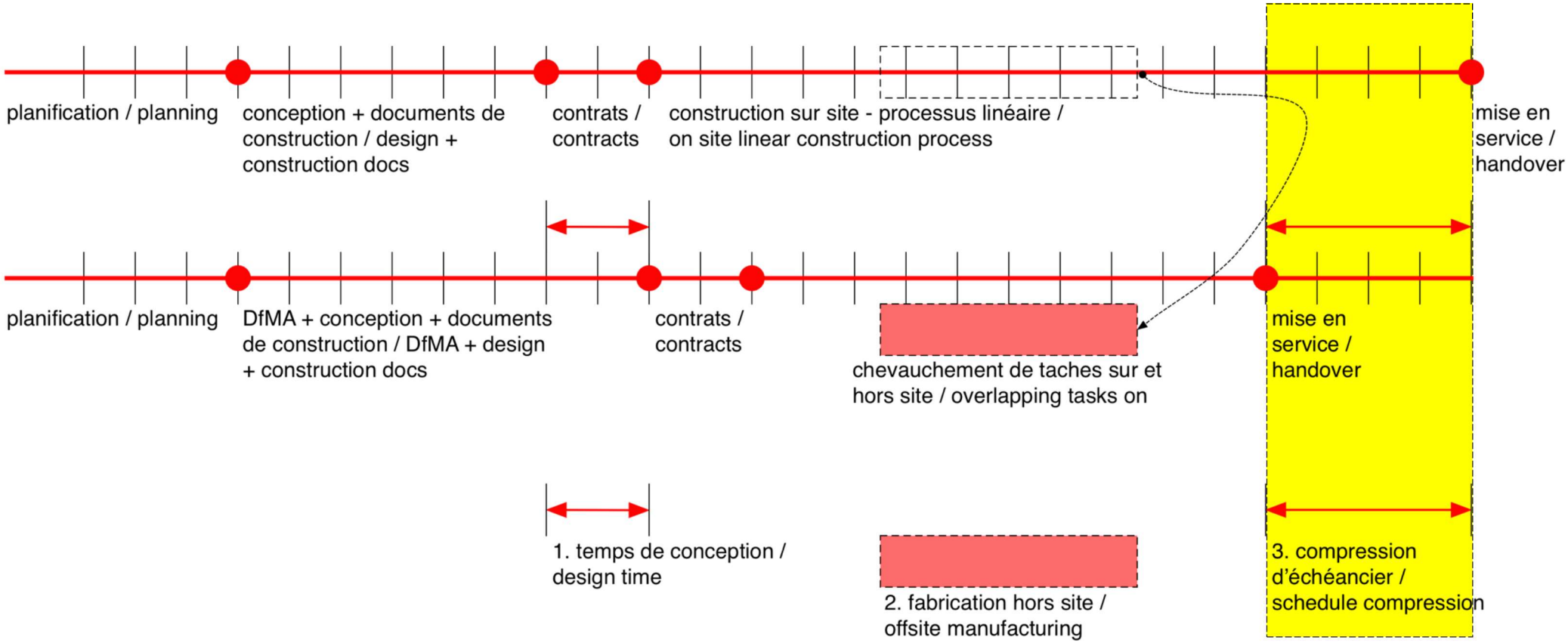
Données cueillies Modular Building Institute (2023)



Capacité du secteur



Modification du flux de production



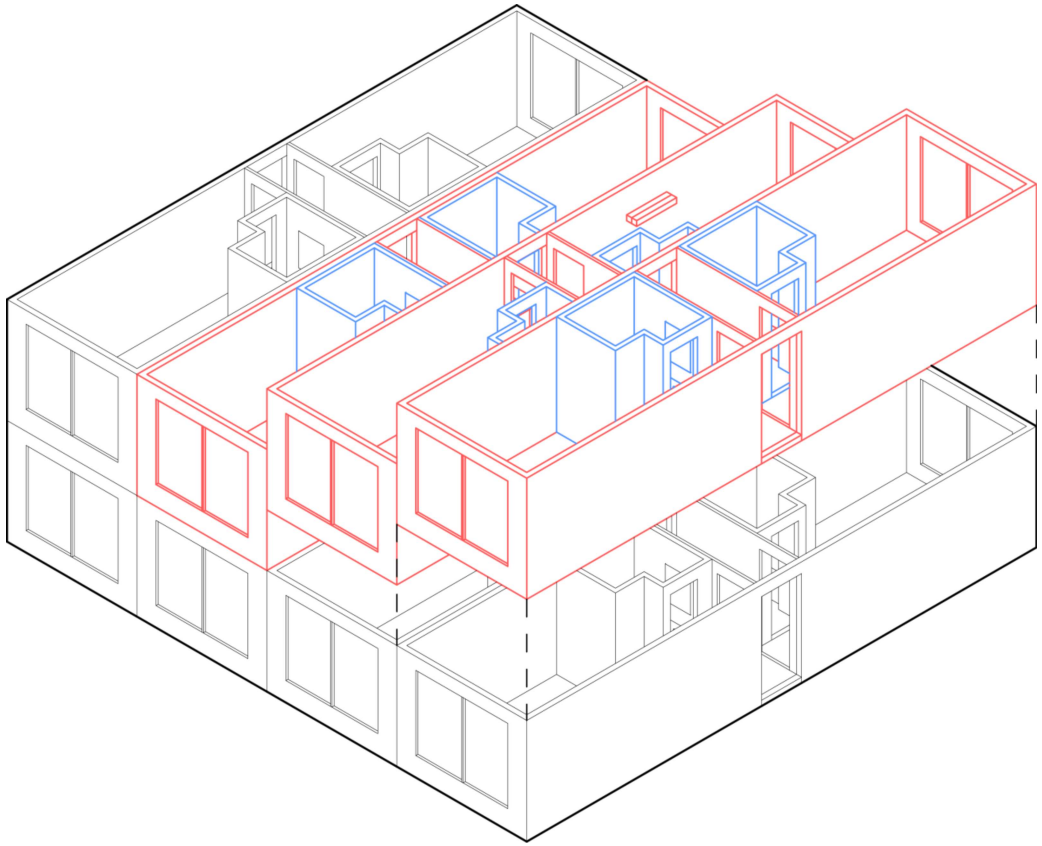
Chevauchement de tâches – réduction de 25 – 40% selon les études

Les approches

La classification de Dietz and Cutler (1972)

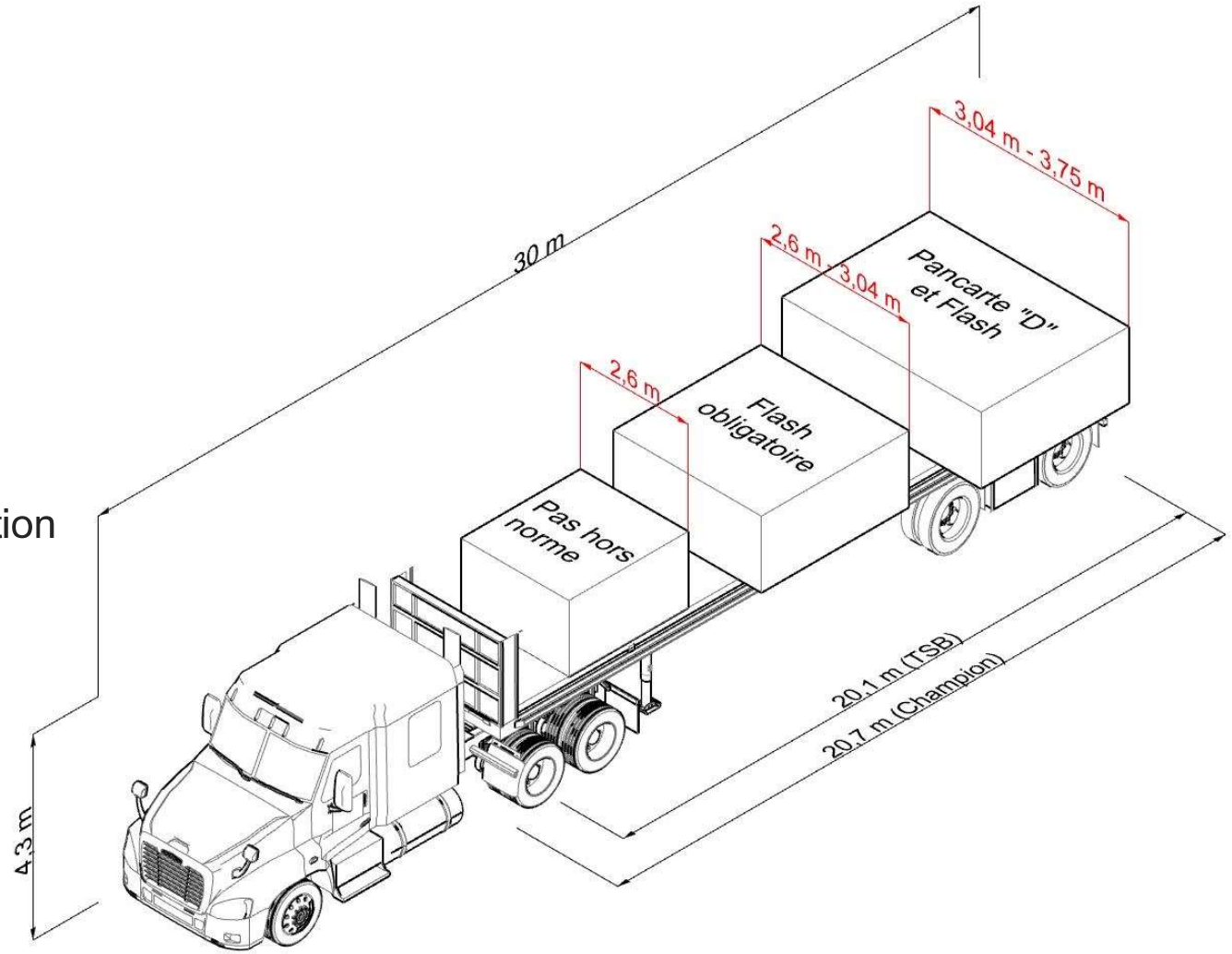
BOXES (modulaire volumétrique)
PANELS (systèmes à panneaux)
PIECES (composantes)
HYBRIDS (la combinatoire)

modulaire volumétrique (grands volumes)
boxes



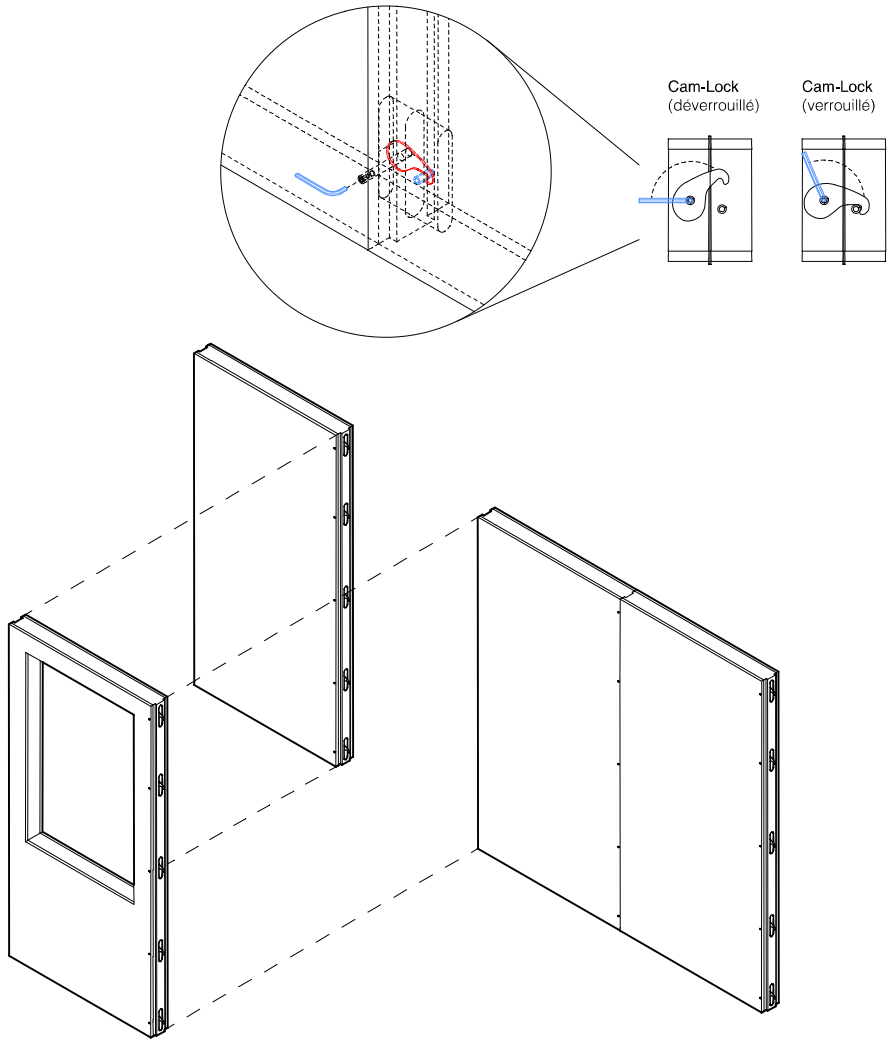

Rooms + Corridor Module
BASE4
Architects | Engineers | Designers

Le transport
critères de conception



Systèmes à panneaux (surfaces 2d)

panelization

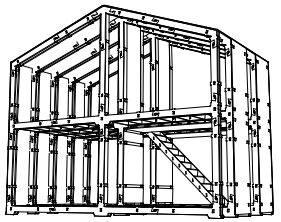


Bensonwood, maisons à panneaux,
https://bensonwood.com

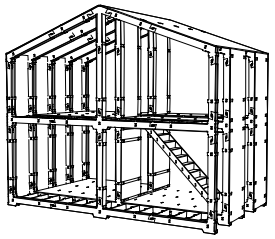

DRIVE SAFELY AND:

Composantes (éléments linéaires 1d)
pieces / parts

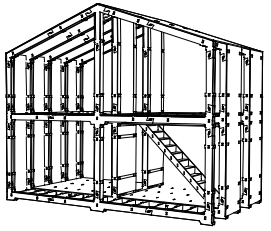
001



002



003



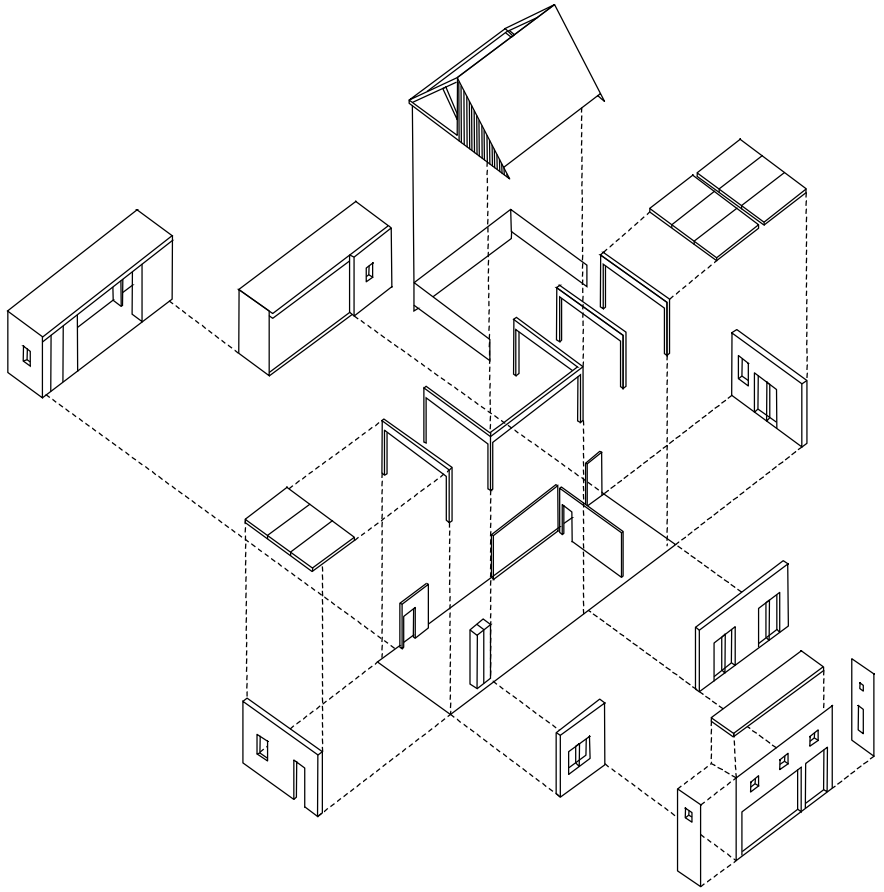
Schématisation composantes Wiki-House,
Pre[FABRICA]tions

page suivante:
Escalier préfabriqué, https://www.storaenso.com


DANGER
PENETRATION
BELOW
1800 874 777

Kits de construction (systèmes complets)

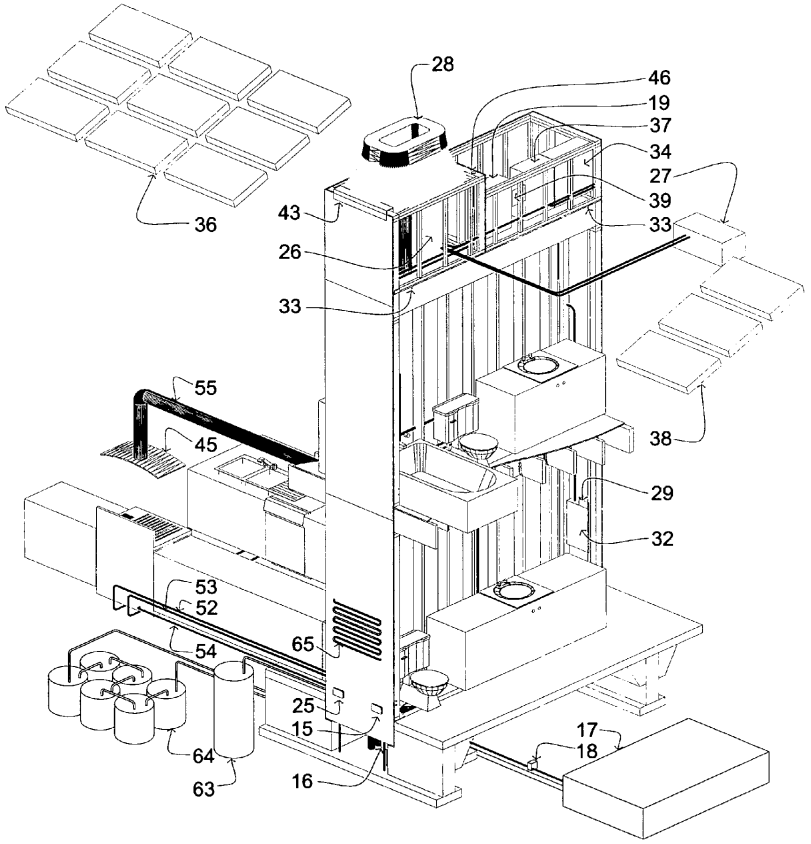
Hybrids



Schématisation composantes Bensonwood,
Pre[FABRICA]tions

page suivante:
Backcountry Hut, https://www.thebackcountryhutcompany.com

Noyaux de services (pods)
Service cores



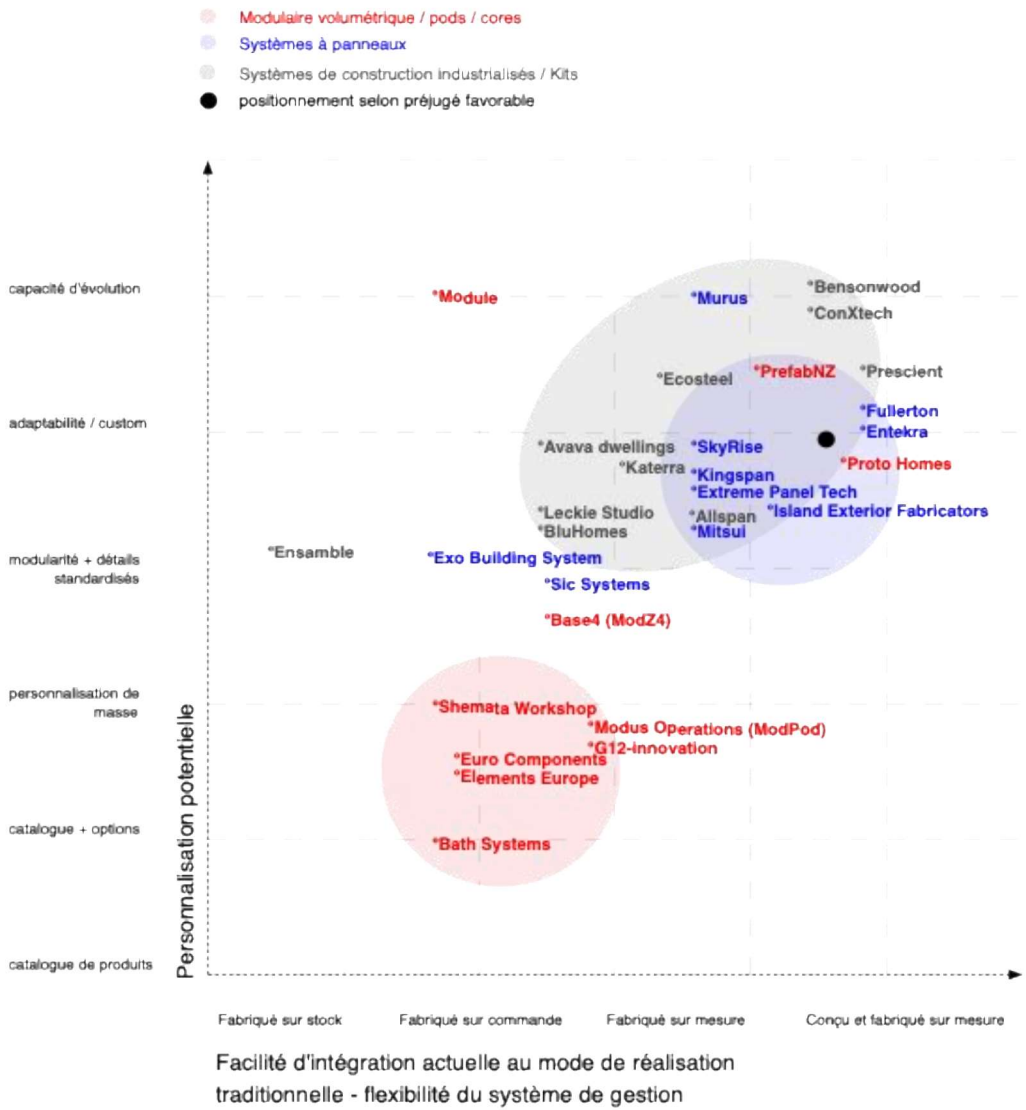
Schématisation composantes Protocore de Protohomes
Pre[FABRICA]tions

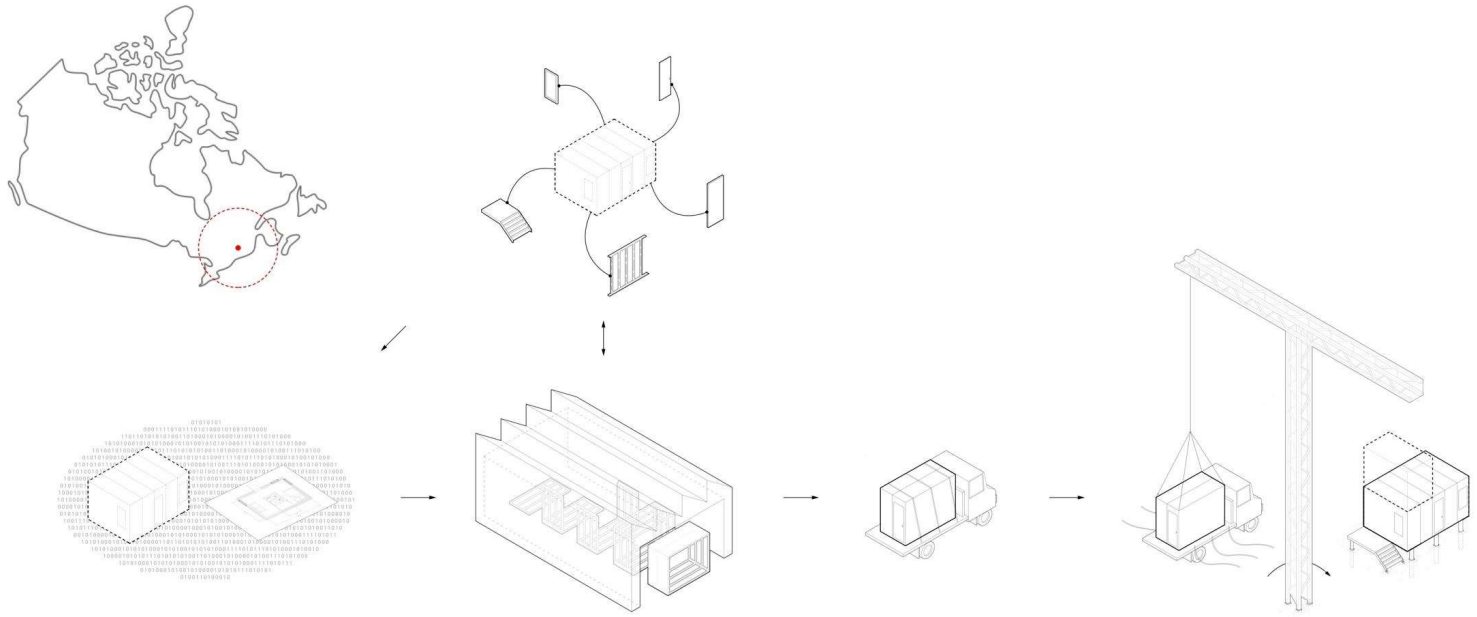
page suivante:
G. Noyaux de services en production, entreprise Bathpods,
https://bathpods.ca
D. Protocore, collection Carlo Carbone

Modèles d'intégration
les modèles d'affaires et les modes émergents

- usine verticalement intégrée
- intégration digitale
- l'usine volante

L’impact du 4.0
la préfabrication «sur-mesure» ?

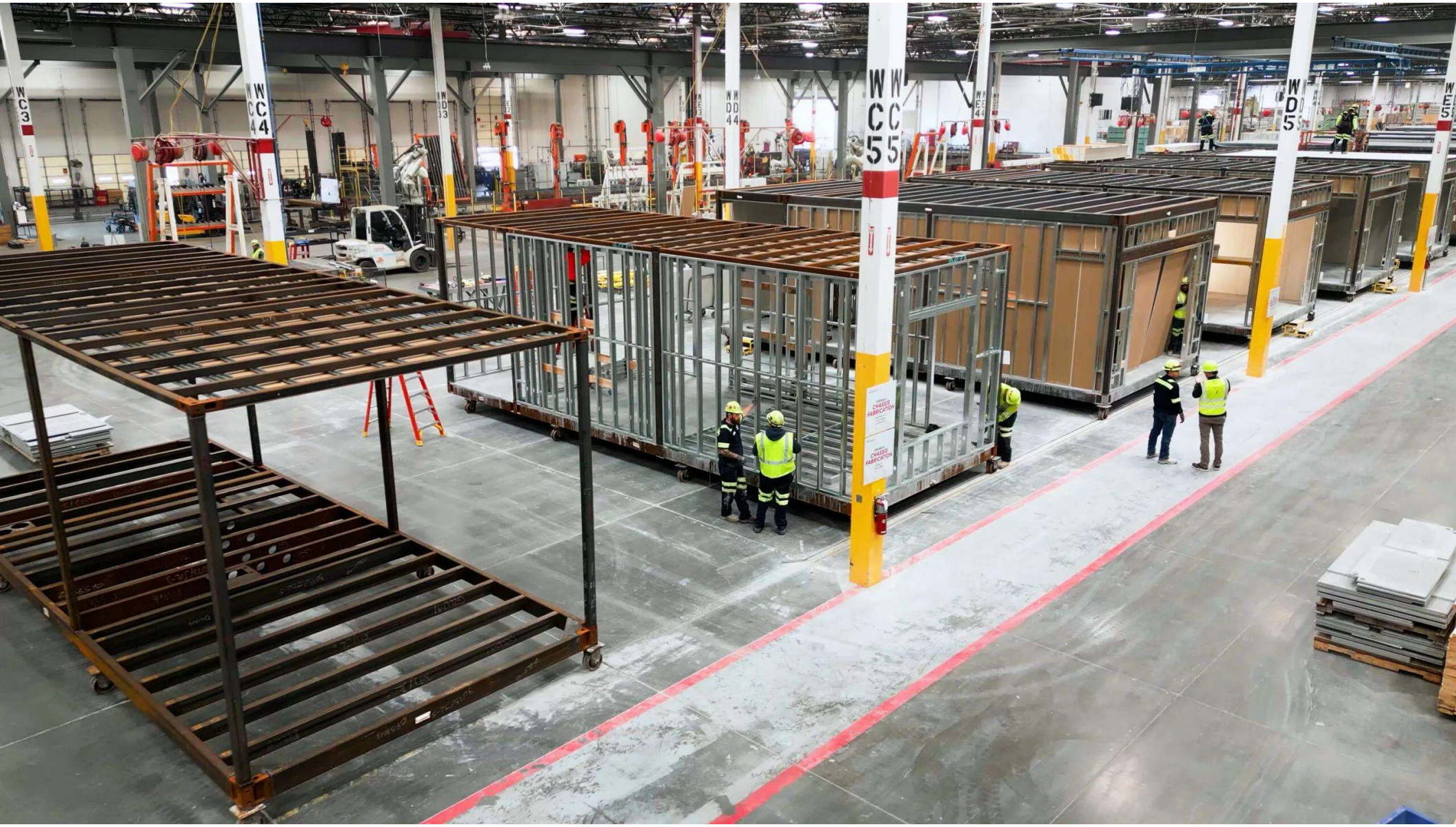


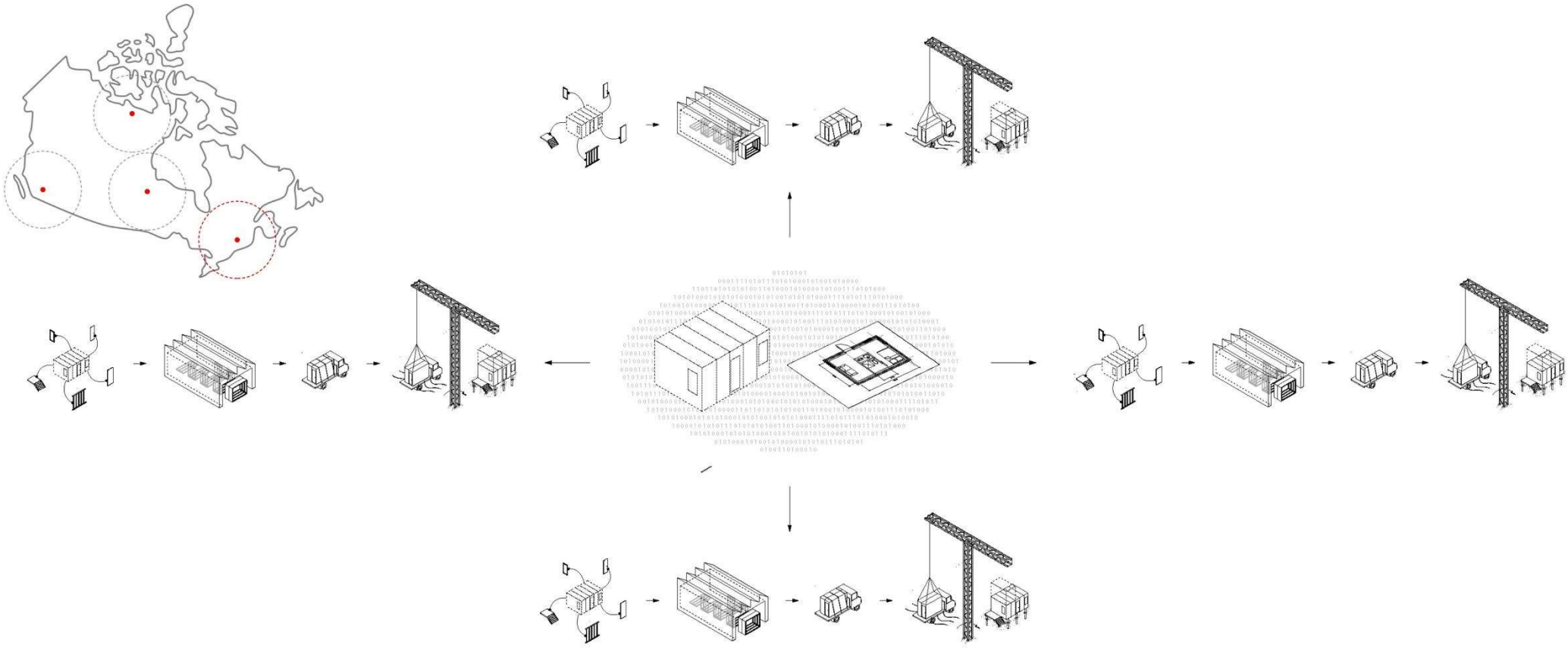


Schématisation,
Pre[FABRICA]tions

intégration verticale

page suivante:
Photo de l'usine Z-modular, https://www.z-modular.com

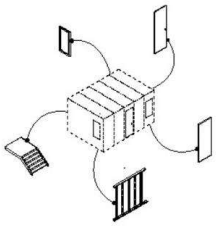

WC 3
WC 4
WC 5
WD 5
CHASSIS FABRICATION
CHASSIS FABRICATION

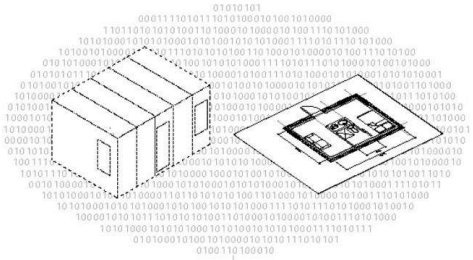


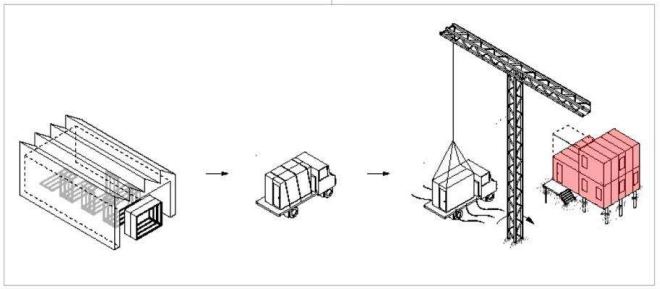
Schématisation,
Pre[FABRICA]tions

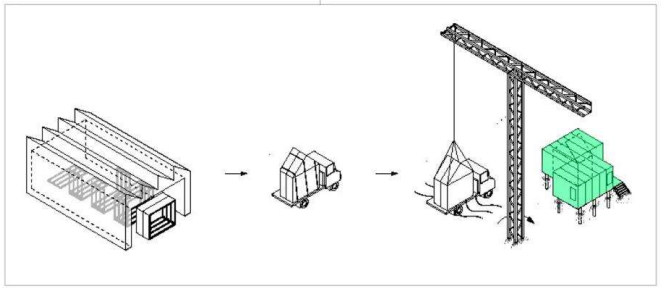
intégration digitale – usines délocalisées

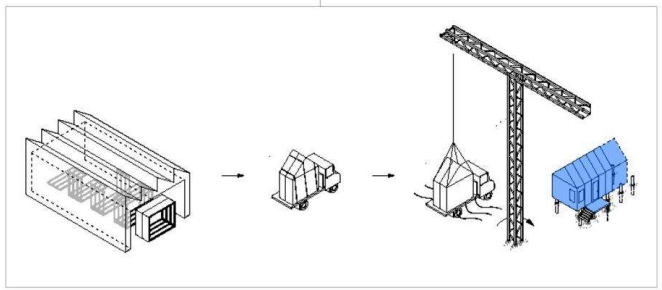
page suivante:
Prototype de classe, Project FROG, https://www.projectfrog.com











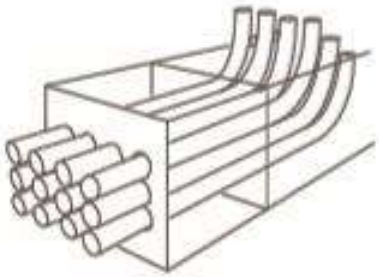
usines volantes - intégrateur

Schématisation,
Pre[FABRICA]tions

pages suivantes:
Image des produits «offsite» de Turner construction,
https://www.turnerconstruction.com/

INCREASING SCALE AND COMPLEXITY

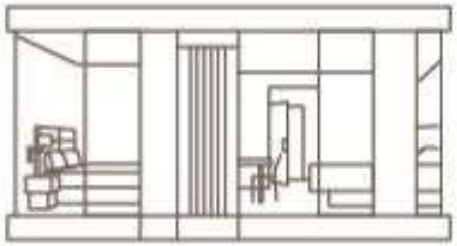
SINGLE TRADE INDIVIDUAL UNITS



MULTI-TRADE PANELS

VOLUMETRIC UNITS

VOLUMETRIC STRUCTURES



PREFABRICATED COMPONENTS

Electrical Kit-of-Parts
Stair Towers
Doors & Hardware
Preglazed Windows

PREFABRICATED SYSTEMS

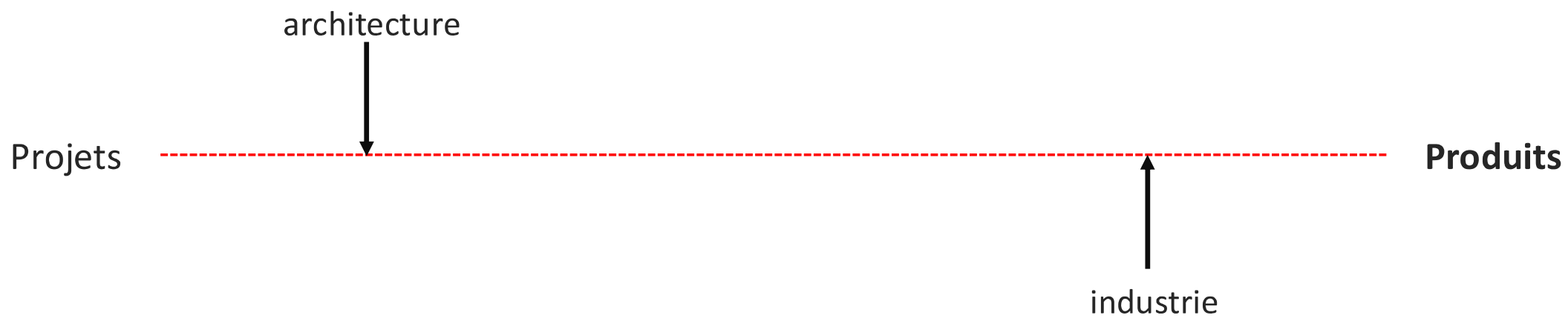
MEPS Racks
MEP Risers
Headwalls
Footwall/Sidewall

SUB-ASSEMBLIES

Bathroom Pods
Electrical Closet Pods
Office Front Systems
Modular Kitchens

MODULES

Modular Stacks
Mechanical/Electrical Penthouses
Patient Rooms
Super Skids



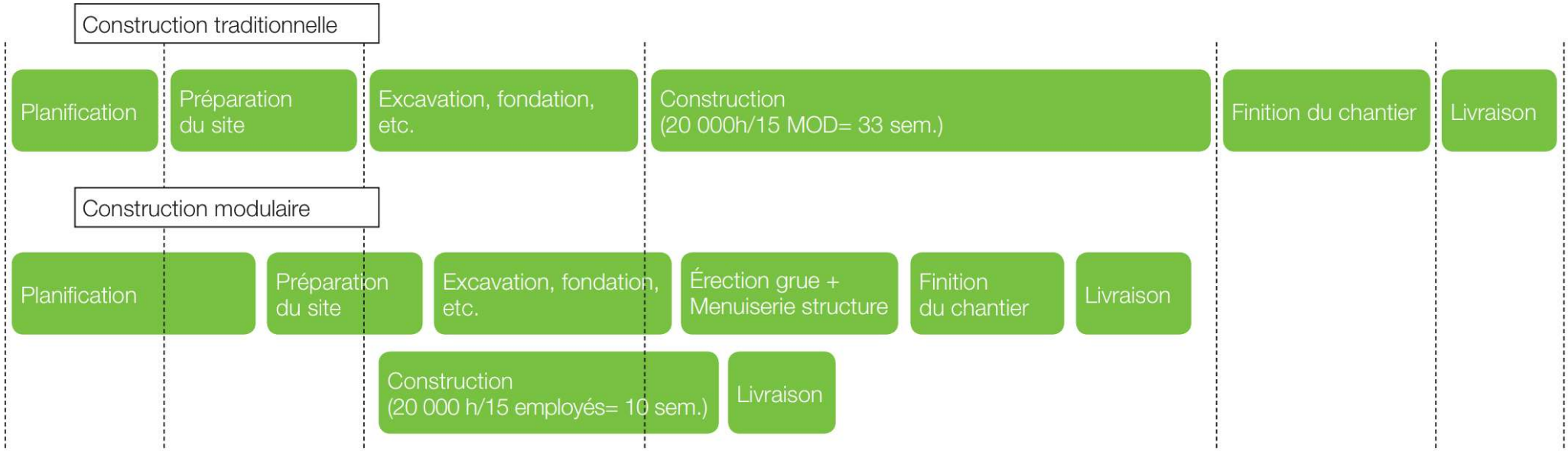
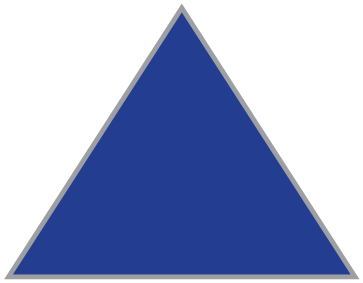


FIGURE 10 • Construction modulaire VS construction traditionnelle

Les gains en temps

Échéancier Guide de Construction Modulaire
Cecobois (2013)

Plus & Delta



COMMUNAUTÉ DE PRATIQUE
INNOVATION CONSTRUCTION

PROGRAMME DU 1er FORUM DE LA COMMUNAUTÉ BÂTIR ENSEMBLE, RÉUSSIR AUTREMENT!

Au programme :

Cpiconstruction.org

8h30 : Ouverture des portes

9h : Mot de bienvenue

9h15 : Discussion sur la collaboration avec Guy Paquin

10h30 : Choix entre 2 ateliers pratiques

- Last Planner system animé par Louis Parent
- Processus de conception unifiée animé par Rédha Lamri

12h45 : Dîner causerie avec Serge Cormier de la FTQ

14h00 : Choix entre 2 ateliers pratiques

- Big Room animé par Bel El Mdari
- Diagnostique technologique animé par Michelle Rafie

18 juin au 1285 rue Hodge, suite 201, Saint-Laurent

16h00 : Discussion en panel avec des experts invités : BÂTIR ENSEMBLE, RÉUSSIR AUTREMENT

17h00: 5 à 7 Réseautage

COMMUNAUTÉ DE PRATIQUE INNOVATION CONSTRUCTION

Inscrivez-vous dès maintenant au tout premier FORUM de la Communauté de pratique du 18 juin 2025!

Lean Construction : Bâtir ensemble, réussir autrement !

COMMUNAUTÉ DE PRATIQUE
INNOVATION CONSTRUCTION

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Merci pour votre participation!!