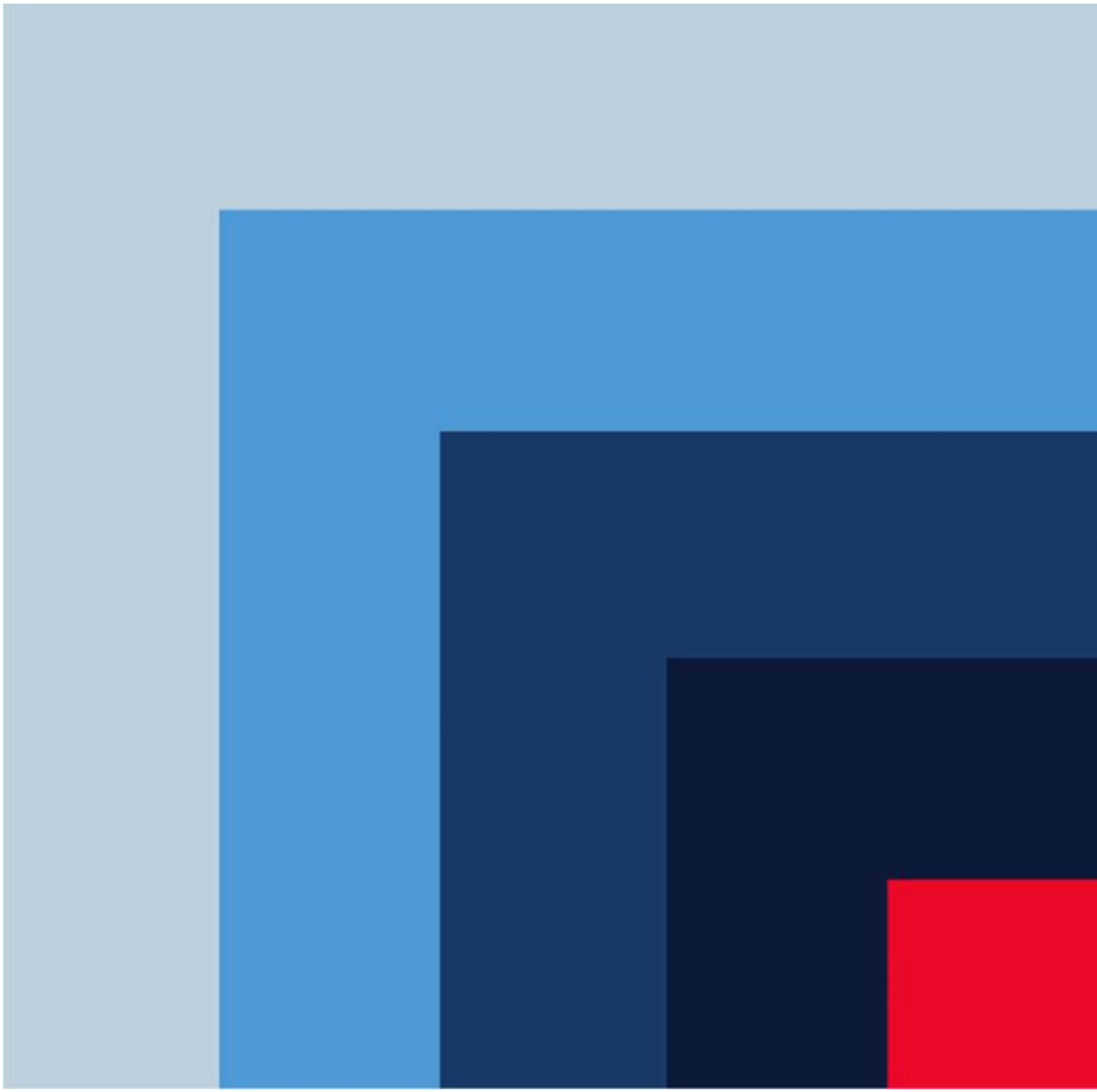
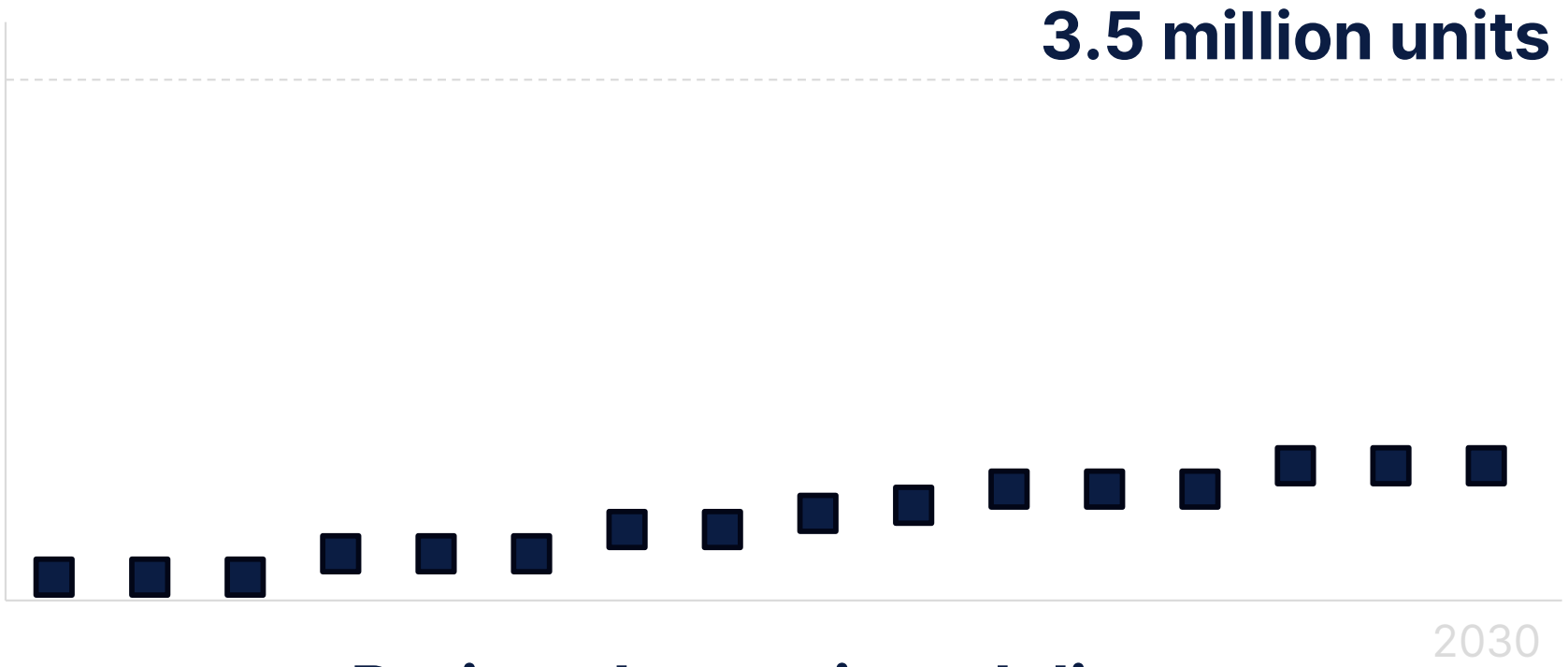
Making
Sustainability
Affordable

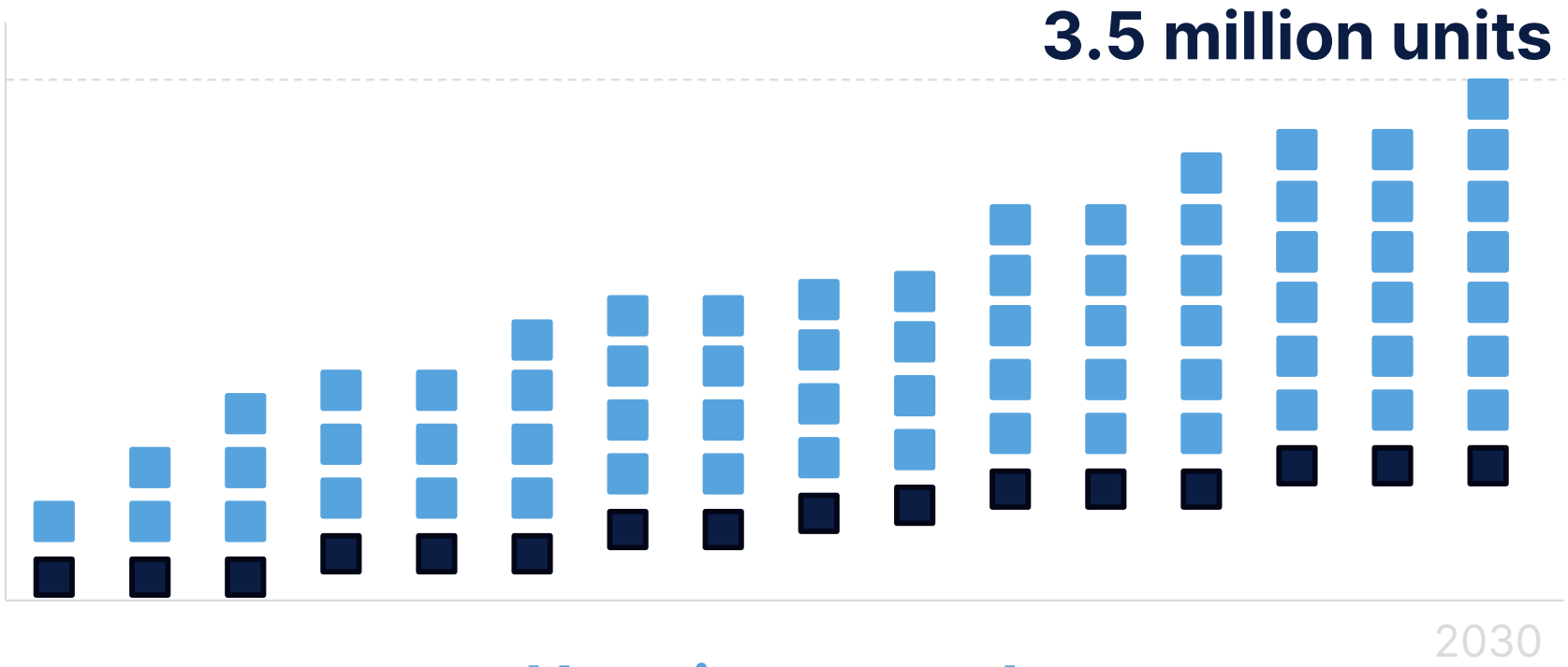


Serotiny Group

3.5 million units



Project-by-project delivery



Housing at scale

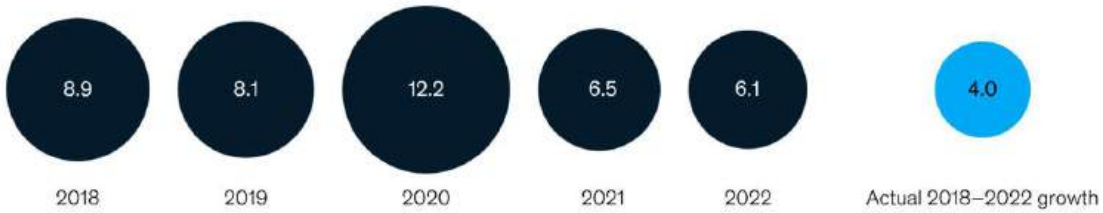
How to scale housing?

How to scale affordable housing?

high-quality
sustainable
beautiful

The North American modular construction sector is not achieving its ambitious growth plans.

Comparing 5-year forecasts for the North America modular construction market, 5-year CAGR, %

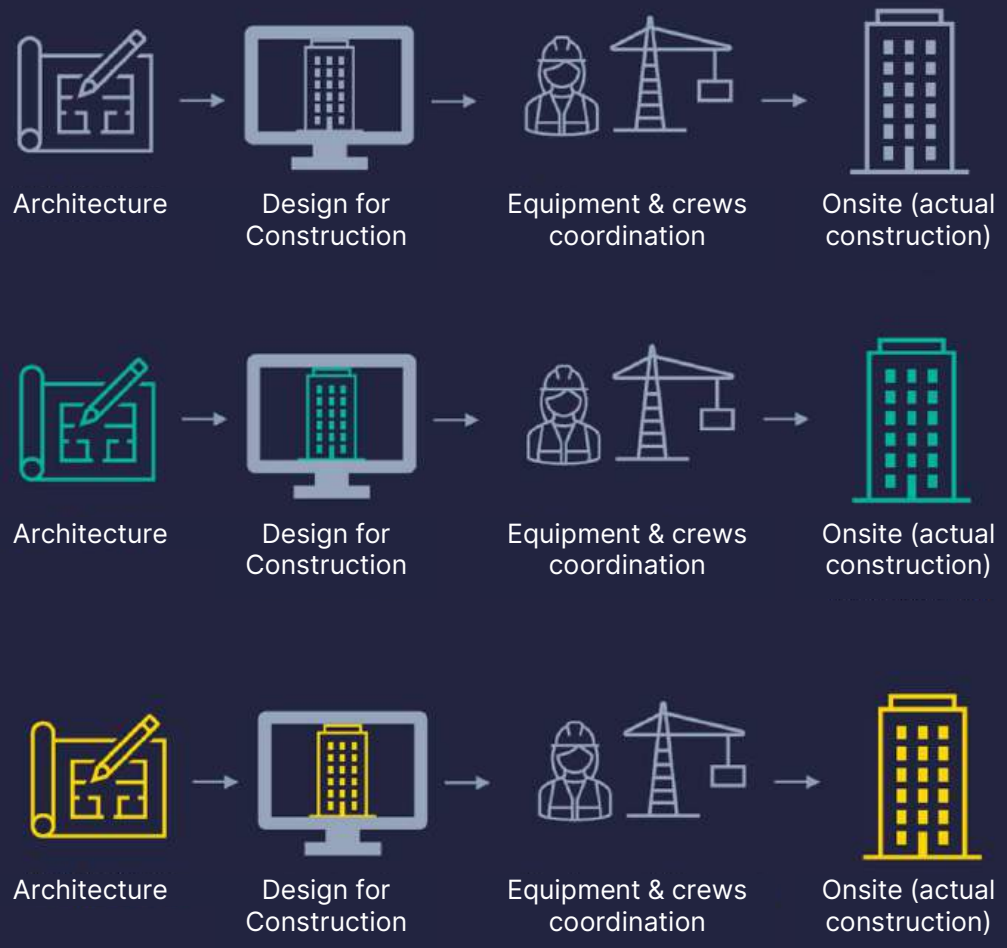


Source: Mordor Intelligence Inc 2018–2020, Inkwood Analytics 2021, Markets and Markets research 2022

McKinsey & Company

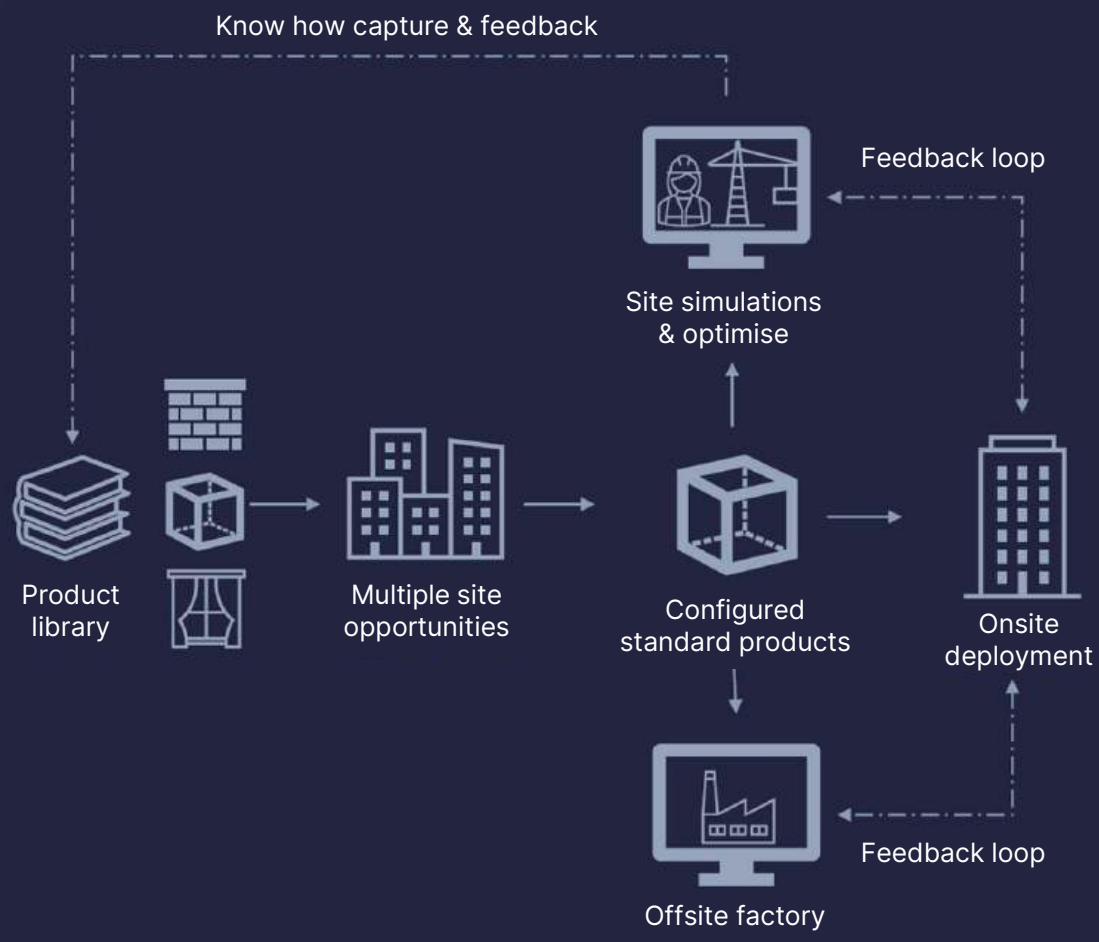
move away from ...

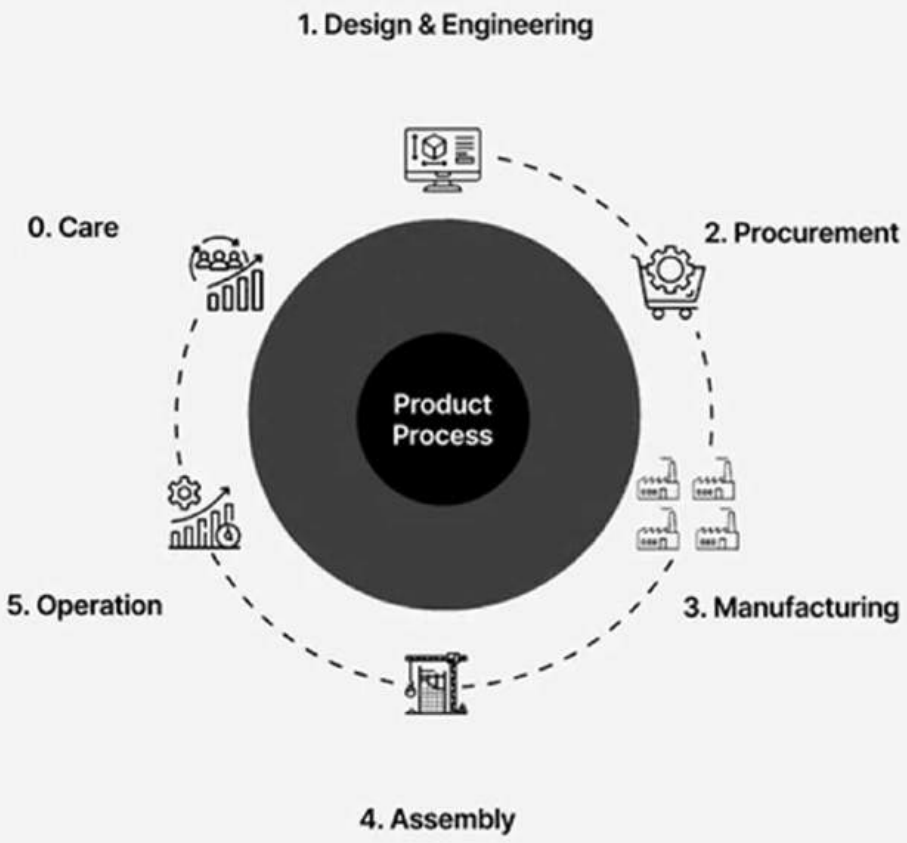
Project Driven Delivery



towards...

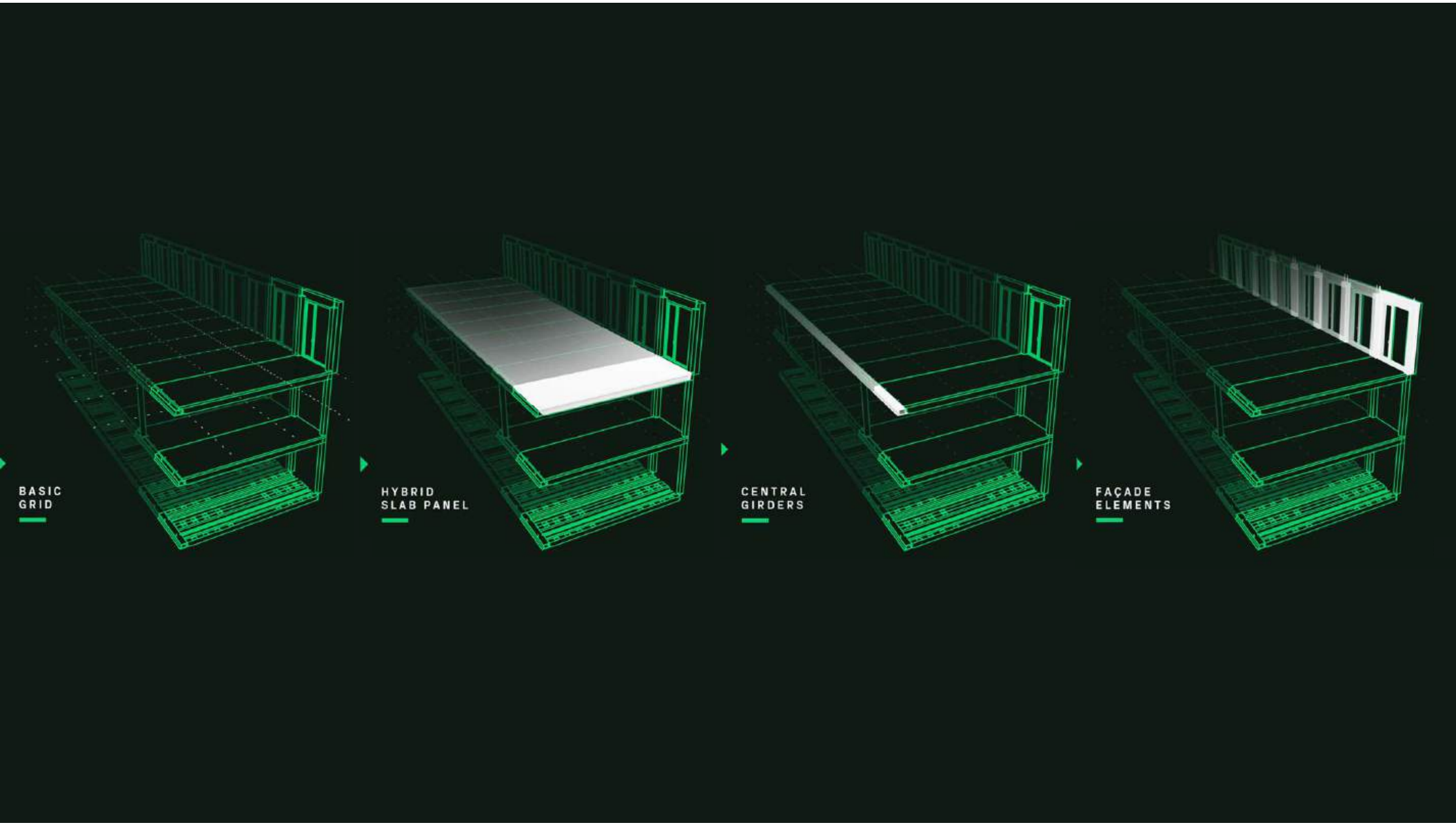
Product Driven Delivery





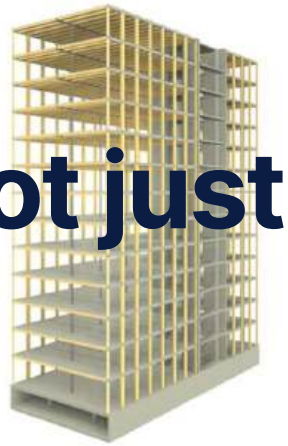
https://vimeo.com/1007092196/1a4ffa832d?share=copy

https://www.youtube.com/watch?v=1Y8ns2Hw9XM


BASIC
GRID
HYBRID
SLAB PANEL
CENTRAL
GIRDERS
FAÇADE
ELEMENTS

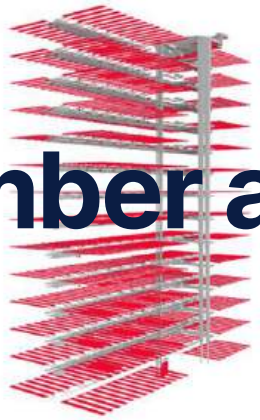
CREE is a Building solution

Not just a Mass timber alternative



Structure

Envelope



MEP

Program

Benefits over Mass Timber Construction

- **Flexible design** with no internal columns
- Higher **acoustic** and **fire rating**
- Standardized **connection details**
- Integrated **cooling and heating** in hybrid slab
- **Lighter** structure
- Under **EMTC** Timber encapsulation requirement
- **Secured** supply chain for Glulam
- **Distributed** manufacturing closed to the project
- Manufactured by majority **non-skilled labor**
- **Faster** installation compared to MTC
- Minimum **MTC waterproofing** during installation
- Lower general construction **insurance premium**

Flexible Efficient

Panelized System

Panelized system offers flexibility in design, procurement, and assembly. It can be assembled in dense urban areas and adapted to different site conditions. Its distributed manufacturing allows for local procurement, customization, and efficient construction.

Resilient Supply Chain

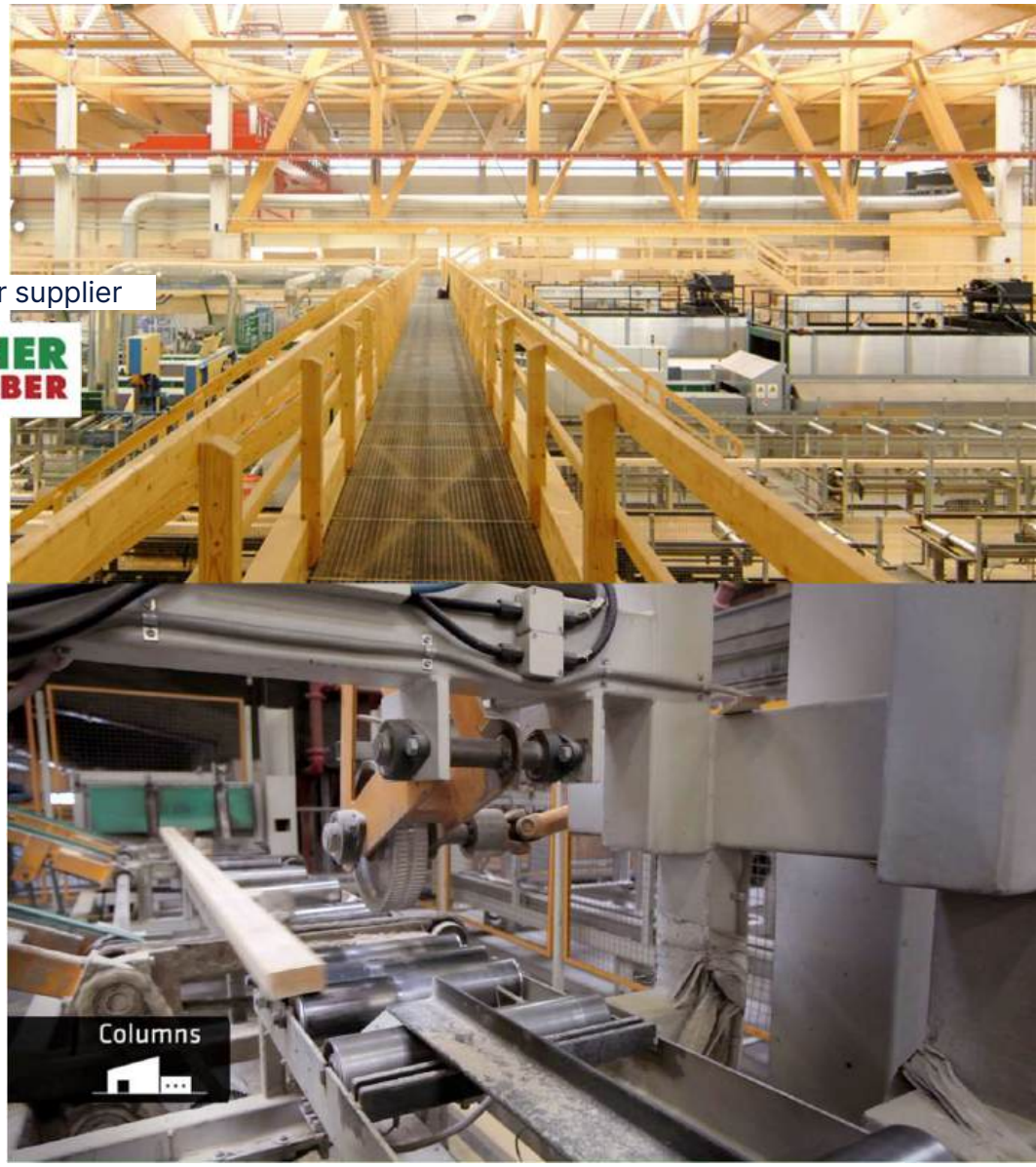
through standard products

+ Partner Timber supplier

HASSLACHER NORICA TIMBER

Glued laminated timber is characterized by high load-carrying capacity, dimensional stability and the ability to form the timber components into almost any shape.

- Large span lengths
- High load-carrying capacity with low density
- High dimensional stability due to gluing
- Fast and dry construction method
- Can be worked with simple tools
- High fire resistance and chemical resistance
- High thermal insulation properties



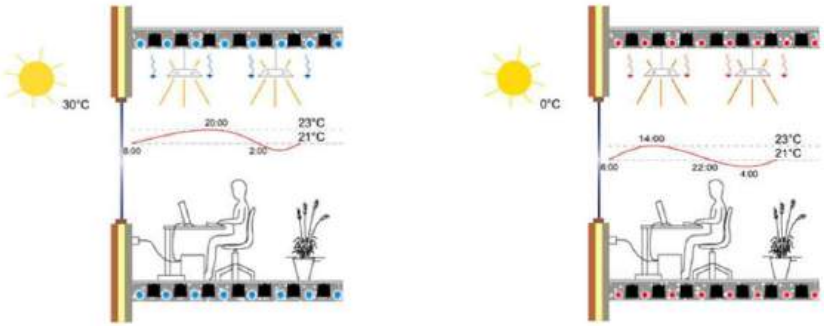
Distributed Manufacturing

Agile and resilient network of distributed micro-factories located close to the construction site are structured to deliver standard components to multiple assemblies. In contrast to volumetric modular factories, which focus on mass production, micro-factories are structured to deliver mass customization through standard components.

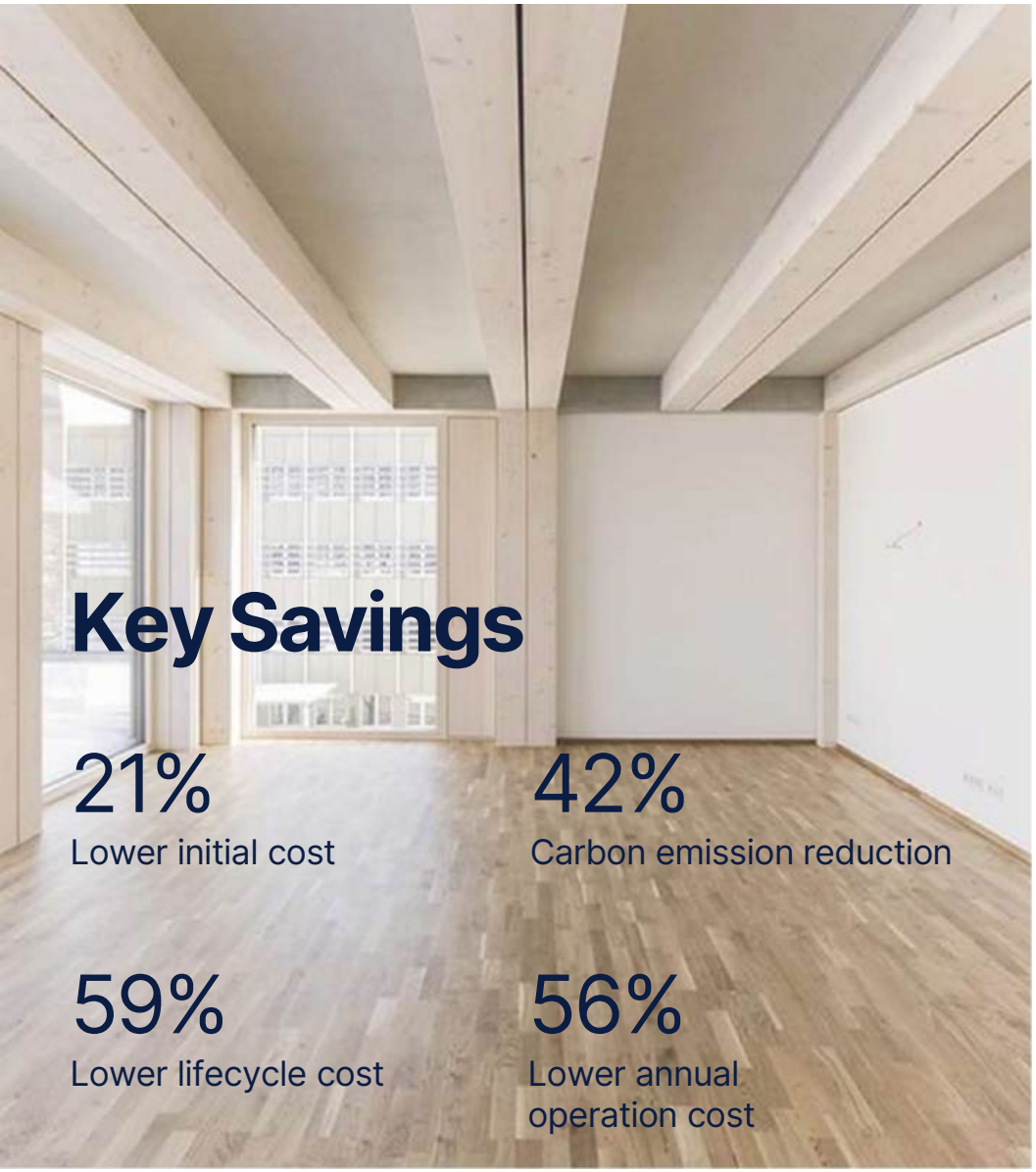
TABS

MODERN NIAGARA

Thermally Activated Building Systems



The primary focus of control strategies for TABS is to ensure optimal comfort while minimizing energy usage.



Benefits of Integrated System

- High energy efficiency
- Faster construction/ installation
- Prefabrication allows for Standardization
- Prefabrication allows for cost efficiency
- Lower O&M
- Higher lifecycle
- Little fluctuation in comfort temperatures
- Good thermal comfort for users
- Faster response time /less than 30 minutes
- More Flexibility in interior layout

Optimized Logistics

Storage and transportation

Lighter and more compact panels facilitate smoother transportation to construction sites, offering an estimated 30% reduction in transport costs vs larger-sized volumetric modules.

Chart 1 visualizes the production process of project example

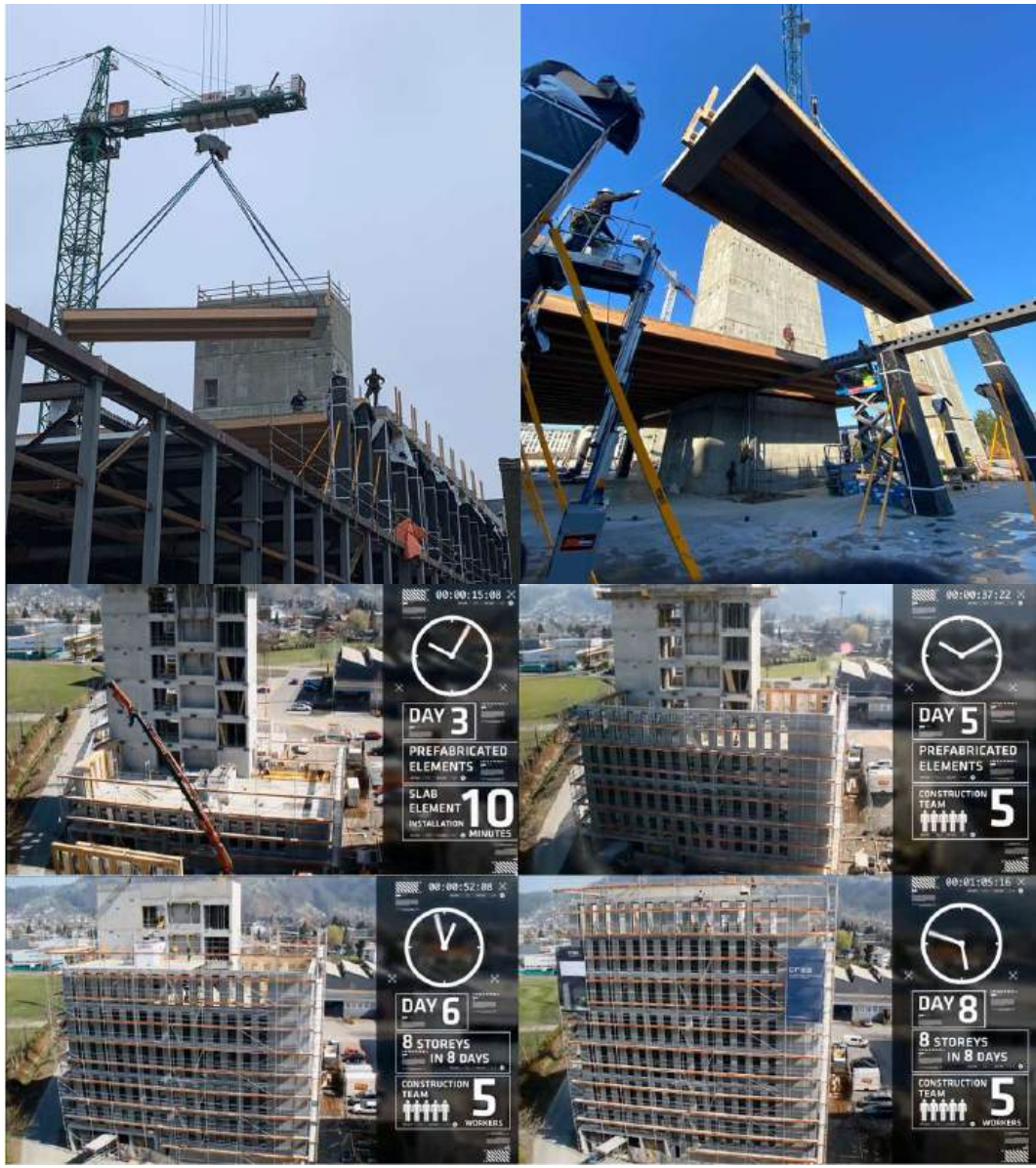
Panelized Assembly

In contrast to transportation size limitations of volumetric modular systems, our panelized system is customizable to various configurations, types of projects, and site constraints. On average, a slab can be assembled by just five on-site workers in 15 minutes, while the installation of the CREE envelope takes approximately 30 minutes.

Rapid Assembly

Faster assembly of approximately 500m2 of enclosed, weatherproof floor space daily, five-times quicker than concrete construction, with 50-70% fewer on-site workers.

The efficient integration of envelope with structure allows each floor to be fully enclosed and waterproofed, enabling concurrent interior finishing during the assembly process. As a result, the overall construction time is significantly reduced.



Benefits of the system

01 | HIGHLY SUSTAINABLE AND RESOURCE-EFFICIENT

The CREE timber-hybrid system is inherently sustainable, uses less materials and incorporates renewable resources where possible.

02 | QUALITY, SCHEDULE, AND COST CERTAINTY

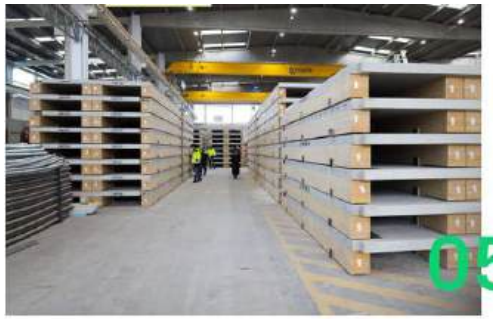
Cost and schedule predictability are ensured early on. As the project progresses, all project participants can view planning changes in real time using the digital twin. This allows for a high standard of quality, utmost efficiency, and rapid estimation of costs, time, carbon footprint, and regulatory compliance.

03 | 400-500 M² OF ENCLOSED FLOOR SPACE PER DAY

The use of completely prefabricated and modular components makes it possible to construct 400–500 m² of enclosed, weatherproof floor space with 6 workers per day - roughly five times the pace of conventional on-site concrete construction.

04 | FREEDOM OF INTERIOR AND FAÇADE DESIGN

The CREE System offers an extraordinary degree of versatility. Interior spaces are highly customizable because there is no need for load-bearing interior walls. Architects are therefore free to create floorspaces with outstanding form and functionality.



08 | REDUCED LIFE-CYCLE COST

The life-cycle cost of a CREE building is remarkably low. Smart heating, cooling, and lighting systems, along with passive design strategies, allow for significantly lower energy consumption.

05 | OFF-SITE PRODUCTION IMPROVES ACCURACY AND QUALITY

Our innovative method of prefabricated slab and wall elements boosts labor productivity. Crucially, the building is assembled on-site, rather than constructed. The lightness of the timber-hybrid composite and the high level of prefabrication provide further boosts to in-time transportation and delivery.

06 | HIGHER PRODUCTIVITY WITH FEWER WORKERS

All core and shell components are prefabricated at off-site facilities, allowing for better health, hygiene, and safety monitoring on building sites. For workers, this means less-populated and inherently safer sites.

07 | HEALTHY INDOOR ENVIRONMENT

End users appreciate the biophilic atmosphere provided by the exposed wood elements and open functional spaces characteristic of a healthy office building. The natural feel of the interiors of a CREE building contribute to a healthy working or living environment.

1925 Victoria Avenue

1925 Victoria Park represents a new development model, integrating holistic sustainability strategies with long-term affordable rental housing and prefab hybrid heavy timber construction. It emphasizes larger family-style units, future adaptability, and community-mindedness, and will be the first Toronto Green Standard Tier 4 (TGS4+) near-net-zero hybrid mass timber development in Toronto. 1925 Victoria Park is developed from a life cycle costing assessment, understanding that long-term operational costs would outweigh initial construction investment. This strategy aims to create long-term value for our client while enabling a more robust and resilient architecture capable of adapting to changes in demographics and use over time. The building form takes its cues from the perimeter block, using a single-loaded corridor around an outdoor courtyard amenity space. This typology lends itself to achieving TGS4 with natural daylighting to all areas of suites and passive cross-ventilation and cooling. The result is an 11 story building constructed of a modular mass-timber system with single-loaded corridors surrounding a raised central courtyard. The building mass was derived from a modular prefab system on a 3m x 3m grid. 1925 Victoria Park will be a model and a catalyst for future responsible development that prioritizes sustainability and thoughtful design while creating much-needed rapid, affordable housing.

Location: Toronto, Canada
GFA: 18580 m2
Height: 43 m
Year of initiation: 2022
Project start: November 2023
Project completion: March 2025

Toronto's most sustainable development

1ST near-net-zero private residence	**1ST** CREE Pilot Project in Ontario	**1ST** 12 story EMTC
8 M Design engineering	**4 M** On-site assembly	**12 M** faster occupancy
185 long-term rental AOD compliant units	**100** Radiant cooling and heating	**40** Monthly utility cost for each unit
46 More Efficient Than NECB standard	**32** less embodied carbon	**68** less operation and maintenance cost

Case Study

Product-driven delivery for affordable housing

Reena

Serotiny Group

Faster Evaluation

Steady Pipeline

Cost Certainty

Reduced Equity Requirement

Long Term Affordability & Sustainability

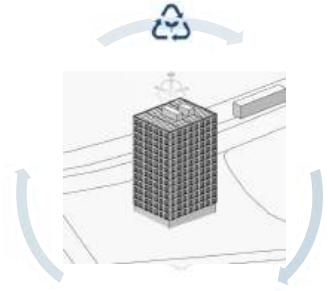
Case Study

Reuse not rework

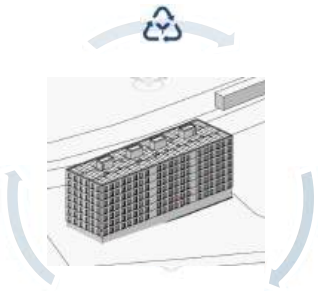
Design once, build many times over

Reena Affordable Housing Prototypes

Configurable Hybrid-Timber Building System



Reena
“Tower” Building Prototype



Reena
“Bar” Building Prototype

Each prototype evaluates:

- Design to Reena’s Housing Model
- Optimized Energy & Operations
- Costing Engineering
- Assembly & Site Logistics
- Procurement & Manufacturing
- Proforma Viability & Affordability Mix

Case Study

Product-driven delivery

1. Standardized building product across multiple sites

Faster Evaluation

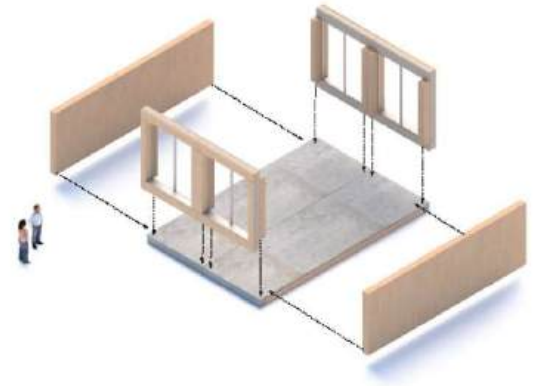
Steady Pipeline

Cost Certainty

Reduced Equity Requirement

Long Term Affordability & Sustainability

Case Study




STUDIO
22 m²


STUDIO
45 m²


1 BEDROOM
45 m²


1 BEDROOM
68 m²


2 BEDROOM
68 m²


2 BEDROOM
68 m²

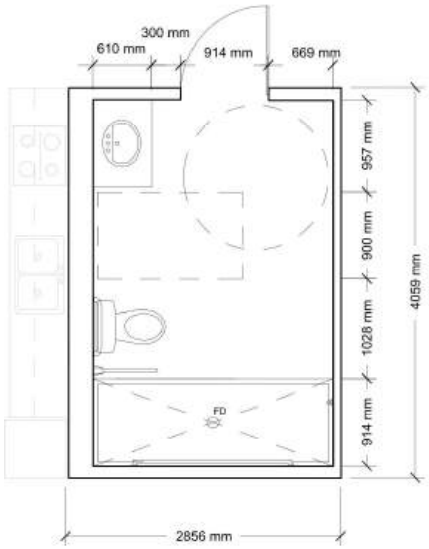

2 BEDROOM
90 m²


3 BEDROOM
90 m²


3 BEDROOM
90 m²

Case Study

Case Study


300 mm
610 mm
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669 mm
957 mm
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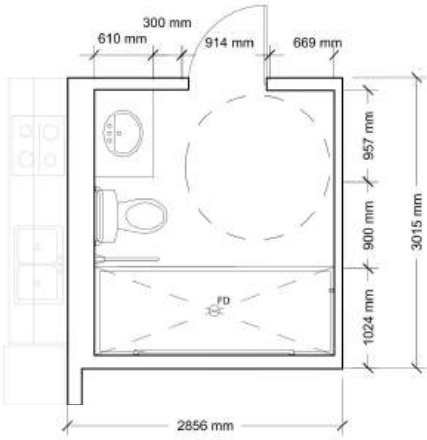
914 mm
4059 mm
FD
2856 mm


300 mm
610 mm
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3015 mm
FD
2856 mm

Case Study

0BD-1BA-01
475 SF

1BD-1BA-01
634 SF

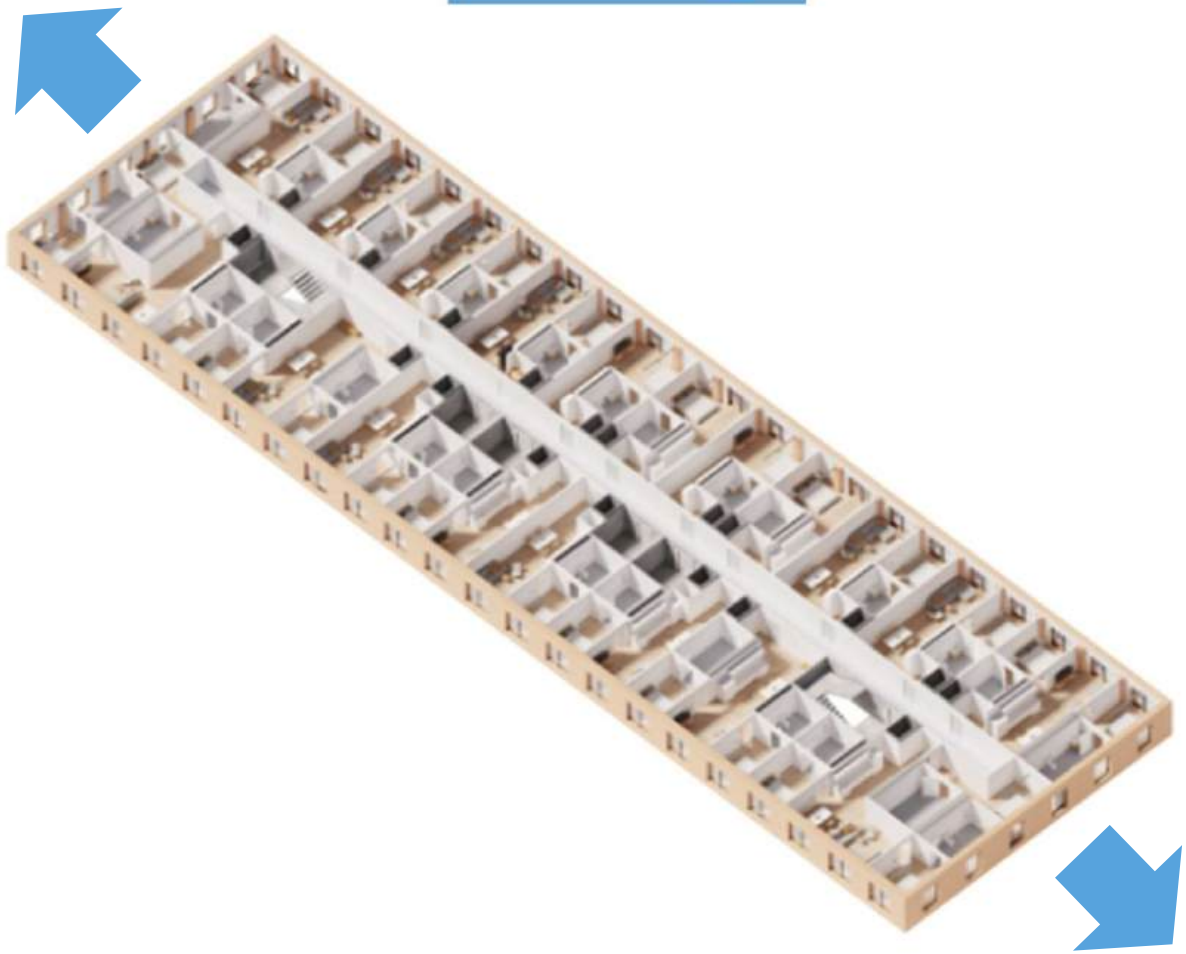
1BD-1BA-02
599 SF

2BD-2BA-01
950 SF

2BD-2BA-02
990 SF

3B-3BA-01
1,415 SF

Case Study



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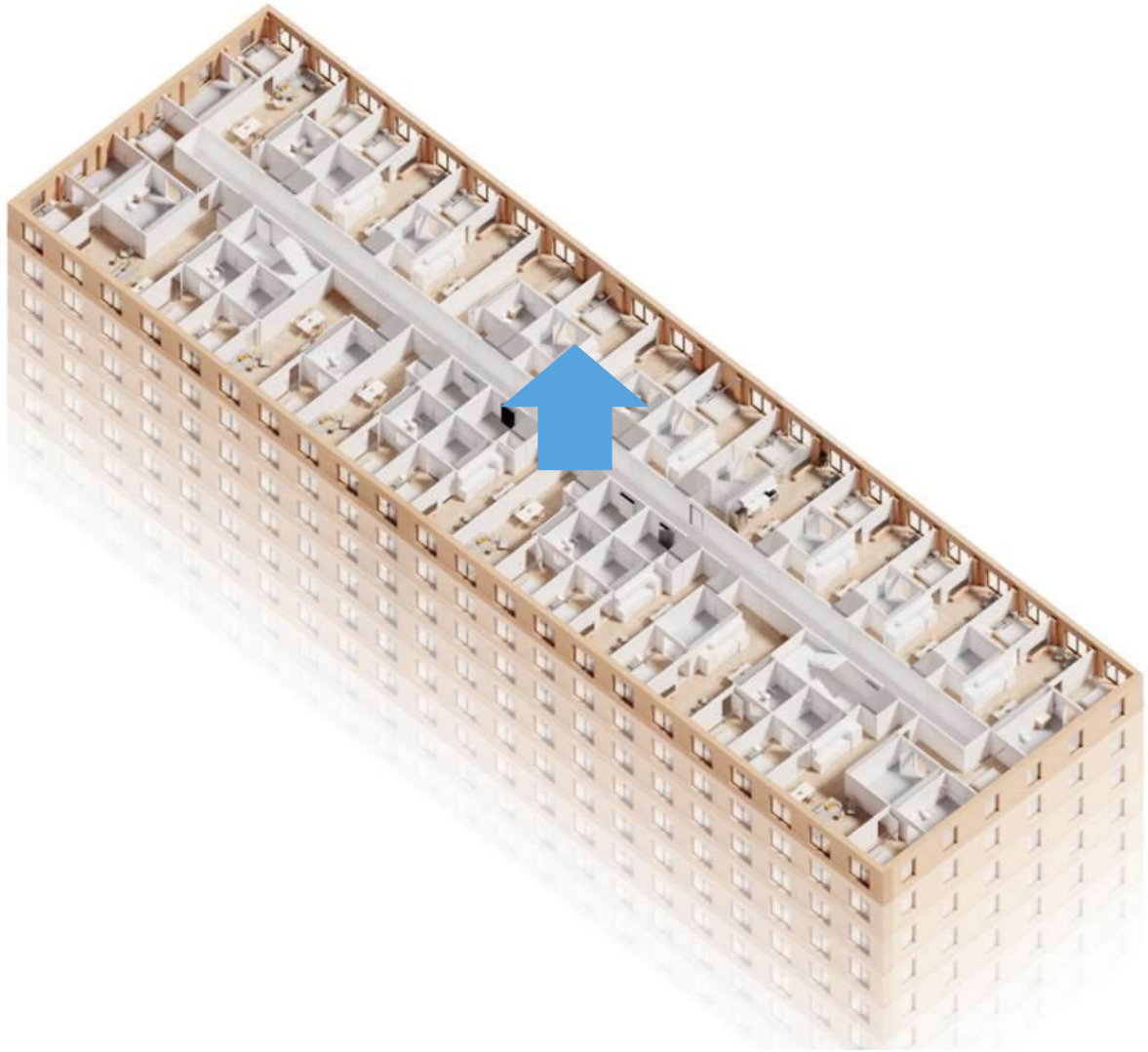
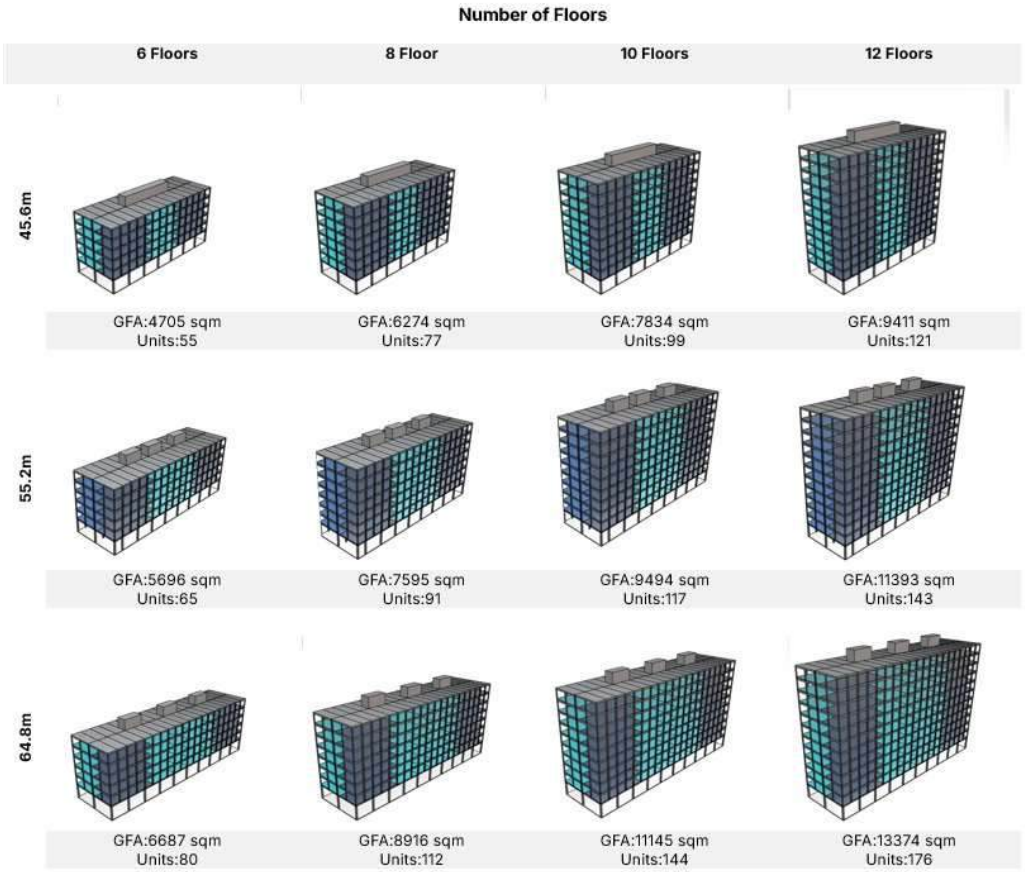


Case Study



KPIs

- Construction Costs
- Development Costs
- Affordability Levels
- Revenue
- Operational Costs
- Energy Savings

Case Study

Product-driven delivery

2. Faster and more robust feasibility and viability

Faster Evaluation

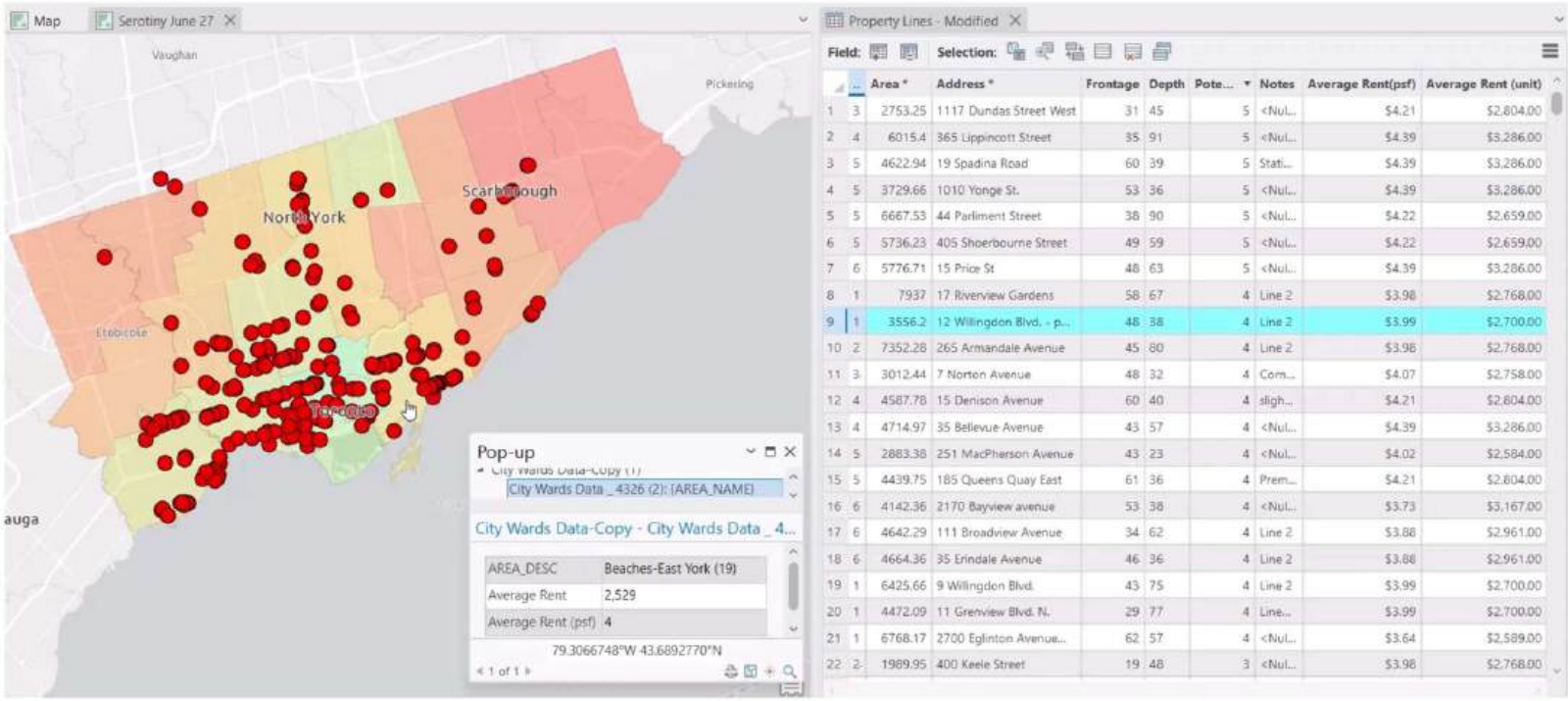
Steady Pipeline

Cost Certainty

Reduced Equity Requirement

Long Term Affordability & Sustainability

Case Study



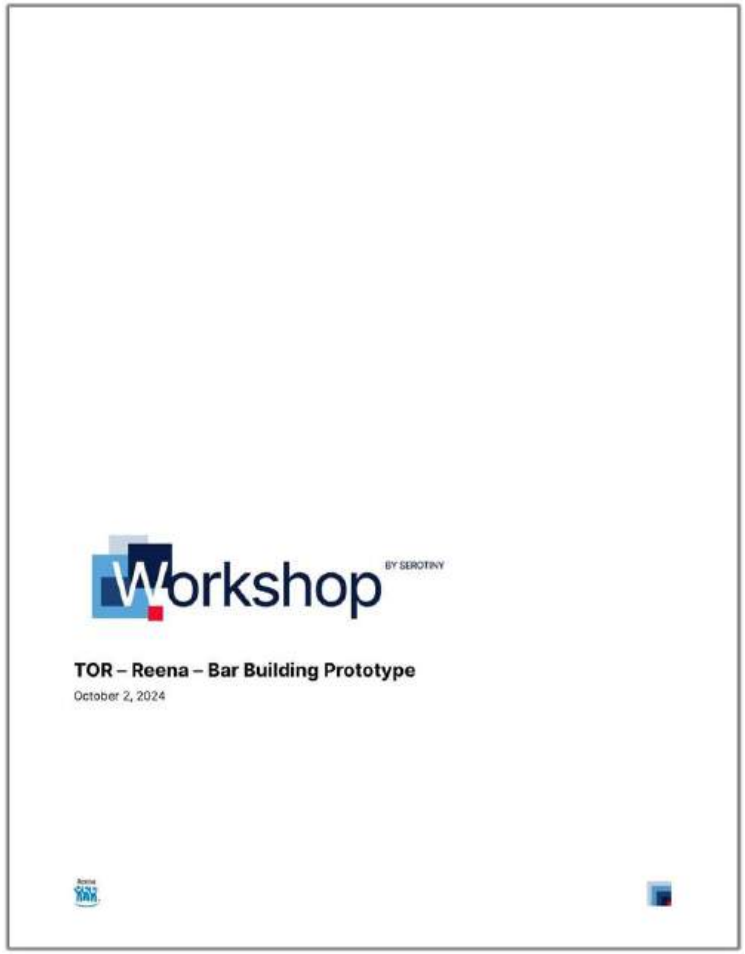
		Area *	Address *	Frontage	Depth	Pote...	Notes	Average Rent(psf)	Average Rent (unit)
1	3	2753.25	1117 Dundas Street West	31	45	5	<Nul...	$4.21	$2,804.00
2	4	6015.4	365 Lippincott Street	35	91	5	<Nul...	$4.39	$3,286.00
3	5	4622.94	19 Spadina Road	60	39	5	Stati...	$4.39	$3,286.00
4	5	3729.66	1010 Yonge St.	53	36	5	<Nul...	$4.39	$3,286.00
5	5	6667.53	44 Parliment Street	38	90	5	<Nul...	$4.22	$2,659.00
6	5	5736.23	405 Shoerbourne Street	49	59	5	<Nul...	$4.22	$2,659.00
7	6	5776.71	15 Price St	48	63	5	<Nul...	$4.39	$3,286.00
8	1	7937	17 Riverview Gardens	58	67	4	Line 2	$3.98	$2,768.00
9	1	3556.2	12 Willingdon Blvd. - p...	48	38	4	Line 2	$3.99	$2,700.00
10	2	7352.28	265 Armandale Avenue	45	80	4	Line 2	$3.98	$2,768.00
11	3	3012.44	7 Norton Avenue	48	32	4	Com...	$4.07	$2,758.00
12	4	4587.78	15 Denison Avenue	60	40	4	sligh...	$4.21	$2,804.00
13	4	4714.97	35 Bellevue Avenue	43	57	4	<Nul...	$4.39	$3,286.00
14	5	2883.38	251 MacPherson Avenue	43	23	4	<Nul...	$4.02	$2,584.00
15	5	4439.75	185 Queens Quay East	61	36	4	Prem...	$4.21	$2,804.00
16	6	4142.36	2170 Bayview avenue	53	38	4	<Nul...	$3.73	$3,167.00
17	6	4642.29	111 Broadview Avenue	34	62	4	Line 2	$3.88	$2,961.00
18	6	4664.36	35 Erindale Avenue	46	36	4	Line 2	$3.88	$2,961.00
19	1	6425.66	9 Willingdon Blvd.	43	75	4	Line 2	$3.99	$2,700.00
20	1	4472.09	11 Grenview Blvd. N.	29	77	4	Line...	$3.99	$2,700.00
21	1	6768.17	2700 Eglinton Avenue...	62	57	4	<Nul...	$3.64	$2,589.00
22	2	1989.95	400 Keele Street	19	48	3	<Nul...	$3.98	$2,768.00

Case Study






Case Study


Workshop
BY SEROTINY
TOR – Reena – Bar Building Prototype
October 2, 2024

Workshop BY SEROTINY

Workshops are ideal launchpads for fostering a collaborative project development. They provide us with the opportunity to directly connect with clients and gain a deep understanding of their business objectives and project requirements.

Through the course of 5 weeks we test-fit the system through various design scenarios, cost engineering, and development pro forma. The primary objective is to create a comprehensive design and delivery roadmaps that empower you to make well-informed decisions from the outset, saving you unnecessary expenses on various consultants.

5 Weekly Steps

Week 1: Massing and Structure
Workshop on the super structural system

- Massing optimization
- Site Configuration
- Create Massing options
- Massing Scenario Testing, set back
- Modular Grid - optimization
- Preliminary FE structural analysis and sizing of members for costing

Week 2: Program and Building System
Workshop on the CREE MEP system

- Create Unit Mix options
- Develop floor plate layouts
- Design scenarios for opening, energy efficiency
- Standardize interfaces for MEP and building envelope
- Design MEP strategy for estimation
- Standardize prefabricated in-slab radiant heating and cooling system (TABs)

Week 3: Envelope and Energy Performance
Workshop on the CREE Prefab Envelope System

- Set the window wall ratio (WWR)
- Review strategies and specifications for rainscreen cladding systems
- Create a strategy for balcony systems (e.g. juliette)
- Benchmark energy performance requirements

Week 4: DFMA
Workshop on the Slab & envelope manufacturing and assembly

- Manufacturing detailed Model (EBOM)
- Manufacturing cost and schedule
- On-site Assembly cost and schedule

Week 5: Cost Engineering and Proforma
Workshop on the project hard and sustainability opportunities and green incentives

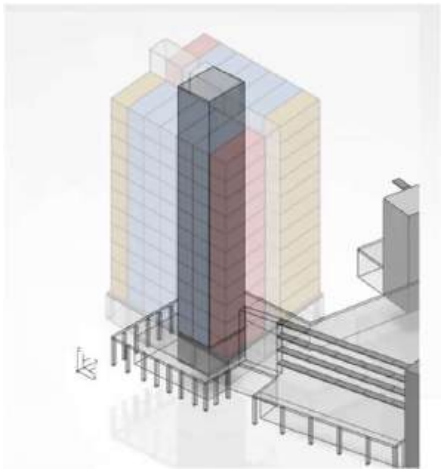
- Project life cycle assessment
- Project cost estimation
- Building Energy consumption (O&M)
- Life cycle costing assessment
- Create development roadmap for next phase
- Analyze project financing through market rent
- Create a roadmap for project financing , through incentives, alternative financing

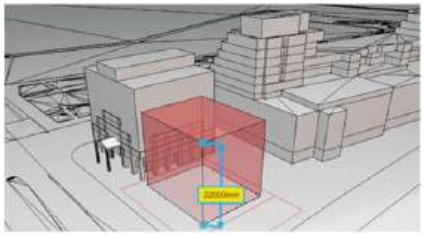
01 Massing and Structural Grid

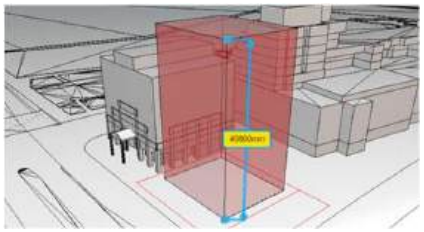
to maximize reuse and increase efficiency

We begin with site-agnostic approach to the massing focusing on standardization of modular grid, while evaluating the logistic and assembly approach early on.

- Evaluate massing scenarios against zoning, shadow, and setback requirements to assess opportunities for additional density
- Configure site layout to simplify site logistics and speed up assembly
- Test-fit modular grid
- Optimize the grid for reuse components across the entire development

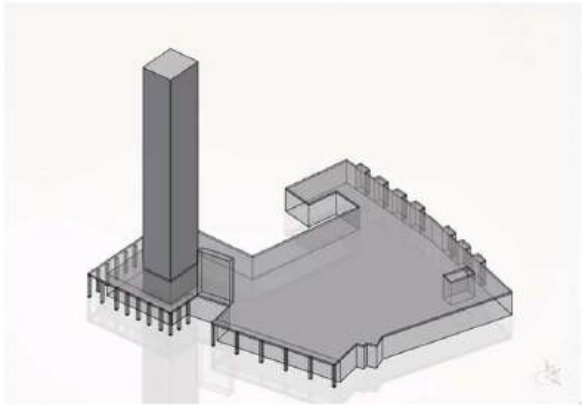


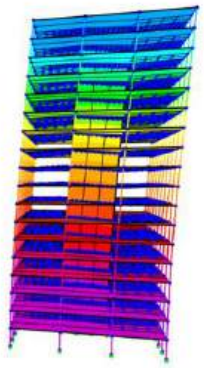




Second, we evaluate structural frameworks. Through multiple design scenarios with FE analysis, we test and optimize the lateral and Gravity loads to determine the sizing of structural members.

- Evaluate structural layouts and frameworks to minimize material use and load transfers
- Optimize lateral and gravity loads through iterative FE analysis and alternate design scenarios
- Determine sizes of GLM columns & beams, steel columns & beams, shear walls, and cores to assist with costing and procurement strategies





02 Programs and Building Systems

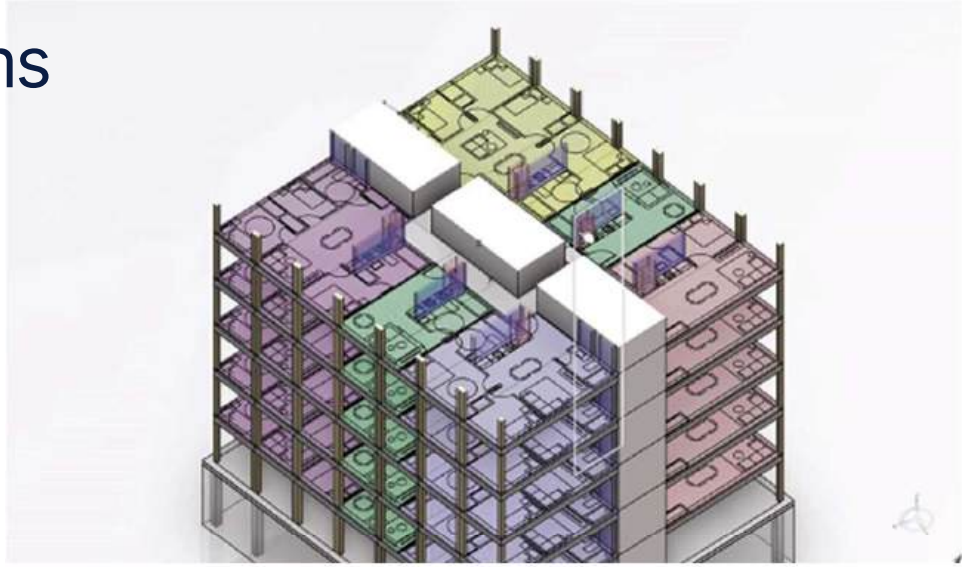
to maximize reuse and increase efficiency

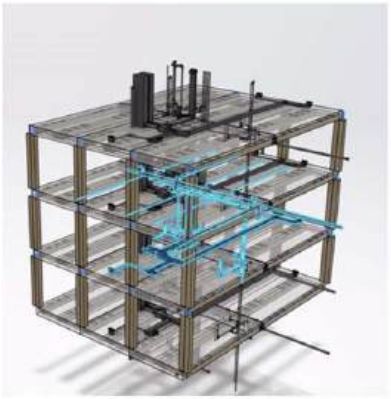
Mechanical system is integrated and optimized with our interior units and modular structural grid, this reduces the rework, clashes to reduce unnecessary waste and reducing the cost of the project, while increasing the system efficiency.

- → Standardize distribution system with prefabricated MEP rises to reduce slab complexity, create repetition, & reduce cost
- → Develop MEP strategy for estimation using a library of prefabricated MEP assemblies
- → Standardize prefabricated in-slab radiant heating and cooling system (TABs) to reduce production costs, increase speed of assembly and system commissioning

Our system offers a column free and open floor for flexible programming. allowing flexible configuration .Standardized MEP products, interfaces, optimized initial and operational cost. These products are integrated and optimized for with the unit layout, modular system and GLM structures .

- → Develop floor plate layouts to maximize system compatibility and floor plate efficiency.
- → Leverage a library of standard suites to quickly assess viability of building layouts
- → Standardized interfaces for MEP and building envelope to allow for high level of prefabrication.





03 Envelope and Energy Performance

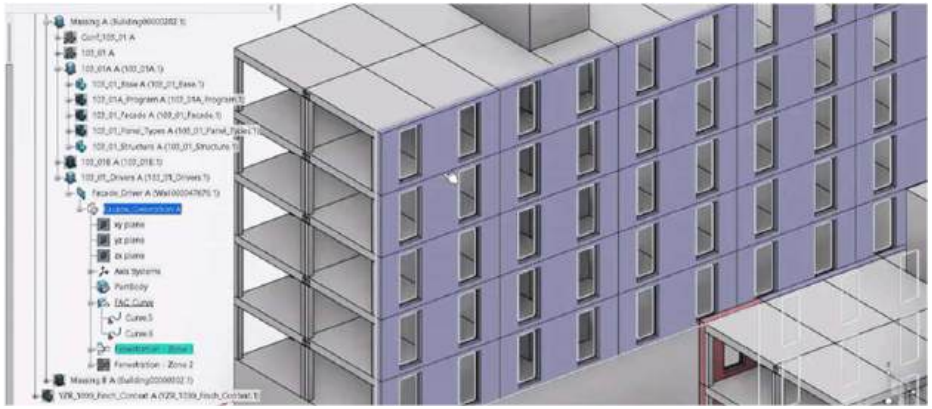
to increase the performance

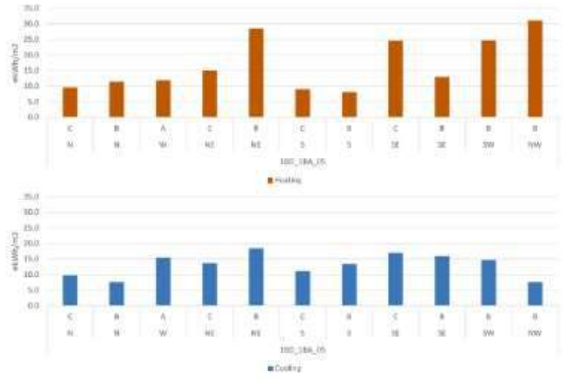
We create a façade strategy, including massing penalization, fenestration, and material systems, focusing on maximizing performance, cost benchmarks, and visual quality.

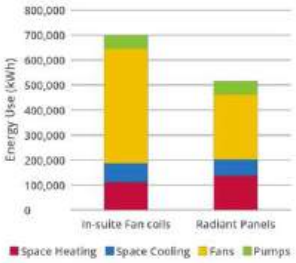
- the window-to-wall ratio will to be carefully balanced to optimize energy efficiency and occupant comfort.
- High-performance glazing and proper insulation can mitigate heat transfer and improve the overall energy efficiency of the building
- Integrate passive design strategies
- Minimize thermal bridging through standard interface connections for Prefabricated balconies and add on balconies, awnings, and shades.
- Create a strategy for balcony systems (e.g. juliette)

Our energy modeling is parametric and configurable allowing to measure the energy use of the project that inform the

- Costing high performance windows, through our partnership with Schuco
- Set the window wall ratio (WWR)
- Review strategies and specifications for rainscreen cladding systems
- Benchmark energy performance requirements







Unit	Avg. Monthly Conditioning Costs	
	Traditional FCU	Radiant System
1BD	$23.10	$17.08
2BD	$29.60	$21.89
3BD	$42.87	$31.70

04 DFMA

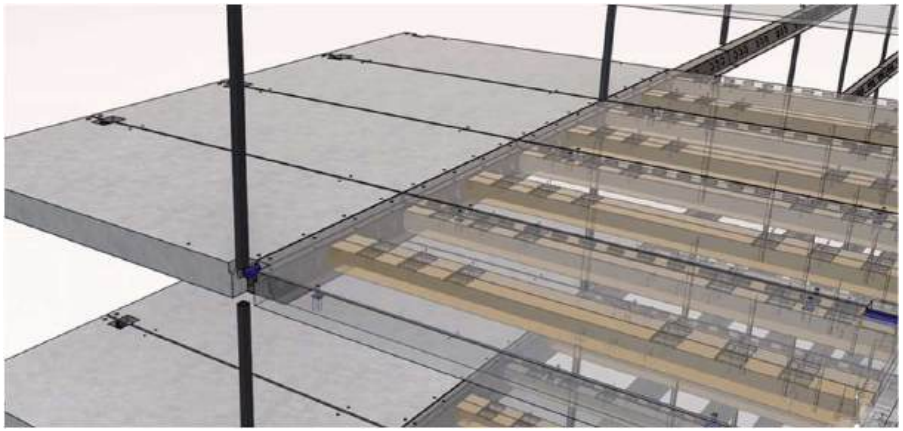
Design for Manufacturing and Assembly

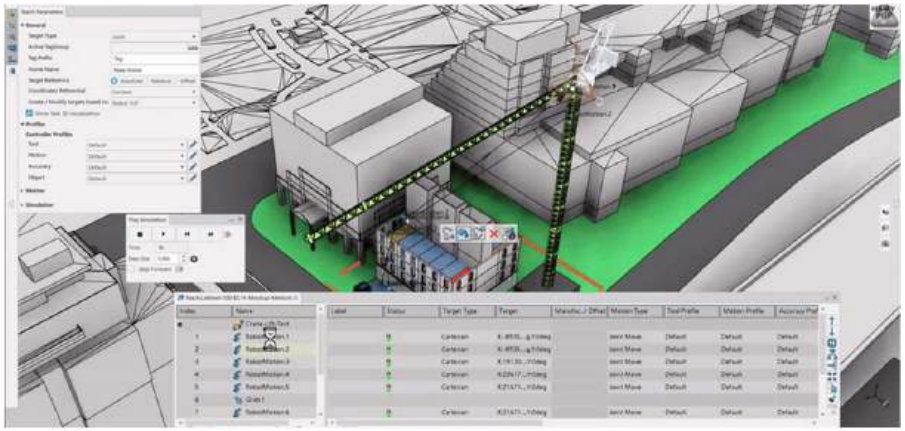
By utilizing our automated design tool, we are able to rapidly generate detailed manufacturing models that enable the extraction of precise EBOM for parts and sub-assemblies. Leveraging historical production data, we can accurately estimate costs for prefabricated assemblies.

- → Validate design through manufacture-ready models of building components
- → Determine production schedule and storage requirements
- → Create high fidelity budgets and procurement packages for prefabricated components in early design using EBOM/MBOM

Enhance program planning, decision-making, and outcomes by producing activity-based estimates for cost, schedule, and uncertainty. Utilize a TAKT planning integrated framework, combined with validated, predictive models, to establish a standard, repeatable model-based cost engineering process tailored to the organization and the technical solutions being developed.

- → Evaluate site logistics and productivity based on unique site layout and configuration
- → Select hoisting equipment
- → Validate budget and schedule through assembly simulation





05 Cost Engineering and Proforma

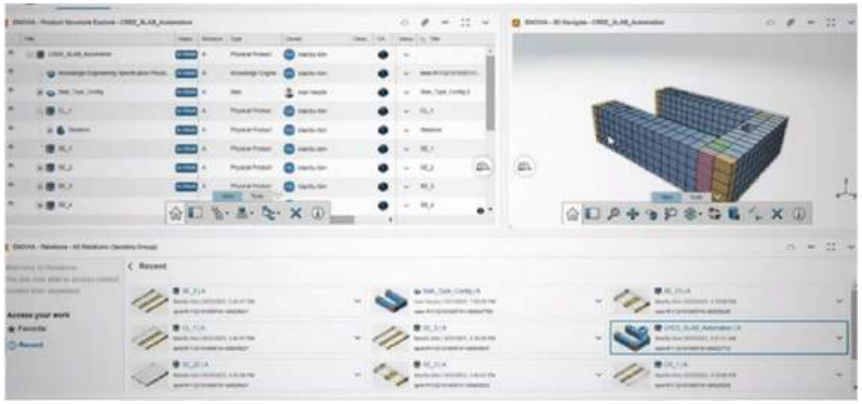
Due Diligence

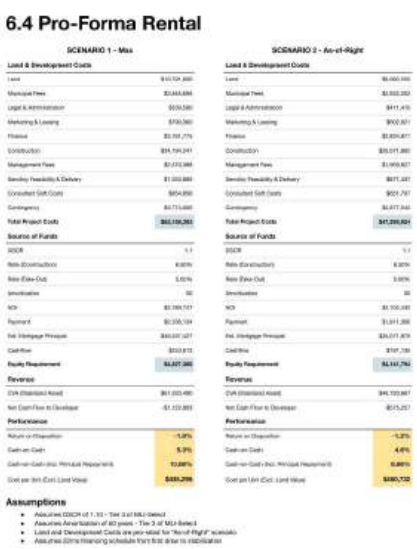
We develop defensible, fact-based cost estimates. The Cost Engineering provides the framework, models, and data required for accurate estimates. Cost engineering dynamically links cost, schedule, and uncertainty to technical requirements, including analysis, design, implementation, and verification.

- Iterate costing scenarios using a pricing catalogue of building components
- Evaluate opportunities to reduce manufacturing and assembly costs by optimizing design
- Provide detailed costs matrix from modular components
- Evaluate opportunities to reduce general conditions through resource efficiency and fast assembly

We evaluate market opportunity, test alternative proforma models (e.g. rental, condo, co-living), and leverage green incentives to create highest value development proposals for each site.

- Create a Energy modeling for life cycle assessment and green financing
- Identify suitable Green loans and incentives
- Evaluate opportunities to alternative financing, ie coliving, mixed market rate rental
- Create O&M cost for nonprofit operators
- Create a cashflow analysis for the project





Product-driven delivery

3. Bundle financing of standardized parts across multiple sites

Faster Evaluation

Steady Pipeline

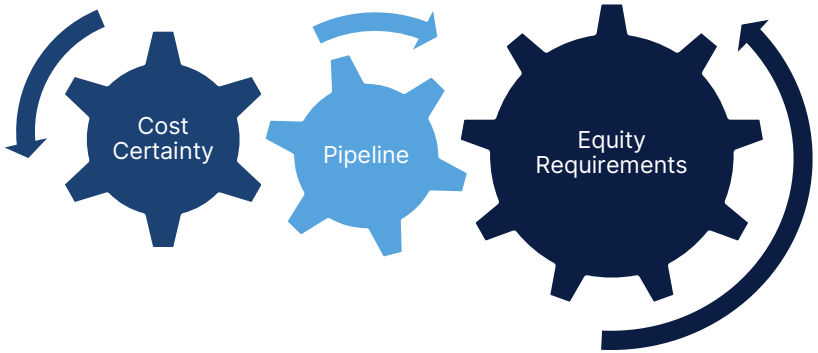
Cost Certainty

Reduced Equity Requirement

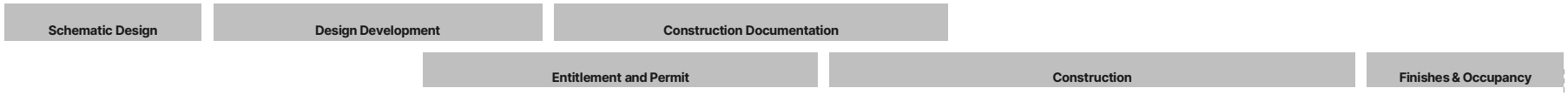
Long Term Affordability & Sustainability

Project funding gap to develop affordable housing at scale

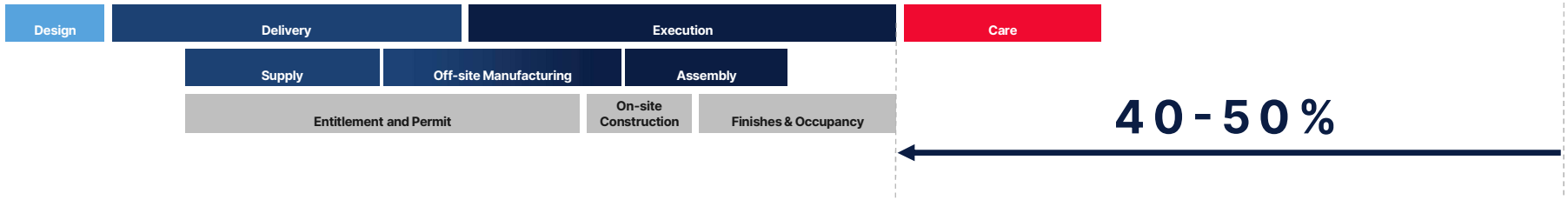
Creating a pipeline of building products to get financing moving



Traditional Construction



Multi-Site Affordable Housing Solution

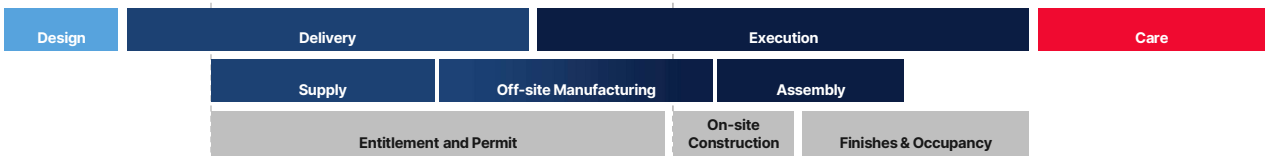


Multi-Site Affordable Housing Solution

Start of procurement for modular parts

Pre-Construction Financing to cover procurement, manufacturing and assembly costs of modular construction

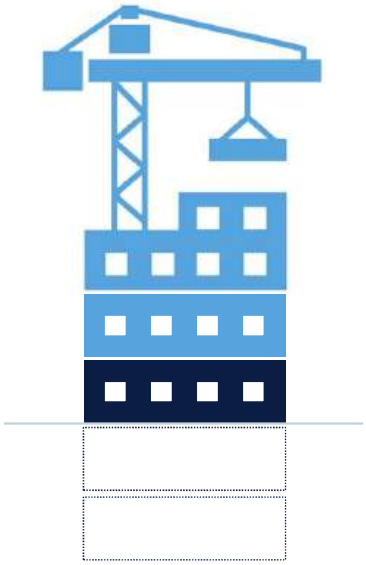
Funds from Construction Financing becomes available



Decoupling project-based risk

Co-mingled Project-based Risks:

- Market
- Supply Chain
- Project Team
- Regulatory
- Construction



Decoupled Controlled, Non-Project-based Risks:

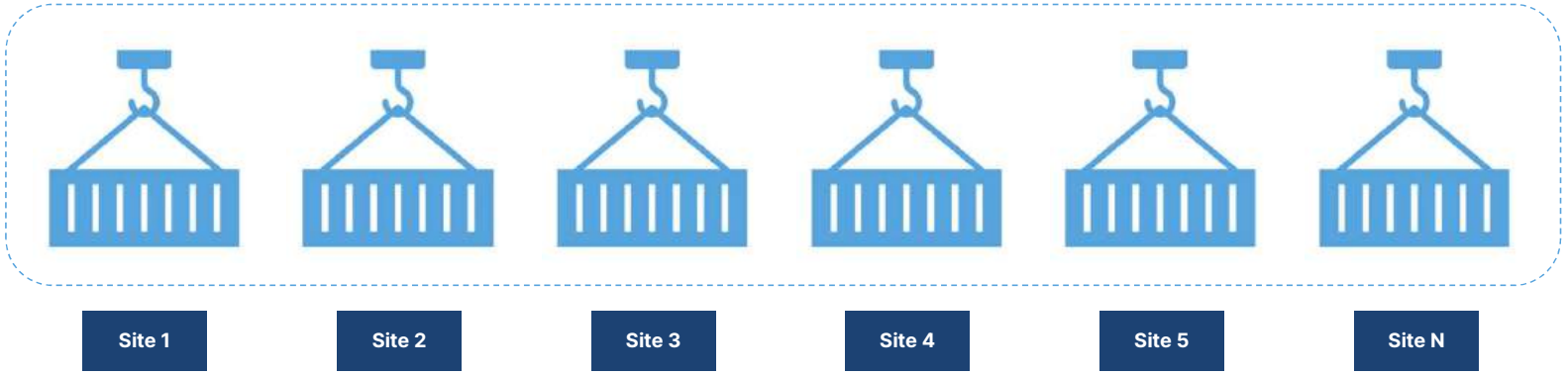
- Standard products
- Manufactured off-site
- Reusable across multiple sites

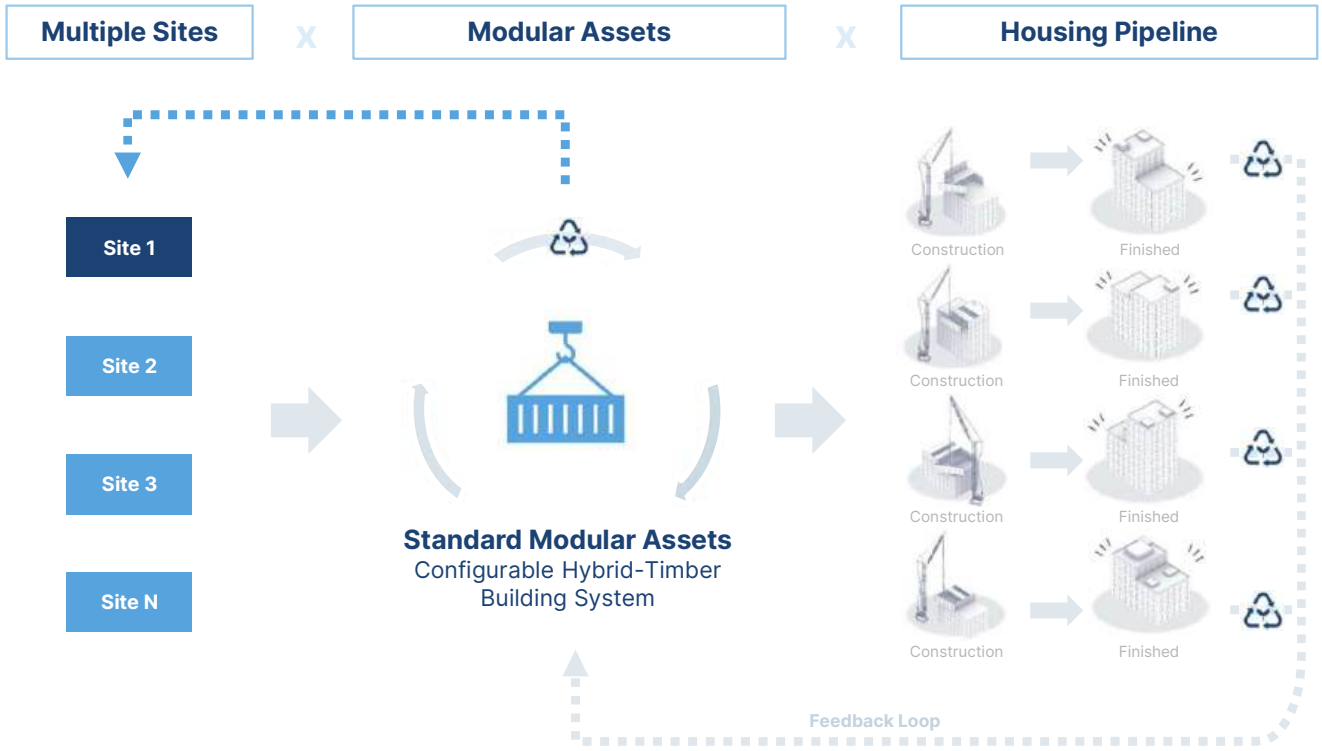
Globally-proven and certified modular system

Investing against modular assets across a portfolio of affordable housing

- ✓ Environmental
- ✓ Social
- ✓ Governance

Bundling the funding needs across multiple sites




Multiple Sites
x
Modular Assets
x
Housing Pipeline
Site 1
Site 2
Site 3
Site N
Standard Modular Assets
Configurable Hybrid-Timber
Building System
Construction
Finished
Construction
Finished
Construction
Finished
Construction
Finished
Feedback Loop


Q&A
The Way Forward is Together