

Thinking Inside the Box: Modular Construction Demystified

Explaining the Graphic: Boston's Largest Modular Project

Presented by

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



Course Description

Modular construction is touted as an opportunity to combat rising interest rates and construction prices through greater efficiency, address skilled labor shortages, and reduce jobsite waste. However, some architects and engineers are hesitant to embrace the modular approach because they don't want their designs to be compromised, and they don't think it has the flexibility or functionality to execute certain project typologies. This session will examine modular wood-frame multi-family projects through the lens of Boston's largest example to date—The Graphic, which features five stories of wood over a concrete podium. Discussion will focus on unique design considerations, detailing and sourcing techniques, and the design/delivery process. The project architect and contractor will offer their insights on this project, as well as the pros and cons of off-site fabrication, quality, timeliness, and sustainability.

Learning Objectives

1. Define modular wood construction and illustrate the various levels of implementation.
2. Discuss the role of architects and engineers in the success of off-site construction techniques.
3. Review potential cost and schedule savings realized through the use of off-site wood construction.
4. Highlight how pre-planning and coordination between the design team and modular component manufacturer can lead to efficiencies in the fabrication and installation process for wood-frame projects.

1. TEAM

BERKELEY

E-ICON
ARCHITECTURE



HALEY
ALDRICH

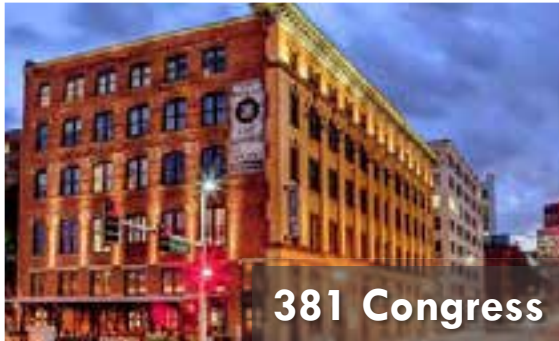
Richard Burck Associates, Inc.



WB&A Wozny / Barbar & Associates, Inc.
CONSULTING ENGINEERS

BERKELEY

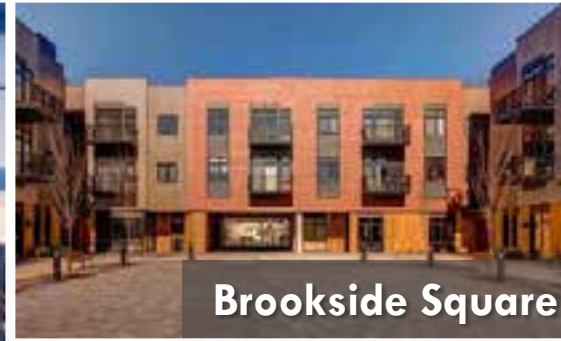
E-ICON
ARCHITECTURE



381 Congress



One Canal



Brookside Square



The Watch Factory



HUB 25



Abbot Mill



Millbrook Lofts

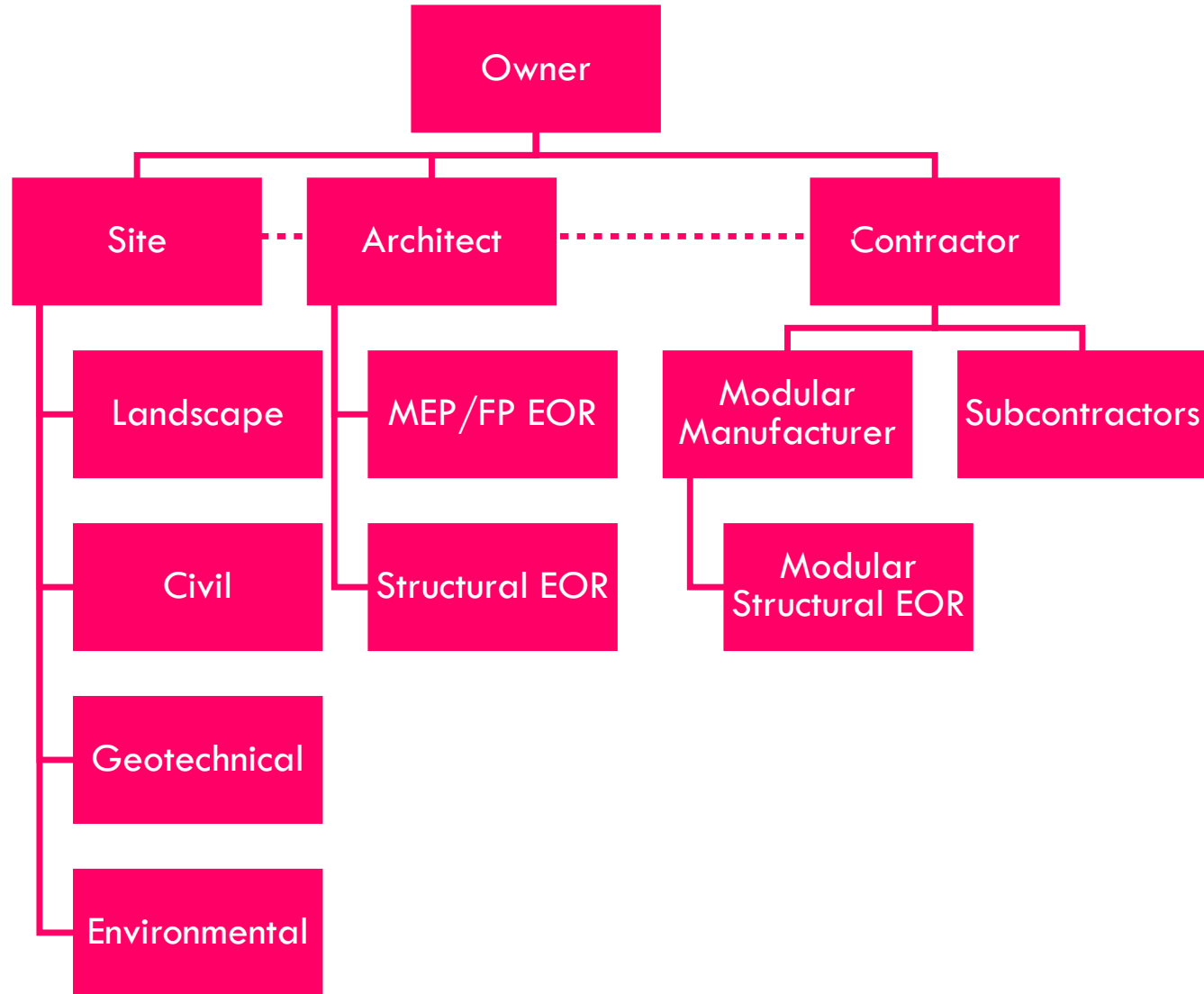


Avenir



Chelsea Place

ORG CHART



2. LEARNING OBJECTIVES

LEARNING OBJECTIVES

1. What goes into the modular decision?
2. What are the design constraints?
3. How do we do this?
4. How do we ensure that we get what we want?



THE GRAPHIC

BLDG A

- Adaptive reuse
- 46 Units
- 5,000 SF Restaurant Space
- 16 surface parking spaces
- 40,000 SF GSF

BLDG B

- Modular Construction [128 modules]
- 125 Units
- 97 Garage parking spaces
- 100,000 SF GSF [w/o parking]

TOTAL PROJECT

- 171 Units [23 IDP Units]
- 113 Parking spaces
- 140,000 SF GSF [w/o parking]



ADAPTIVE REUSE

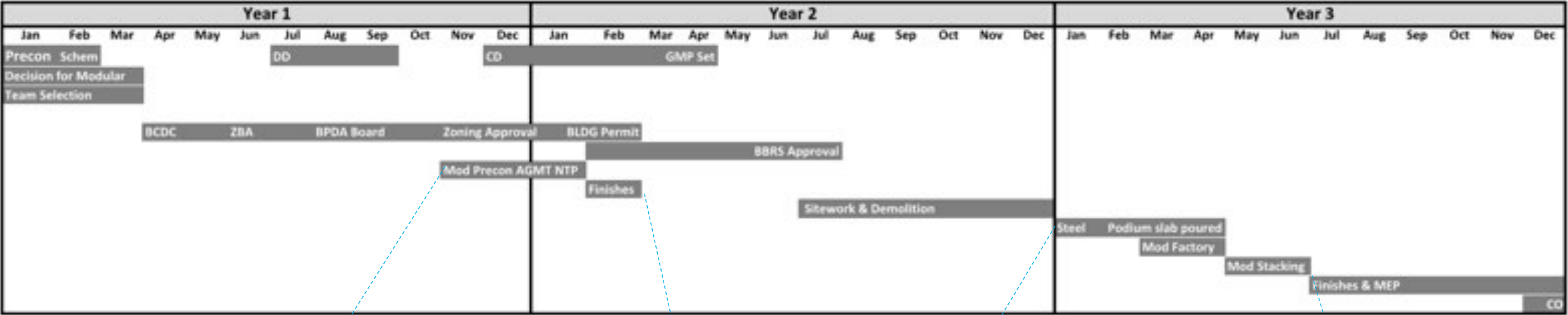


MODULAR



3. THE MODULAR DECISION

TIME = MONEY



Mod Precon AGMT NTP

Finishes

Make decisions early.
No changes!

Save 3-6 months!

Steel

Podium slab poured

Mod Factory

Mod Stacking

SIMULTANEOUS CONSTRUCTION

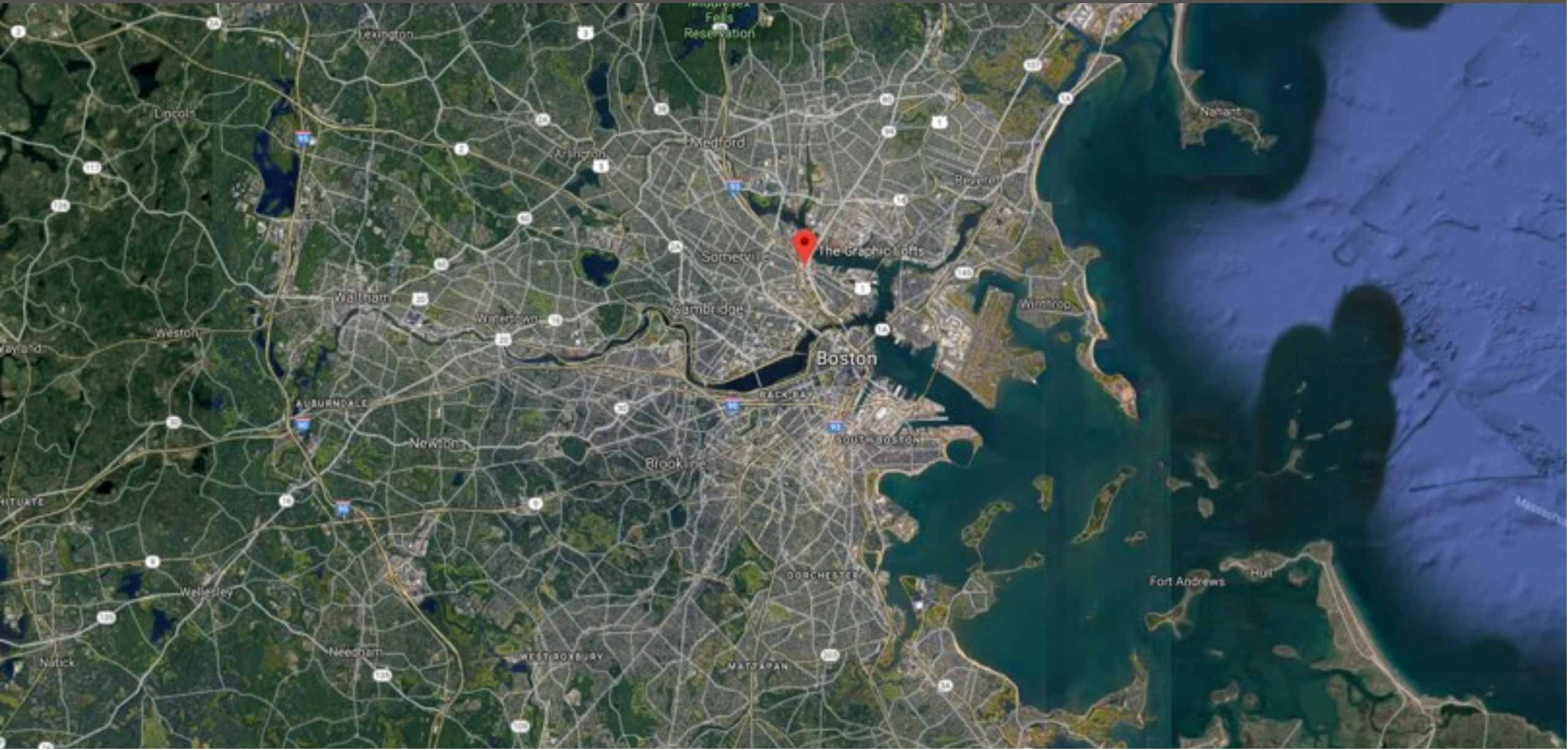
4/20/2018



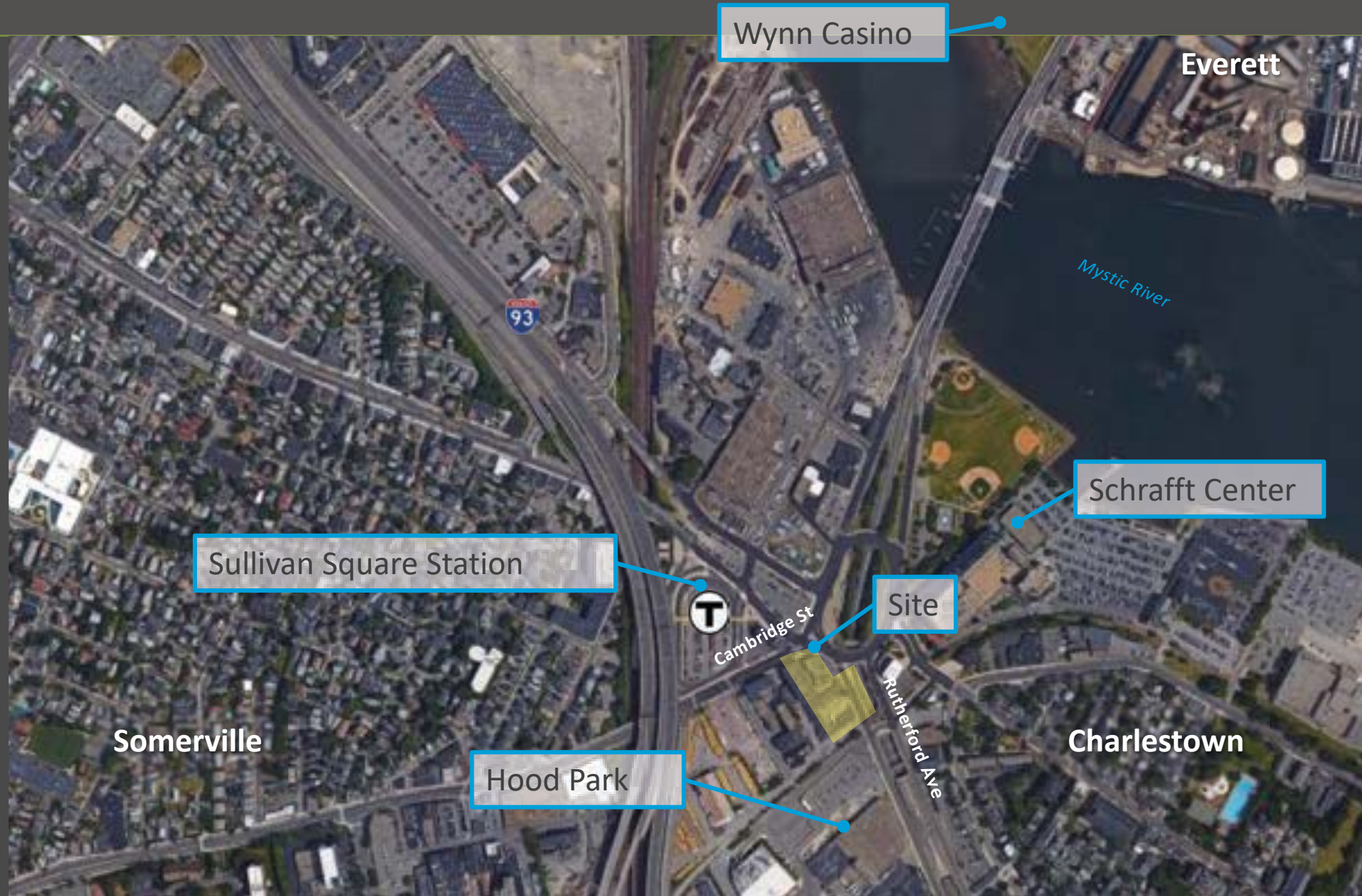
4/12/2018



CONTEXT



URBAN SITE



URBAN SITE



MARKET PERCEPTION



CHALLENGES

Owner Upfront costs:

- Payment to modular manufacturer
- Off-site storage
- Early trade contractor involvement

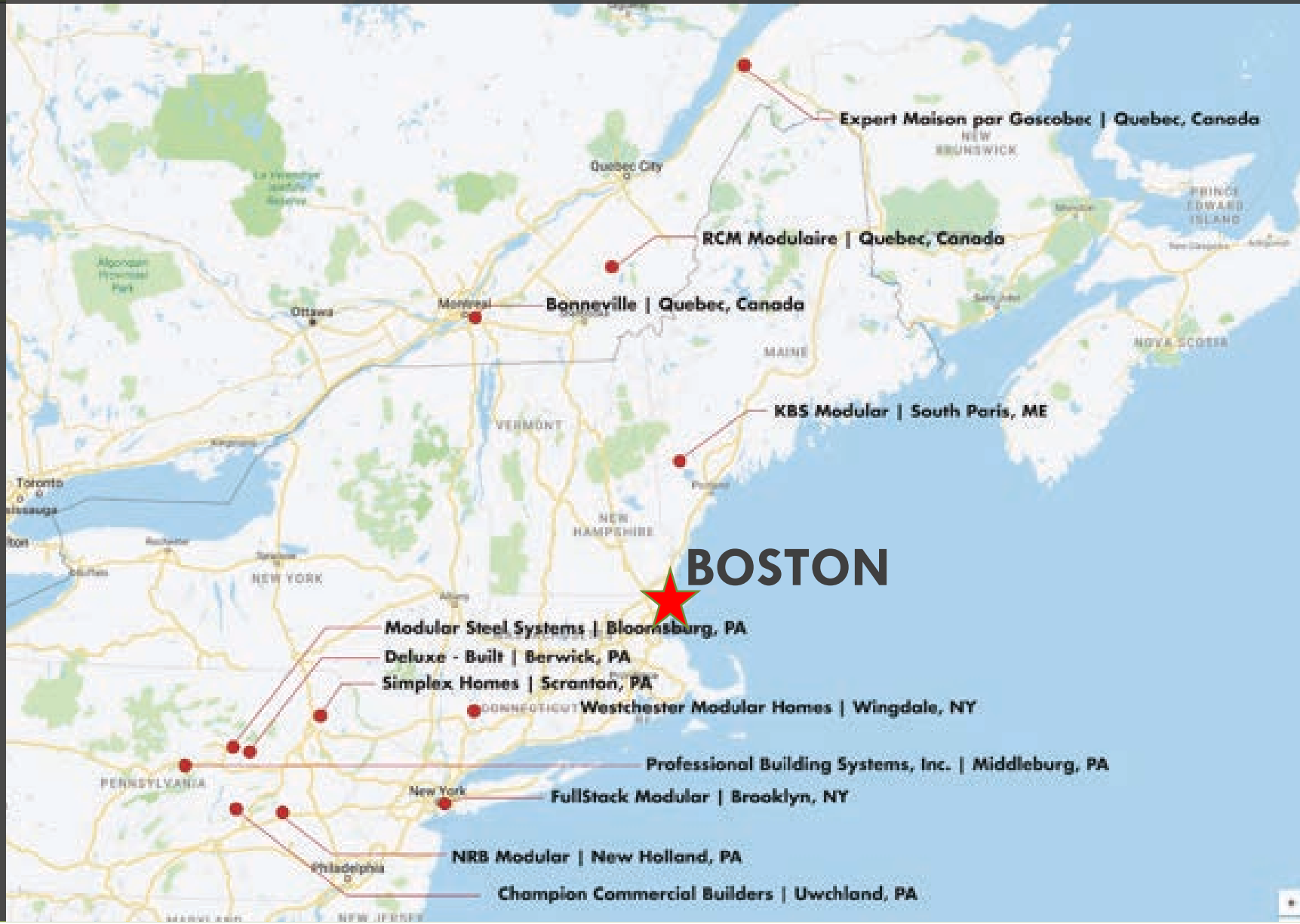


CASH FLOW

"Why isn't it cheaper?"

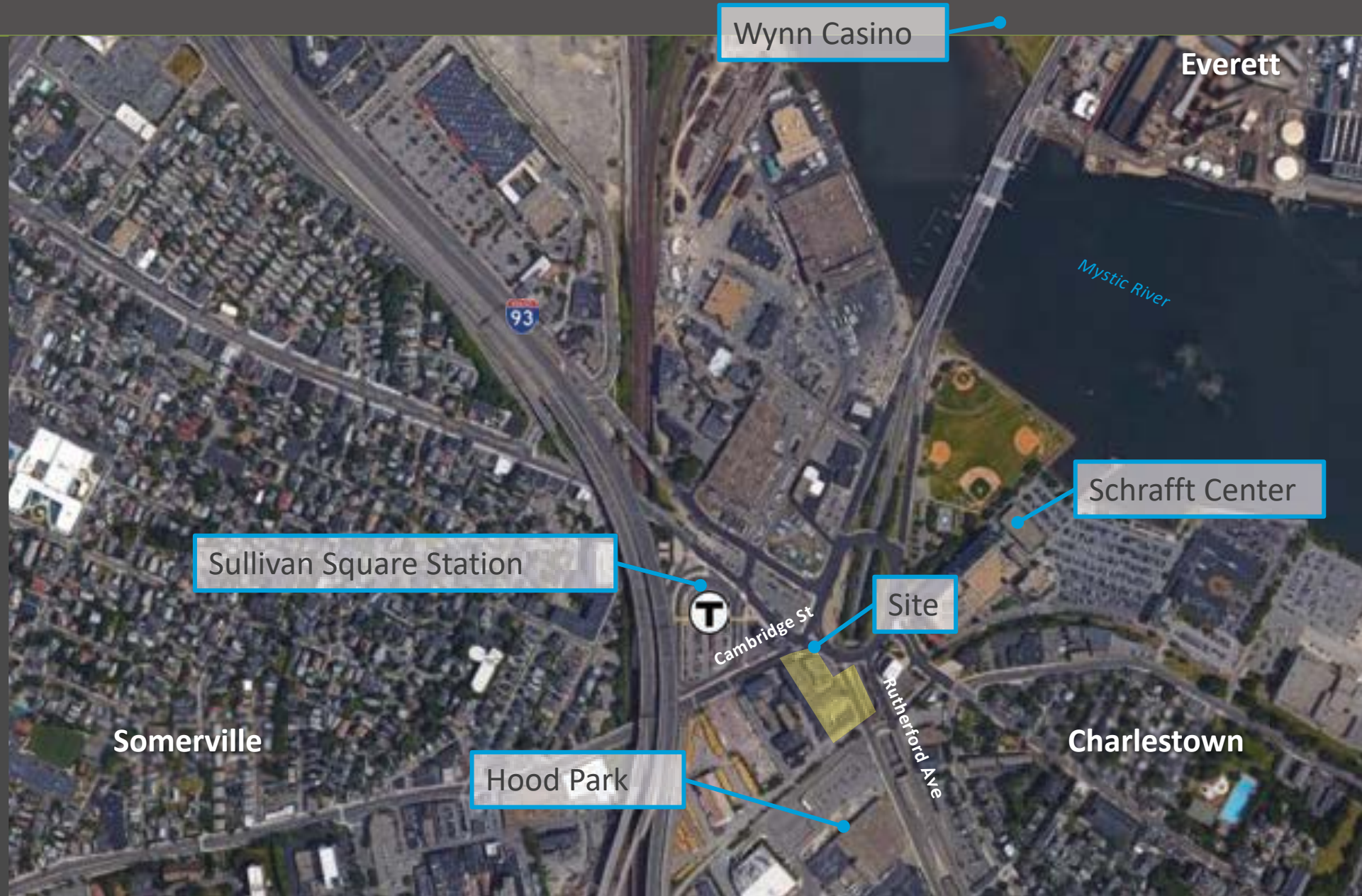


LOCATION



4. DESIGN CONSTRAINTS

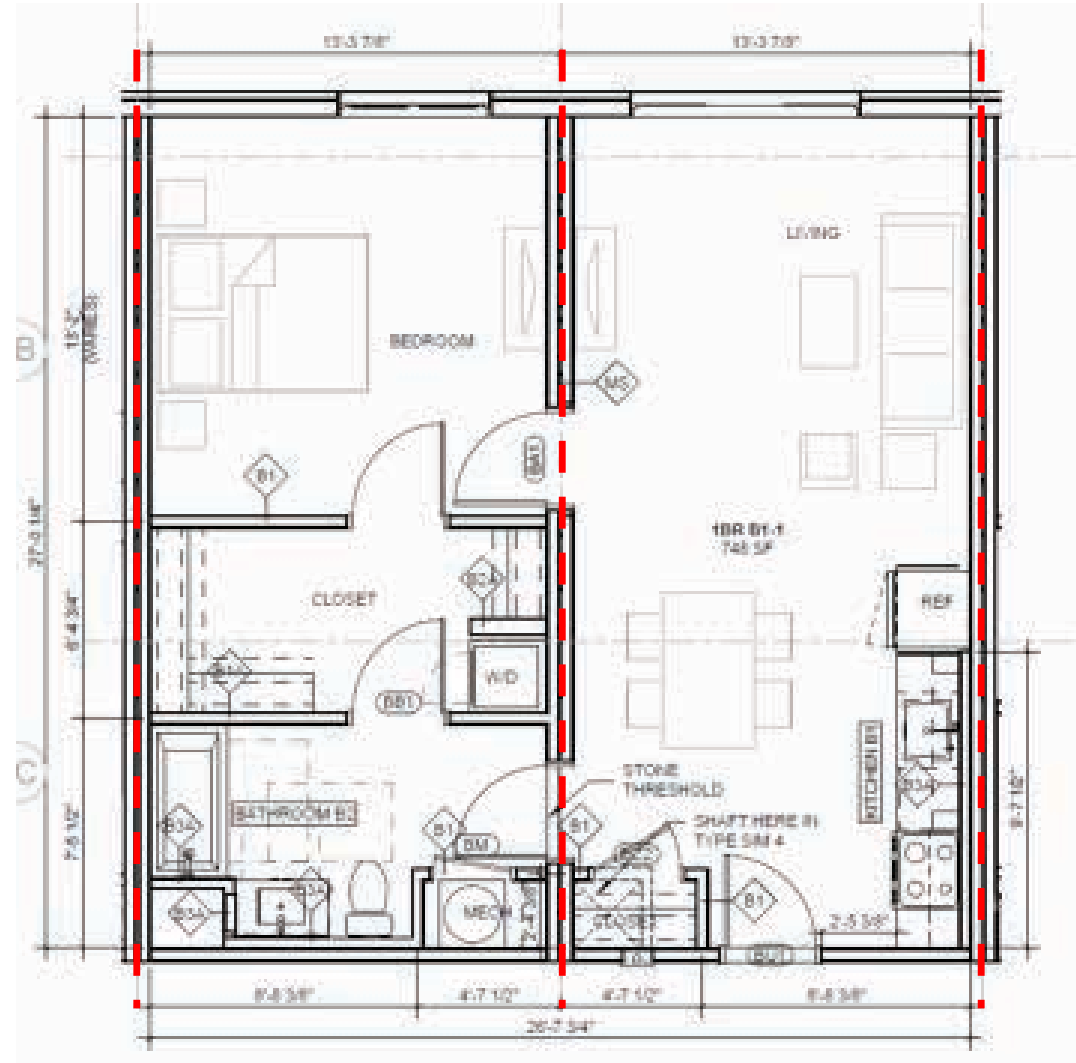
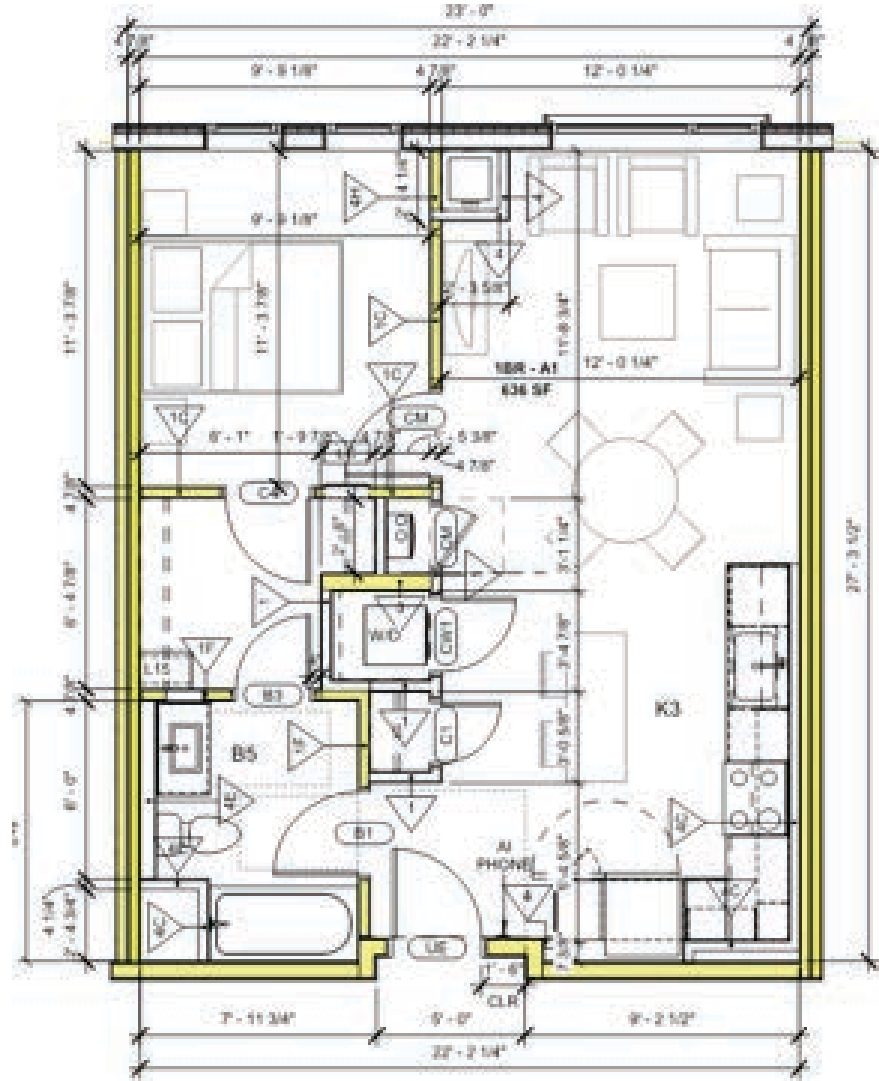
URBAN SITE



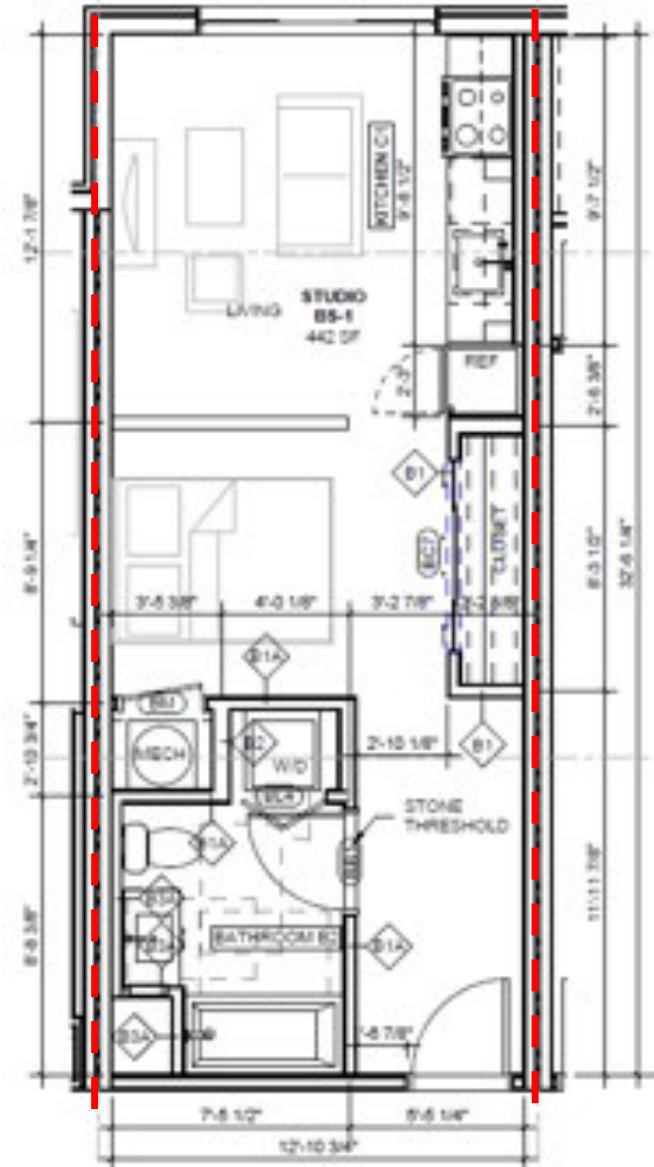
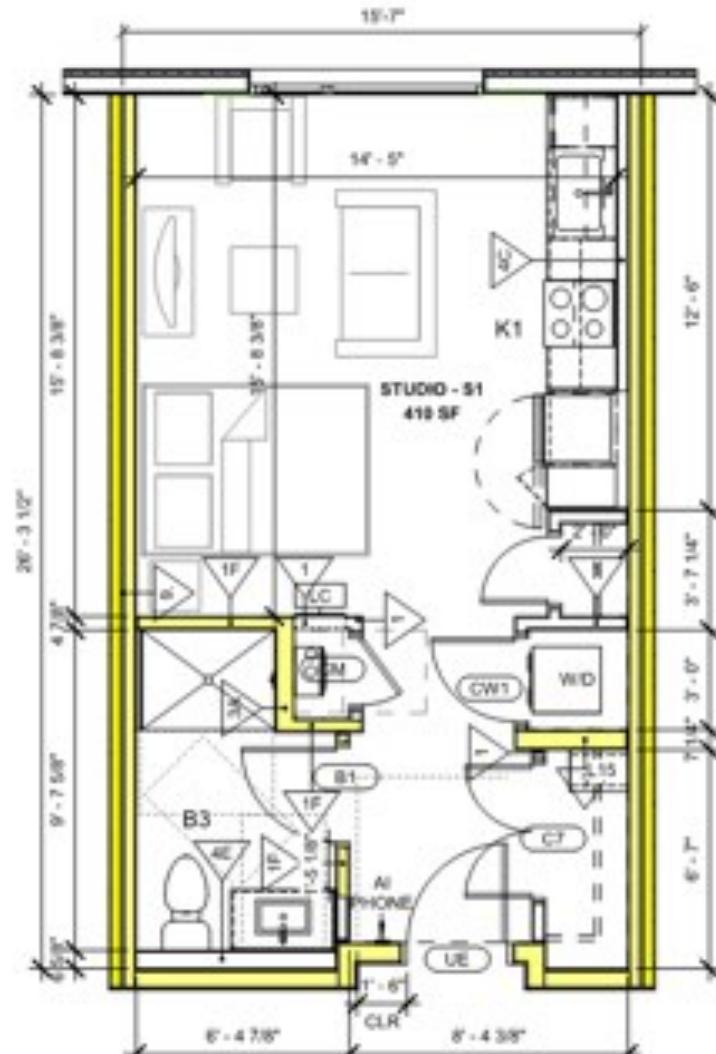
BUILDING LAYOUT



UNIT LAYOUT – 1BR



UNIT LAYOUT - STUDIO



BUILDING LAYOUT



VISUALIZATION – LAYOUT & FINISHES



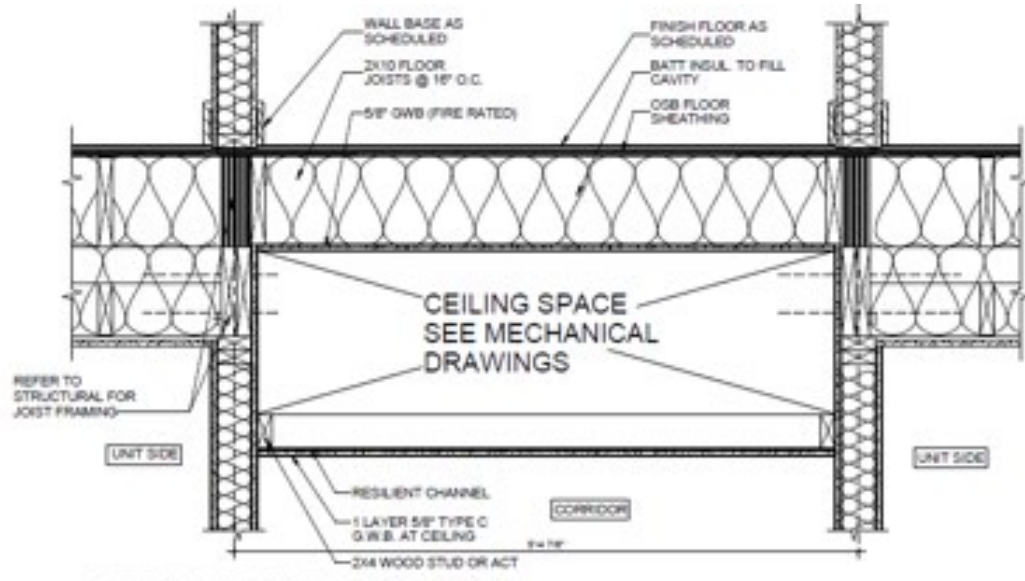
5. HOW DO WE DO THIS?

A 3D perspective view of a building's structural frame. The frame consists of a grid of vertical columns and horizontal beams. A specific set of beams is highlighted in green and orange, showing their connection to the rest of the structure. The perspective is from an elevated angle, looking down at the building's layout.

[illegible]

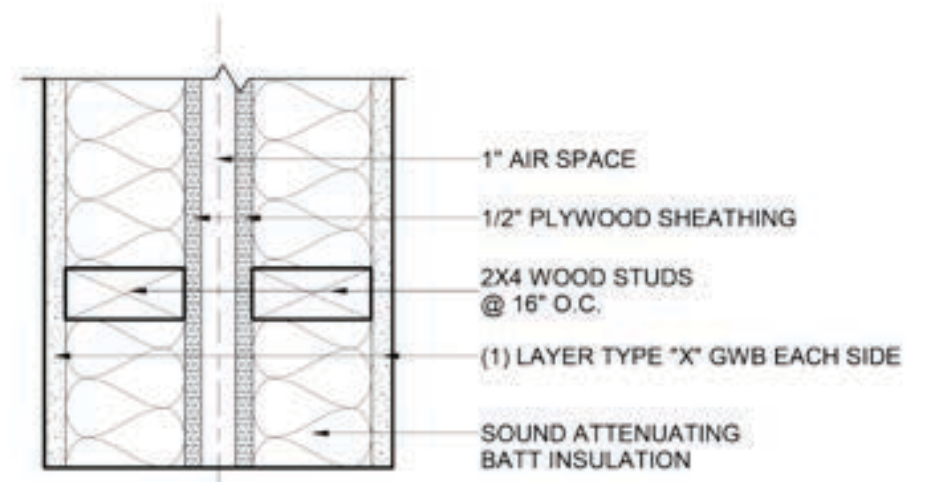
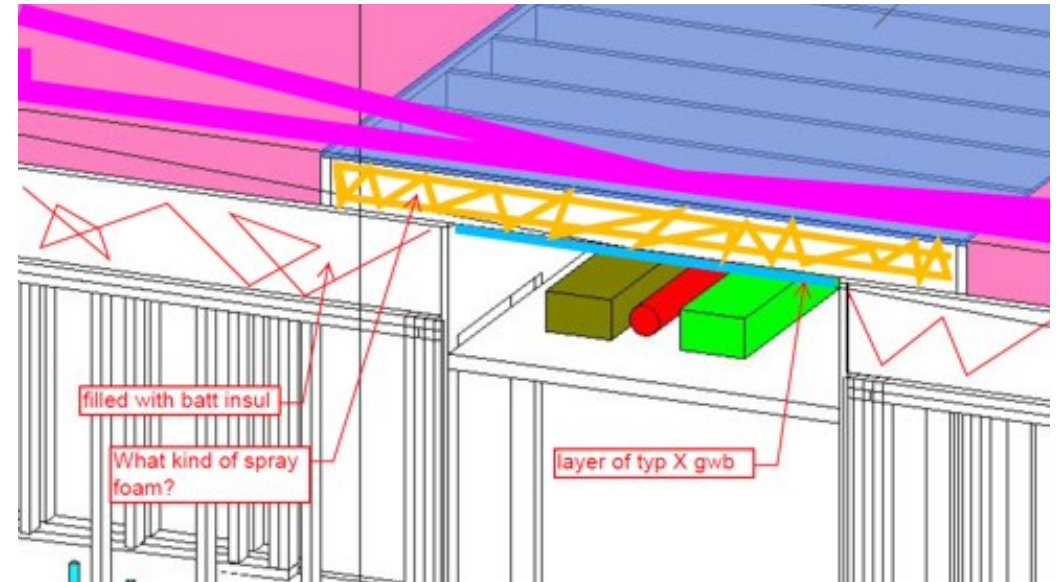
Modular 2D

MEP & DETAILS

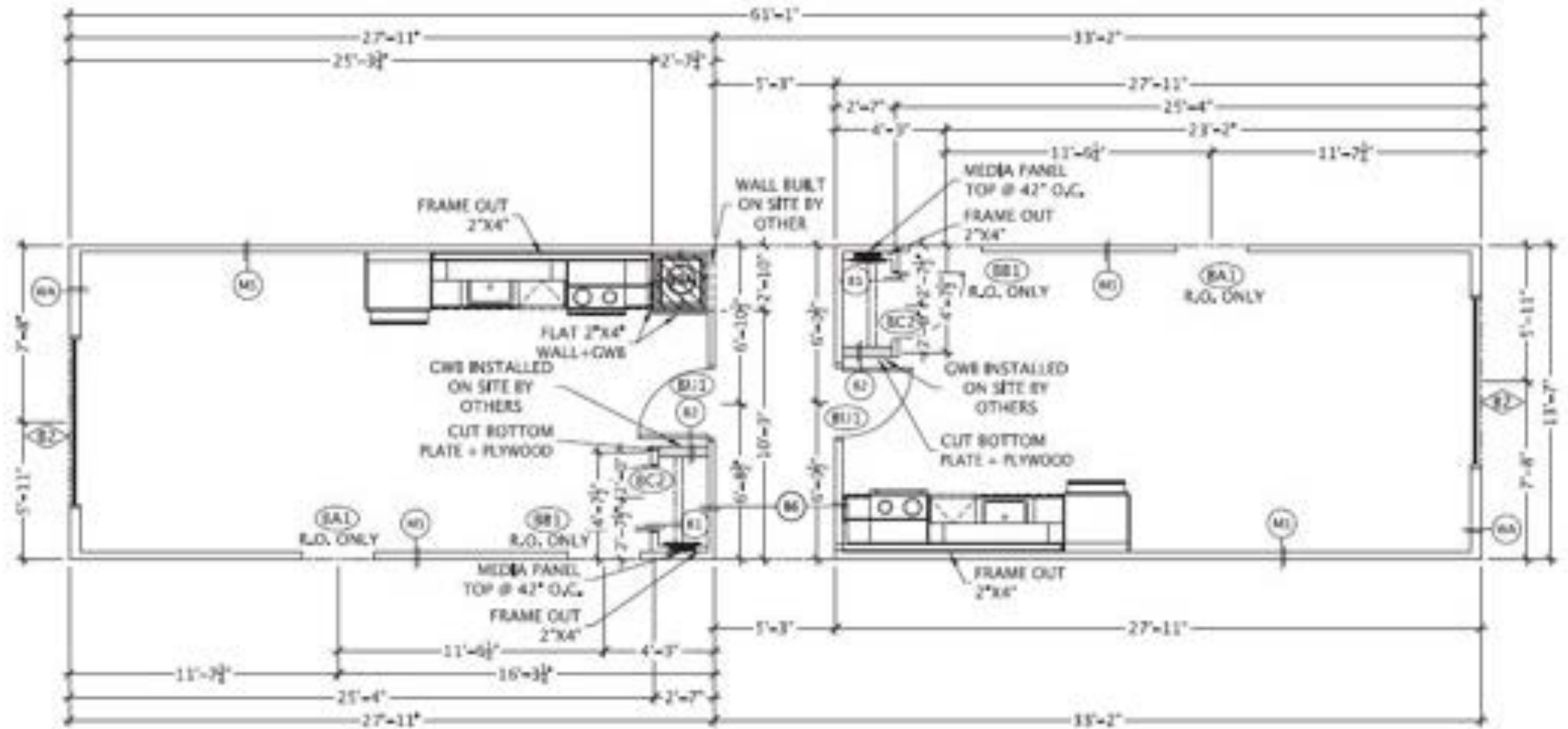


TYPICAL MODULAR FLOOR/CEILING ASSEMBLY (TOP TO BOTTOM)

- FINISH FLOORING (REFER TO FINISH SCHEDULE)
- OSB PANEL SHEATHING
- WOOD JOIST
- NON-COMBUSTIBLE FIBERGLASS BATT INSUL. TO FILL CAVITY
- CEILING JOISTS @ 16" O.C.
- RESILIENT CHANNEL @ 16" O.C. TYP.
- 5/8" TYPE 'C' GWB
- UL L539



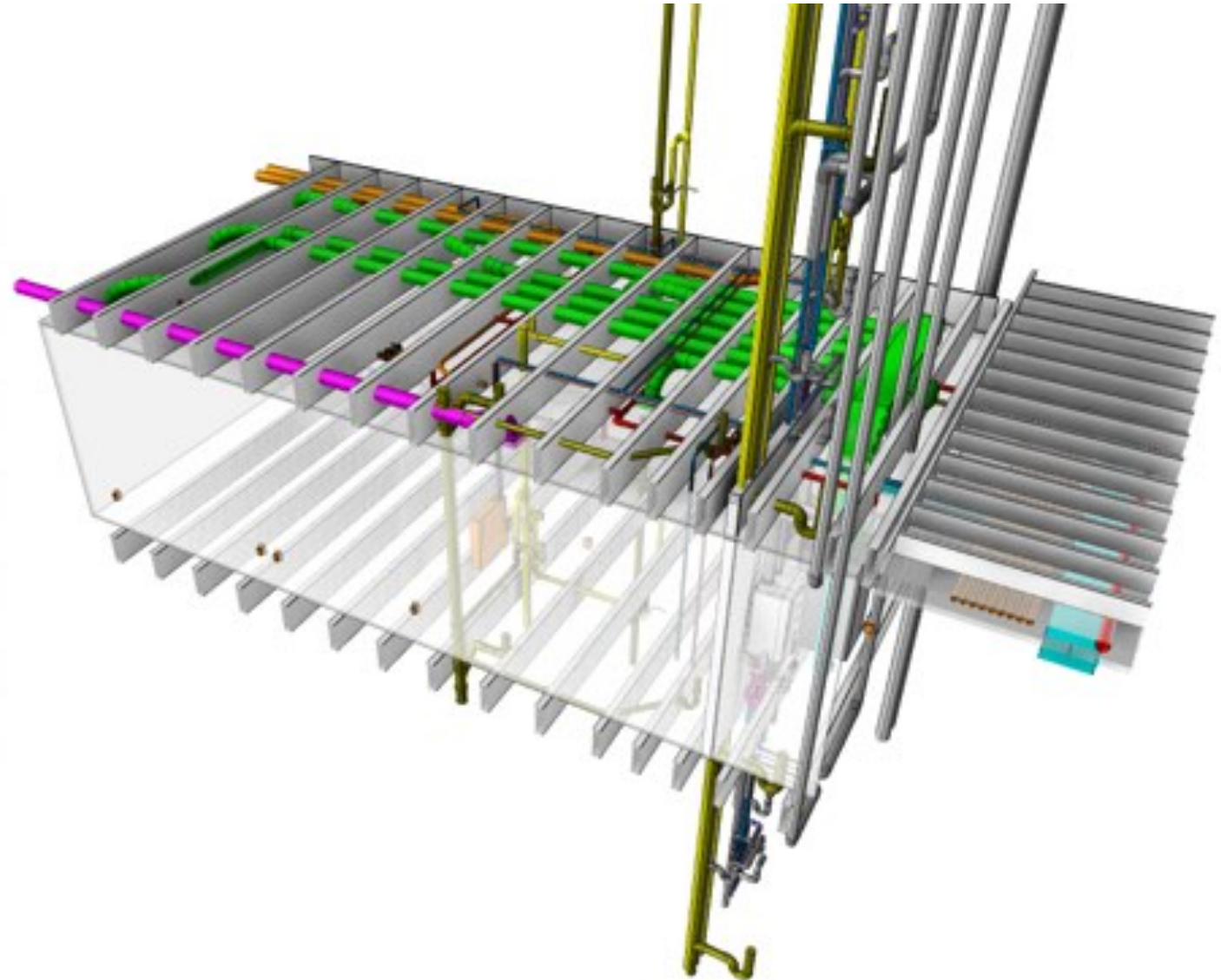
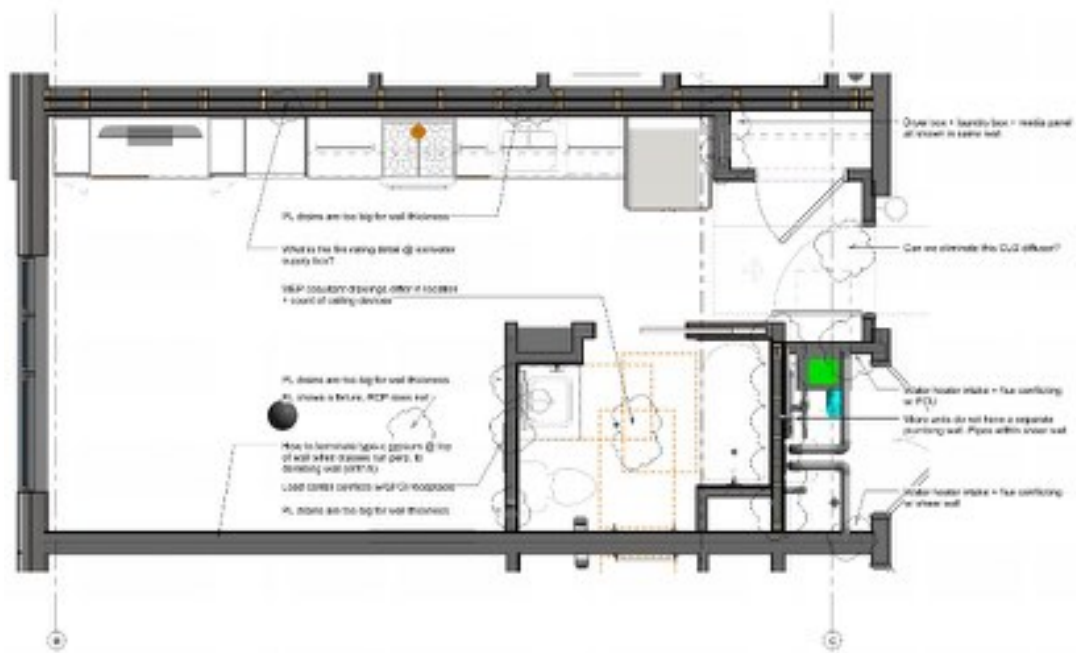
TYPICAL SHOP DRAWINGS



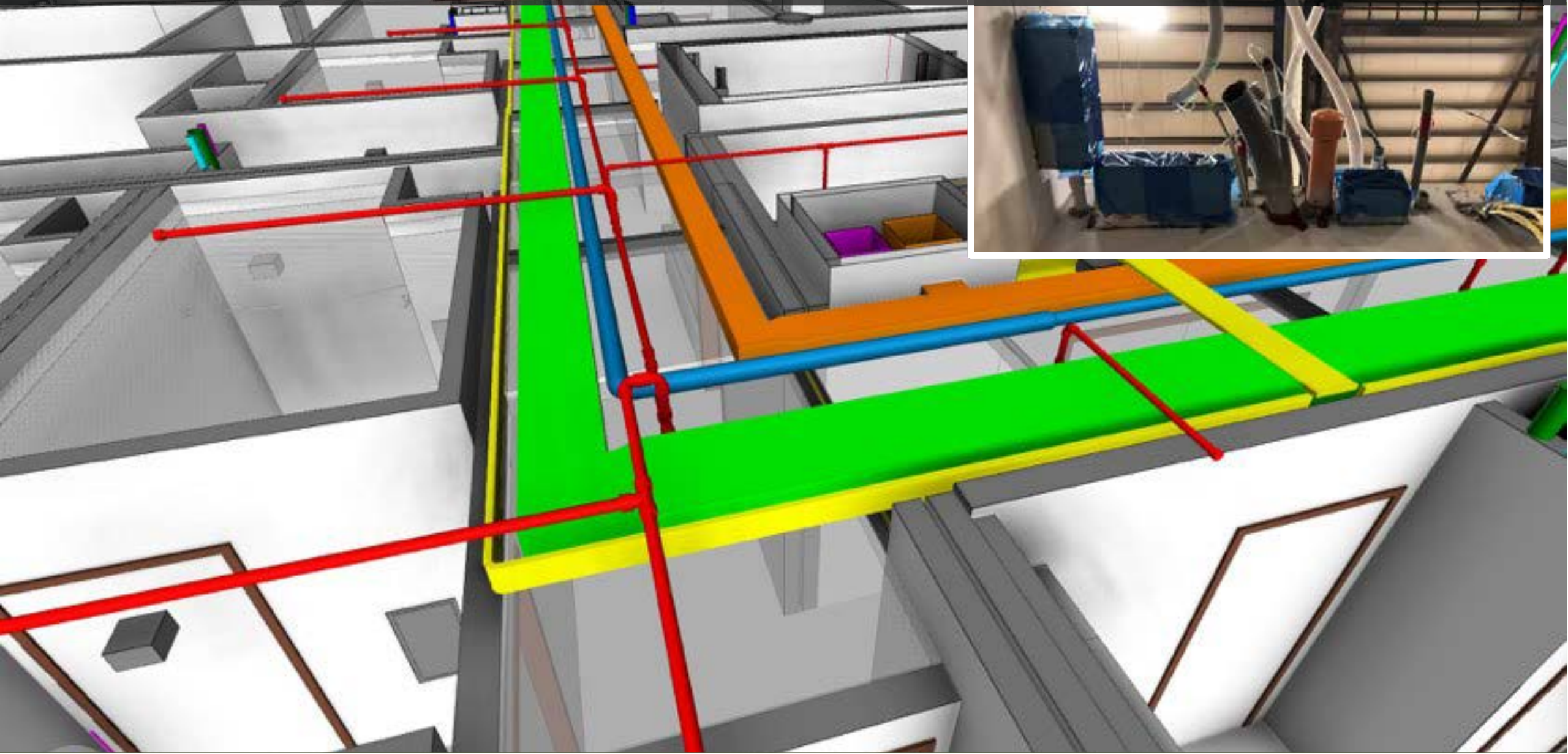
This architectural floor plan shows a building layout with various rooms and structural details. Key features include:

- Dimensions:** Overall dimensions are 66'-7" wide by 15'-6" deep. Internal dimensions are provided for most sections.
- Annotations:**
 - "NO ZIP PANEL" (WA)
 - "CUT BOTTOM PLATE+PLYWOOD ONE INSTALLED ON SITE BY OTHERS"
 - "FRAME OUT 2"x4"
 - "MEDIA PANEL TOP @ 42" A.F.F."
 - "DOOR SC6 INSTALLED ON SITE BY OTHER"
 - "WALL BUILT ON SITE BY OTHERS"
 - "FRAME OUT 2"x6"
 - "CUT BOTTOM PLATE+PLYWOOD ONE INSTALLED ON SITE BY OTHERS"
- Room Markers:** Circled letters B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, B12, B13, B14, B15, B16, B17, B18, B19, B20, B21, B22, B23, B24, B25, B26, B27, B28, B29, B30, B31, B32, B33, B34, B35, B36, B37, B38, B39, B40, B41, B42, B43, B44, B45, B46, B47, B48, B49, B50, B51, B52, B53, B54, B55, B56, B57, B58, B59, B60, B61, B62, B63, B64, B65, B66, B67, B68, B69, B70, B71, B72, B73, B74, B75, B76, B77, B78, B79, B80, B81, B82, B83, B84, B85, B86, B87, B88, B89, B90, B91, B92, B93, B94, B95, B96, B97, B98, B99, B100, B101, B102, B103, B104, B105, B106, B107, B108, B109, B110, B111, B112, B113, B114, B115, B116, B117, B118, B119, B120, B121, B122, B123, B124, B125, B126, B127, B128, B129, B130, B131, B132, B133, B134, B135, B136, B137, B138, B139, B140, B141, B142, B143, B144, B145, B146, B147, B148, B149, B150, B151, B152, B153, B154, B155, B156, B157, B158, B159, B160, B161, B162, B163, B164, B165, B166, B167, B168, B169, B170, B171, B172, B173, B174, B175, B176, B177, B178, B179, B180, B181, B182, B183, B184, B185, B186, B187, B188, B189, B190, B191, B192, B193, B194, B195, B196, B197, B198, B199, B200, B201, B202, B203, B204, B205, B206, B207, B208, B209, B210, B211, B212, B213, B214, B215, B216, B217, B218, B219, B220, B221, B222, B223, B224, B225, B226, B227, B228, B229, B230, B231, B232, B233, B234, B235, B236, B237, B238, B239, B240, B241, B242, B243, B244, B245, B246, B247, B248, B249, B250, B251, B252, B253, B254, B255, B256, B257, B258, B259, B260, B261, B262, B263, B264, B265, B266, B267, B268, B269, B270, B271, B272, B273, B274, B275, B276, B277, B278, B279, B280, B281, B282, B283, B284, B285, B286, B287, B288, B289, B290, B291, B292, B293, B294, B295, B296, B297, B298, B299, B300, B301, B302, B303, B304, B305, B306, B307, B308, B309, B310, B311, B312, B313, B314, B315, B316, B317, B318, B319, B320, B321, B322, B323, B324, B325, B326, B327, B328, B329, B330, B331, B332, B333, B334, B335, B336, B337, B338, B339, B340, B341, B342, B343, B344, B345, B346, B347, B348, B349, B350, B351, B352, B353, B354, B355, B356, B357, B358, B359, B360, B361, B362, B363, B364, B365, B366, B367, B368, B369, B370, B371, B372, B373, B374, B375, B376, B377, B378, B379, B380, B381, B382, B383, B384, B385, B386, B387, B388, B389, B390, B391, B392, B393, B394, B395, B396, B397, B398, B399, B400, B401, B402, B403, B404, B405, B406, B407, B408, B409, B410, B411, B412, B413, B414, B415, B416, B417, B418, B419, B420, B421, B422, B423, B424, B425, B426, B427, B428, B429, B430, B431, B432, B433, B434, B435, B436, B437, B438, B439, B440, B441, B442, B443, B444, B445, B446, B447, B448, B449, B450, B451, B452, B453, B454, B455, B456, B457, B458, B459, B460, B461, B462, B463, B464, B465, B466, B467, B468, B469, B470, B471, B472, B473, B474, B475, B476, B477, B478, B479, B480, B481, B482, B483, B484, B485, B486, B487, B488, B489, B490, B491, B492, B493, B494, B495, B496, B497, B498, B499, B500, B501, B502, B503, B504, B505, B506, B507, B508, B509, B510, B511, B512, B513, B514, B515, B516, B517, B518, B519, B520, B521, B522, B523, B524, B525, B526, B527, B528, B529, B530, B531, B532, B533, B534, B535, B536, B537, B538, B539, B540, B541, B542, B543, B544, B545, B546, B547, B548, B549, B550, B551, B552, B553, B554, B555, B556, B557, B558, B559, B560, B561, B562, B563, B564, B565, B566, B567, B568, B569, B570, B571, B572, B573, B574, B575, B576, B577, B578, B579, B580, B581, B582, B583, B584, B585, B586, B587, B588, B589, B590, B591, B592, B593, B594, B595, B596, B597, B598, B599, B600, B601, B602, B603, B604, B605, B606, B607, B608, B609, B610, B611, B612, B613, B614, B615, B616, B617, B618, B619, B620, B621, B622, B623, B624, B625, B626, B627, B628, B629, B630, B631, B632, B633, B634, B635, B636, B637, B638, B639, B640, B641, B642, B643, B644, B645, B646, B647, B648, B649, B650, B651, B652, B653, B654, B655, B656, B657, B658, B659, B660, B661, B662, B663, B664, B665, B666, B667, B668, B669, B670, B671, B672, B673, B674, B675, B676, B677, B678, B679, B680, B681, B682, B683, B684, B685, B686, B687, B688, B689, B690, B691, B692, B693, B694, B695, B696, B697, B698, B699, B700, B701, B702, B703, B704, B705, B706, B707, B708, B709, B710, B711, B712, B713, B714, B715, B716, B717, B718, B719, B720, B721, B722, B723, B724, B725, B726, B727, B728, B729, B730, B731, B732, B733, B734, B735, B736, B737, B738, B739, B740, B741, B742, B743, B744, B745, B746, B747, B748, B749, B750, B751, B752, B753, B754, B755, B756, B757, B758, B759, B760, B761, B762, B763, B764, B765, B766, B767, B768, B769, B770, B771, B772, B773, B774, B775, B776, B777, B778, B779, B780, B781, B782, B783, B784, B785, B786, B787, B788, B789, B790, B791, B792,

COORDINATION - MODULE



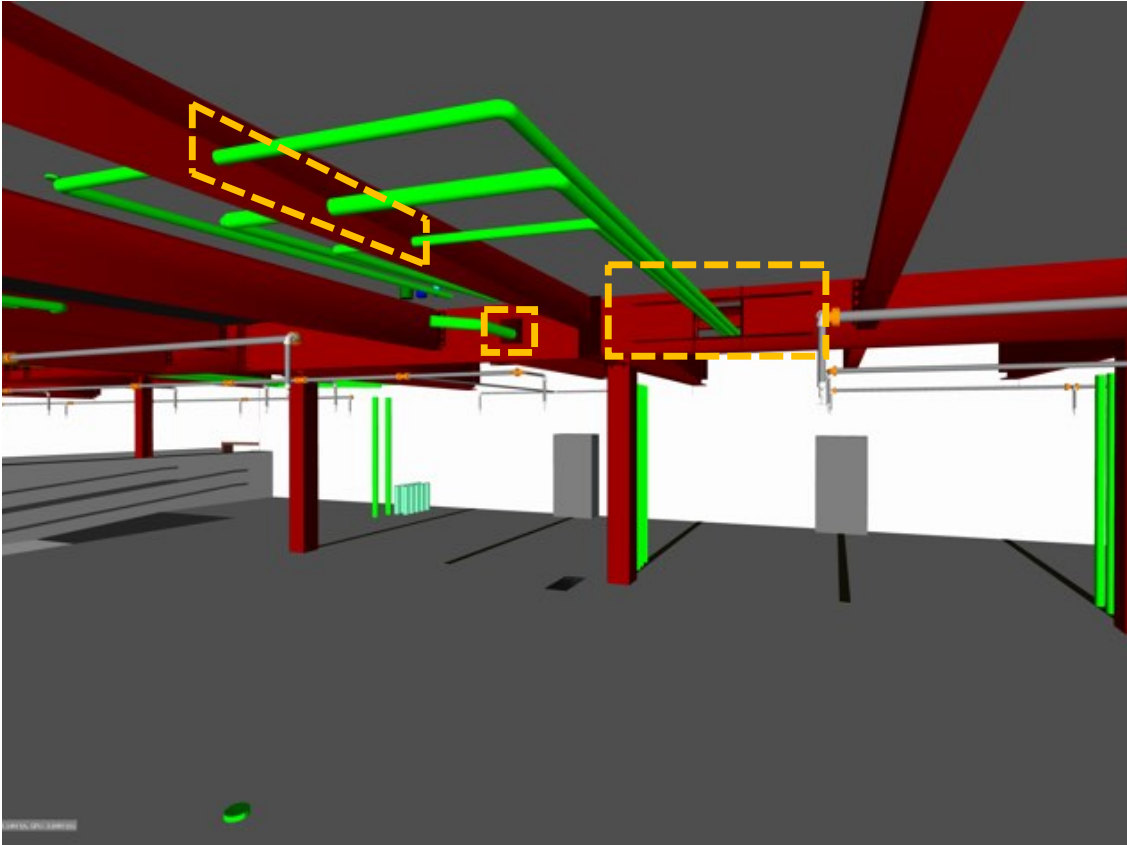
COORDINATION – BUILDING/FIELD



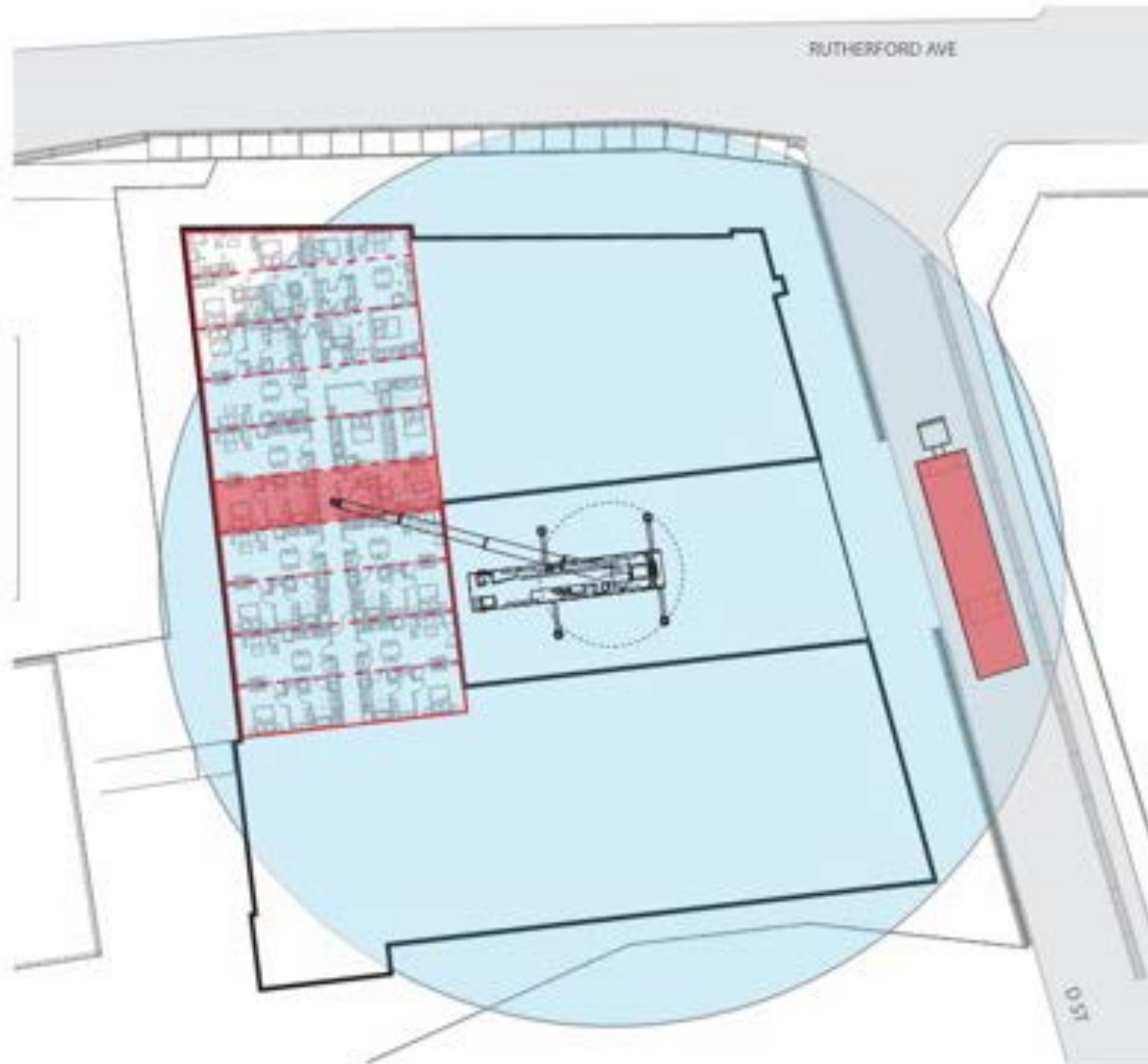
MODULAR + FIELD INTERFACE



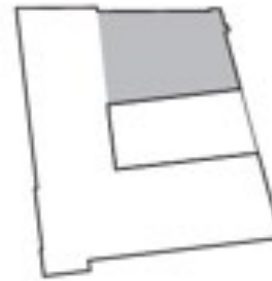
MODULAR + FIELD INTERFACE



LOGISTICS



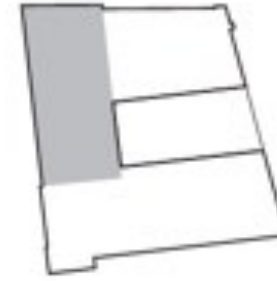
PHASE 1
28 Modules



CRANE SPECIFICATIONS

MODEL: GROVE GMK6400
LOAD RADIUS: 130 FT
LOAD WEIGHT: 35000 LBS

PHASE 2
40 Modules



MODULE DETAILS

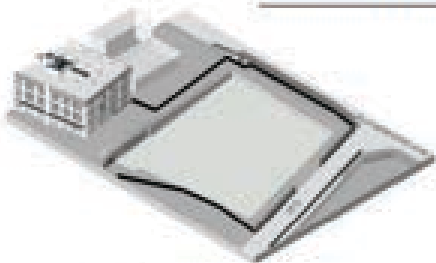
NUMBER OF MODULES: 128
WEIGHT: 25000 - 35000 LBS
DIMENSIONS: W13'-6" x L60' x H10'-6"

PHASE 3
60 Modules



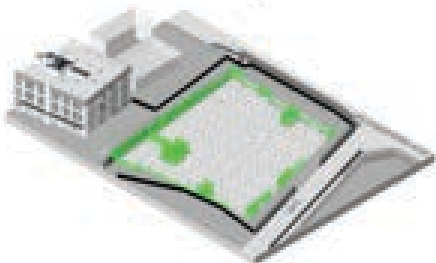
4D SCHEDULE

FOUNDATIONS & PODIUM SLAB



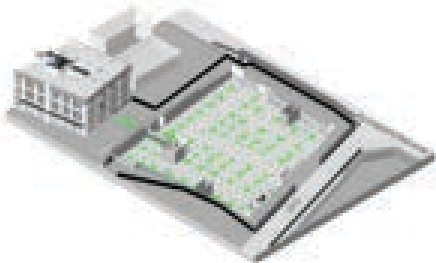
1

INSTALL GEO-PIERS
20 days



2

FORM/POUR WALLS & FOOTINGS
25 days



3

FORM/POUR INTERIOR FOOTINGS
10 days



4

STRUCTURAL STEEL &
SLAB ON DECK
20 days

MODULE INSTALLATION



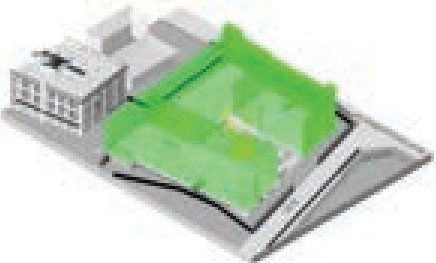
5

PHASE I
10 days



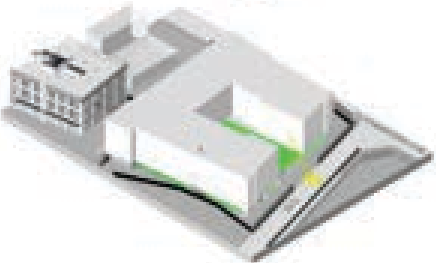
6

PHASE II
10 days



7

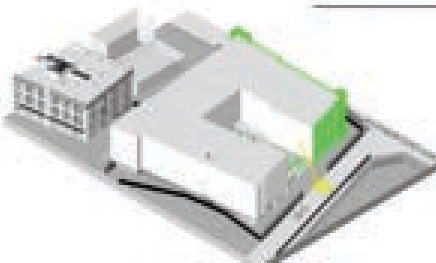
PHASE III
10 days



8

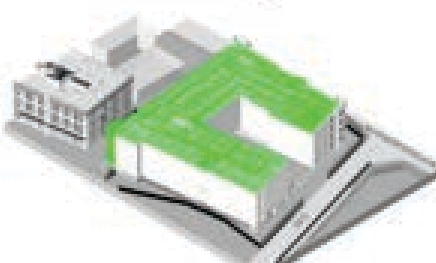
RELOCATE CRANE TO D STREET
COMPLETE PODIUM STEEL AND SLAB
10 days

FACADE CONSTRUCTION



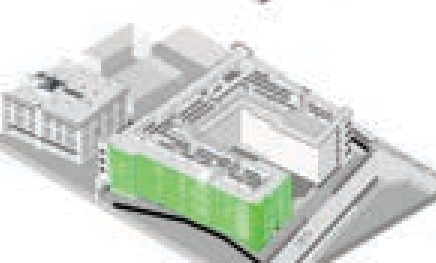
9

EAST & SOUTHEAST FACADE
22 days



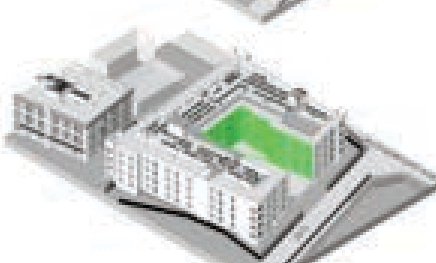
10

ROOFING & NORTH FACADE
50 days



11

WEST & SOUTHWEST FACADE
37 days

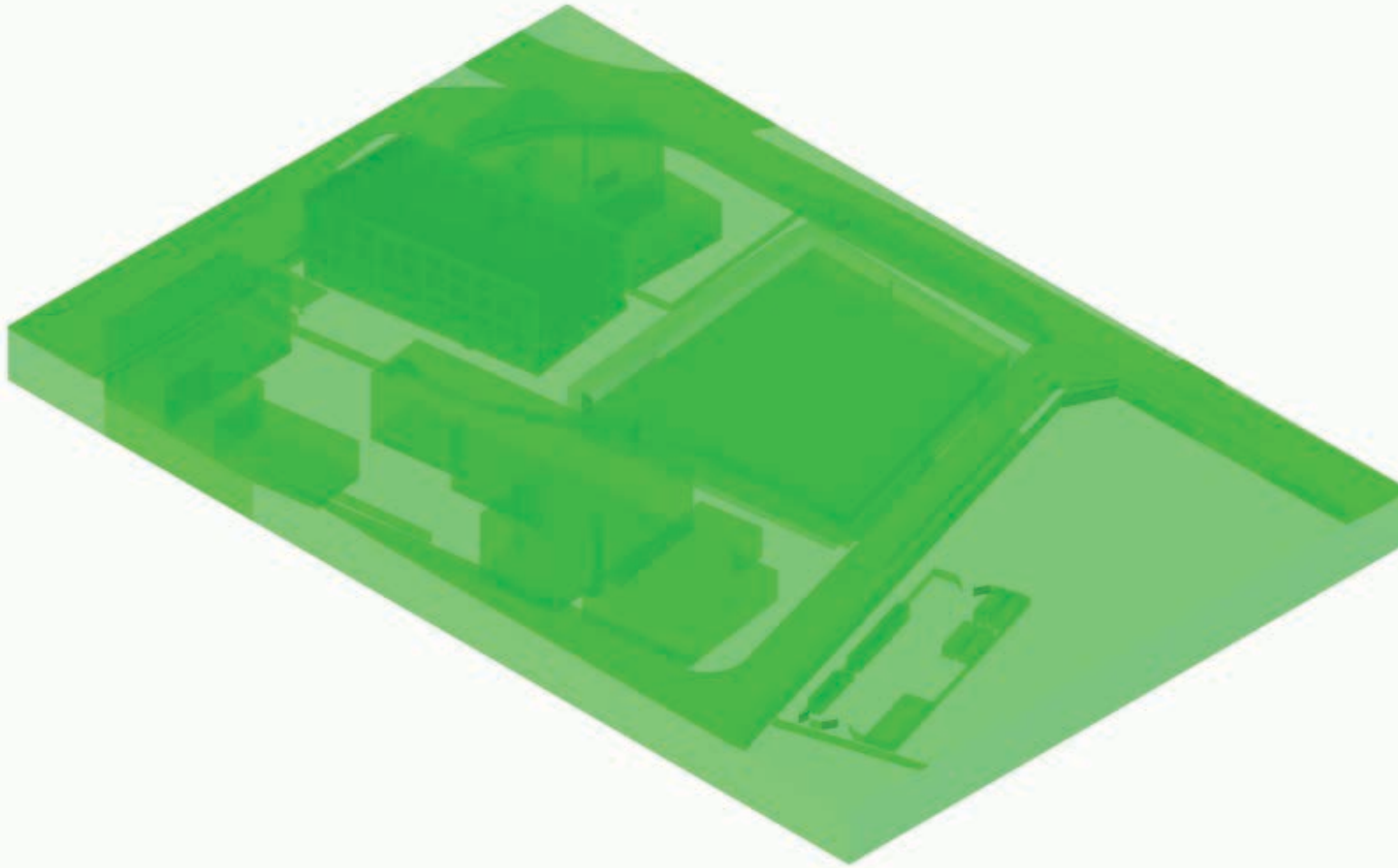


12

COURTYARD ELEVATIONS FACADE
47 days

4D SCHEDULE

Monday 12:00:00 AM 9/26/2017 Day=1 Week=1



6. HOW TO GET WHAT WE WANT?

SITE & PODIUM

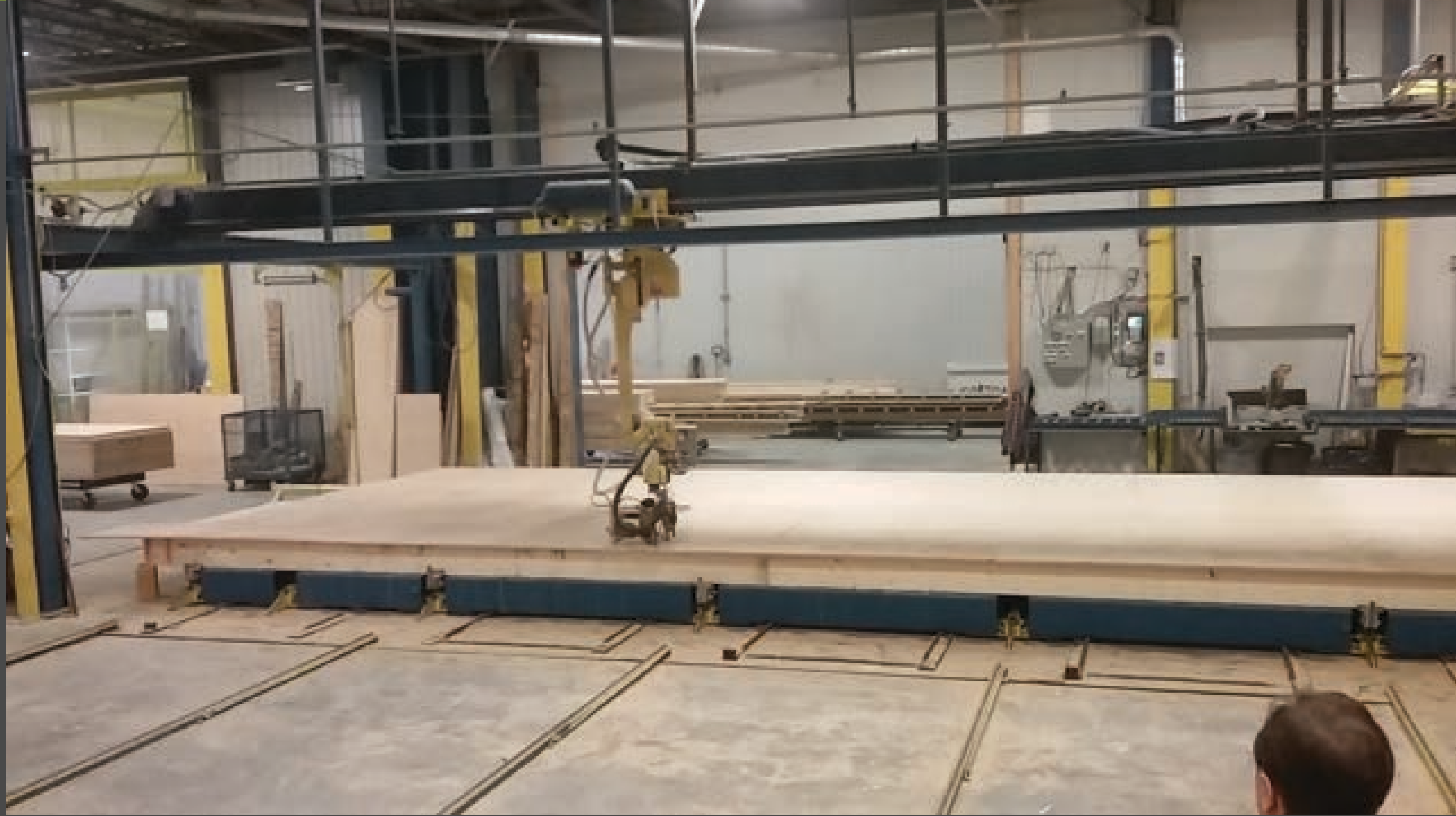


FACTORY VISITS









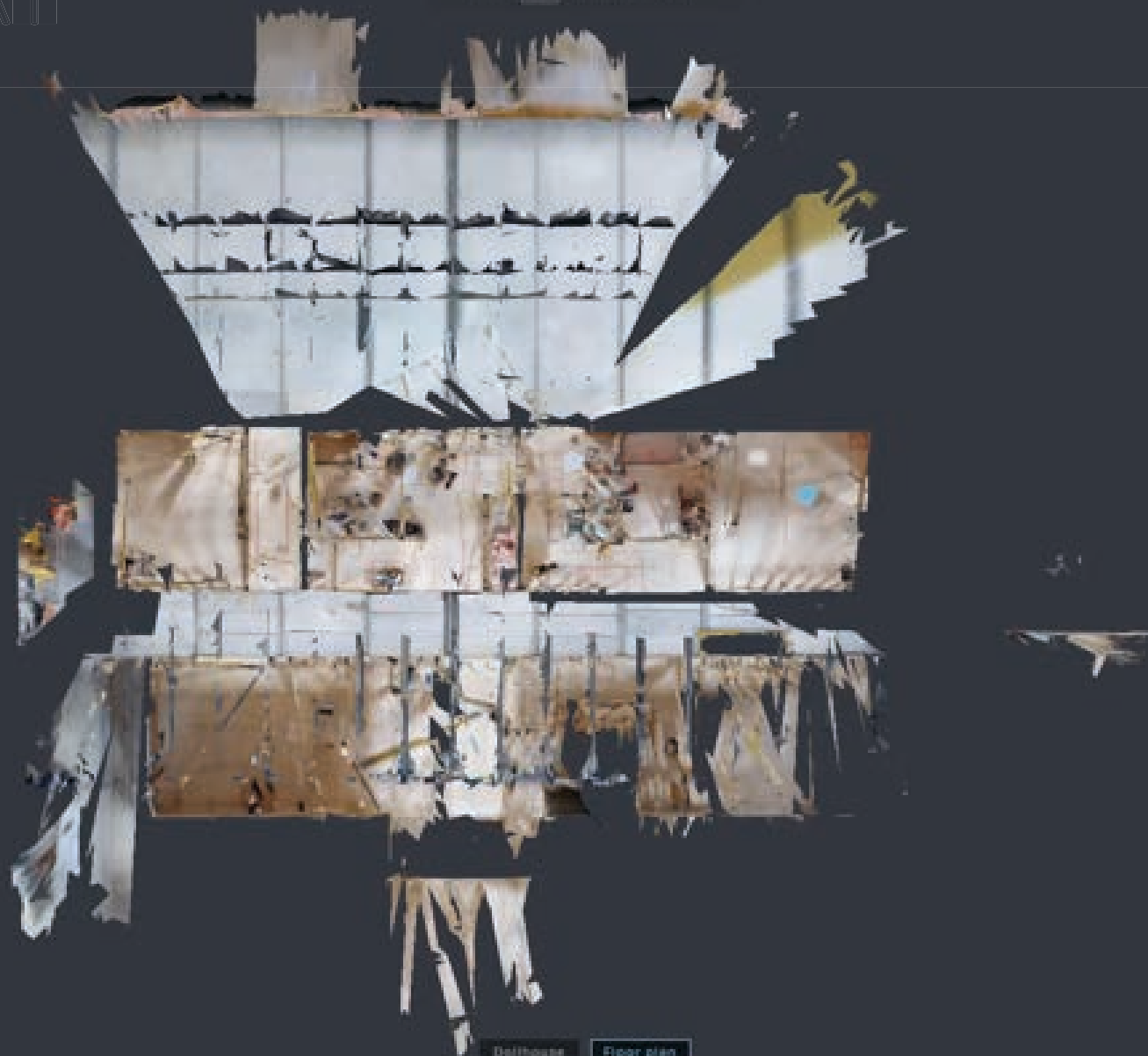






MATTERPORT

Press **Esc** to exit full screen



Ballhouse

Floor plan













FACTORY STORAGE



TRANSIT

BEFORE MODULES
ARRIVE ONSITE...



OFF SITE STORAGE



STACKING









05-31-2018 Thu 13:06:16



THE
GRAPHIC
LOFTS
.COM

MATTERPORT OF MODULES

As Installed on-Site

Your CPU is not
handle this site
Consider change
quality.

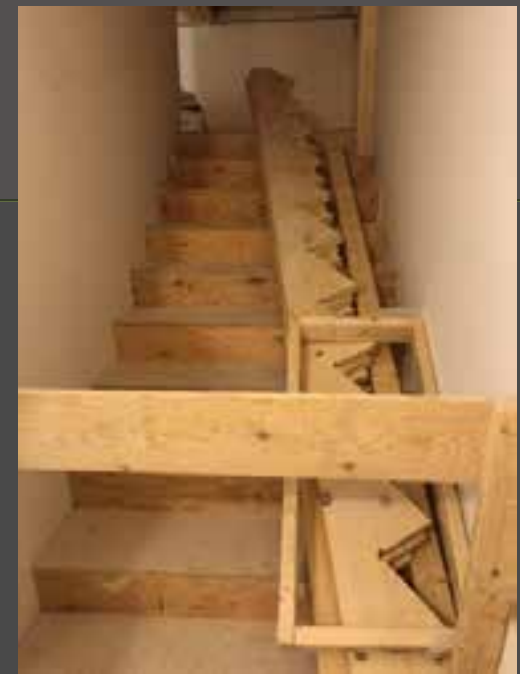
5/31/2018 1:06:26 PM

TOCC

ON SITE



ON SITE





Bedroom Rear plan

INTERIORS







7. REALITY CHECK

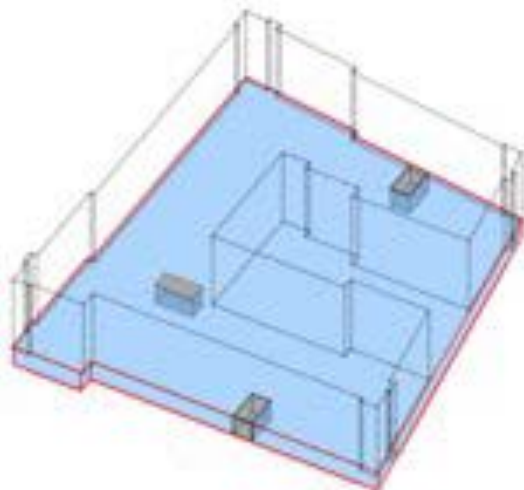
CHALLENGES

- Manufacturers and BIM
- Scoping: Factory vs Field
- Labor Force
- Coordination:
 - Windows
 - Cladding
 - Load Centers (various MEP)

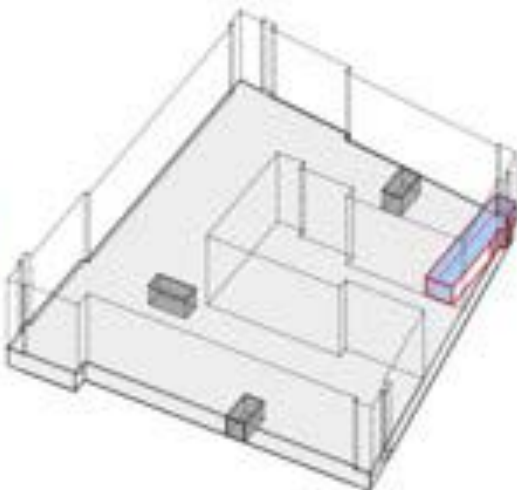


SEQUENCING

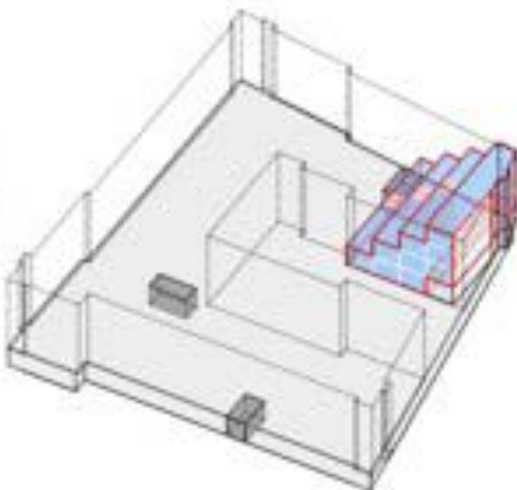
Week 1



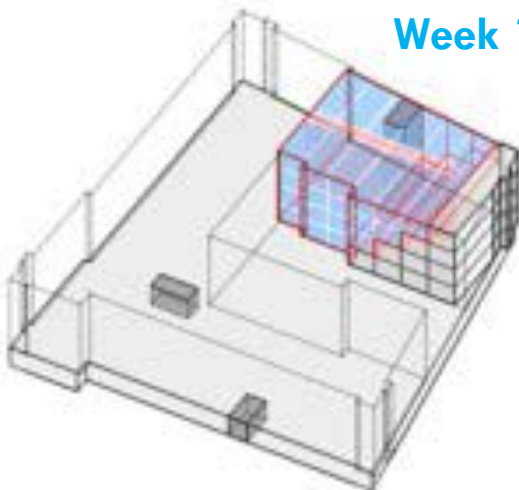
Podium



Modular Cell

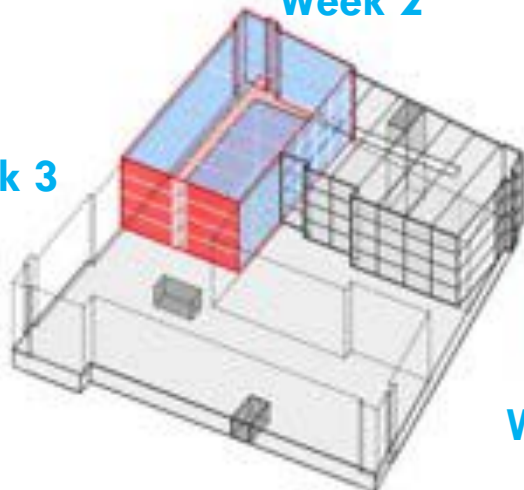


Modular Application Tier

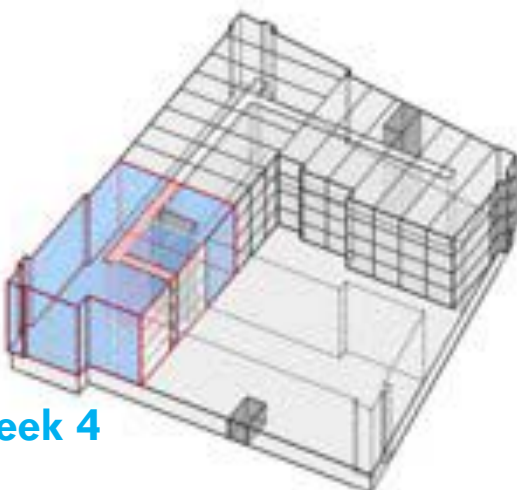


Modular Phase 1

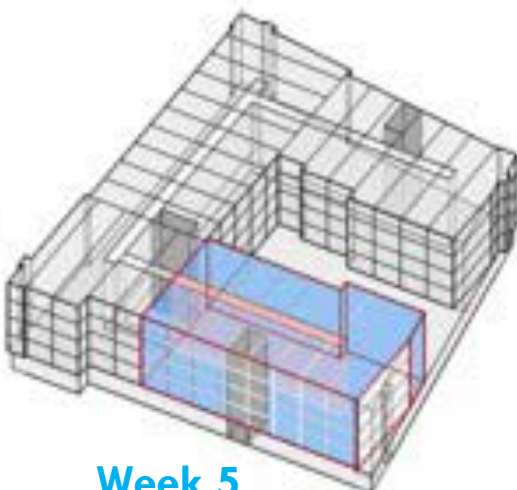
Week 2



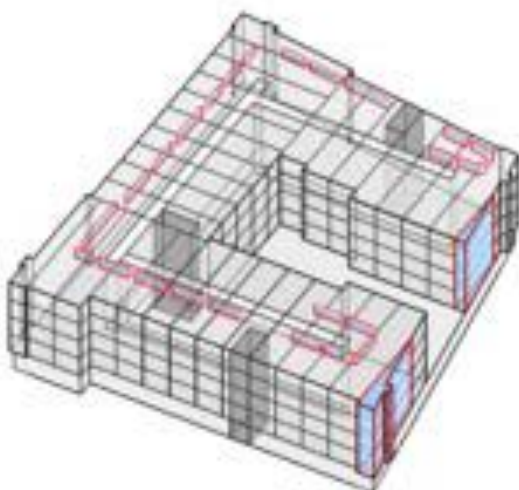
Modular Phase 2



Modular Phase 3



Modular Phase 4



Completion

Week 3

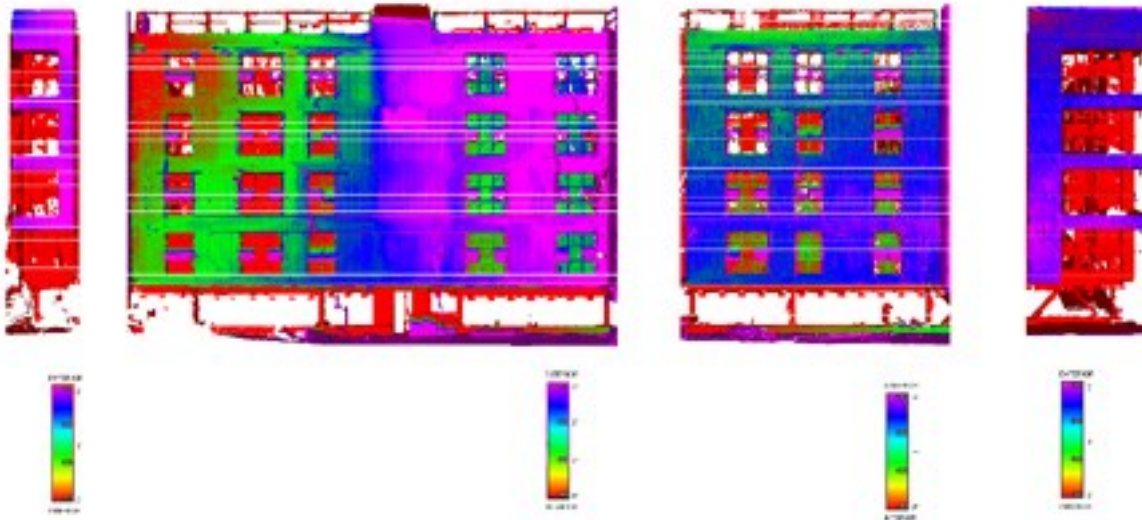
Week 4

Week 5

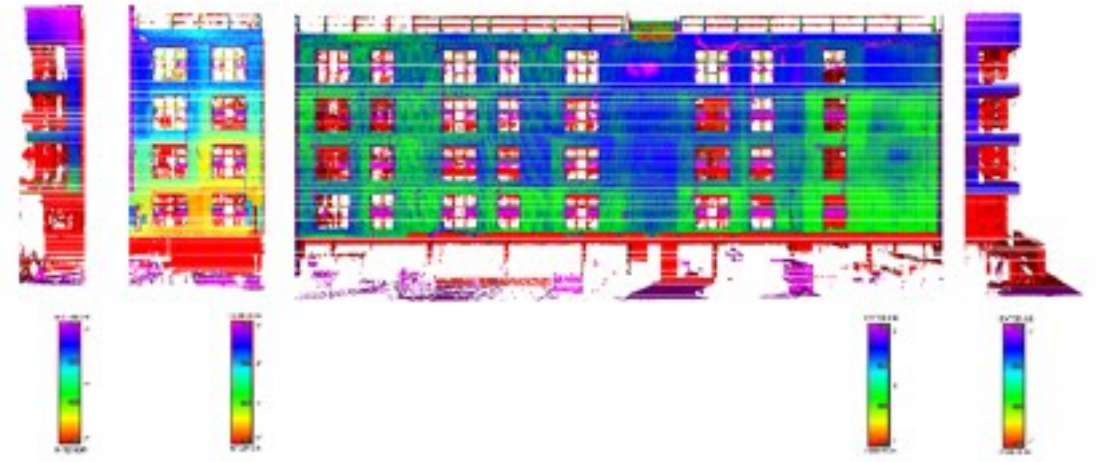
FAÇADE



① North elevation
1:100



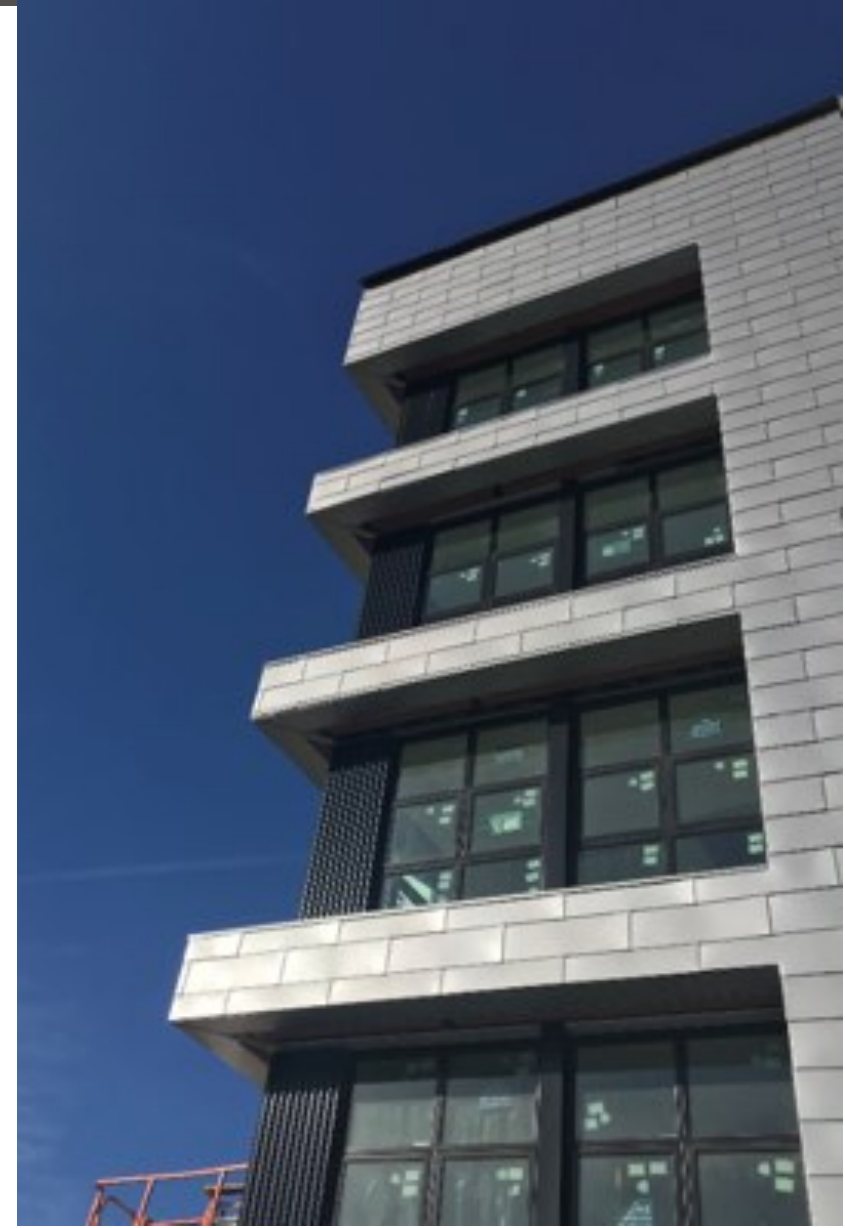
② South elevation
1:100



8. WOULD WE DO THIS AGAIN?

LESSONS LEARNED:

1. Decide Modular early and don't make changes
2. Modular can save time but is not a “silver bullet”
3. No limit to design, as long as you coordinate
4. Teamwork, communication & collaboration is critical
5. Spend time at the Factory!





An aerial photograph of a cityscape under a blue sky with scattered white clouds. In the foreground, a large building with a green facade and a flat roof is visible, with many white rectangular objects, possibly solar panels or construction materials, laid out on its roof. To the left of this building is a multi-lane highway with traffic. In the middle ground, there are several large, low-rise industrial or commercial buildings, some with red brick facades, and large parking lots filled with cars. In the background, a dense urban skyline with various skyscrapers is visible across a body of water. The text 'THANK YOU' is superimposed in the center of the image in a large, white, sans-serif font.

THANK YOU



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> QUESTIONS?

This concludes The American Institute of
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Course

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