



ReFAB PreFAB: The Practice and Science of Prefabrication at the Cutting Edge

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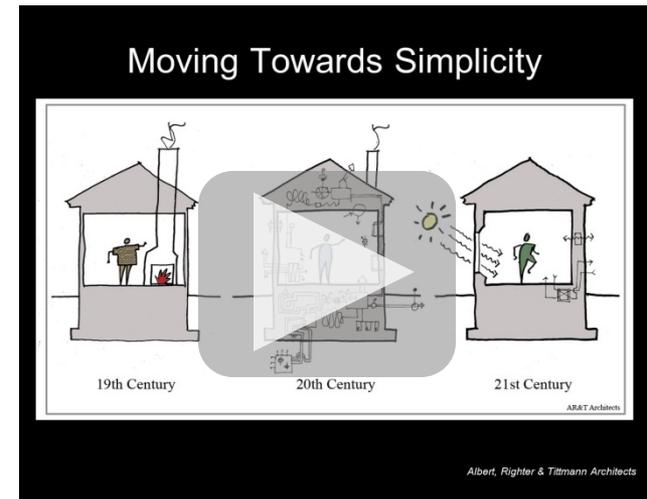
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Research, Building Science and Architecture

Detailing for Durability

Healthy Homes Research

Researching Resiliency



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Course Description 1 of 2

Although prefabrication is not new to the practice of architecture, its full potential, particularly in residential design and construction, has yet to be realized. The time for architects to take the lead in realizing this potential is now. New concepts and technologies in prefabrication are creating exciting new architecture and opening the opportunity for architects to influence a larger segment of the construction industry. Not only will prefabrication expand architects' influence, it will also help revitalize residential neighborhoods, influence sustainable design, and provide lower-cost home-ownership alternatives.



Course Description 2 of 2

In an effort to realize this ambition, Andrew Daley, Jason Fleming, and Peter Muessig (all recent M.Arch. graduates of the Rice School of Architecture in Houston, TX) set out to design and build a pre-fabricated, consolidated kitchen/bath/mechanical “core” tailored specifically for renovation of existing homes. Having just successfully installed their first fully working prototype, the three will present their project as a case study of the opportunities and challenges inherent to pre-fabrication.



Learning Objectives

1. Recognize the potential of prefabricated residential architecture in new construction and in renovation of existing residential structures.
2. Understand the potential of sustainable design, computer modeling in the factory process, and new architectural avenues based on mass production.
3. Identify the benefits of prefabricated architecture, including cost savings, reduced material consumption and waste, reduced exposure to regional labor shortages, expedited delivery, and increased quality of design and construction.
4. Recognize the limitations of prefabrication (specifically what can be completed in the factory, what must be completed on site, and when and how to make concessions) and develop strategies that permit design flexibility.





Peter Muessig, Assoc. AIA

Designer
Interloop Architecture
Houston, TX
Speaker



Jason Fleming, Assoc. AIA

Designer
Morris Architects
Houston, TX
Speaker



Stephen Schreiber, FAIA

University of Massachusetts Amherst
Moderator

Submit a question to the moderator via the Chat box. They will be answered as time allows.

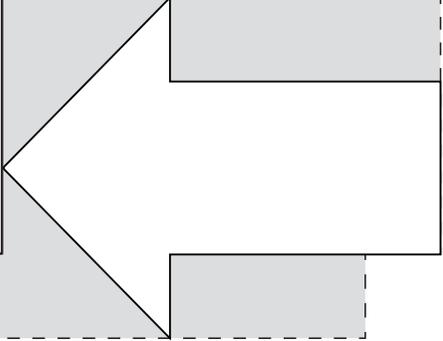




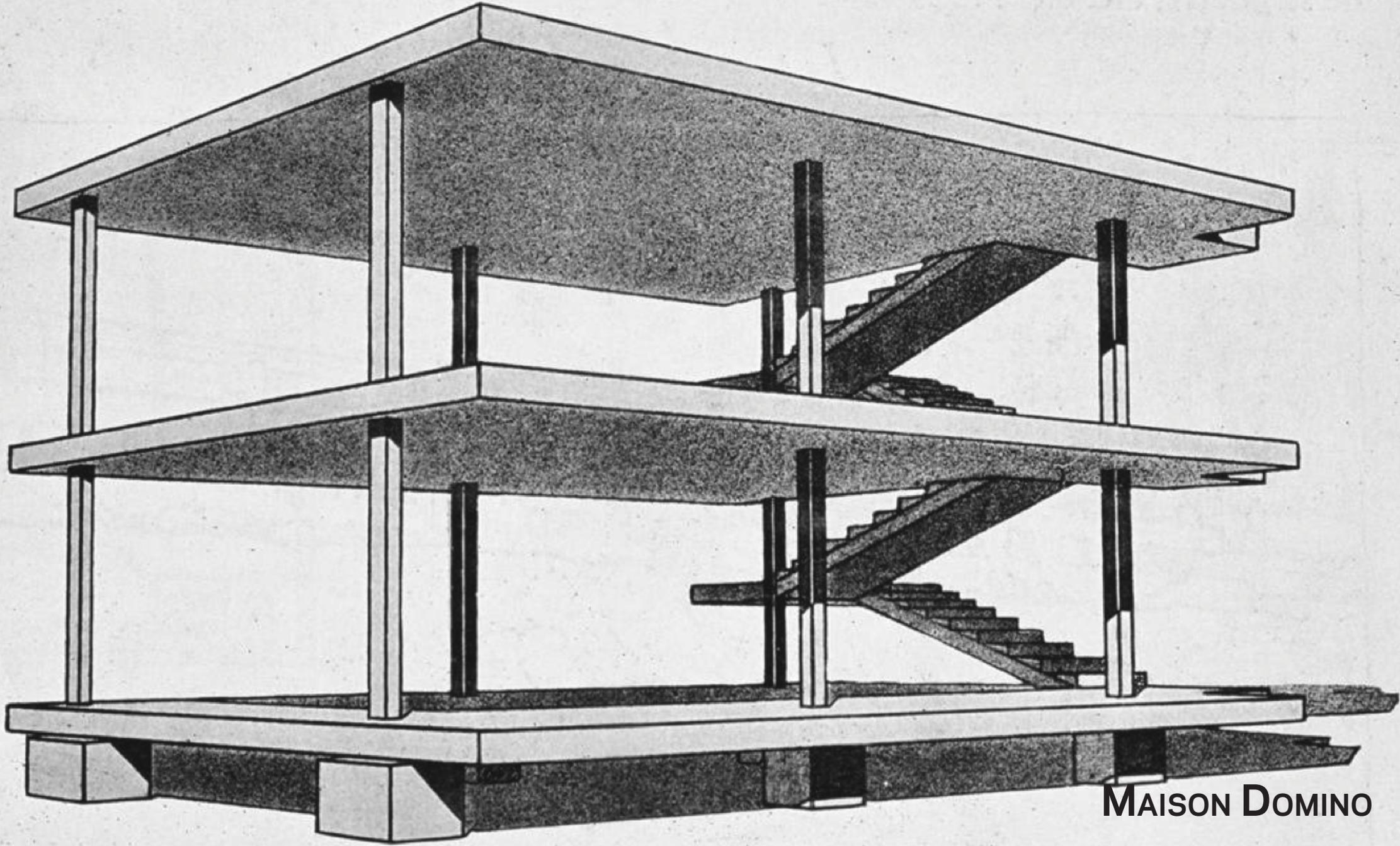
INHOUSE OUTHOUSE

SLEEP
LIVE

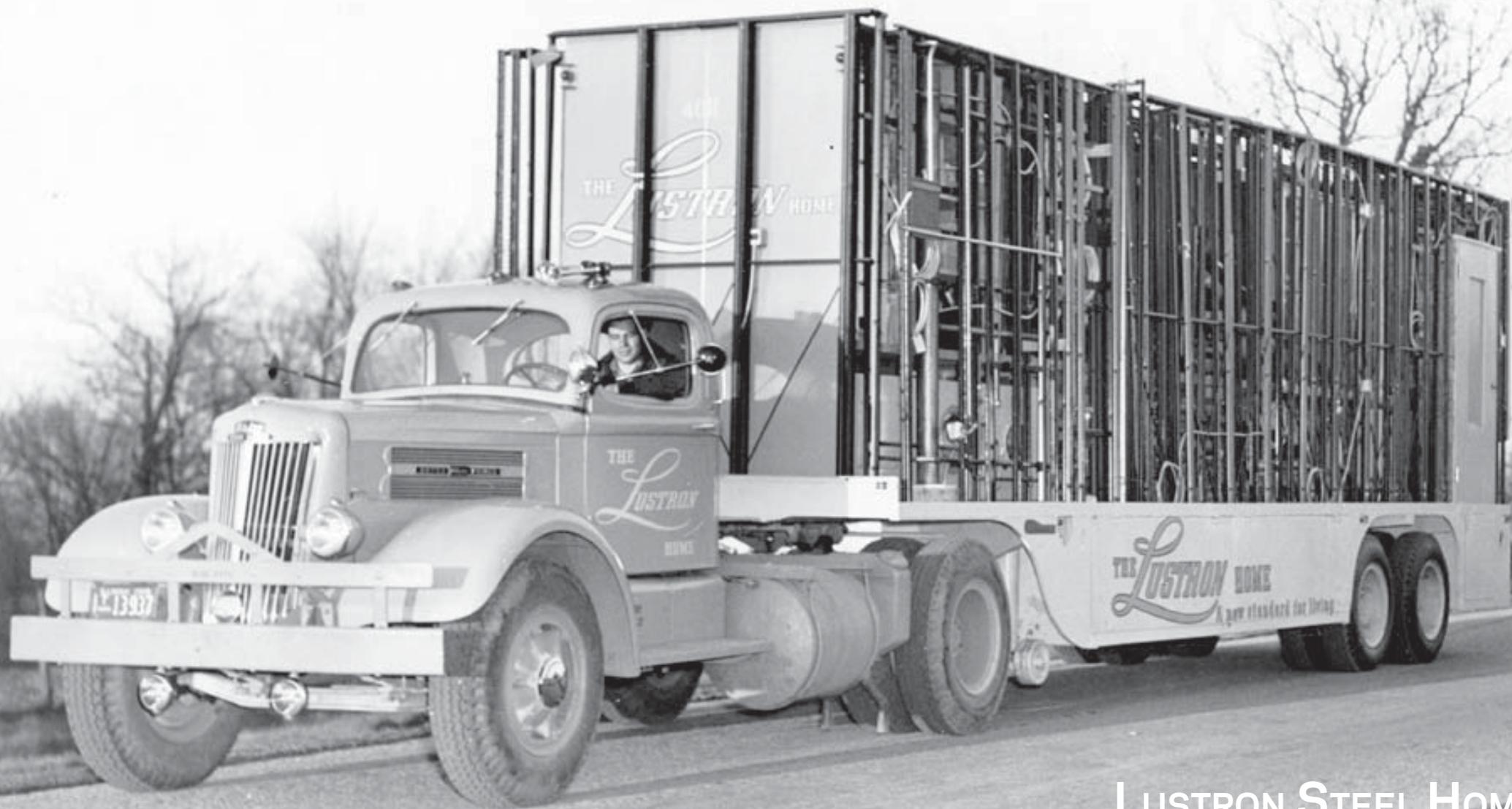
+OFFICE
MECH
BATH
KITCHEN



HISTORY



MAISON DOMINO



LUSTRON STEEL HOMES



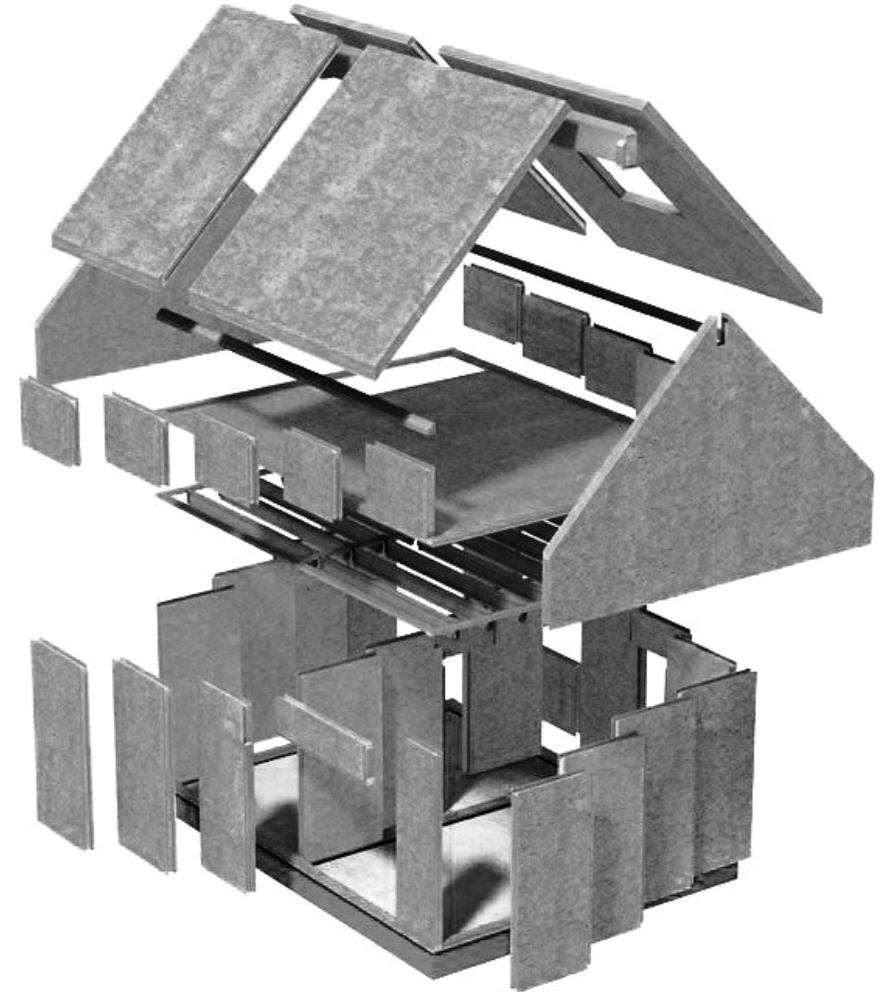
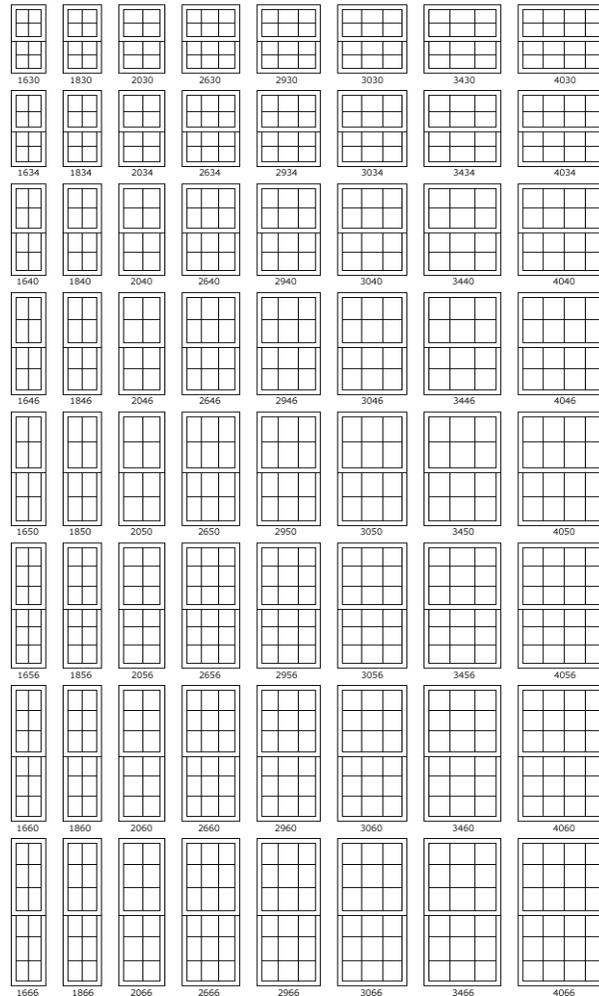
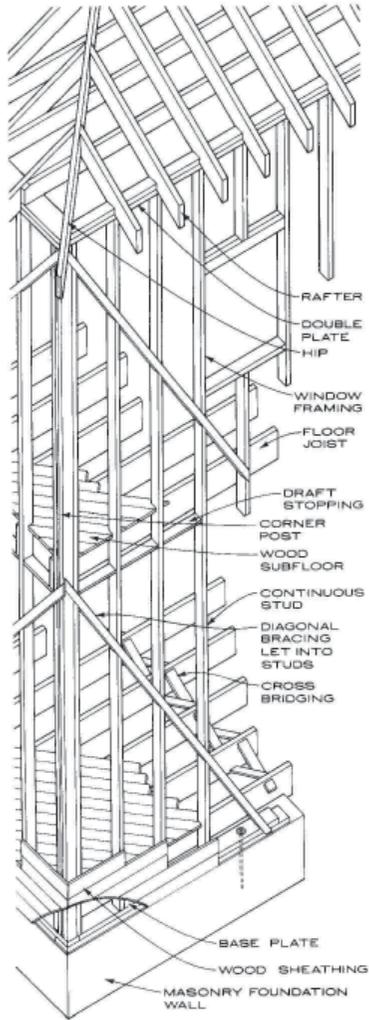
LE CORBUSIER - UNITÉ D'HABITATION



MOSHE SAFDIE - HABITAT 67



MODULAR BUILDING COMPONENTS

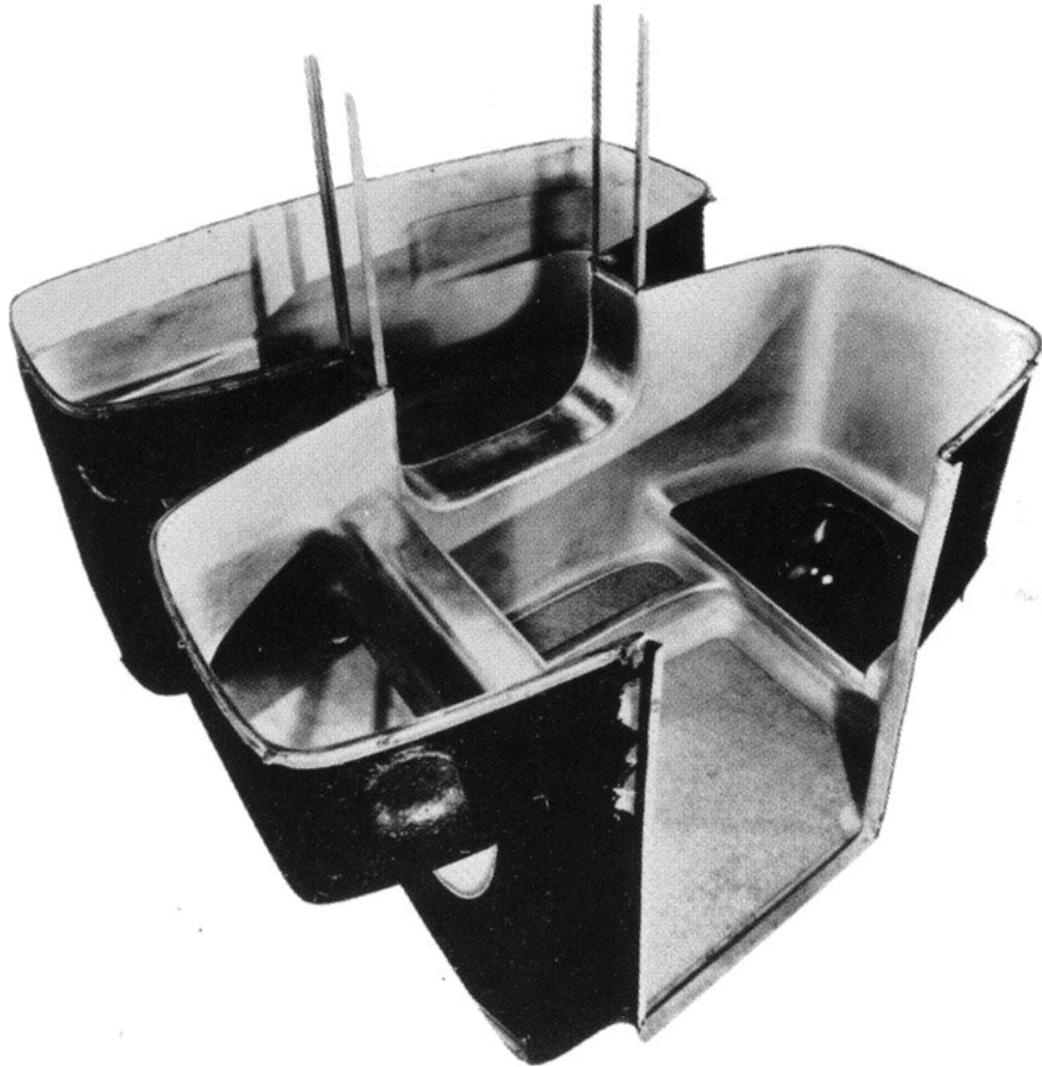


BALLOON FRAME

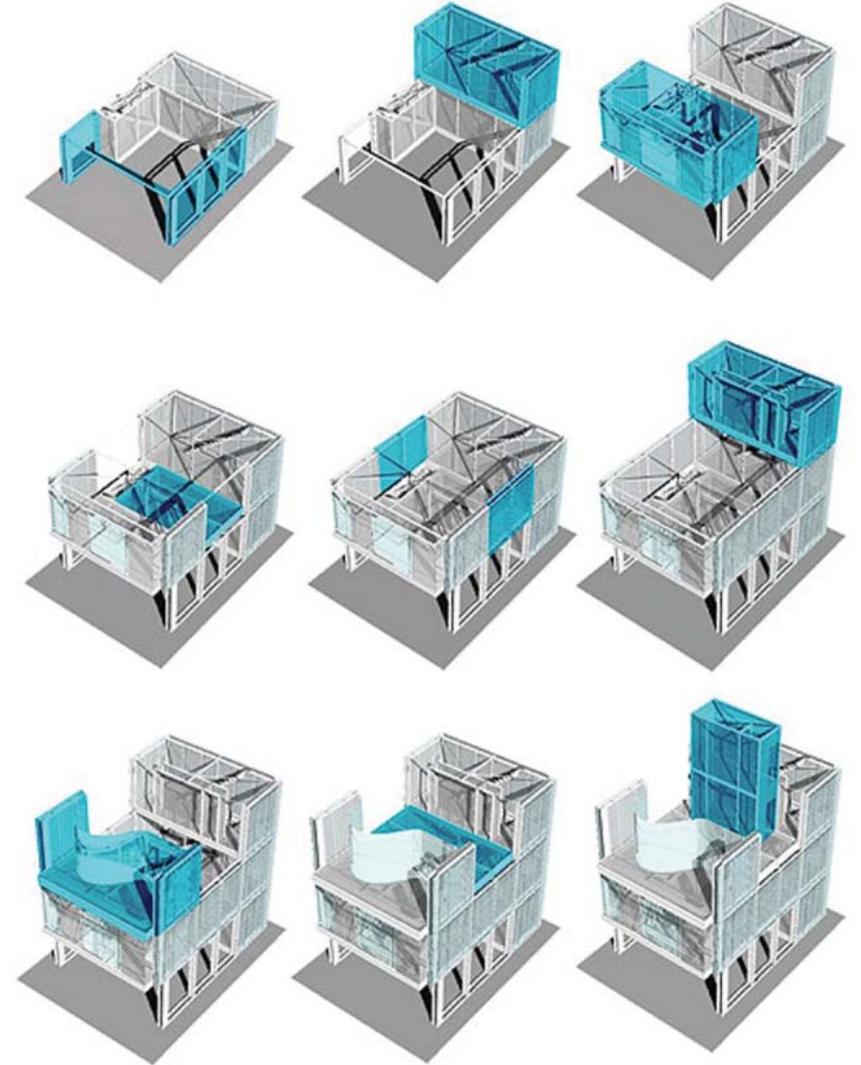
WINDOWS

SIPS PANELS

MODULAR BATHROOM SYSTEMS



FULLER - BATHROOM POD

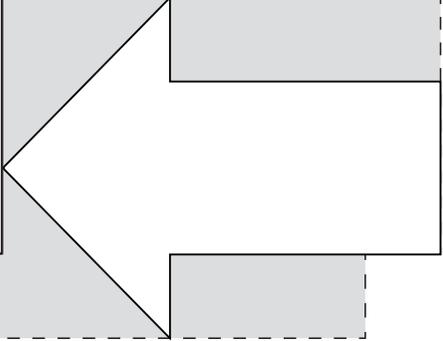


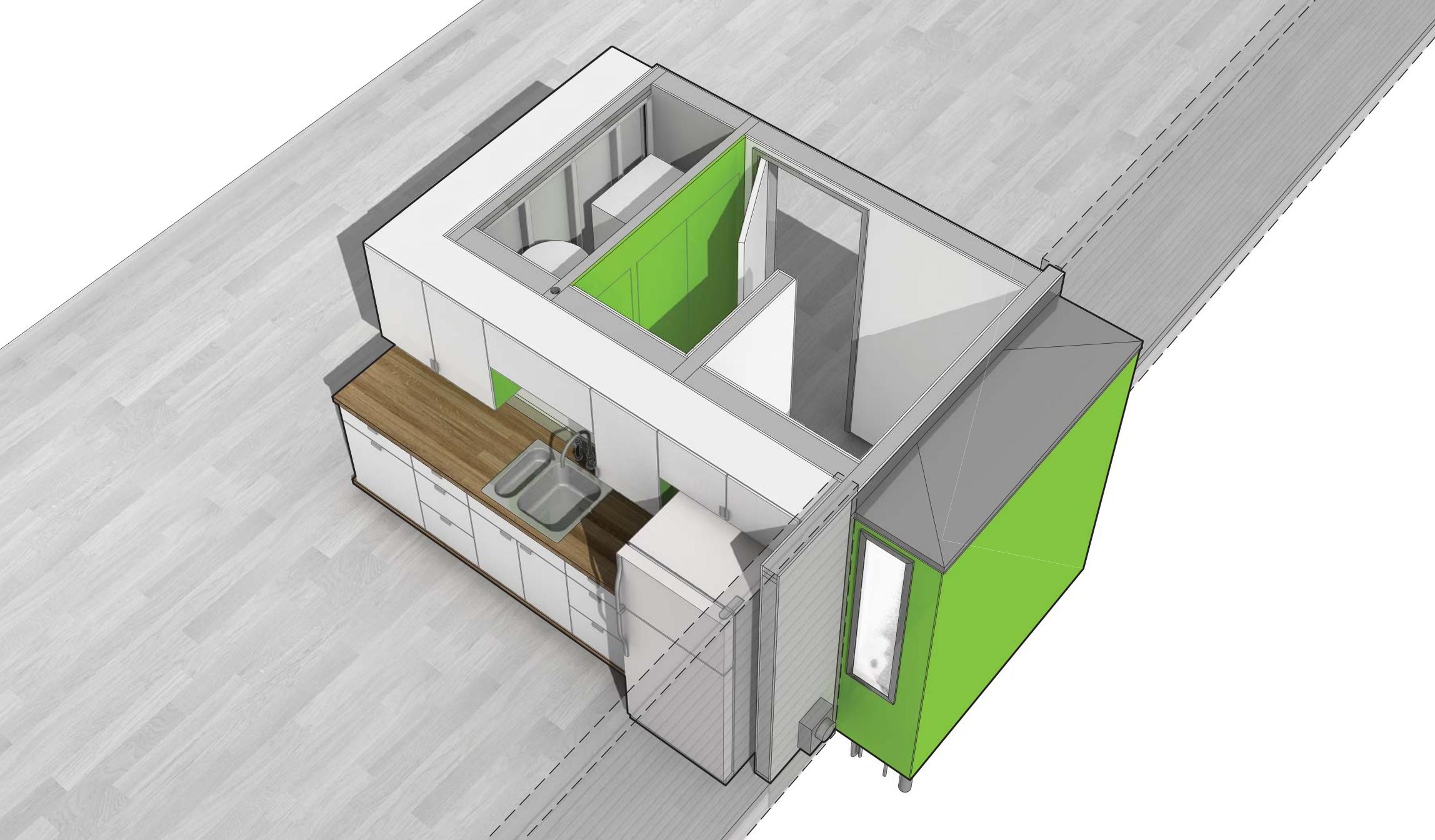
KIERAN + TIMBERLAKE - CELLOPHANE HOUSE

PROJECT

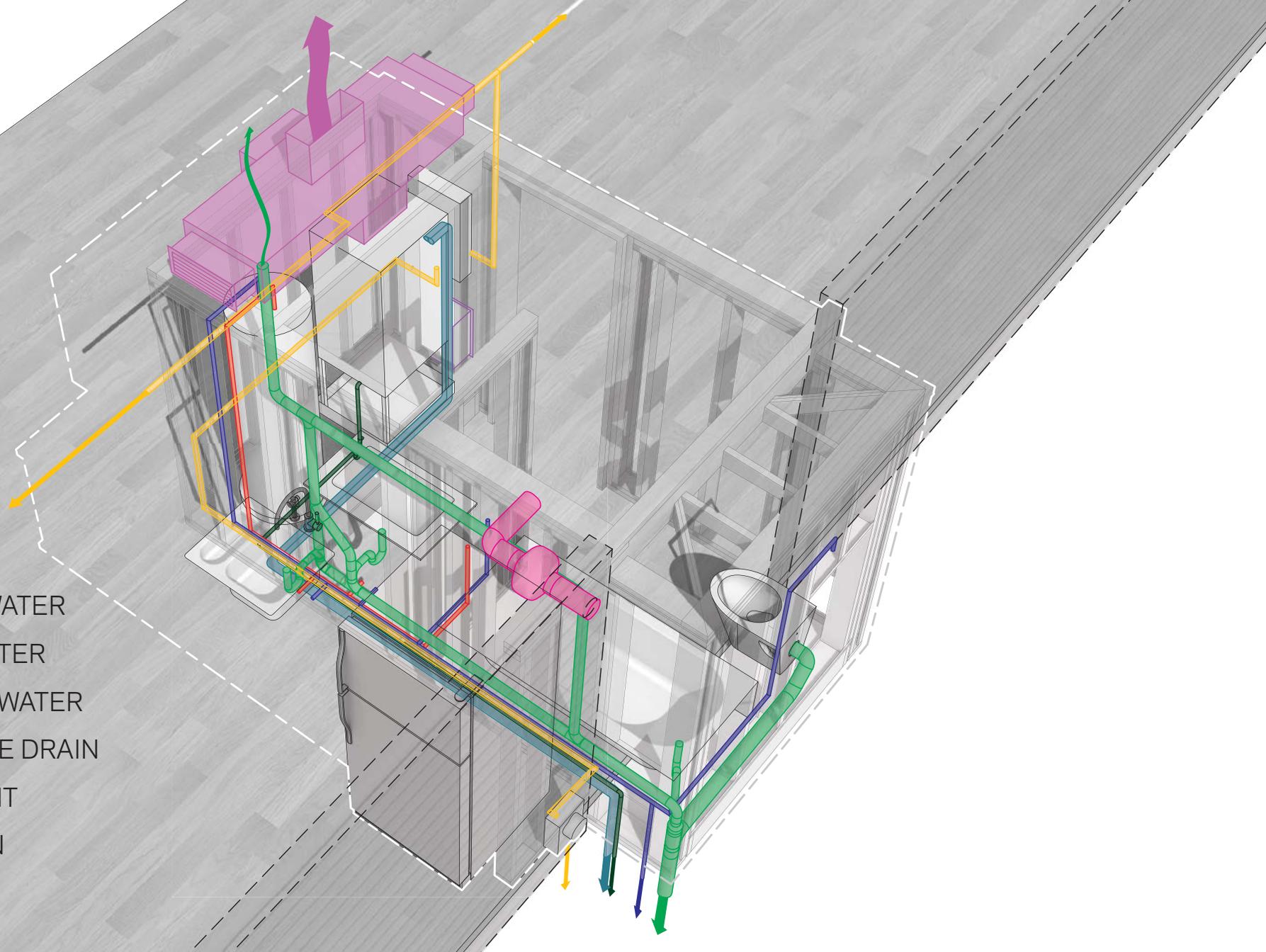
SLEEP
LIVE

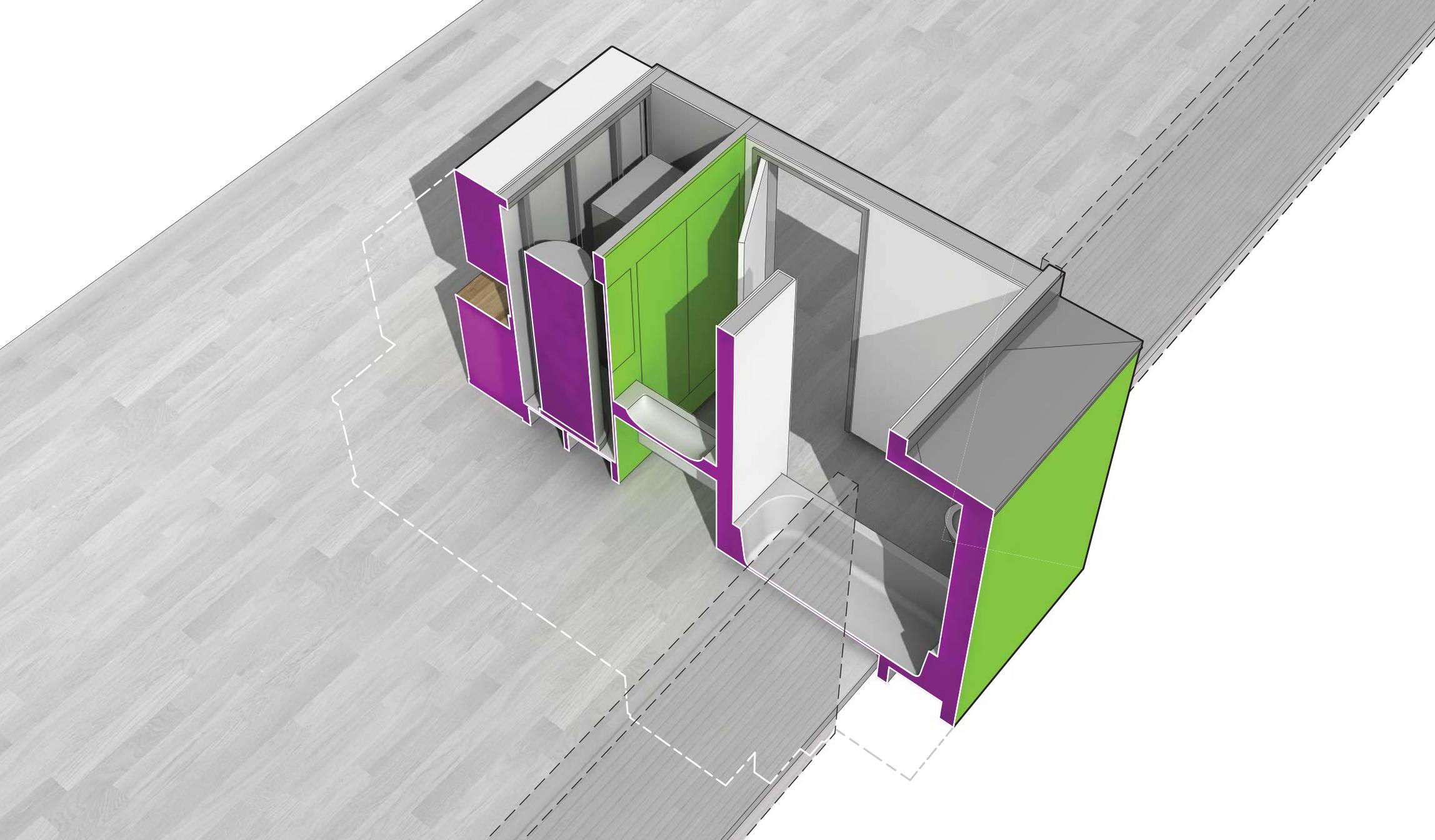
+OFFICE
MECH
BATH
KITCHEN

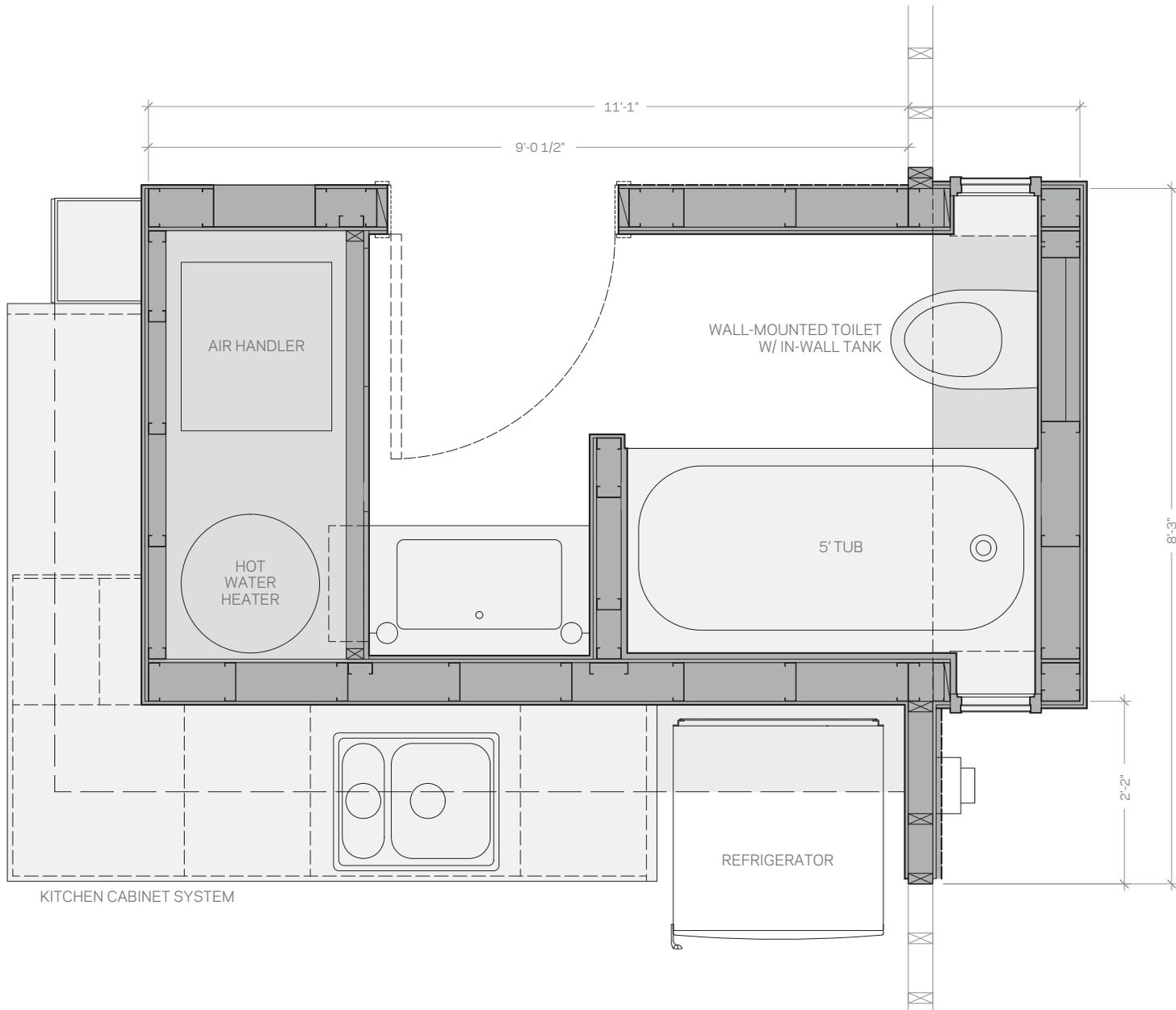




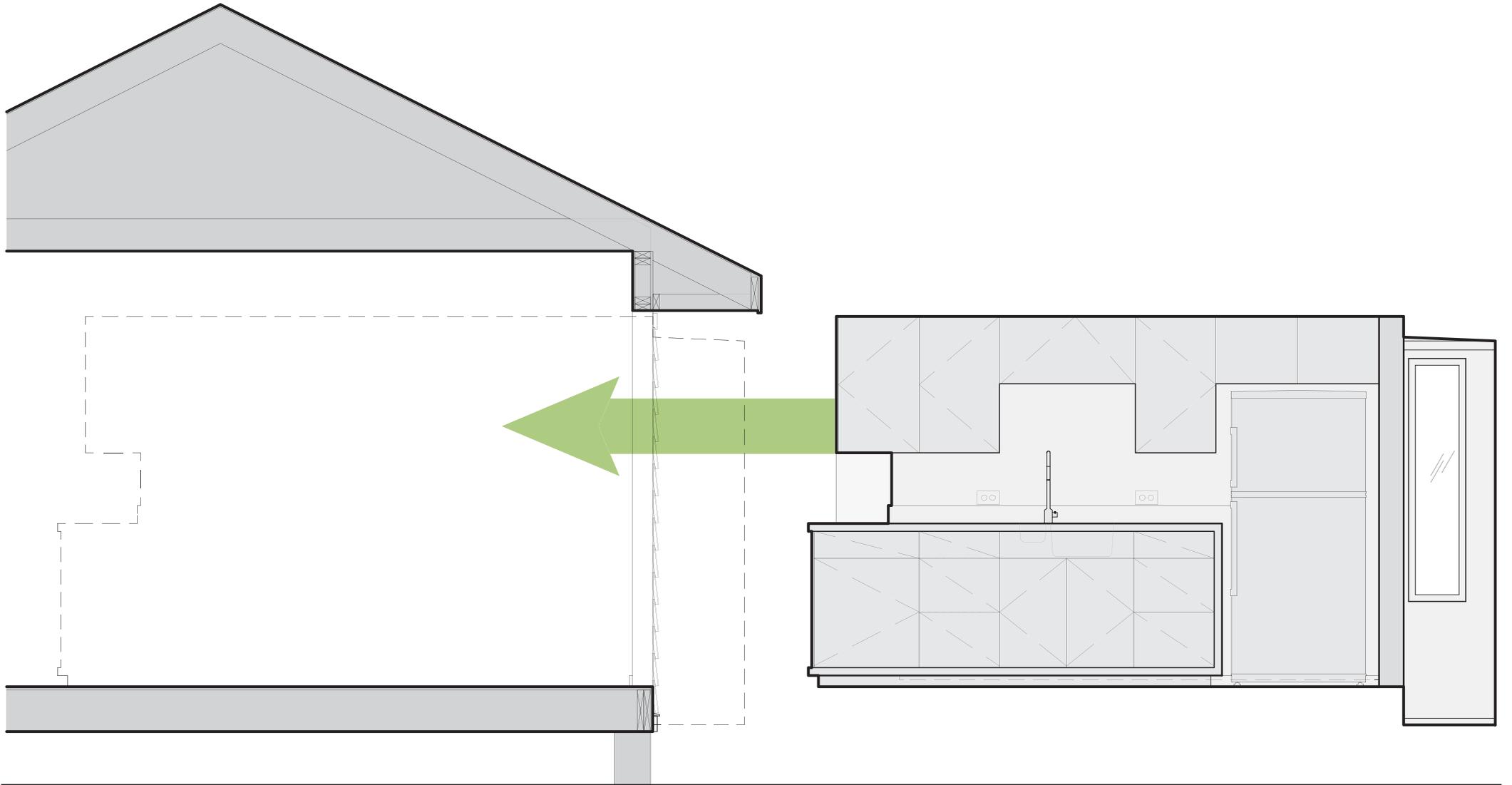
- PLUMBING COLD WATER
- PLUMBING HOT WATER
- PLUMBING WASTE WATER
- HVAC CONDENSATE DRAIN
- HVAC REFRIGERANT
- HVAC VENTILATION
- ELECTRICAL







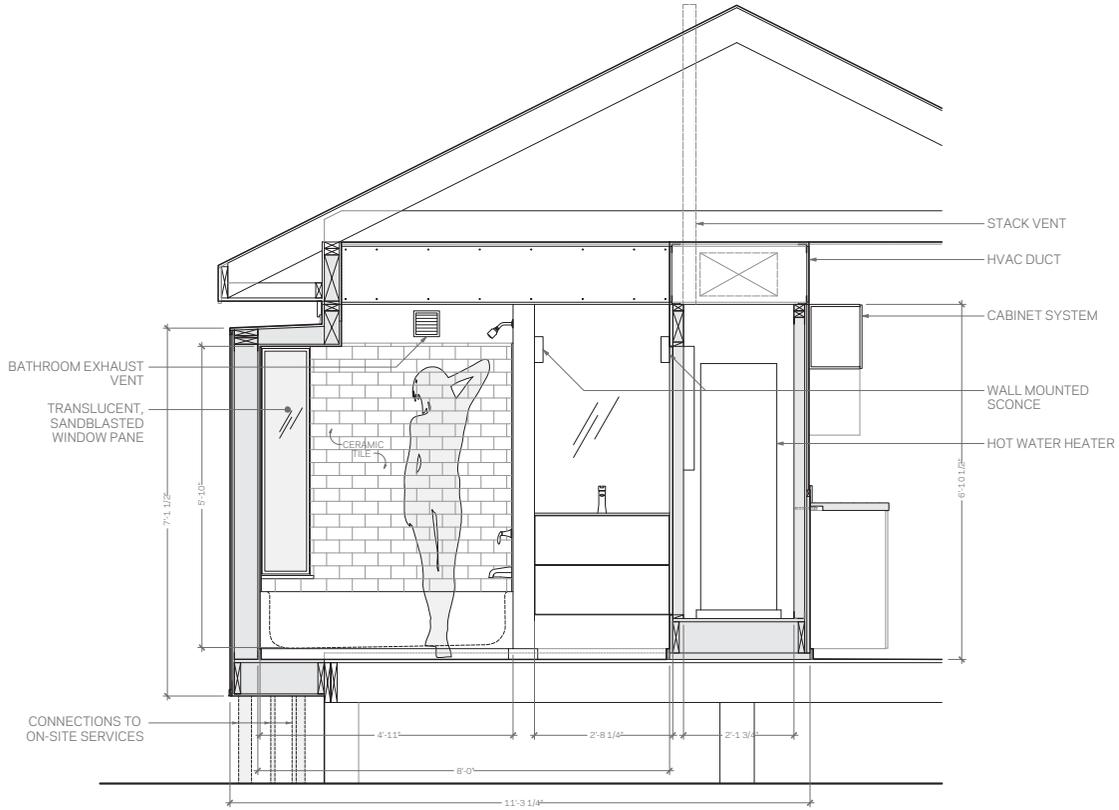




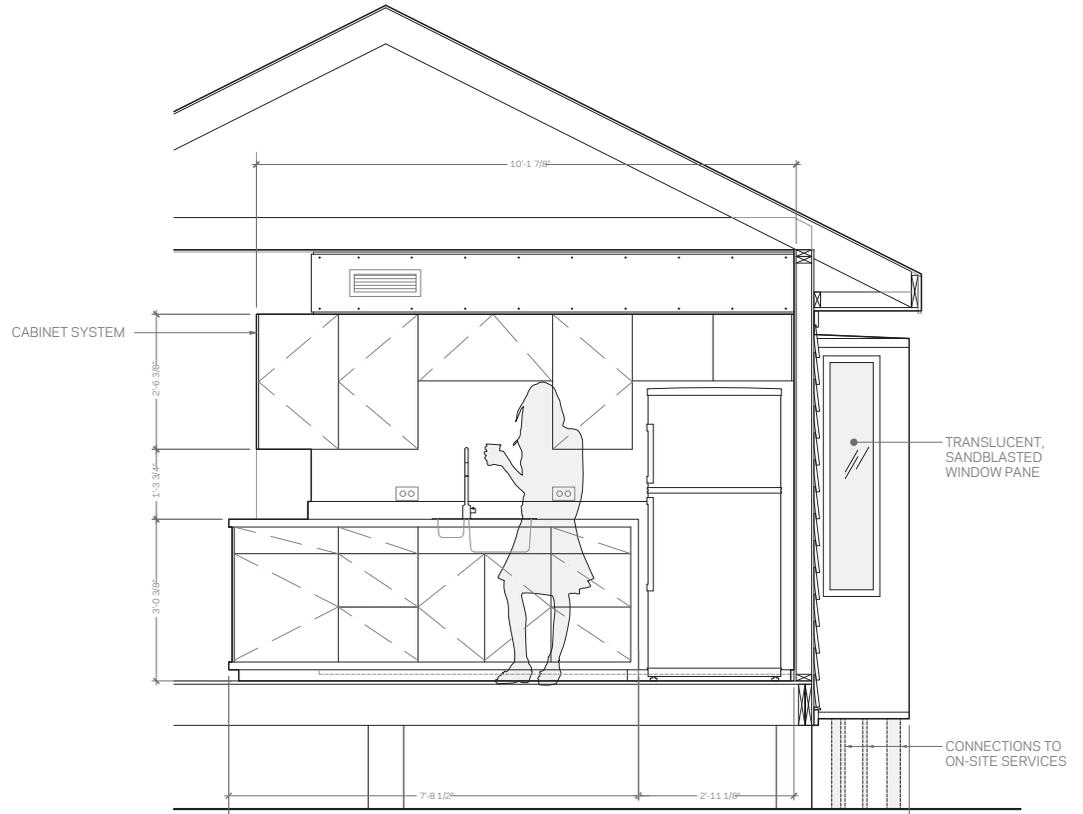




VISION



SECTION : BATHROOM



SECTION : KITCHEN







OUTHOUSE
2012

XS HOUSE
2003

zeROW HOUSE
2008-2009

DELIA'S
2005

WORKYARD
2006

SIX SQUARE HOUSE
1999

DUPLEXES
2008

CORE INSERT
2008

BASTROP

STUART

DOWLING

LIVE OAK

ELGIN

FRANCIS

DELANO

HOLMAN

ALABAMA

WINBERN

EWINS



3303

EXISTING CONSTRUCTION CONDITION



PLUMBING



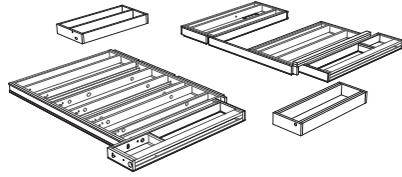
ELECTRICAL



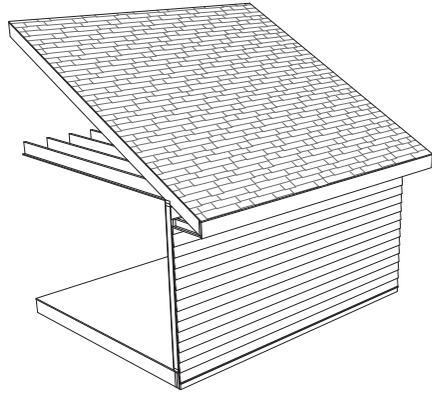
MECHANICAL



PARALLEL TIMELINES

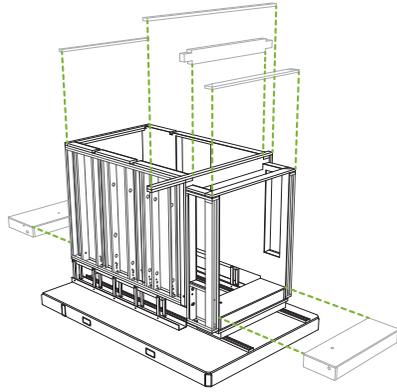


FLAT ASSEMBLE PRIMARY WALLS.
FACTORY SEQUENCE

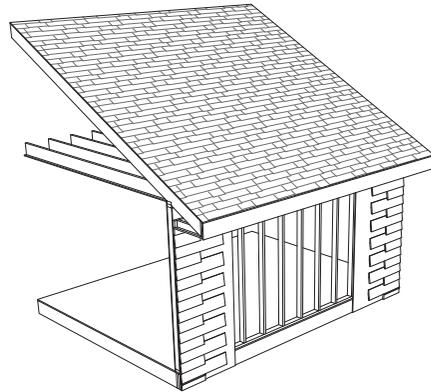


EXISTING HOUSE.
ON-SITE PREPARATION SEQUENCE



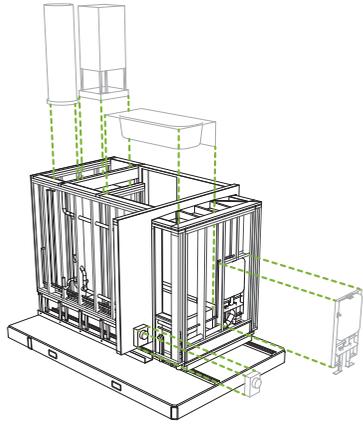


ERECT WALLS + ATTACH FLOOR ASSEMBLIES.
FACTORY SEQUENCE

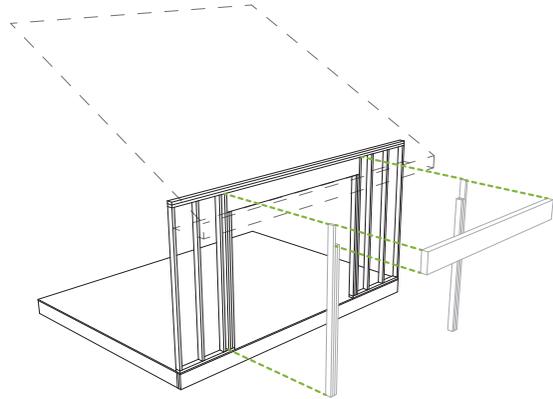


REMOVE + SALVAGE EXISTING EXTERIOR CLADDING.
ON-SITE PREPARATION SEQUENCE



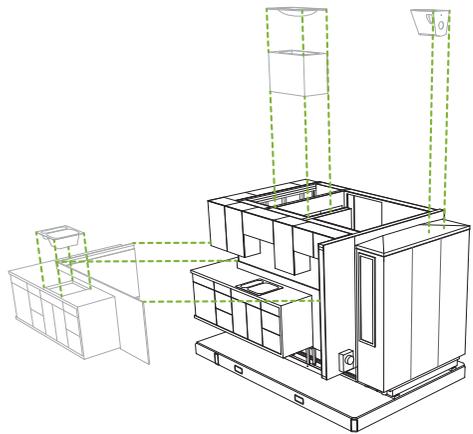


ROUGH-IN MECHANICAL.
FACTORY SEQUENCE

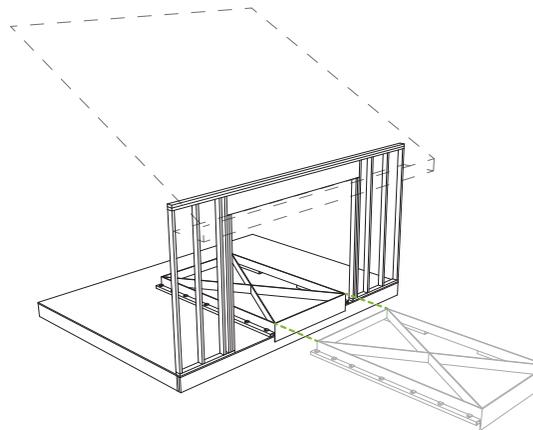


FRAME OPENING.
ON-SITE PREPARATION SEQUENCE



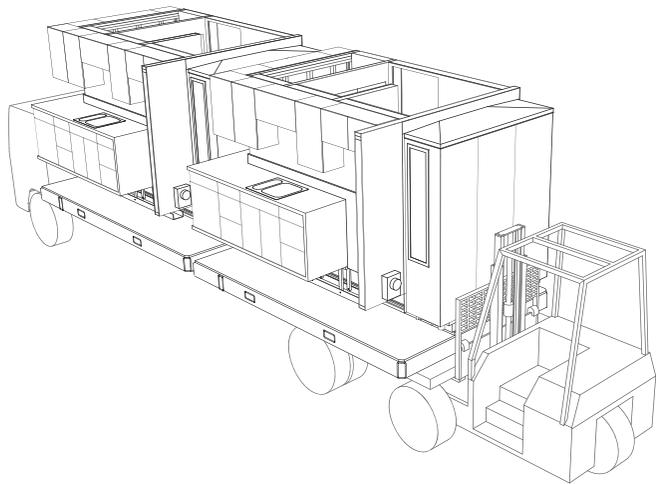


INSTALL CABINETS + FIXTURES.



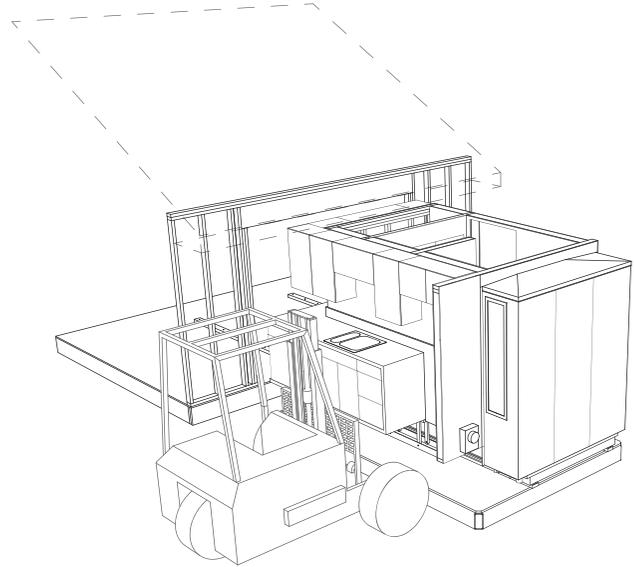
INSTALL + LEVEL GUIDE TRACKS.





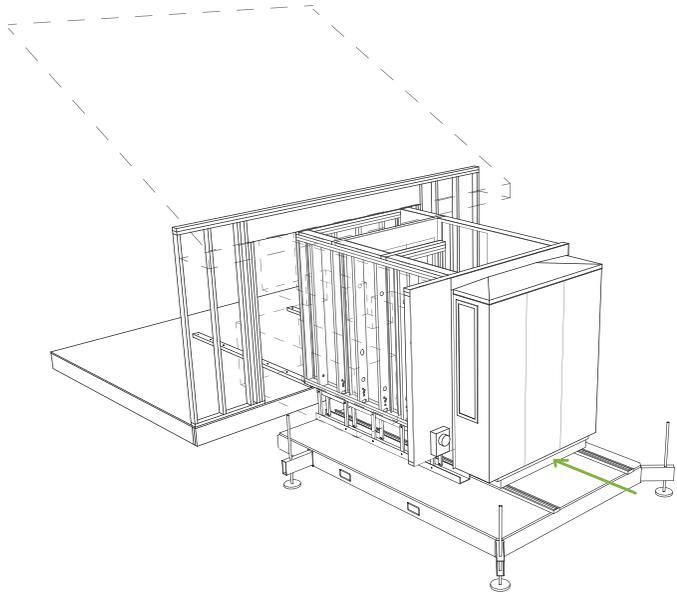
DELIVER TO SITE.
DELIVERY SEQUENCE





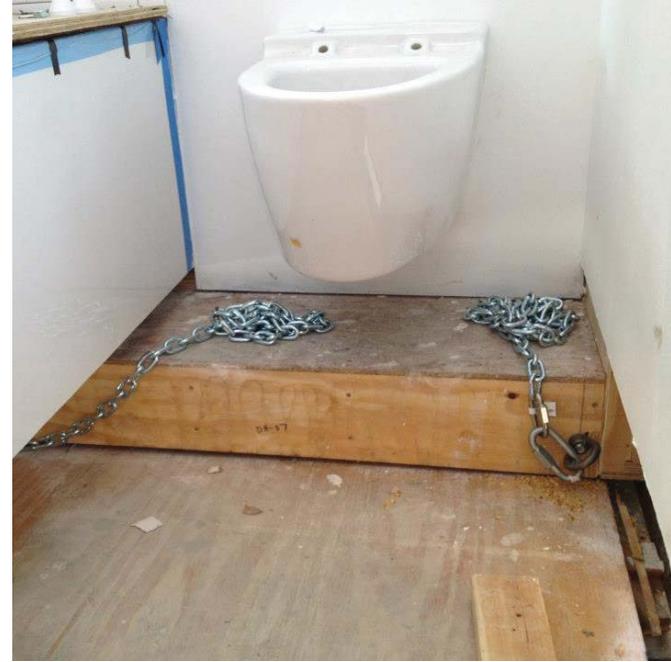
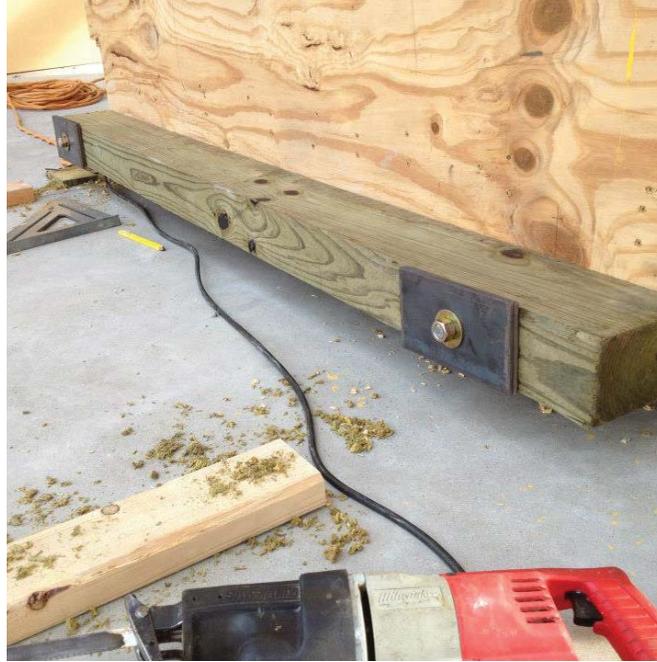
POSITION OutHouse.
DELIVERY SEQUENCE

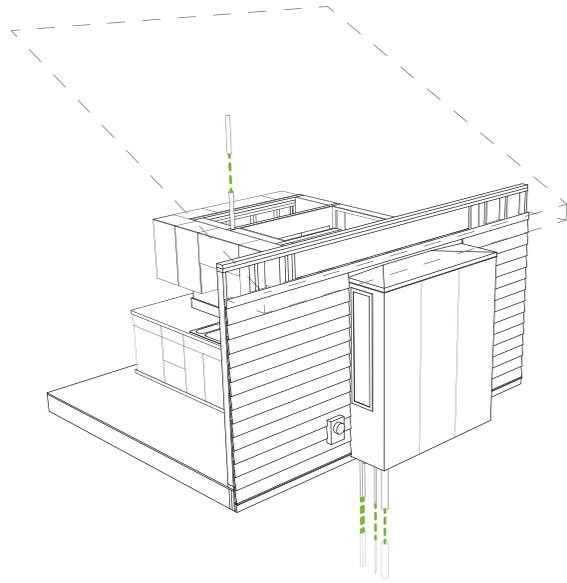




INSERT OutHouse.

INSTALLATION SEQUENCE



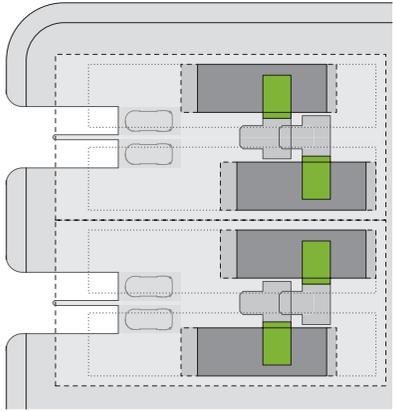


CONNECT SERVICES.
INSTALLATION SEQUENCE

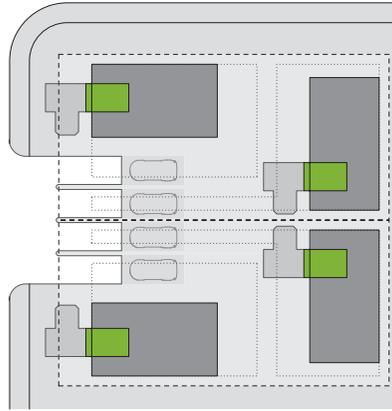


CHALLENGES OF PRE-FABRICATION

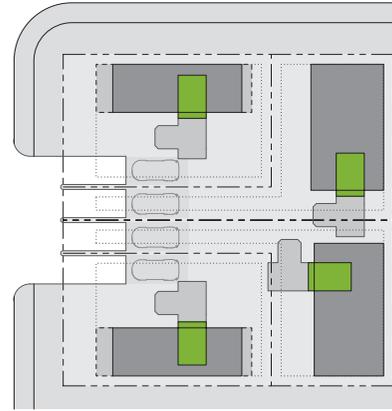




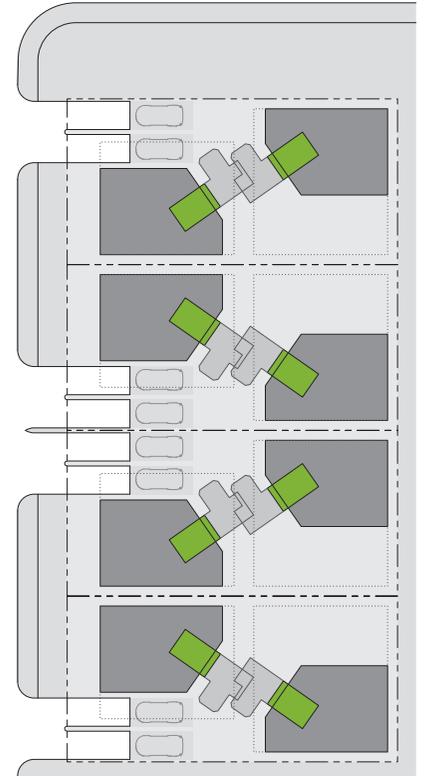
SITE PLAN ONE BEDROOM UNITS



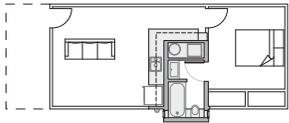
SITE PLAN TWO BEDROOM UNITS



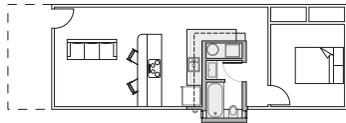
SITE PLAN MIXED UNITS



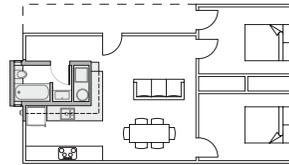
BLOCK PLAN TWO BEDROOM UNITS



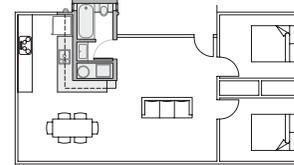
ONE BEDROOM 480 sf



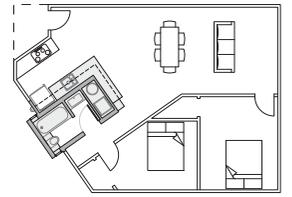
ONE BEDROOM 600 sf



TWO BEDROOM 840 sf



TWO BEDROOM 840 sf



TWO BEDROOM 880 sf



CASE STUDY

LABOR
SAVINGS



MATERIAL
SAVINGS



FACTORY
OVERHEAD



COST OF
TRANSPORT

SITE BUILT ANALOGUE COST ESTIMATE

Item	Materials Cost	Labor Cost	Total Cost
Framing	\$700.00	\$800.00	\$1,500.00
Plumbing	\$800.00	\$1,200.00	\$2,000.00
Electrical	\$800.00	\$1,200.00	\$2,000.00
Mechanical	\$3,500.00	\$1,250.00	\$4,750.00
Insulation	\$650.00	\$200.00	\$850.00
Siding	\$250.00	\$600.00	\$850.00
Window	\$150.00	\$100.00	\$250.00
Gypsum Board	\$200.00	\$800.00	\$1,000.00
Paint	\$250.00	\$600.00	\$850.00
Tile	\$450.00	\$400.00	\$850.00
Door + Trim	\$700.00	\$300.00	\$1,000.00
Cabinets + Counter	\$1,200.00	\$800.00	\$2,000.00
Fixtures + Appliances	\$8,000.00	\$0.00	\$8,000.00
TOTALS	\$17,650.00	\$8,250.00	\$25,900.00

COMPARATIVE LABOR HOURS ESTIMATES

Item	Analogue On-Site	OutHouse Factory	OutHouse On-Site
Framing	32	8	16
Plumbing	48	22	4
Electrical	48	22	4
Mechanical	50	23	4
Insulation	8	4	0
Siding	24	0	24
Window	4	2	0
Gypsum Board	32	12	8
Paint	24	10	4
Tile	16	8	0
Door + Trim	12	0	12
Cabinets + Counter	32	16	0
TOTALS	330	127	76

ON-SITE LABOR HOURS COMPARISON



OVERALL LABOR HOURS COMPARISON



MATERIAL COST COMPARISON



PREFABRICATION COSTS



\$2,697.25 Total Savings Per OutHouse Unit

CONCLUSIONS:

- (1) Prototype = Testing ground for hypotheses and technical issues
- (2) Prototype = Proof of Concept
- (3) OutHouse reimagines status quo of site-based construction
- (4) OutHouse represents an alternative future for decaying urban communities
- (5) OutHouse operates as building system, residential space, and community emblem.

CONCLUSIONS:

(6) A small package can have broad sweeping impact

(7) OutHouse as a small package allows flexibility and adaptability

(8) OutHouse can effect change through efficient and exhaustive design, despite being small

(9) OutHouse can be feasible and attractive to broad sets of audiences



Peter Muessig, Assoc. AIA

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