



OPENING THE PLAYBOOK ON MODULAR DESIGN

World of Modular 2023

2023 **WORLD OF
MODULAR**
ANNUAL CONFERENCE & TRADESHOW

x **EVstudio**
architecture : engineering : planning

PRESENTER



**Dean Dalvit, AIA, PE,
Founding Principal EVstudio**

design@evstudio.com

www.evstudio.com



[Twitter: evstudioaep](https://twitter.com/evstudioaep)



[Facebook: EVstudioAEP](https://facebook.com/EVstudioAEP)



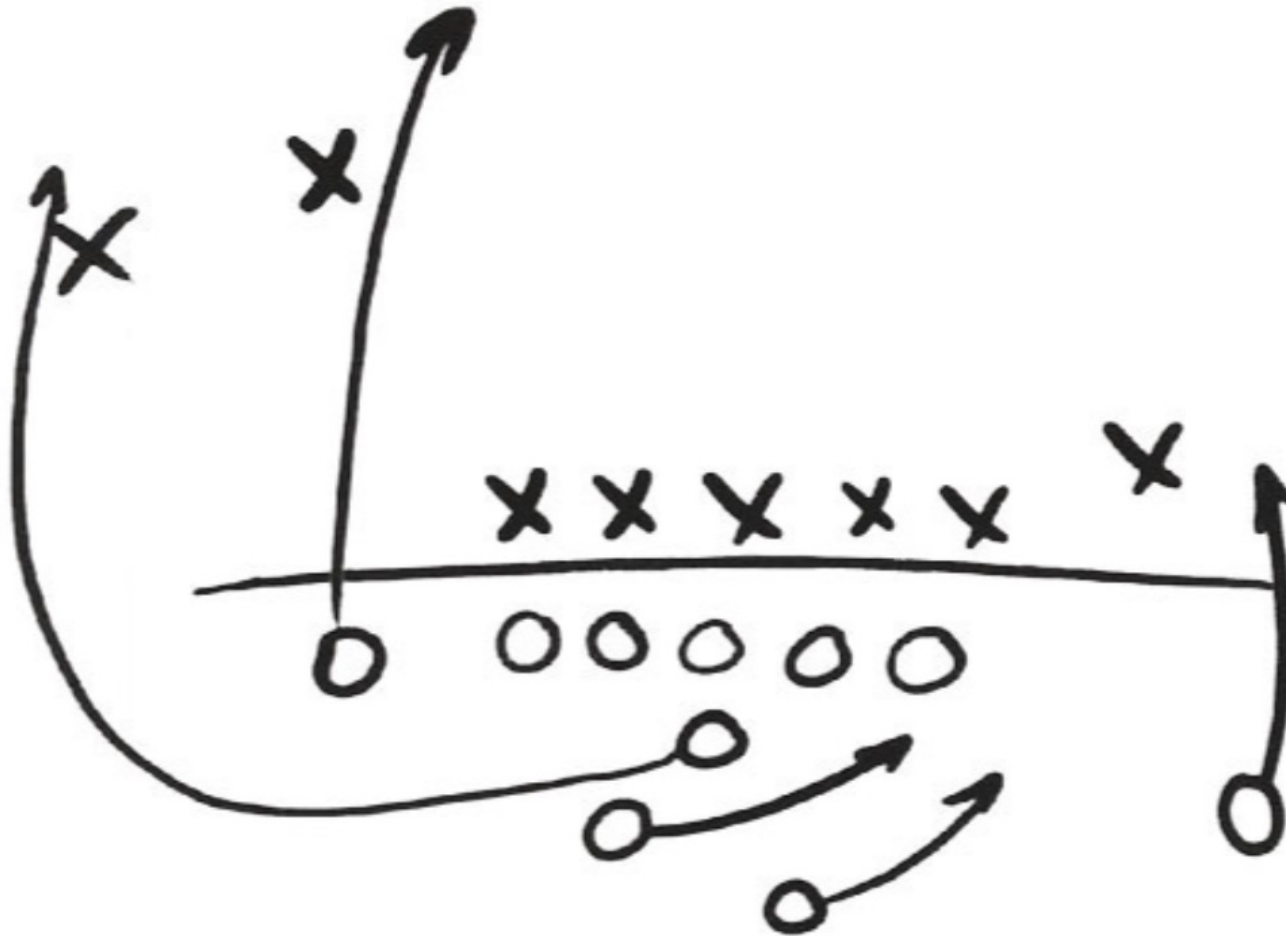
[LinkedIn: deandalvit](https://linkedin.com/in/deandalvit)



[Instagram: @evstudioae](https://instagram.com/evstudioae)

OPENING THE PLAYBOOK:

Architecture and Engineering Design for Success in Modular Development



Offense:

Owner / Developer

Factory

General Contractor

A/E Design Team

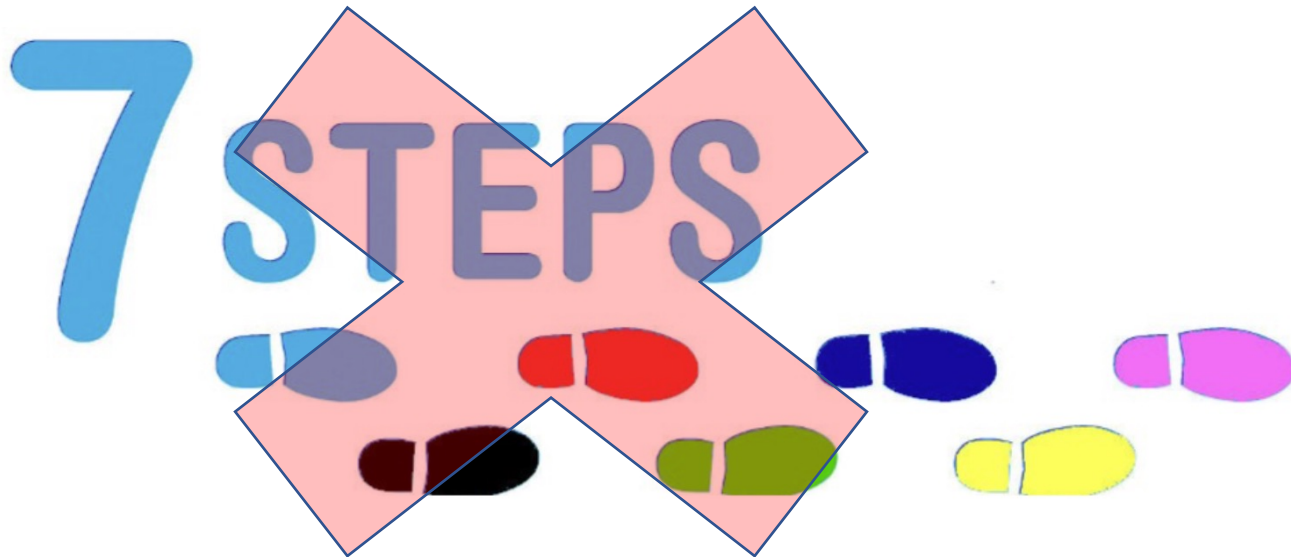
Defense:

Traditional Design

Approach

No Cute Acronyms or Secret Steps

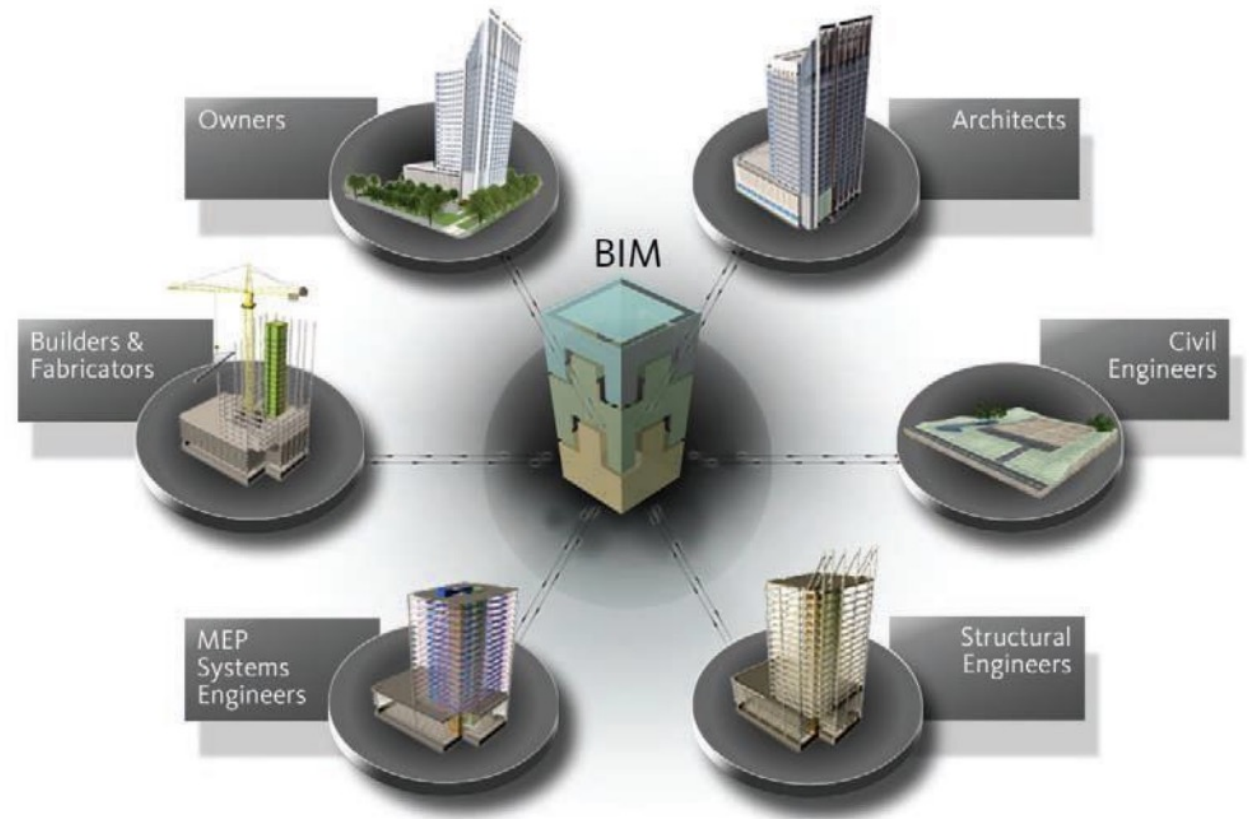
- If this was easy, everyone would be doing it
- Truth is, it's not for everyone
- We're developing this playbook to help, because there isn't one



OPENING THE PLAYBOOK:

Barriers to Design Industry and Factory Insourcing

- Access to all necessary disciplines in real time
- Management of 5-8 design disciplines
- Not tailored to systems and workflows the industry is used to working with



OPENING THE PLAYBOOK:

What to Expect for Design and Documentation Effort



- More upfront work
- More coordination
- More stakeholders
- More time
- No such thing as “Field Verify”

OPENING THE PLAYBOOK:

...And Twice as Many Jurisdictions to Work With

- Two separate sets to create and manage
- Typically three times the reviews
- State set
- Local set
- Third party reviews



HAVE A DOCUMENT MANAGEMENT PLAN

OPENING THE PLAYBOOK:

Team Approach and Strategy

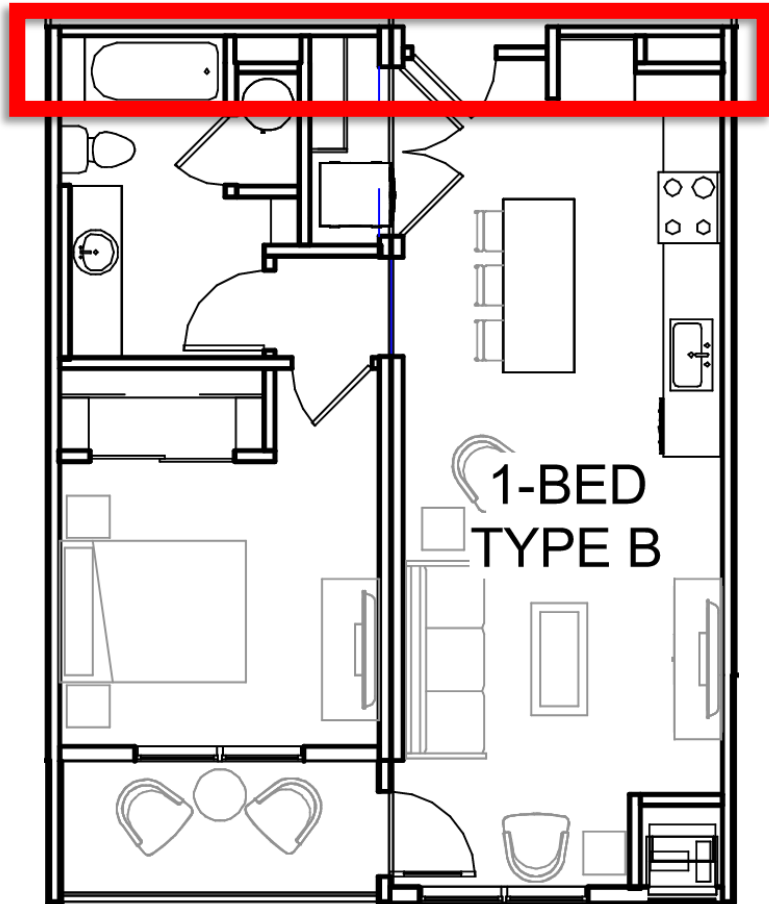
- Team experience
- Modular design needs
- Desire
- Responsibility matrix

RED outlined documents are available for download on EV's website at www.evstudio.com/modular

Architectural Services Responsibility Matrix					
Coordinating Design Teams:		EVstudio		Exhibit: N/A	
EVstudio (EV)				Last Modified 12/1/2021	
TBD Arch					
Factory					
Project: Template					
Design Phase	Construction Scope	LOD	Primary Scope	Secondary Scope	Revit Model Management
Entitlements / Planning	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	EV	N/A	N/A
Project Management / Schedule Development	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	EV	N/A
Specification Development - Finishes	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	EV	N/A
Compliance Docs (LEED, Energy, Title 24, etc)	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	EV	Factory	N/A
Consultant Engagement	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	N/A	N/A
Design Change Log Management	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	N/A	N/A
Exterior Skin Design	Site-Built	N/A	EV	N/A	EV
	Factory-Built	N/A	N/A	N/A	N/A
Schematic Design	Site-Built	100	EV	N/A	EV
	Factory-Built	100	EV	Factory	EV
Design Development	Site-Built	200	EV	N/A	EV
	Factory-Built	200	EV	Factory	EV
Construction Documents	Site-Built	200	EV	N/A	EV
	Factory-Built	200	Factory	EV	Factory
Permit Submittal Management	Site-Built	N/A	EV	N/A	EV
	Factory-Built	N/A	Factory	EV	Factory
Bid Assistance	Site-Built	N/A	N/A	N/A	N/A
	Factory-Built	N/A	N/A	N/A	N/A
Construction Coordination	Site-Built	350	N/A	N/A	N/A
	Factory-Built	350	Factory	N/A	Factory
Component Shop Drawings	Site-Built	400	N/A	N/A	N/A
	Factory-Built	400	Factory	N/A	Factory
Modular Shop Drawings	Site-Built	400	N/A	N/A	N/A
	Factory-Built	400	Factory	EV	Factory
Construction Administration	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	EV	N/A
RFI Responses	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	N/A	N/A
Jobsite Visits	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	N/A	N/A
Manage RFI Process	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	N/A	N/A
Shop Drawing Review	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	EV	N/A
Product Specification Review	Site-Built	N/A	EV	N/A	N/A
	Factory-Built	N/A	Factory	EV	N/A

OPENING THE PLAYBOOK:

Get Comfortable with Means and Methods



- Entirely different way of thinking than we've been trained
- Total integration of everything
- Example: Plumbing chase in or out of wall impacts floor plan and critical Type B unit clearances

OPENING THE PLAYBOOK:

The Process—Modular Deliverables and Scope Add Analysis

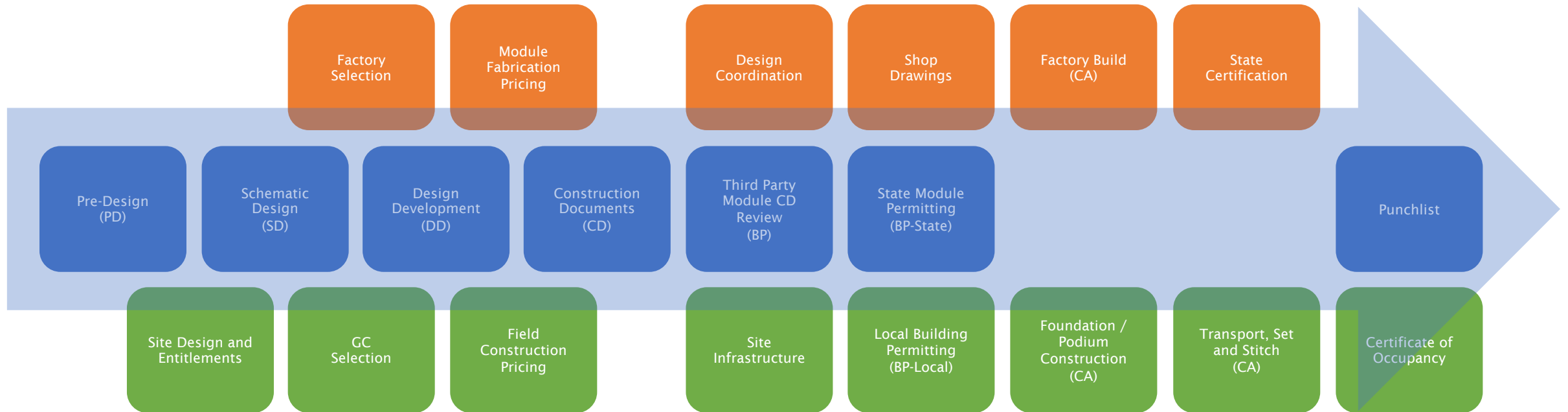
- Proper Design Sequencing is critical to avoiding endless redesign and delays in permit set delivery

RED outlined documents are available for download on EV's website at www.evstudio.com/modular



OPENING THE PLAYBOOK:

The Process



OPENING THE PLAYBOOK:

Swim Lane Map

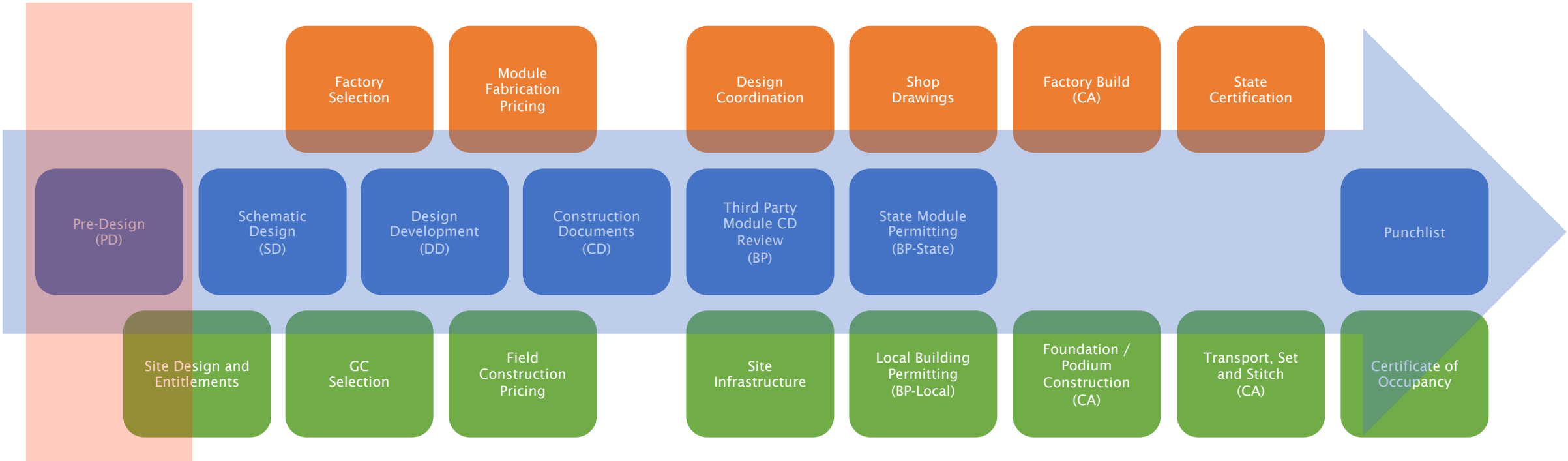
Schematic Design Phase (SD)				Design Development Phase (DD)				Construction Documents Phase (CD)	
SD1	SD2	SD3	SD4	DD1	DD2	DD3	DD4	CD1	CD2
Signed Contract and/or PO	Assemble Master Set Plans	Master Set Design Lock and engineering kick-off	Building Permit Pre-app	Model Release	Documentation	Peer Review	Detail Review	Department Review	Upload ITR set

Schematic Design Phase (SD)				Design Development Phase (DD)				Construction Documents Phase (CD)	
SD1	SD2	SD3	SD4	DD1	DD2	DD3	DD4	CD1	CD2
Signed Contract and/or PO	Assemble Master Set Plans	Master Set Design Lock and engineering kick-off	Building Permit Pre-app	Model Release	Documentation	Peer Review	Detail Review	Department Review	Upload ITR set

Architecture		
Steps	Project Scope and with PM	<ol style="list-style-type: none">1. Review Project Scope and Schedule with PM2. Set up Project Revit file for each Master3. Research all applicable local and state building codes and document them on Project Cover Sheet3. Assess any deviations from state set for plans or specs, document them on cover sheet and alert FW
Receivables		<ol style="list-style-type: none">1. Signed Contract and/or PO
Deliverables	or non-MSA scope to PM	

Phase 1 – Pre-Design (PD)

Pre-Design (PD)



OPENING THE PLAYBOOK:

Get Off on the Right Foot

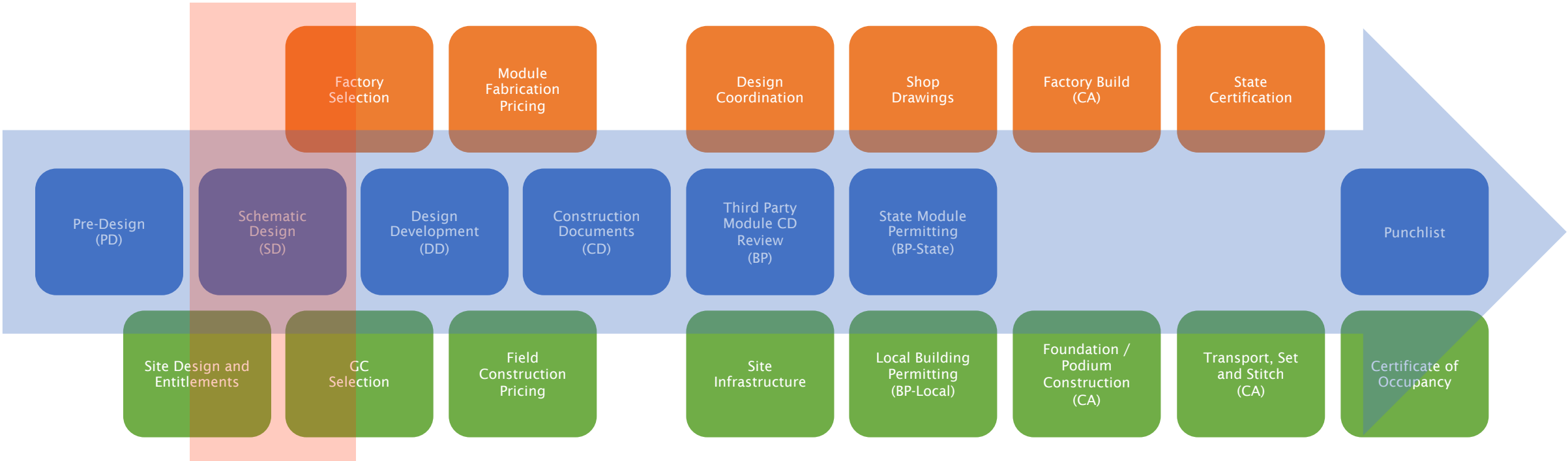
Pre-Design
(PD)

- Site feasibility should contemplate a modular layout
- Demising plan to accommodate modules
- Work out unit mix and count
- Building geometry to anticipate grid spacing
- Uniform geometry



Phase 2 - Schematic Design (SD)

Schematic Design (SD)



OPENING THE PLAYBOOK:

Offsite Construction Constraints

Schematic
Design
(SD)

- Factory limitations
- State DOT regulations
- Site limitations
- Field work

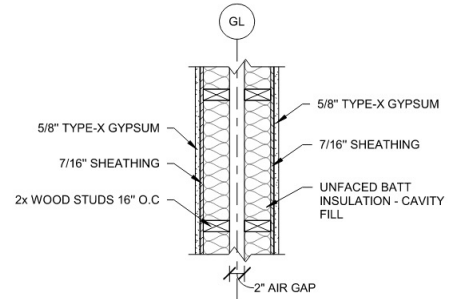


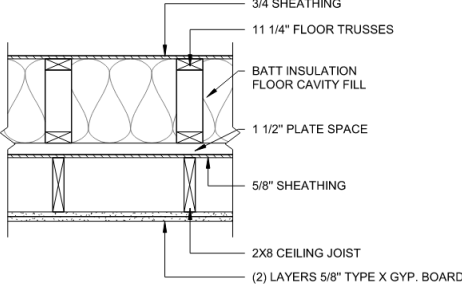
OPENING THE PLAYBOOK:

Design From Inside Out

Schematic
Design
(SD)

- Assemblies and subassemblies
- Start with the kit of parts
- Build plans around a defined design palette and common language
- Nearly opposite of the typical outside in design approach

MD1-X	MATEWALL PARTITION 1-HR RATED		
			
FIRE ASSEMBLY	MARK	STC	ASSEMBLY NOTES
GA FILE NO. WP 3370 "GENERIC" (TL-93-270)	MD1-4	58	2x4 WOOD STUDS

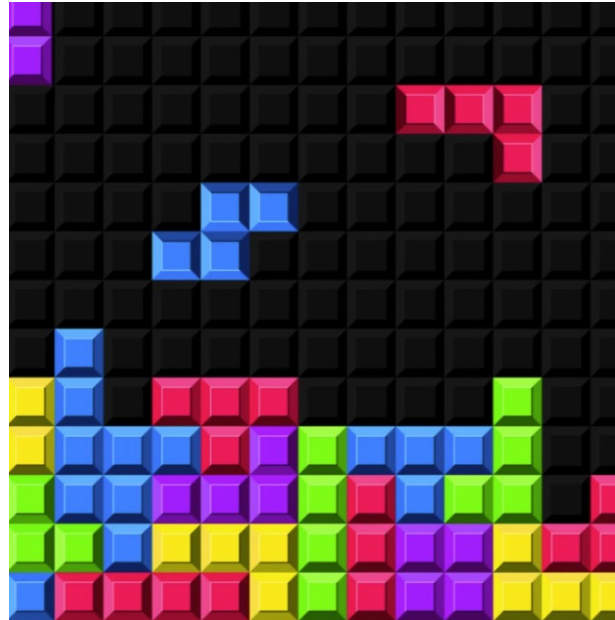
FB1	FLOOR/CEILING ASSEMBLY 1-HR RATED		
			
FIRE ASSEMBLY	MARK	STC	ASSEMBLY NOTES
2018 IBC TABLE 721.1(3) ITEM 21-1.1	FB1	---	FLOOR/CEILING SYSTEM PER 2018 IBC 721.1(3), ITEM 21-1.1

OPENING THE PLAYBOOK:

Tetris Game

Schematic
Design
(SD)

- Kit of parts
- Building blocks for unit plans
- Unit plans assemble to form building plans
- Building massing
- Iterate



OPENING THE PLAYBOOK:

If Starting From a Previous Concept...

Schematic
Design
(SD)

#	Criteria	Current	Potential	Description
1	Module Orientation	0	0	Module orientation is parallel with gridlines wherever in-situ modules & crosswalls. Center loaded. Consider Design if Applicable.
2	Module Widths Standardized	0	0	Max 20 Module Widths throughout Project. Min 10 Module Widths throughout Project or projects according to SD Modules.
3	Module Square Footage Maximized	0	0	Maximized square footage throughout modular. Reduce total square footage for factory portion. Packaged transportation and lift fees.
4	Module Type Standardized	0	0	Max 20% unique Module Types.
5	Module Complexity	0	0	Vertical Angles, Complex or Non-Traditional Framing Layouts.
6	Building Complexity	0	0	Vertical Angles, clear spans, corner conditions or highly complex Module Layouts.
7	Modular Assemblies Implemented	0	0	Floor / Wall / Ceiling Assemblies Integrated. Building Height & Width Adjusted.
8	Stair & Elevator Shafts Coordinated with Module Layout	0	0	Factors Bulk Shafts are designed within gridlines. Bulk Shafts are coordinated with Modules.
9	MEP Accommodations	0	0	MEP are located in proximity to Access Points. Thickness walls / shafts integrated for MEP routing.
10	Module Articulation & Finishes to Accommodate Tolerances	0	0	Consider wall articulations. Interior Clearings Provide Good Finishes. Exterior Facade accommodates Module Girdlines.
Total		0	0	Out of 10 possible points

Analysis	Score
This score would indicate that the Building does not take the key elements for efficient fabrication or Modular Construction. As the analysis focuses on Building Layout only, other factors may contribute to the viability of Modular Construction for this selected project.	0-3 Points
As this score is in the mid-range of available points, it indicates that the Building Design is viable for Modular Construction, however may not recognize the full value and efficiencies that a higher score would benefit from.	4-6 Points
As this is the most common range for Modular Projects, it indicates that the Building Design incorporates many of the feasibility criteria and will facilitate an efficient fabrication process.	7-8 Points
A top rating indicates that the Building Design incorporates all attributes required to maximize the efficiency and benefits associated with Modular Construction. The building layout incorporates thoughtful design standards associated with Design for Manufacture and Assembly best practices.	9-10 Points

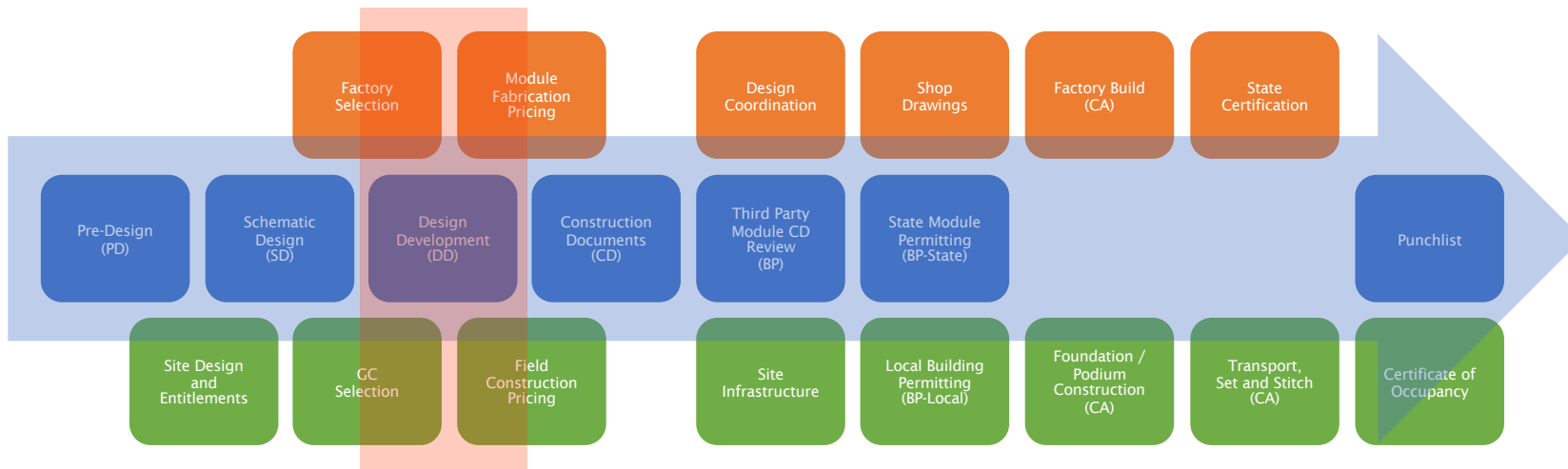
The Feasibility Scorecard and Associated Consulting Services are being provided as an advisory consultant for the customer listed above and does not warrant or represent any professional services or liability associated with the contractor. This Document and the Associated Content is the Property of EV Studio and is not to be duplicated or shared without written authorization.

RED outlined documents are available for download on EV's website at www.evstudio.com/modular

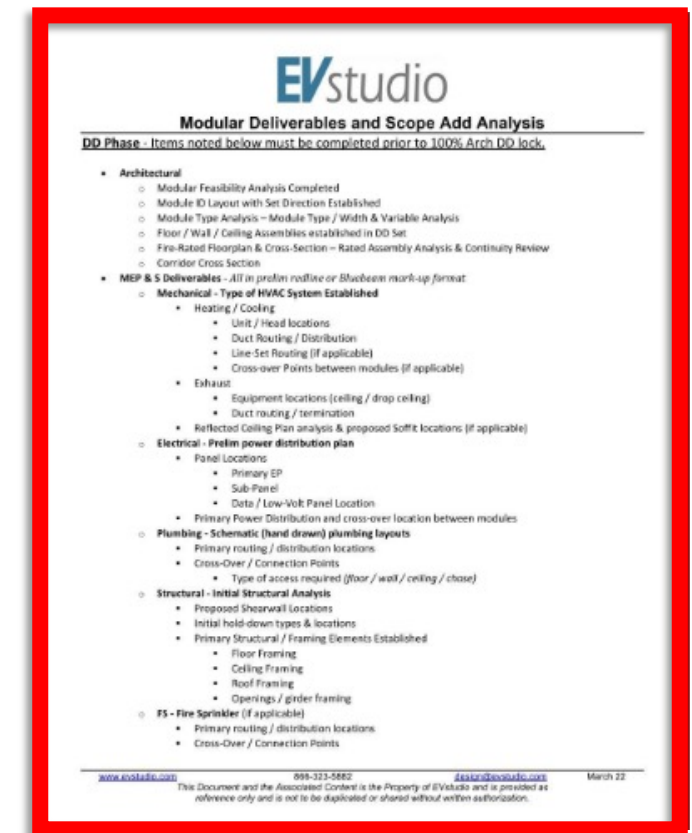


Phase 3 - Design Development (DD)

Design Development (DD)



- Develop a Design Process to compliment the manufacturing and site assembly process



OPENING THE PLAYBOOK:

Factory First

Design
Development
(DD)

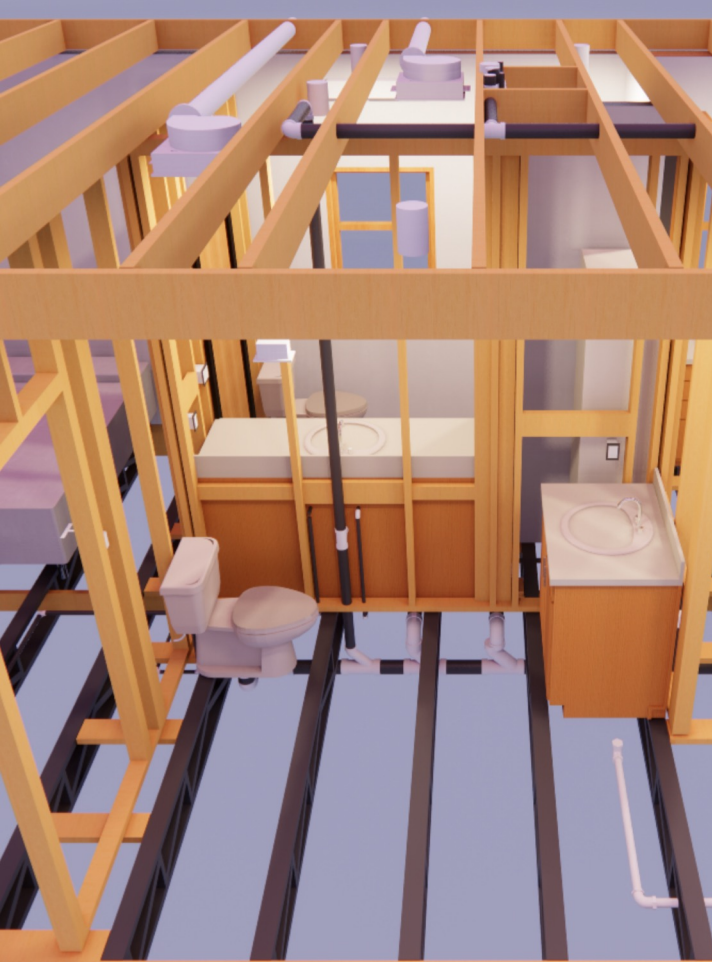


- Constraints, limitations and opportunities
- Tools, Procurement, SKUs, Logistics, SOPs
- Best not to get much further than SD Phase without a manufacturer selected

OPENING THE PLAYBOOK:

All Disciplines, All the Time

Design
Development
(DD)

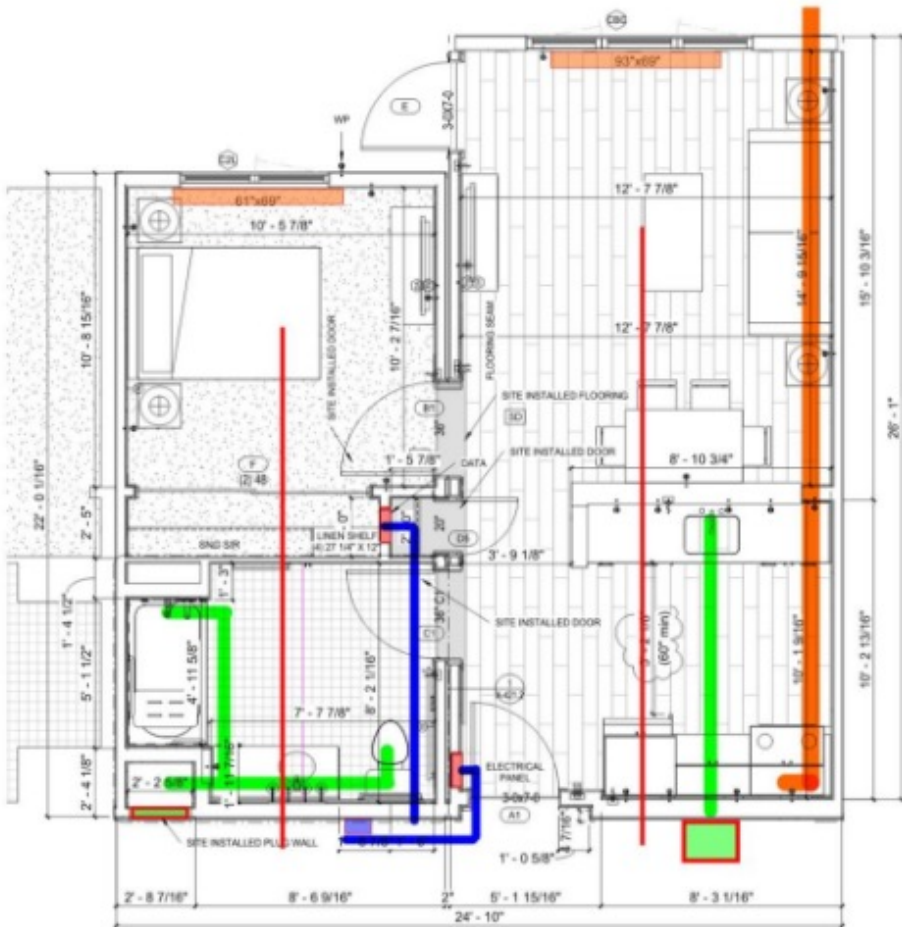


- Route MEP early and often
- Lock HVAC decisions early as they drive plan decisions
- Sort out structural conditions and constraints in the beginning
- The dreaded soffit – Example scenarios

OPENING THE PLAYBOOK:

The Process - DD Phase

Design
Development
(DD)



- Preliminary MEP routing and access locations
- Preliminary equipment layouts/locations
- Reflected ceiling and soffit locations
- Structural locations
- Sequencing discussion

OPENING THE PLAYBOOK:

Think Like the Factory

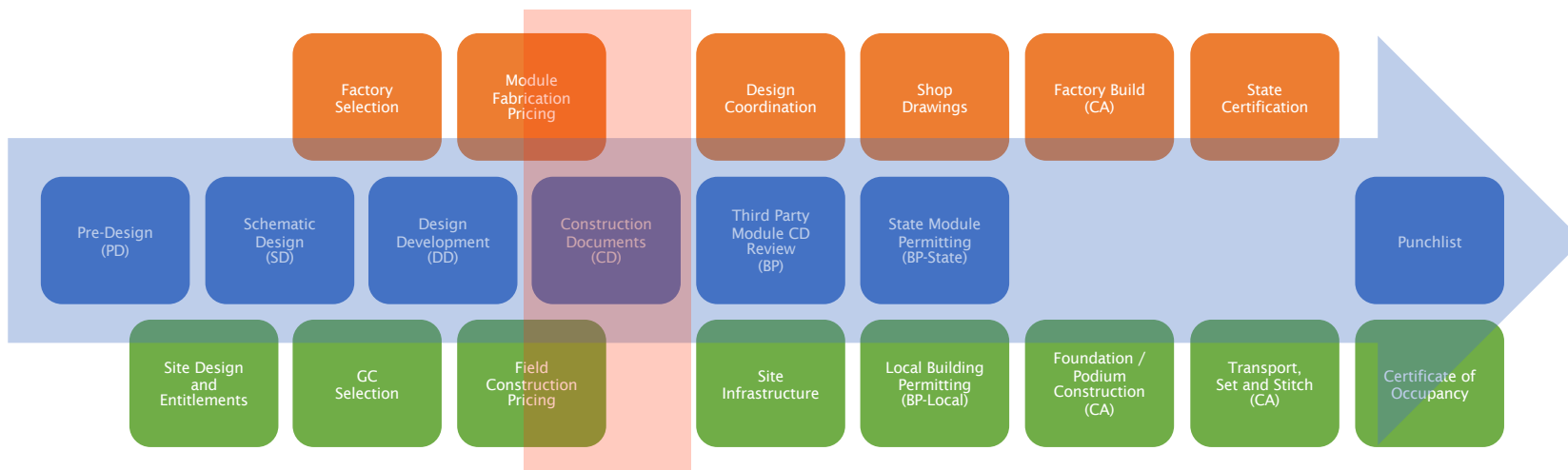
Design
Development
(DD)

- Square foot vs. velocity
- Simplicity drives velocity
- Trade offs for field vs. factory work – who should be at the table?
- What is shipped loose? Who manages the BOM? What is the responsibility of each party?
- BIM realities and limitations today
- Time spent vs. diminishing returns

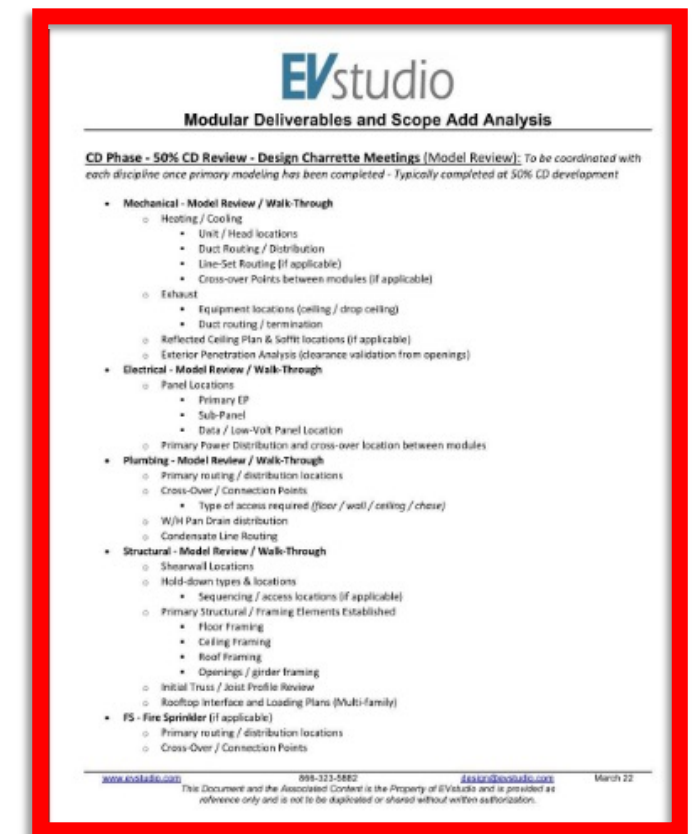


Phase 4 – Construction Documents (CD)

Construction Documents (CD)



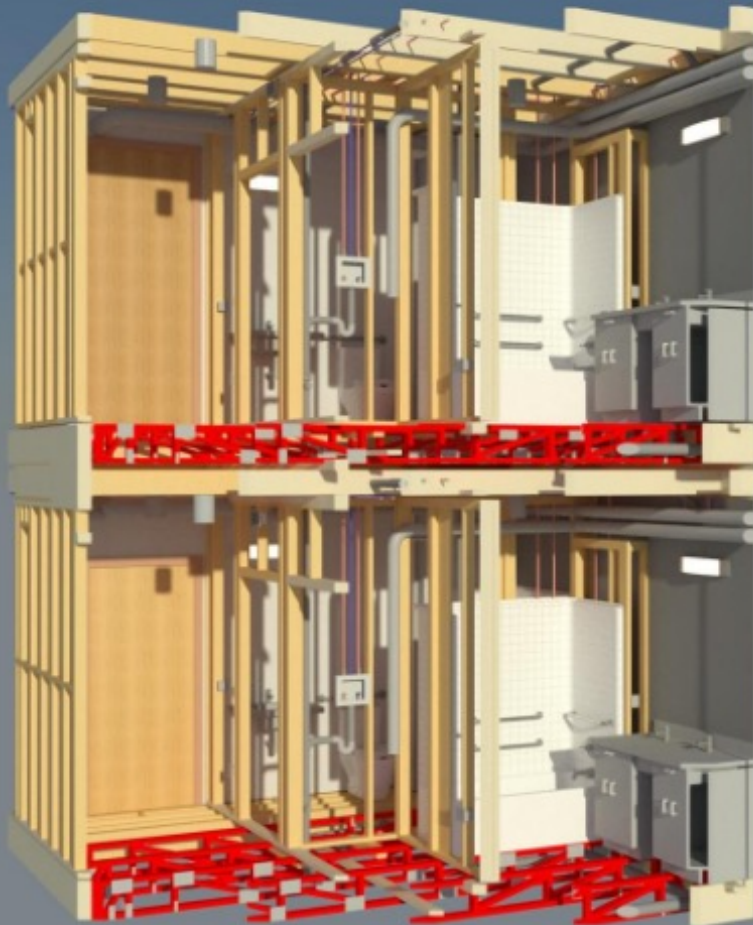
- Develop a Design Process to compliment the manufacturing and site assembly process



OPENING THE PLAYBOOK:

The Process – 50% CD Design Charrette (Model Review)

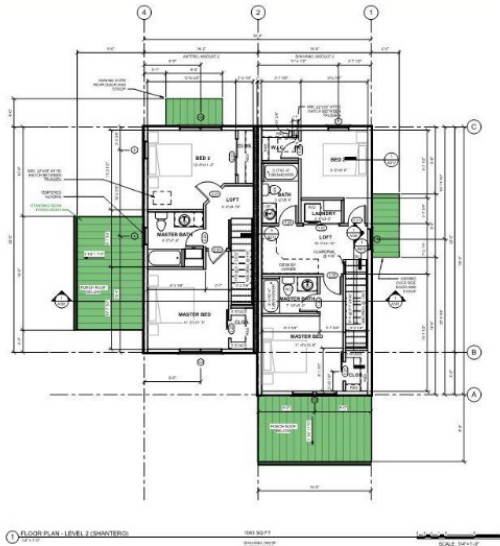
Construction
Documents
(CD)



- MEP & S Model review / walk-through
- MEP routing and distribution
- Equipment layouts/locations
- Clearance and coordination analysis

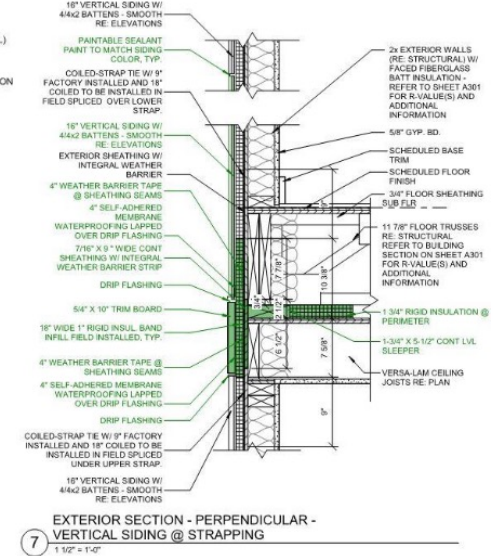
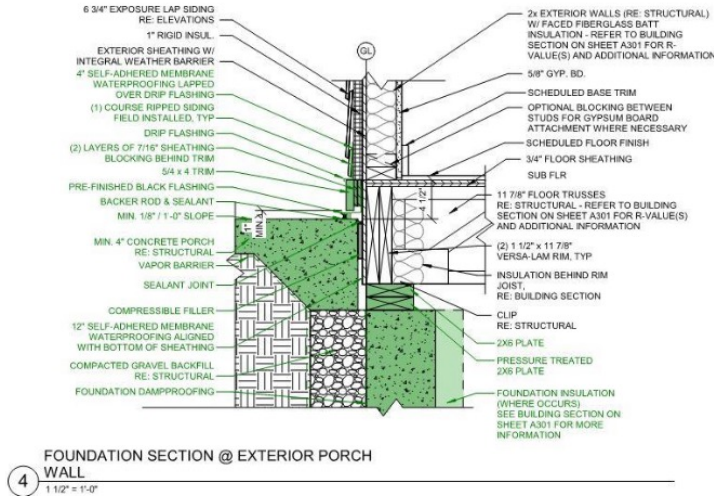
OPENING THE PLAYBOOK: The Deliverables

Construction Documents (CD)



CD Deliverables

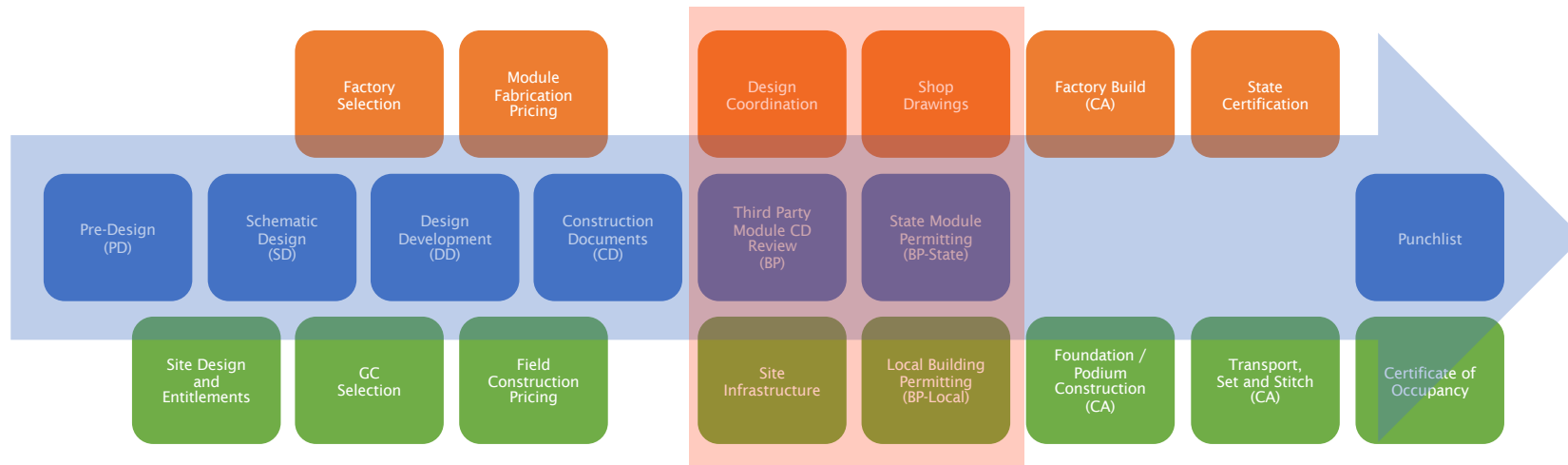
- Full Scope Delineation
- Sequencing Details
- Min. LOD 200 Revit Development



■ Scope Delineation

Phase 5 – Design Coordination and Shops

Design
Coordination



- Develop a Design Process to compliment the manufacturing and site assembly process

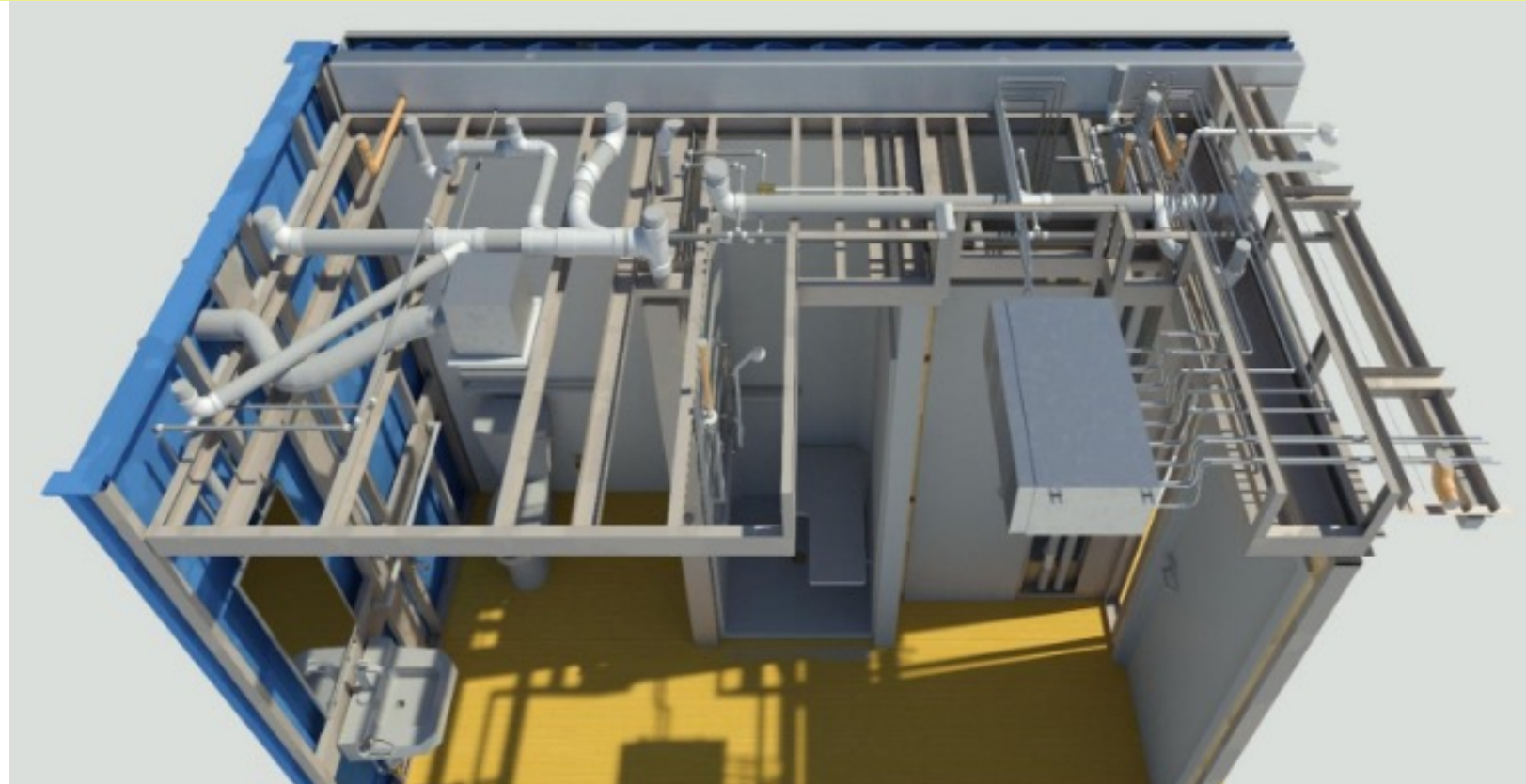


OPENING THE PLAYBOOK:

The Deliverables – Design Coordination

Design
Coordination

- Coordinated Model Development should be an integral part of the Design Deliverables



OPENING THE PLAYBOOK:

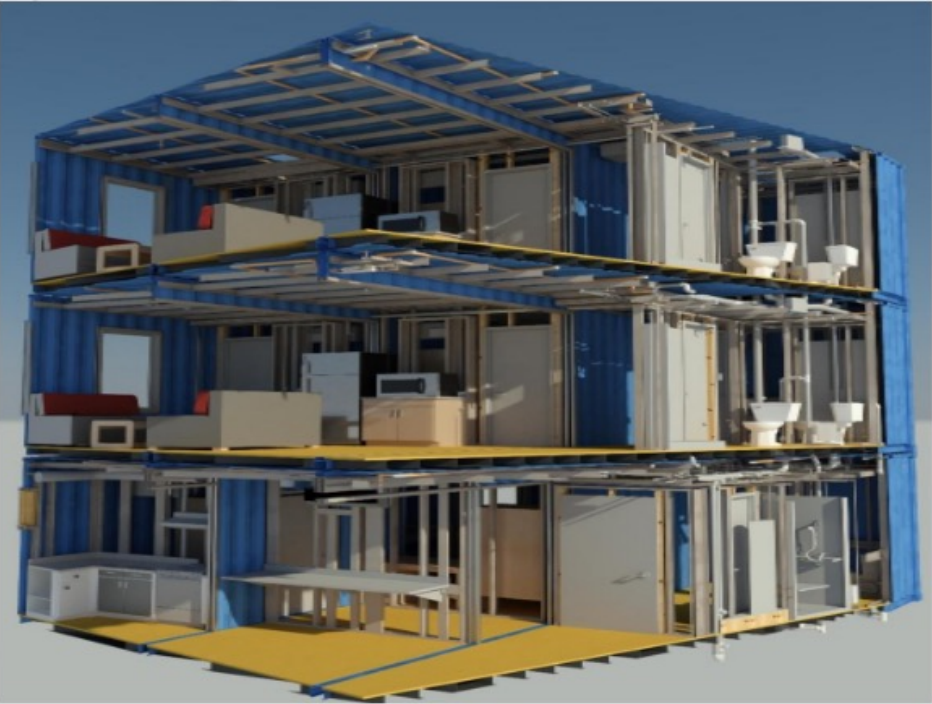
The Deliverables – Revit Model Checklist

Design
Coordination

Modular Design Docs & Revit Model Development

This Document and the Associated Content is the Property of neUdesign Architecture, LLC and is not to be duplicated or shared without written authorization.

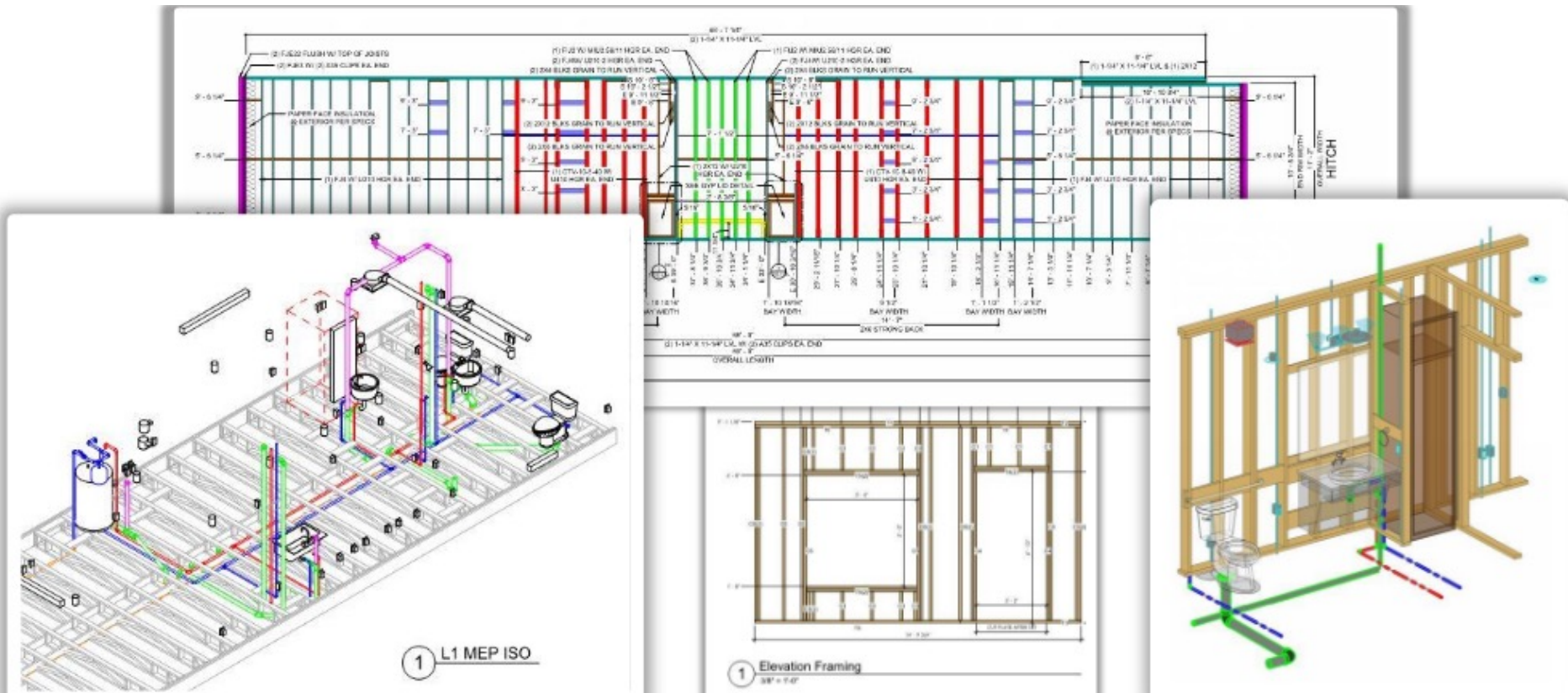
Component	Primary Scope	LOD Component					Adv. Man.
		SD	DD	CD	Design Coord.	Shops	
Building Components							
Foundation							
Hold-Downs / Imbeds	Struct		100	200	350	Shops	
Bearing Plates	Struct			200	350	Shops	
Floors							
Assembly Thickness / Massing	Arch	100	200				
Primary Structure (rims / beams)	Struct		100	200	350	Shops	
Sloped Joists / Deck Framing	Struct		100	200	350	Shops	
Joists / Trusses	Struct			200	350	Shops	
Bracing, Bridging, Strongbacks	Shops				350	Shops	
Hangers	Shops				350	Shops	
Temp Framing / Sheathing	Shops					Shops	
Insulation	Arch			Draft		Shops	
Decking	Arch			200	350	Shops	
Underlayment	Shops				350	Shops	
Finishes	LVT Arch			Draft			



Revit Model Checklist

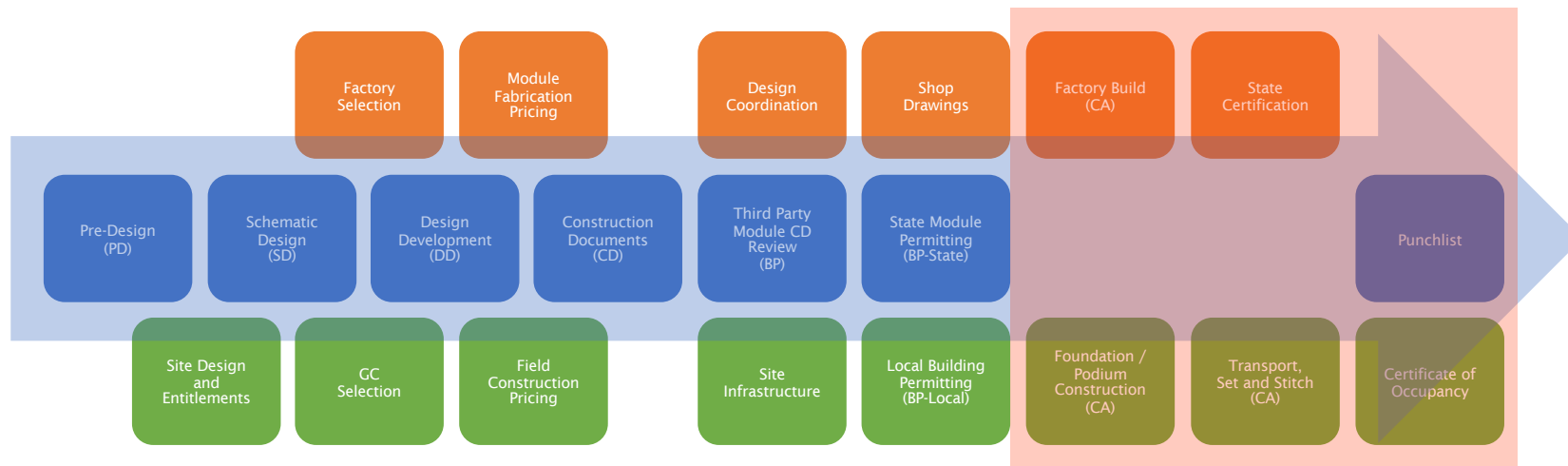
OPENING THE PLAYBOOK: The Deliverables – Shop Drawings

Shop
Drawings

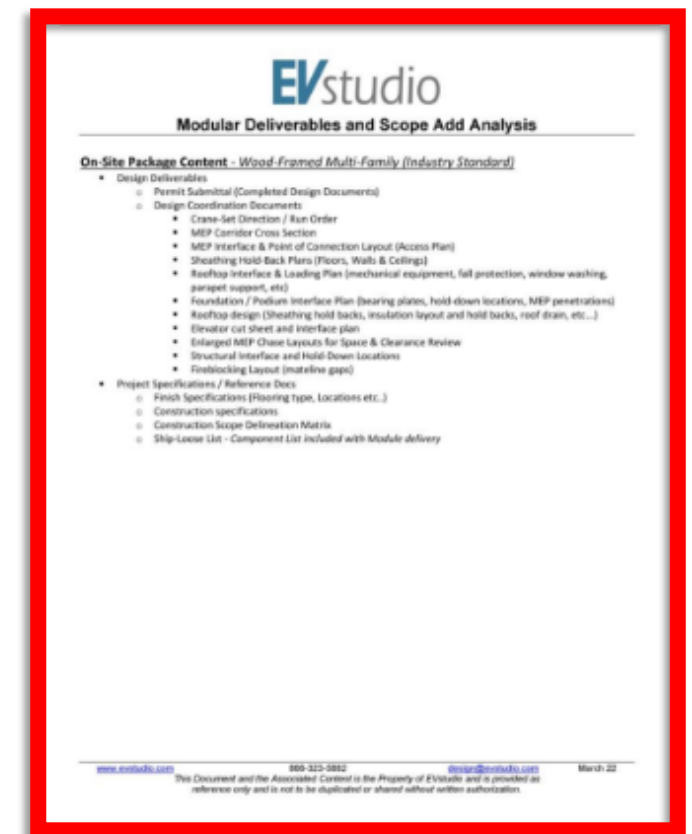


Phase 6 – Fabrication, Transport, Set, and Stitch

Transport,
Set, and Stitch
(CA)

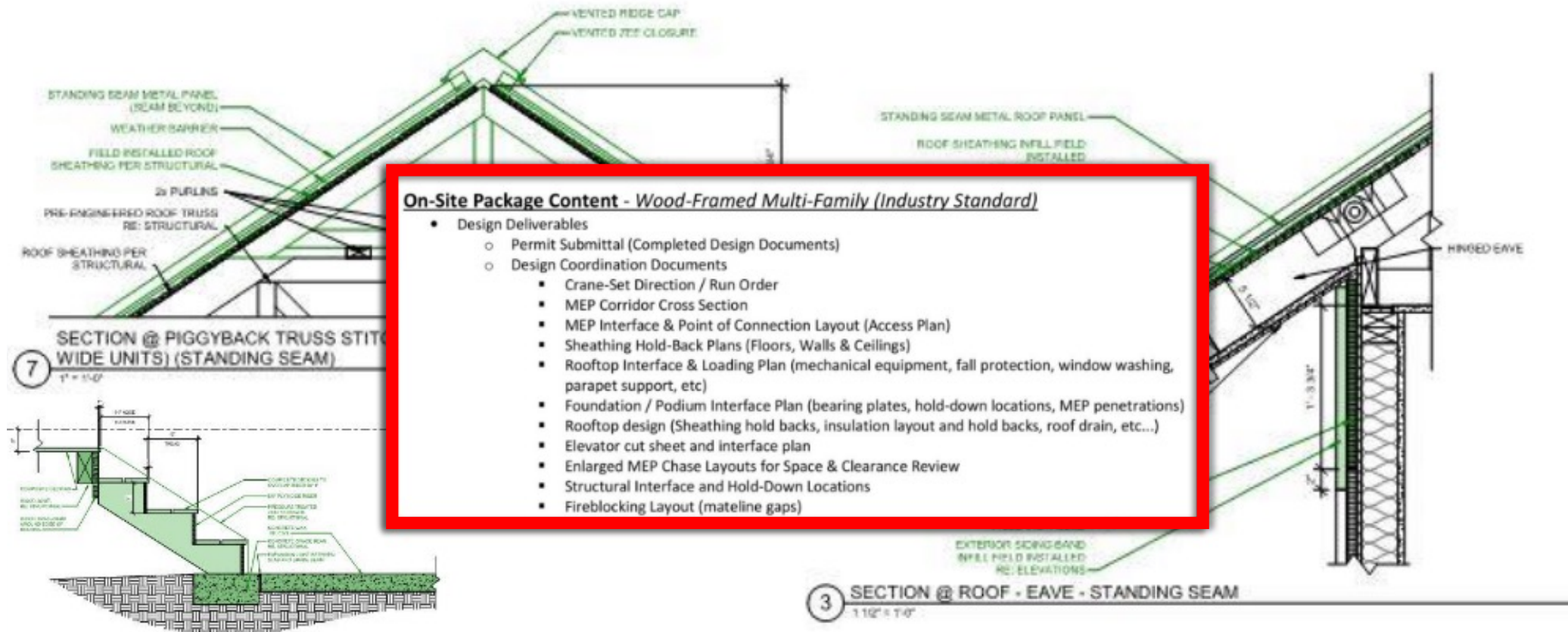


- Develop a Design Process to compliment the manufacturing and site assembly process



OPENING THE PLAYBOOK: The Deliverables – Transport, Set, and Stitch

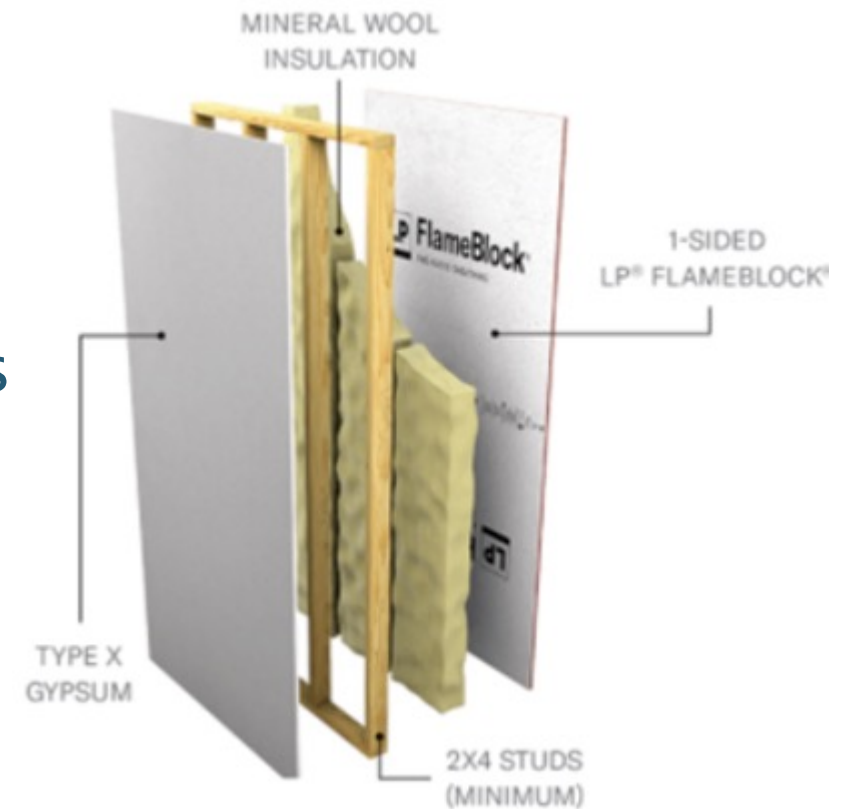
Transport,
Set, and Stitch
(CA)



OPENING THE PLAYBOOK:

Standards

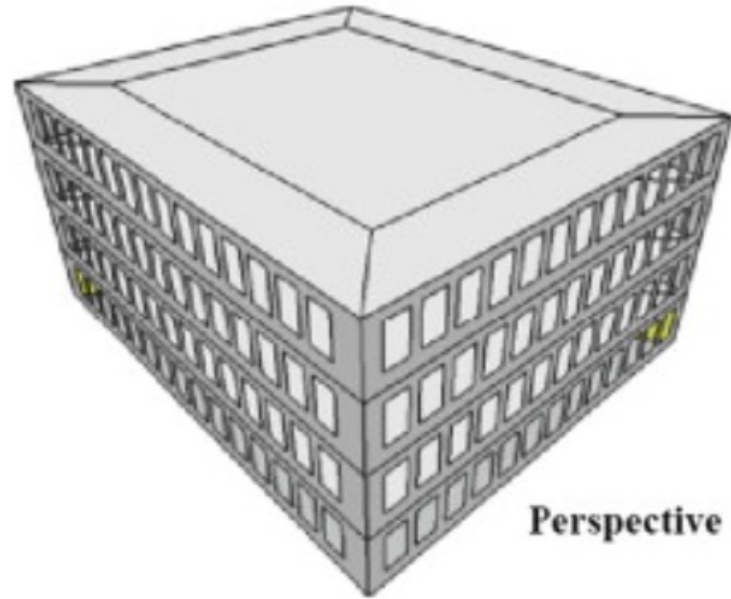
- What standards?
- What the Modular Industry must do to thrive
- A tale of three floor/ceiling assemblies
- An appeal to MBI to standardize basic elements and best practices
- Provide resources freely to the design and development community
- Open real opportunities for innovation
- Work together to expand the Playbook



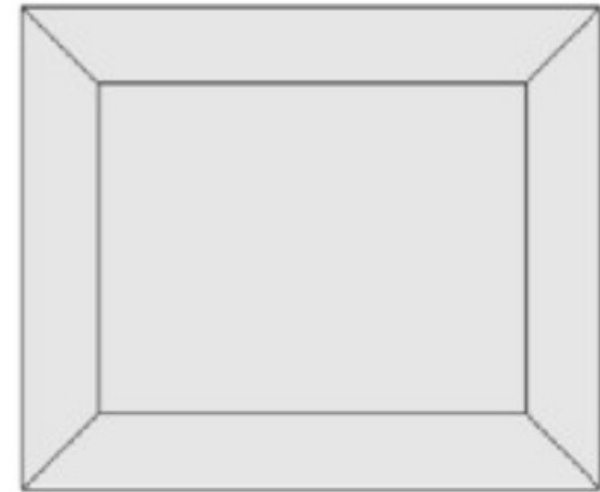
OPENING THE PLAYBOOK:

The Stigma of Modular

It doesn't have
to be this way



Perspective



Plane

A simple rectangular building.

OPENING THE PLAYBOOK:

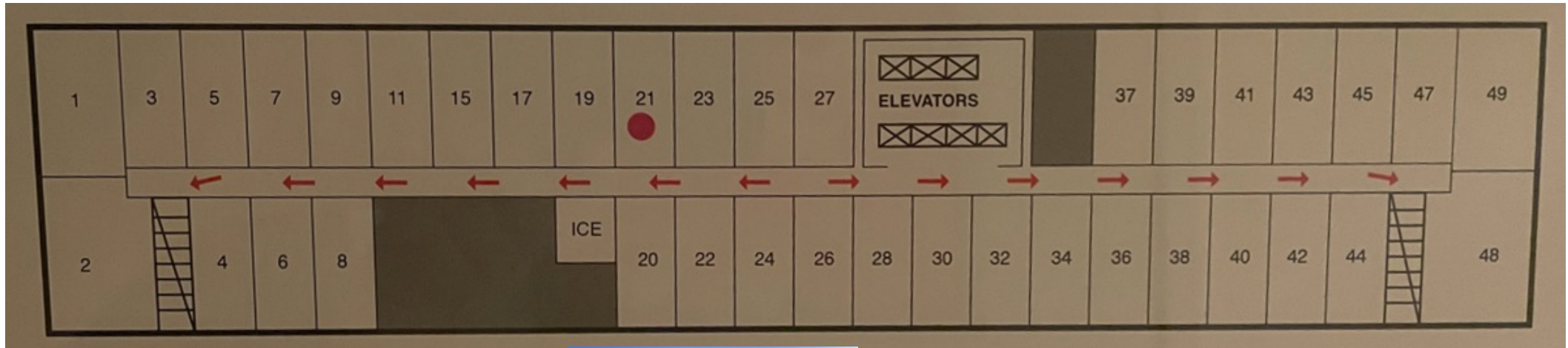
Anything is Possible.



- Repeat vs. Custom with variables
- Unit stacking
- How to maintain variety?
- Breaking mass
- Field cladding
- Roofs, Decks, Awnings..

OPENING THE PLAYBOOK:

Embrace Patterns

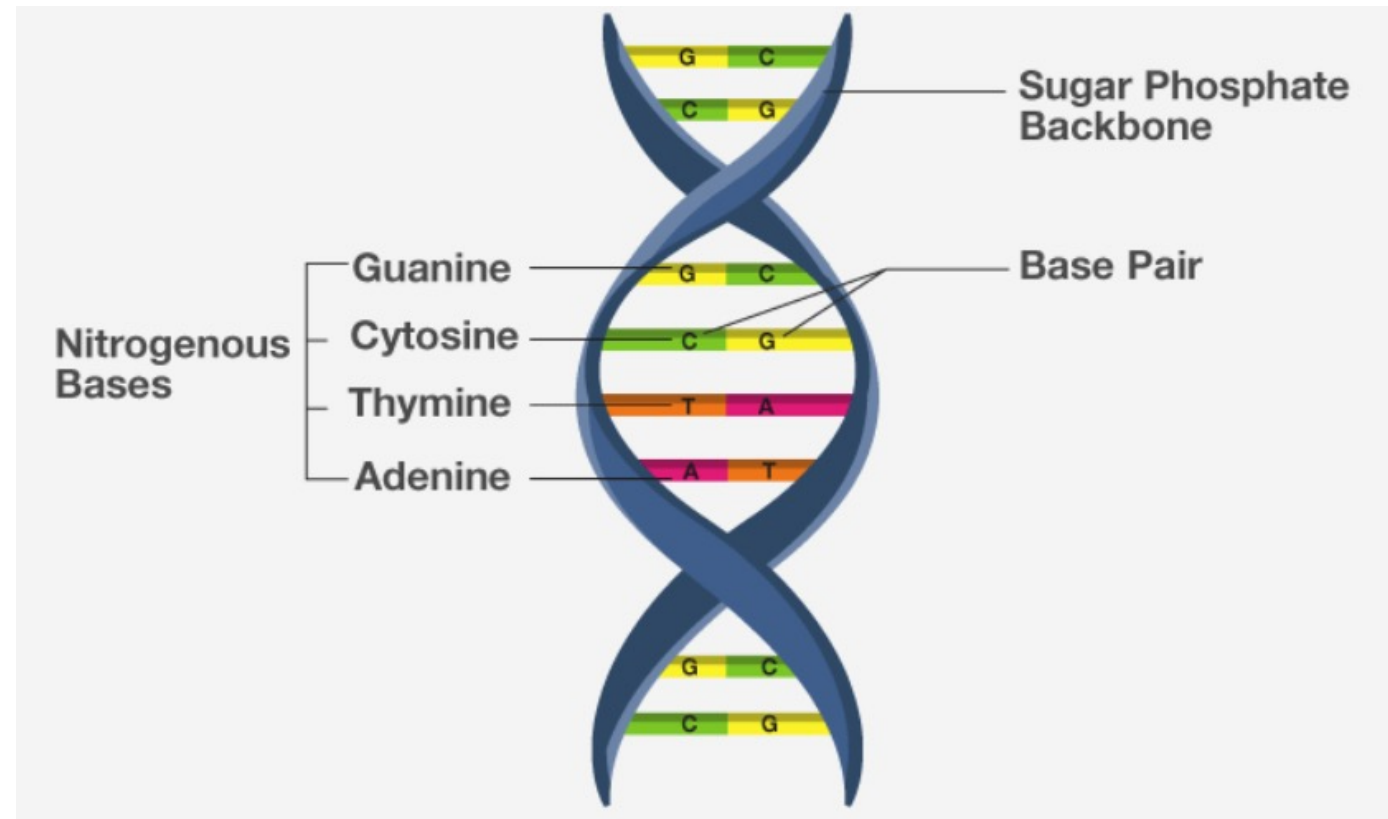


Strong Architecture is
based in strong patterns

OPENING THE PLAYBOOK:

How does DNA do it?

- Four chemical compounds, seemingly infinite outcomes
- Design Puzzle for architects working in offsite construction



OPENING THE PLAYBOOK:

Opportunity for Great Architecture



QUESTIONS?

Opening the Playbook on Modular Design

2023 **WORLD OF**
MODULAR
ANNUAL CONFERENCE & TRADESHOW

x

EVstudio
architecture : engineering : planning