Innovations in Affordable Single Family Home Construction

by Sam LaTronica

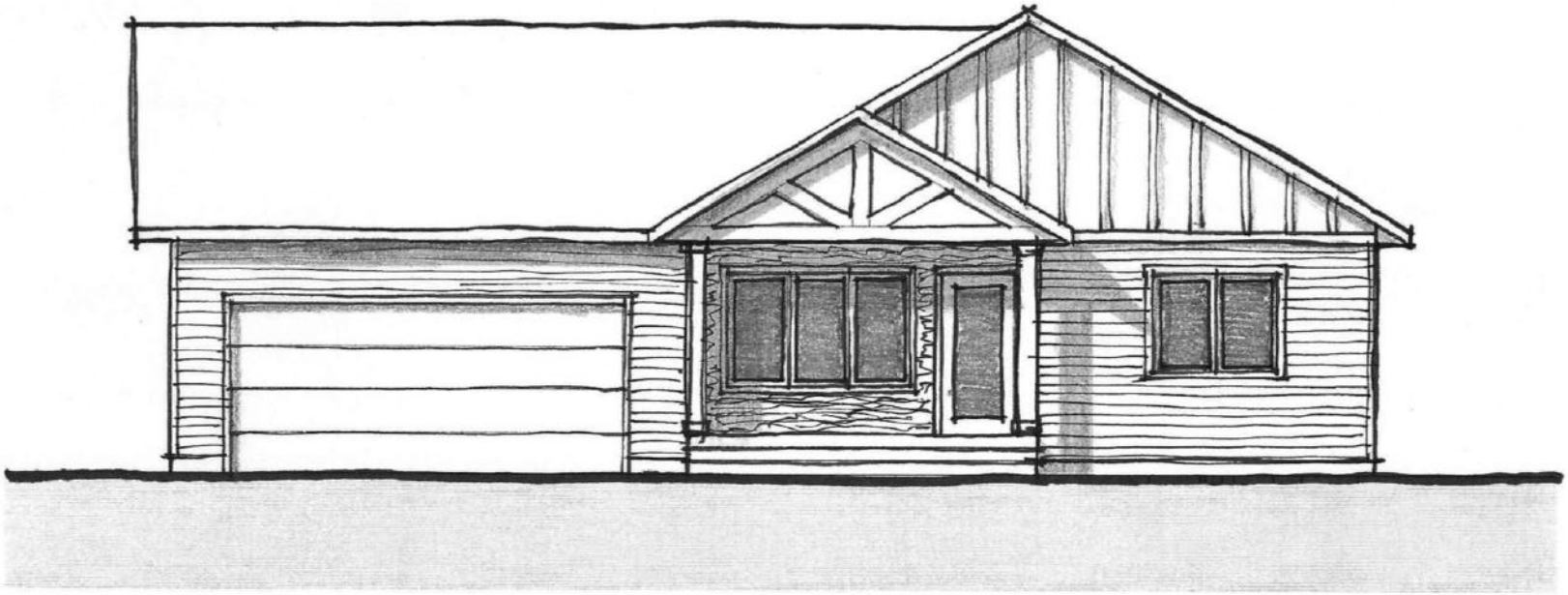


Image credit: SWMHP

JCHS

NeighborWorks® AMERICA

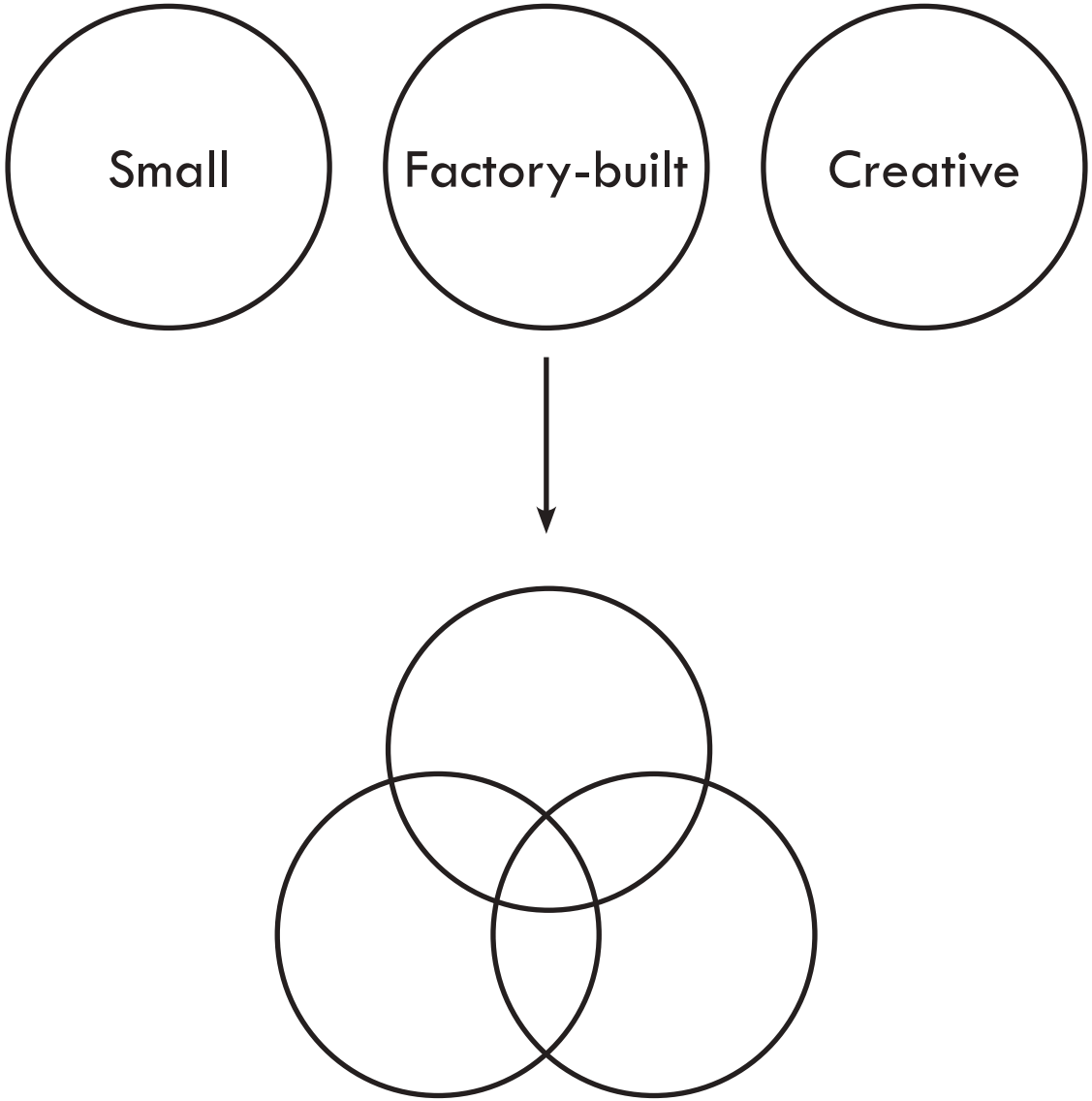
Goals

1. Affordable for lower-income potential homebuyers
- Upfront and long-term costs
- Ideally requires no subsidy on development side

2. Environmentally sustainable
- Green and recycled materials
- Energy efficient

3. Healthy

Innovations



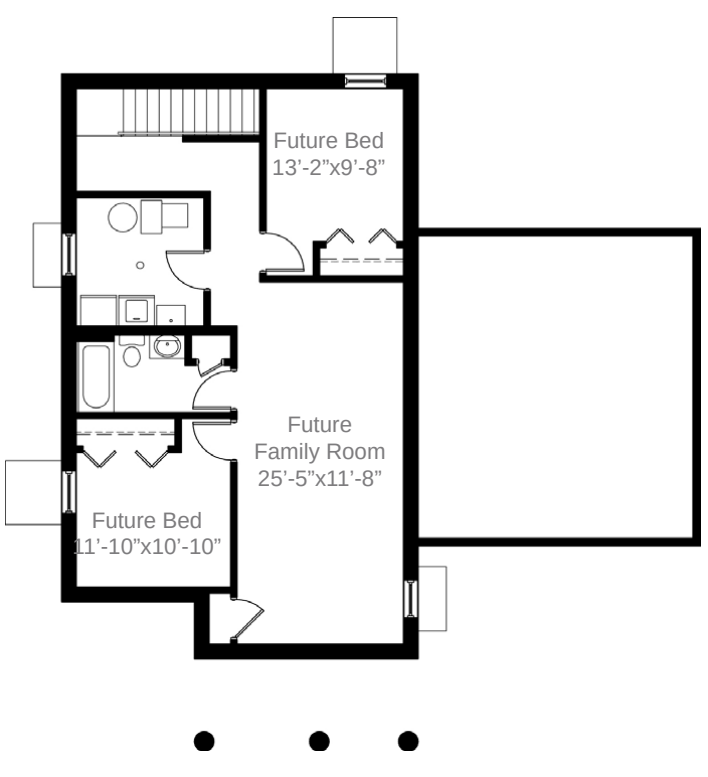
Small

Definition:

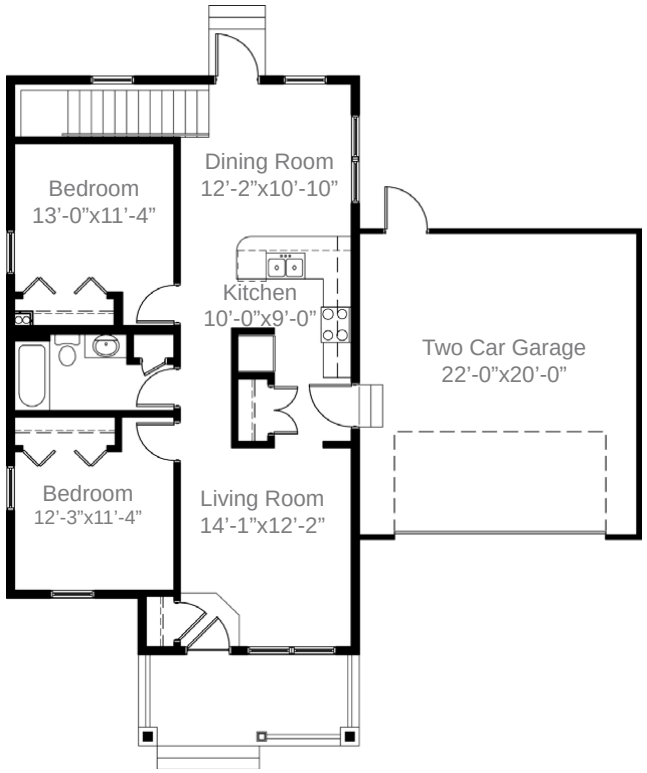
- “Small” is relative to the market.
- For Midwest CDCs, smallest single family homes range from approximately 900 - 1,100 square feet.
- Census:

  Under 1,400
  1,400 - 1,799
  1,800 - 2,399
  2,400 - 2,999
  3,000 - 3,999
  4,000 +

Small



Basement



First Floor

Image credit: SWMHP

Small

Opportunities

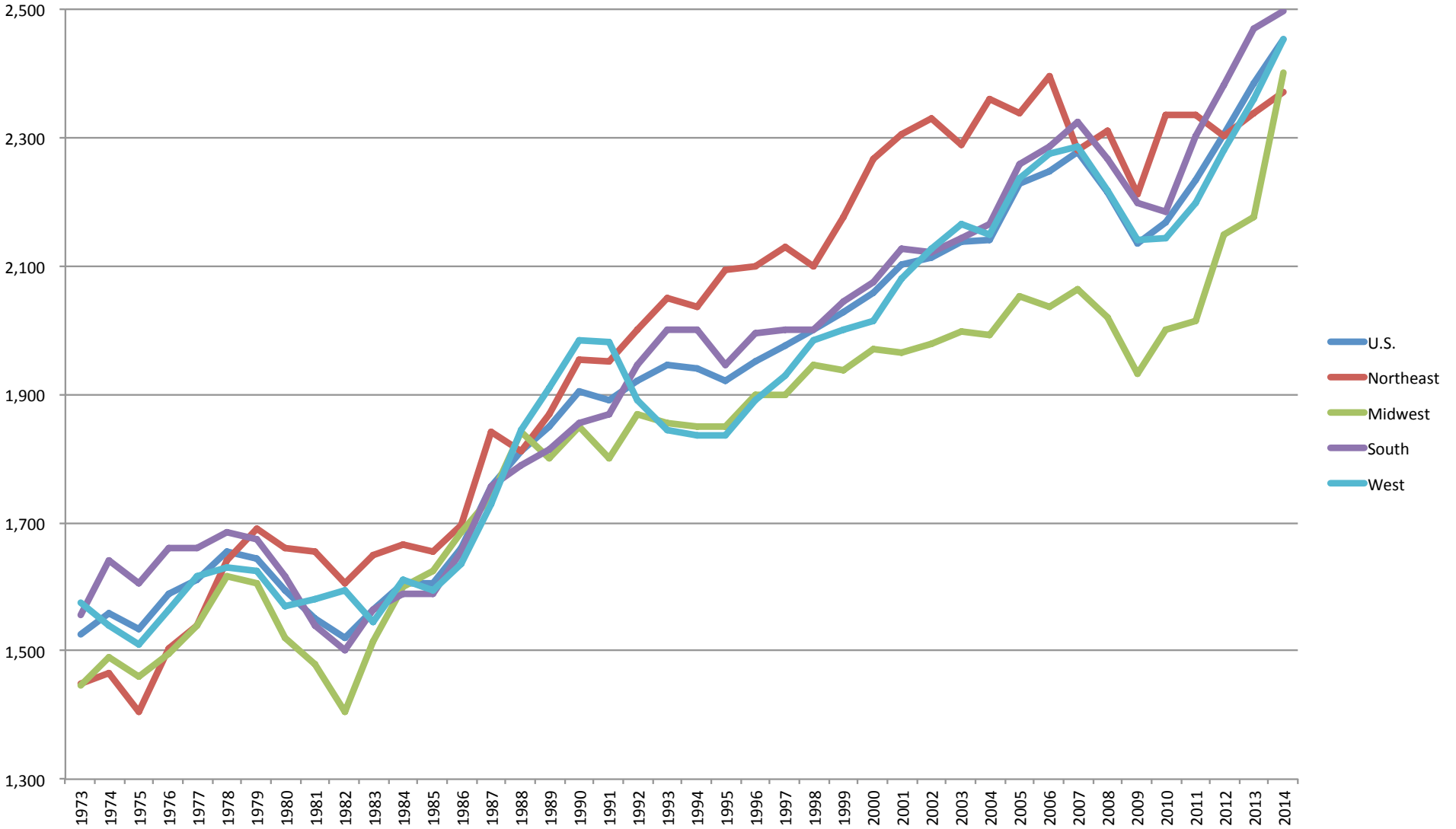
- Fewer materials
- Shortened construction time
- Long-term savings on utilities and maintenance
- Can fit on smaller and irregular infill lots
- Growing interest in certain markets

Challenges

- No guarantee that construction costs will be much lower
- Could stigmatize affordable housing
- Data suggests that most markets aren’t ready for smaller houses

Small

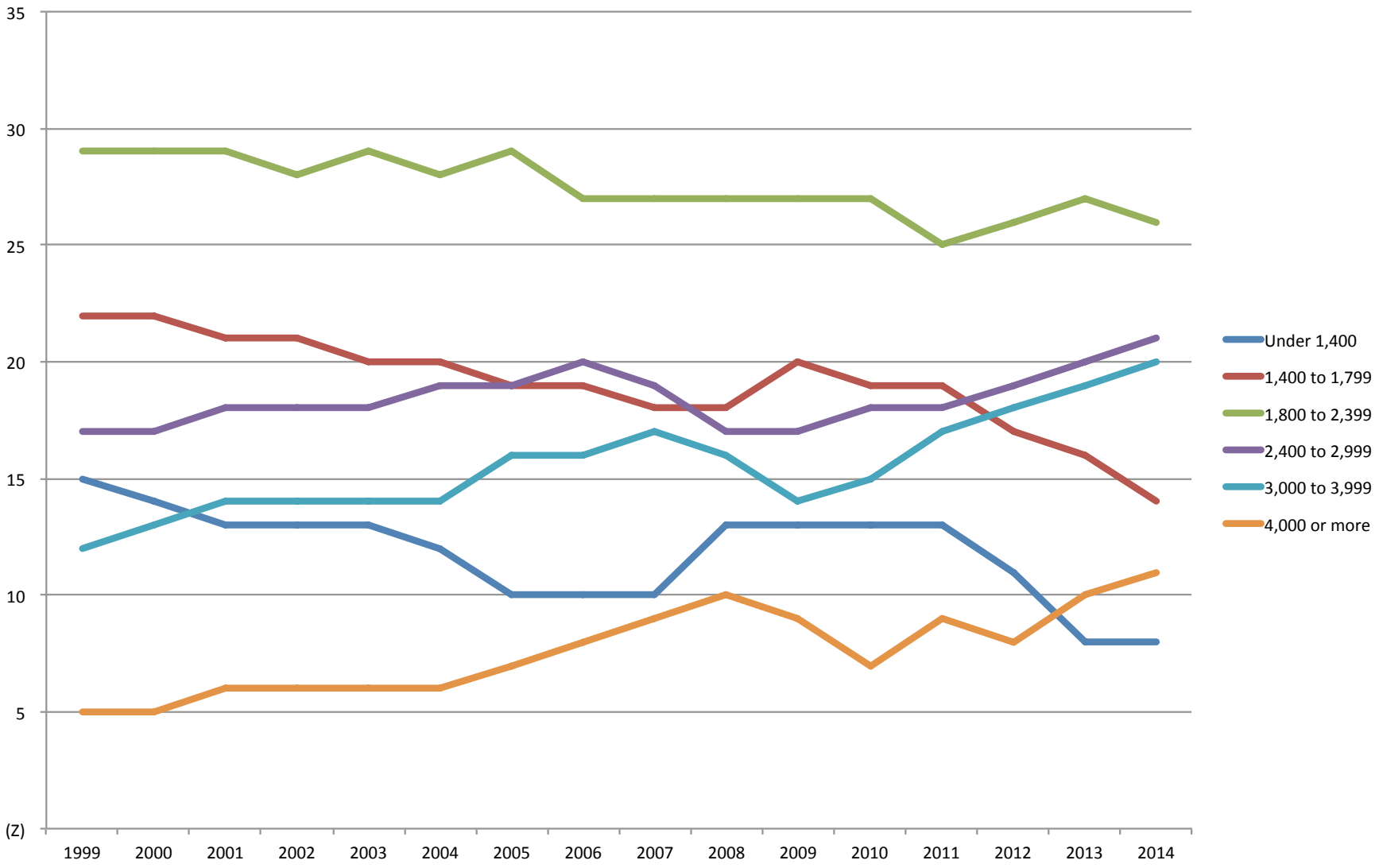
Median Size of Newly Constructed Single Family Homes in Square Feet



Data Source: US Census

Small

Market Share of Different Home Size Ranges (as a percent)



Data Source: US Census

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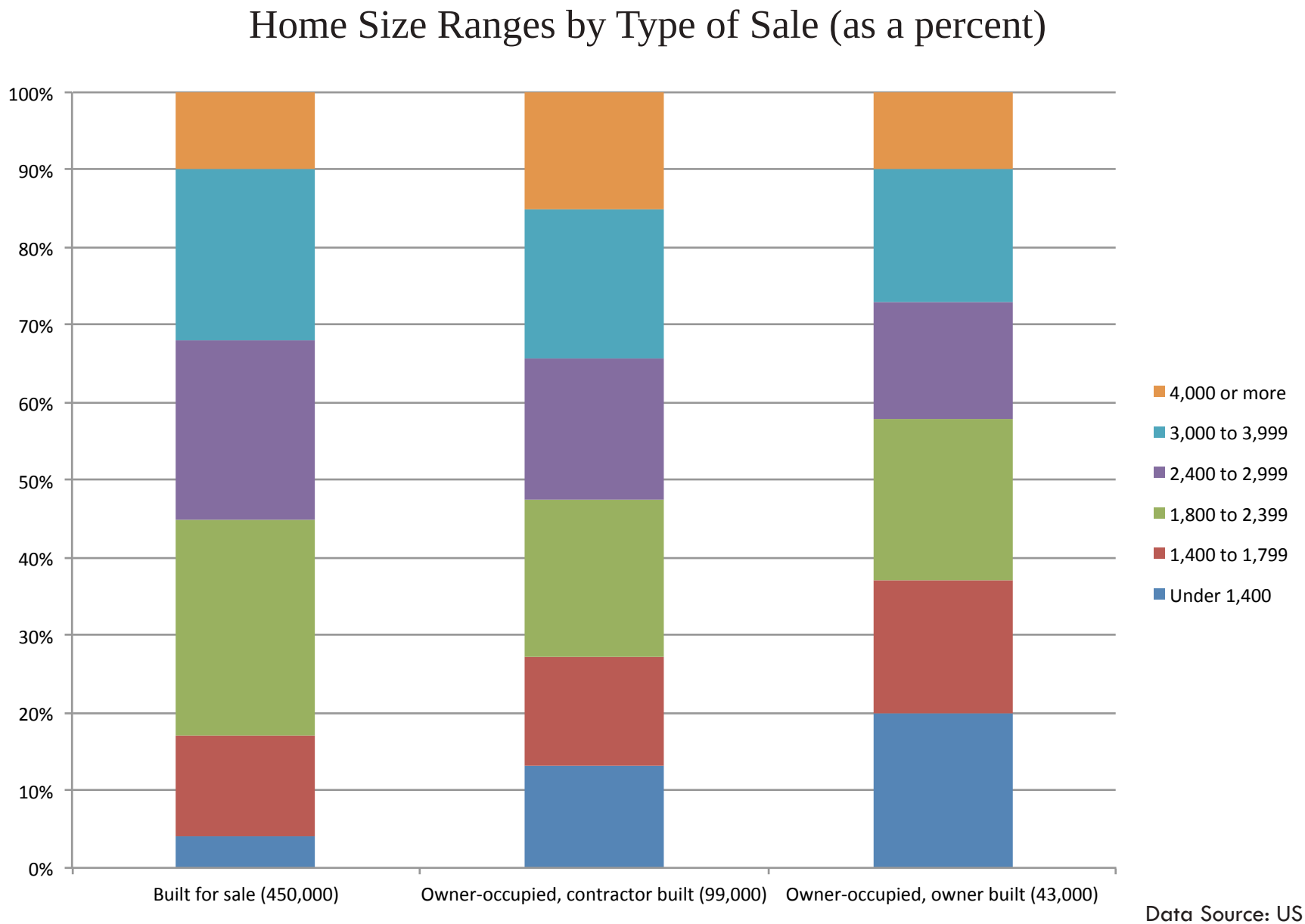


Data Source: US Census

Factory-Built

NeighborWorks Rural Initiative

The Housing Construction Spectrum

100% on site

100% in factory

Site-built
A unit constructed entirely on its own lot; also referred to as 'stick-built'

Pre-Cut
'Kit' homes; all parts are cut and prepared in a factory, ready to be constructed on site

Panelized
Constructed using a panelized building system in which walls are factory built and assembled on a prepared foundation

Modular
A unit made of factory built modules put together on site

Manufactured
A factory built unit constructed on a steel chassis as of June 15th, 1976

Designed to meet local, state, or regional codes

Designed to meet federal 'HUD' code

Mobile Home
A manufactured unit constructed before the passage of the federal code

Image credit: NeighborWorks

Factory-Built

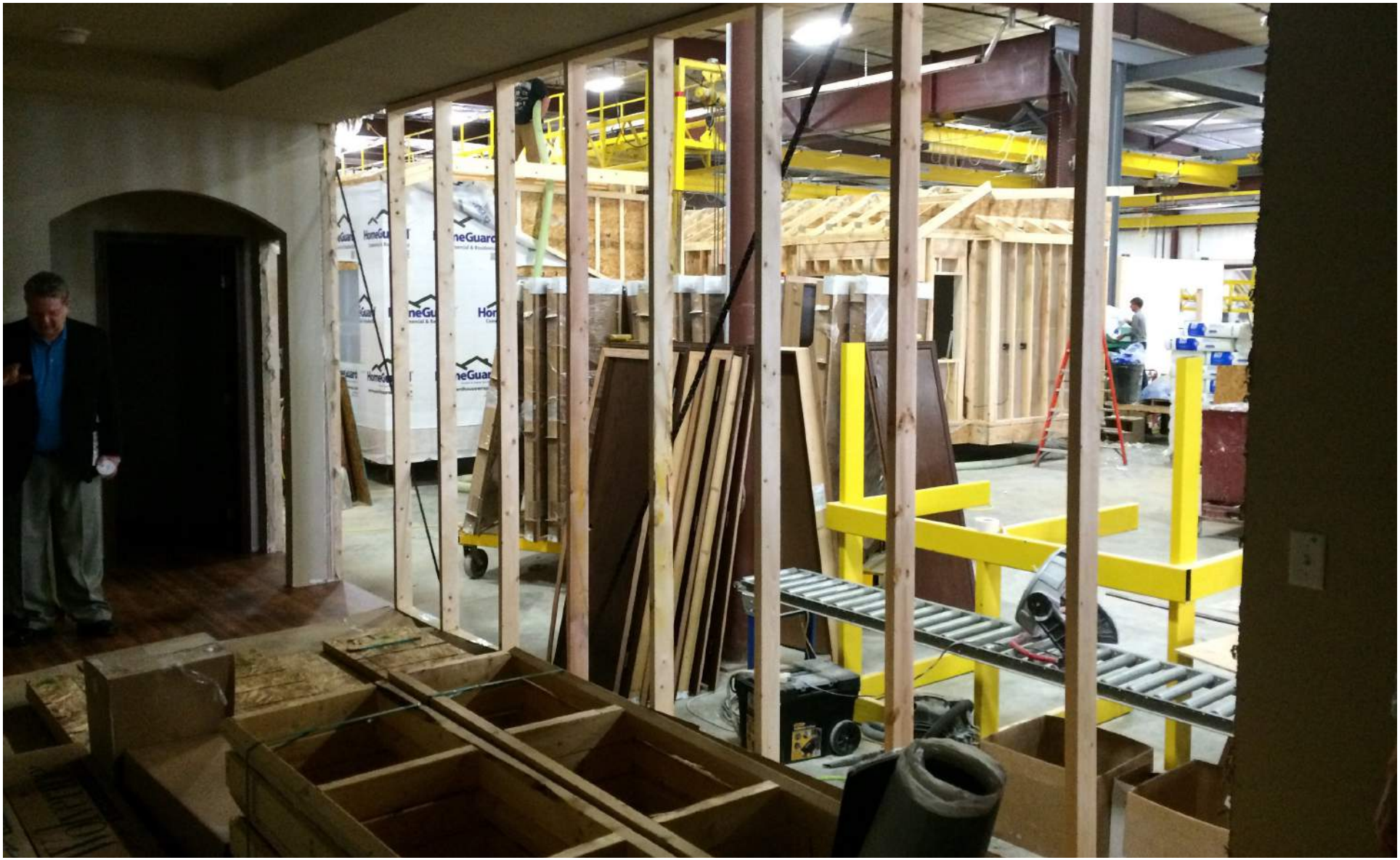
Modular

Factory-Built

Modular

Factory-Built

Modular



Factory-Built

Modular

Factory-Built

Modular

Image credit: www.colorado.gov

Factory-Built

SIPs

Image credit: www.buildingsonfire.com

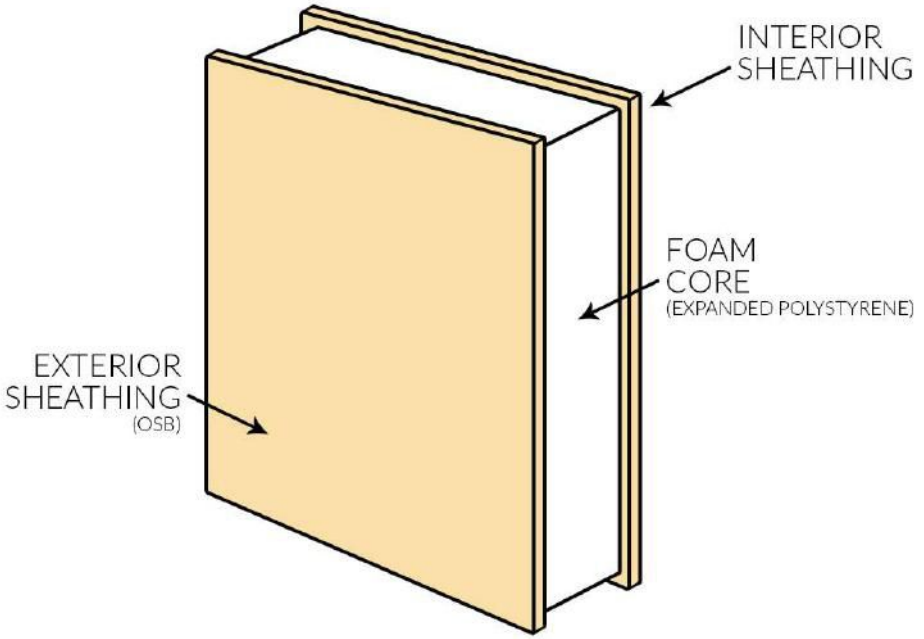


Image credit: www.coloradotimberframe.com

Factory-Built

SIPs

Image credit: http://tightlinesdesigns.com

Image credit: http://buildipedia.com

Factory-Built

Opportunities

- Efficiency of factory conditions
- Shortened construction time
- Consistency can stabilize production cycle
- Greater structural integrity
- Efficient use of materials
- SIPs provide a much tighter building envelope

Module Dimensions:
Length: < 68’ is best, 76’ max
Height: 15’6” or less is best, 16’ max
Width: 16’ most economical, 18’ max
Maximum dimensions increase transportation costs

Image credit: www.the-homestore.com

Image credit: www.motherearthnews.com

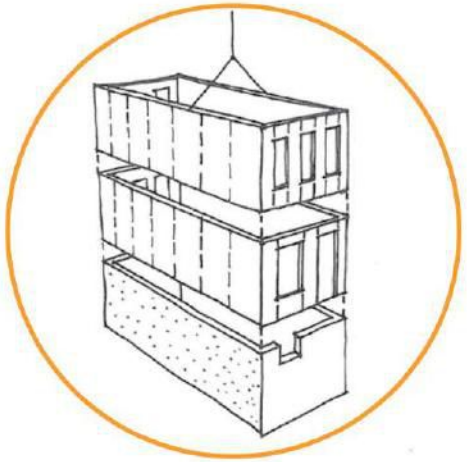
Factory-Built

SITE BUILT

16' Stick Built - Urban

BID BREAKDOWN	Cost	$ Per Sq. Foot
Contractor 1	$205,503	$161
Contractor 2	$259,156	$202
Contractor 3	$156,199	$122
Contractor 4	$179,205	$140
AVERAGE		
Average Cost with No Site Work	$200,016	$156

Modular construction significantly lowers the cost of construction in the city.



MODULAR

16' Modular - Urban

	Cost	$ Per Sq. Foot
AVERAGE		
Average Cost with No Site Work	$159,090	$124

BID BREAKDOWN	Modular Vendor 1	Modular Vendor 2
Modular Vendor Cost of Box	$84,522	$90,266
Contractor 1 Finish Costs + Box	$158,798	$164,542
Contractor 2 Finish Costs + Box	$190,956	$196,700
Contractor 3 Finish Costs + Box	$121,267	$127,011
Contractor 4 Finish Costs + Box	$153,852	$159,596

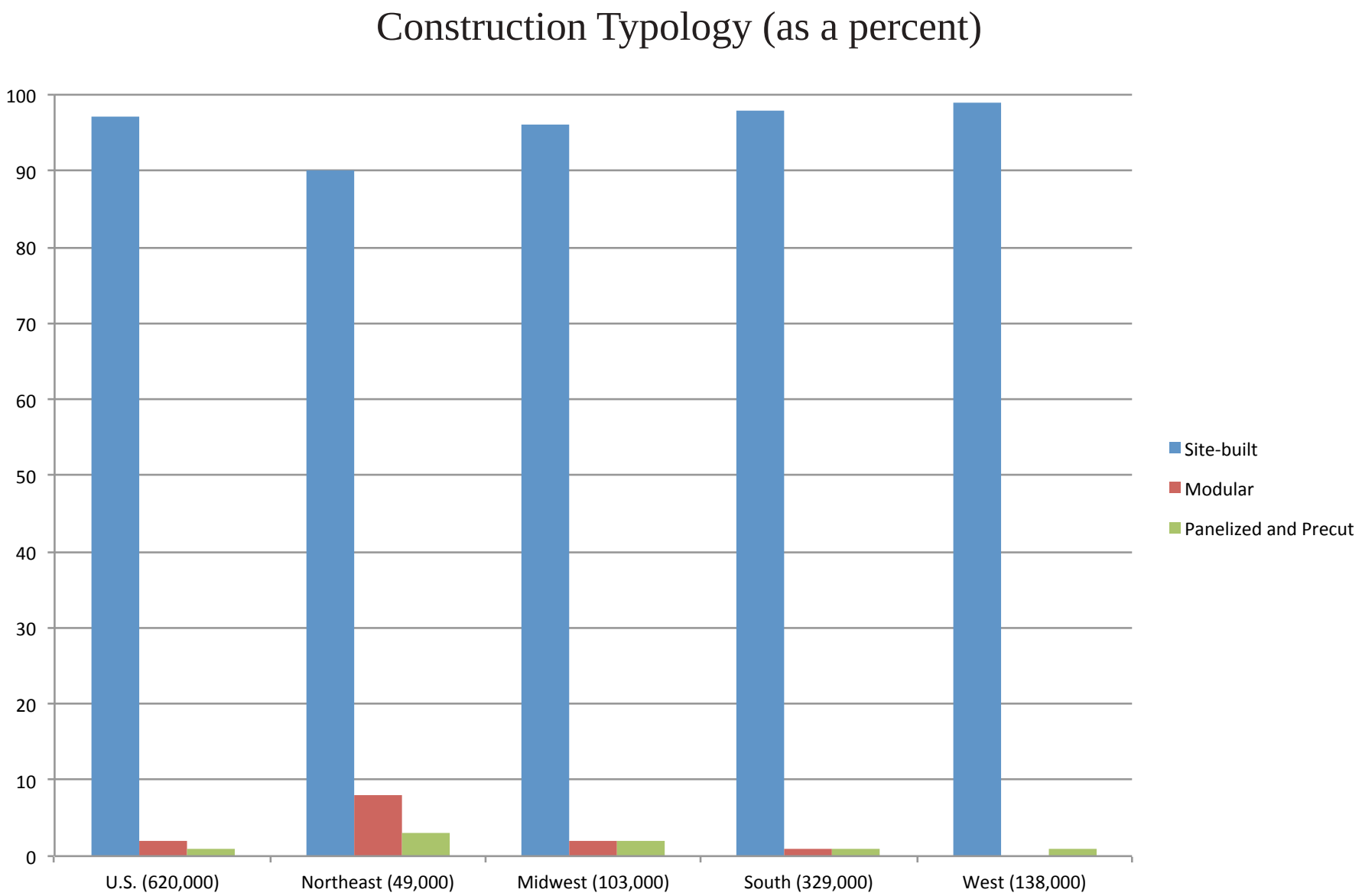
Image credit: May 8 Consulting

Factory-Built

Challenges

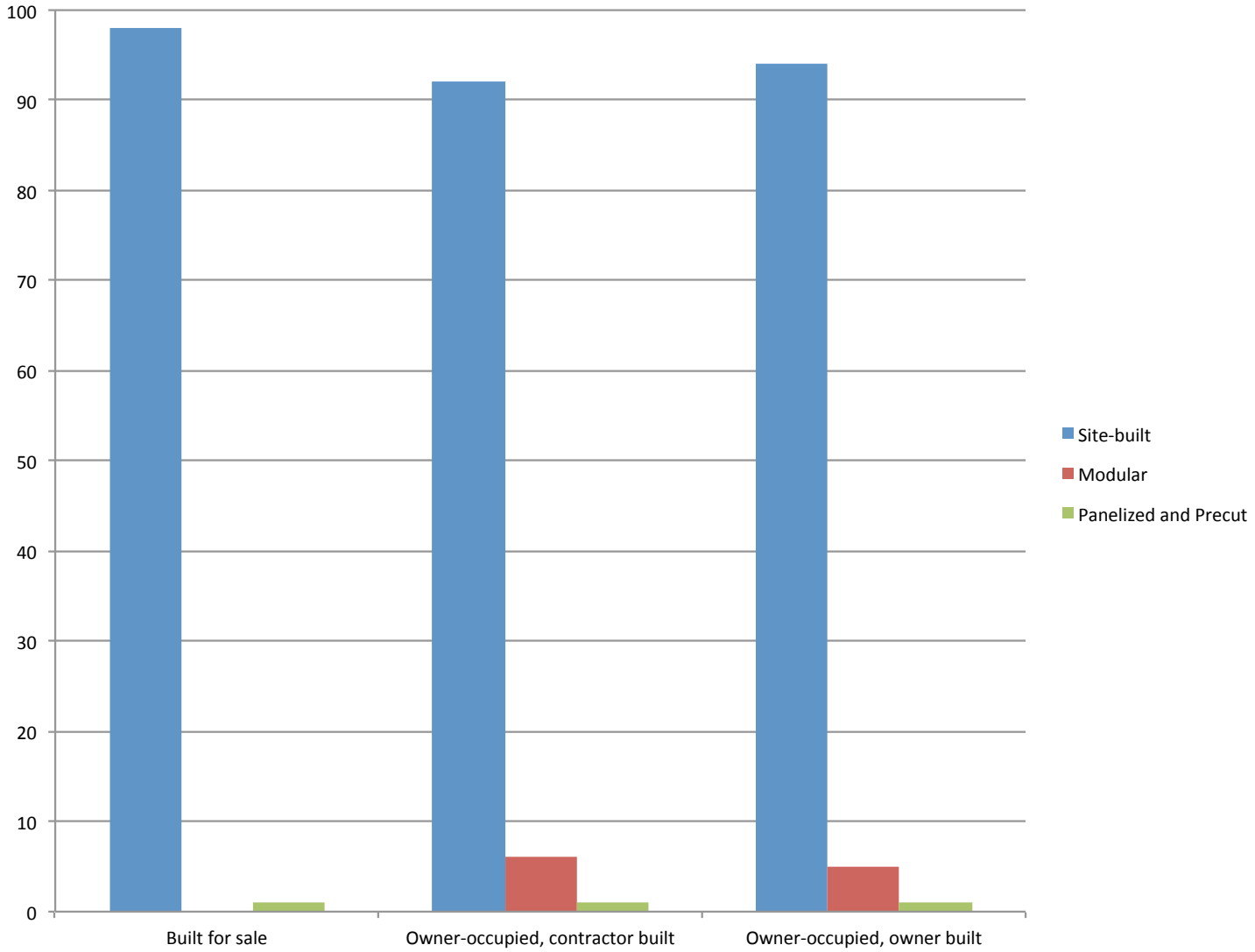
- More potential in higher-cost markets
- Often more complicated than anticipated
- Transportation issues
- Suppliers prefer higher-volume
- Capacity of local labor force
- Local codes and inspections
- SIPs can be compromised if they get wet
- Tighter envelopes require expensive ventilation systems
- External design is limited

Factory-Built



Data Source: US Census

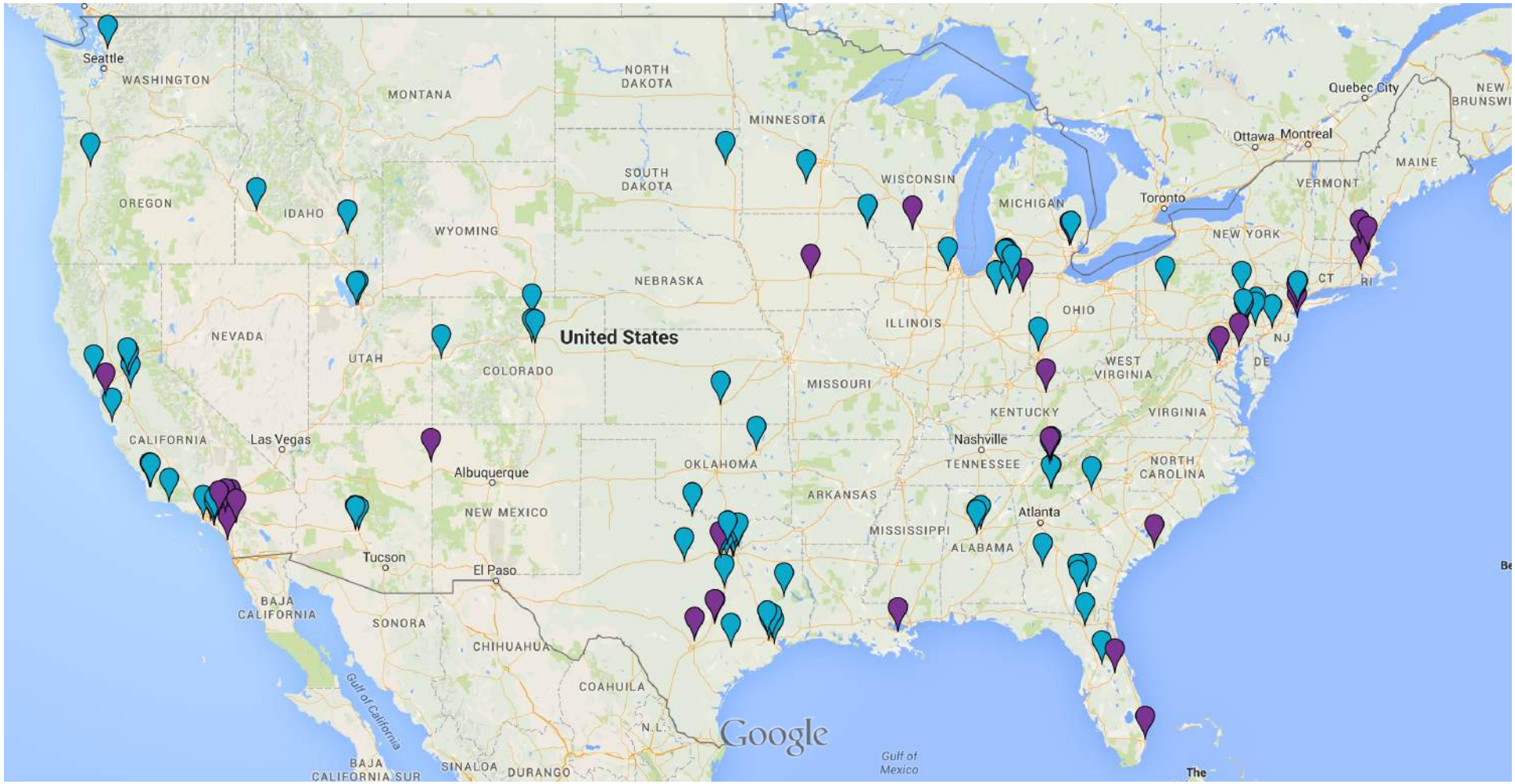
Construction Typology by Type of Sale (as a percent)



Data Source: US Census

Factory-Built

Modular



Manufacturers

Developers/Contractors

Data Source: Modular Building Institute

Creative

Design Innovations

Techniques that can be used in conjunction with smaller or modular or smaller housing to get to the most affordable price point.
Examples include:

- Accessory Dwelling Units (ADUs)
- Cohousing
- Unfinished space
- Easy build-outs
- Efficient use of space
- Replicability
- Flexible exteriors

See HUD's "Building Innovation for Homeownership."

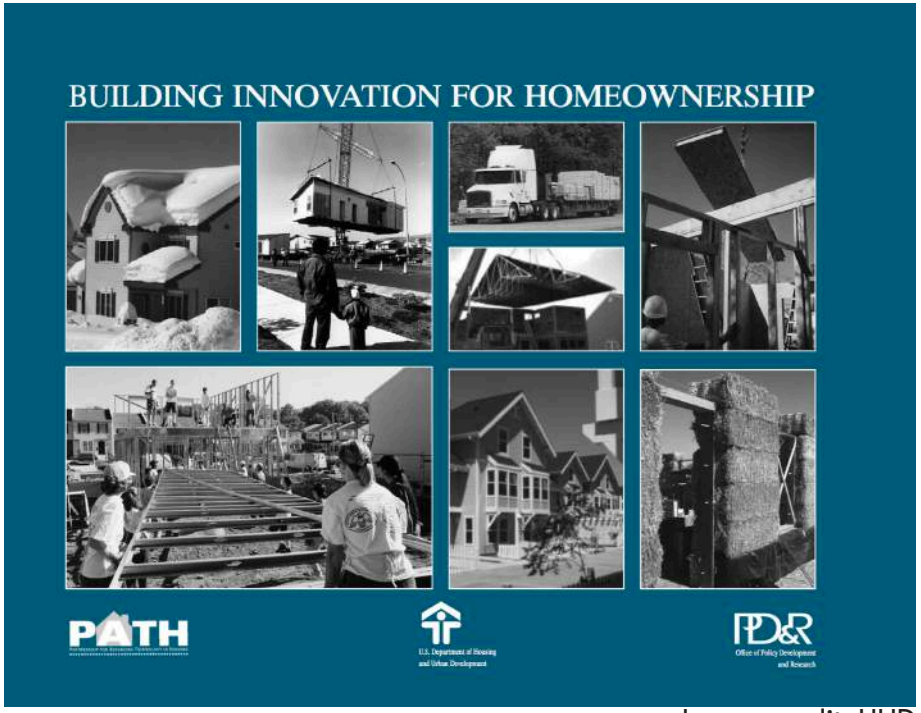


Image credit: HUD

Creative

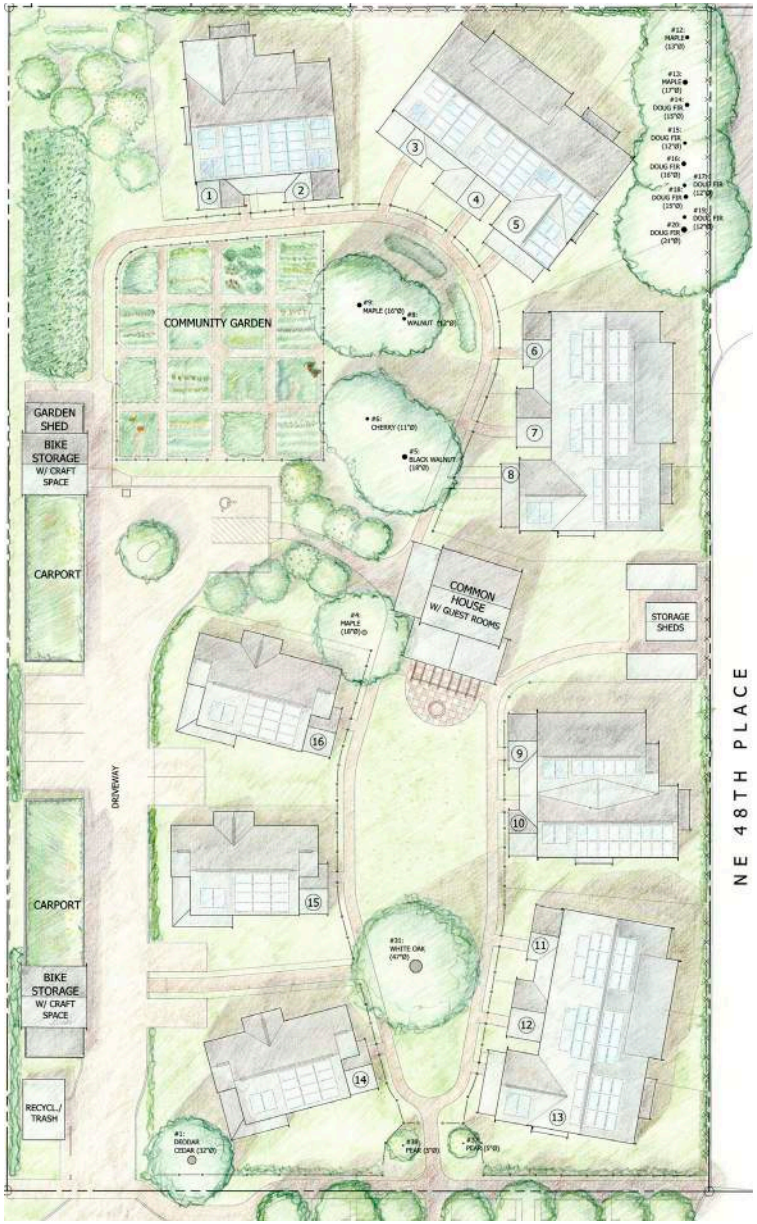


Image credit: https://cullygrove.files.wordpress.com

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Shared Amenities:

Central building, covered patios, garden, protected bike racks, edible foliage

Creative

Image credit: Orange Splot, LLC

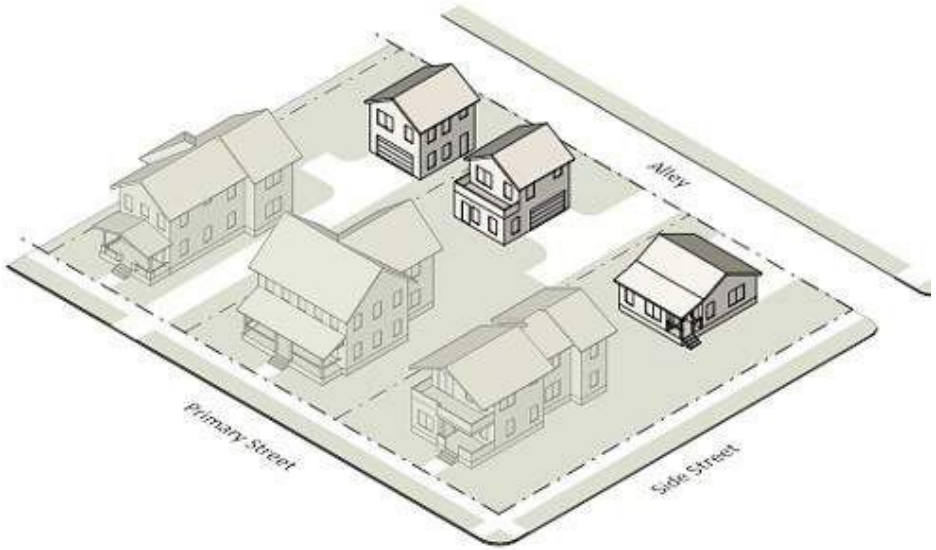


Image credit: www.indyweek.com

Creative

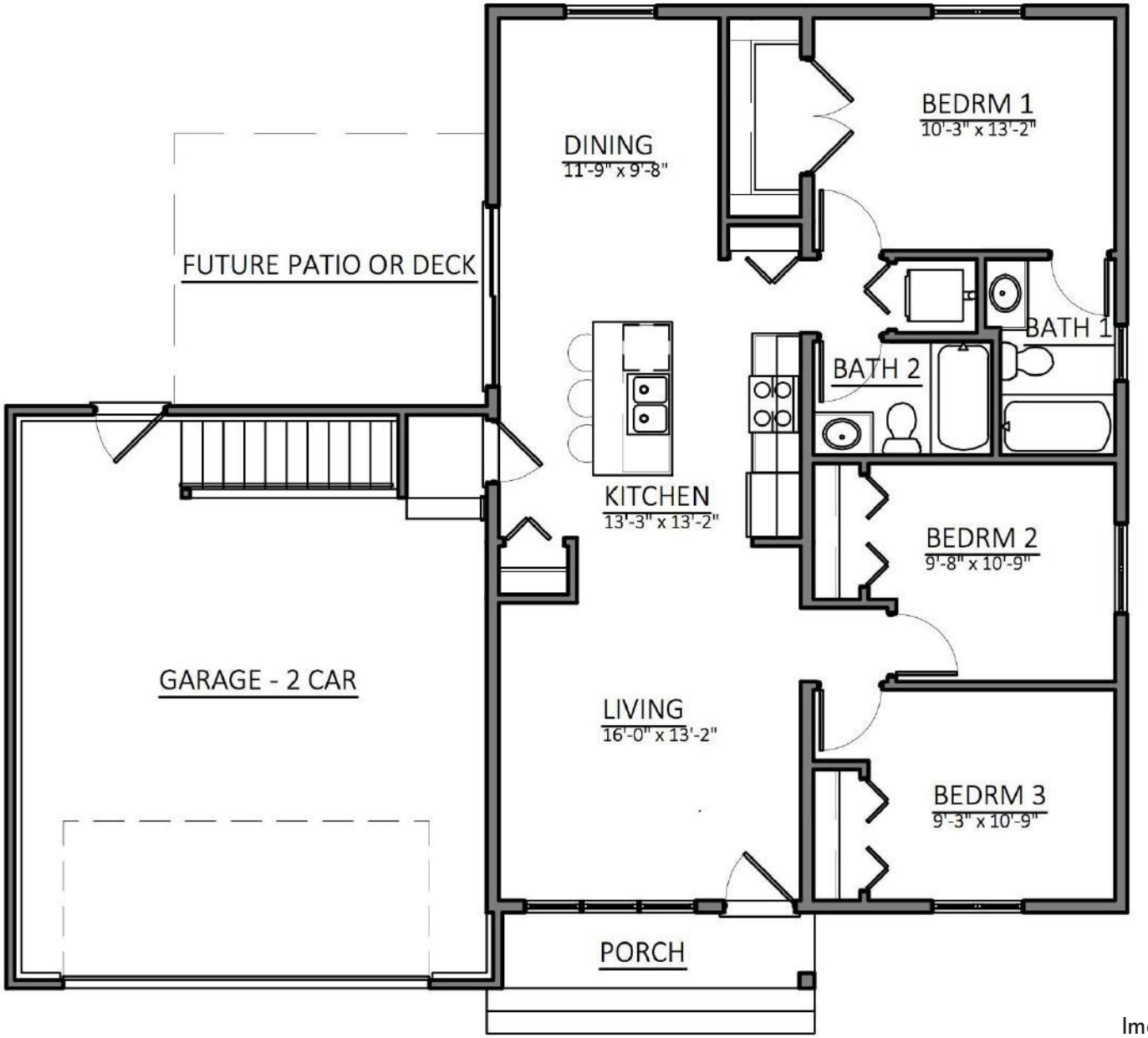


Image credit: SWMHP

Case Study

Next Step

"Next Step is the first and only national strategy and scalable approach to bring factory built homes to nonprofits nationwide. We aggregate demand for the factory built housing industry by organizing, brokering and training nonprofits on the Next Step System for doing business."

Image credit: Next Step

Next Step®
Affordable Housing Done Right

Case Study

Image credit: Next Step

Image credit: Next Step

The Brookdale

1,232 square feet

3 bedroom

2 bathroom

- Open floor plan
- Eat-in kitchen
- Great closet space
- 28’ x 44’
- 2x6 Exterior walls
- 2x4 Interior walls
- ENERGY STAR construction
- ENERGY STAR appliances

Case Study

Image credit: Next Step

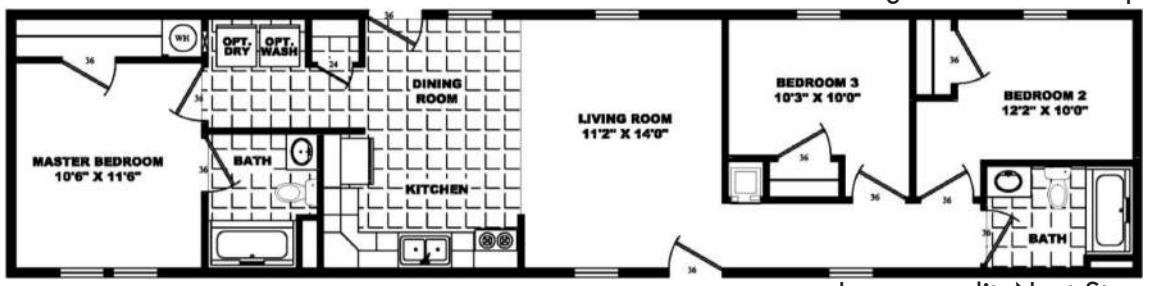


Image credit: Next Step

Discovery A

1,024 square feet

3 bedroom

2 bathroom

- Open floor plan
- Great closet space
- 16’ x 64’
- 2x6 Exterior walls
- 2x4 Interior walls
- ENERGY STAR construction
- ENERGY STAR appliances

Case Study

Lessons Learned

- Manufactured housing is key to affordability - otherwise CDCs are using a subsidy
- Decreasing footprint doesn’t reduce cost without producing greater volume
- Variation drives cost
- Exploring “Tiny Homes”
- Have experienced supply chain issues with top national producers
- Most markets are not adopting small designs
- CDCs sometimes add green features until they see the cost

Case Study

Southwest Minnesota Housing Partnership

"The Southwest Minnesota Housing Partnership is a non-profit community development corporation serving thirty counties in rural Minnesota. We aim to build strong and healthy places to live so that the communities of our region thrive."

Southwest Minnesota Housing Partnership

Case Study

Case Study

Case Study

Lessons Learned

- Integration of disciplines within CDC is crucial
- Efficient space makes small more palatable
- Setting modules in place is highly complicated
- Develop strong relationships with builders
- Address accountability early
- Labor shortage can drive up prices
- There is a learning curve, but it is important to follow through
- Keep an eye on suppliers throughout process
- More potential for modular in multi-family project due to economies of scale

Case Study

423 Armstrong St., Kansas City, KS

Developer: Community Housing of Wyandotte County (CHWC)
Architect: Clockwork Architecture + Design

Bedrooms: 2
Bathrooms: 2
Square feet: 1,107
Total Development Cost: $215,607
Sales Price: $159,900
Development Subsidy: $65,000 (grant)
Construction Typology: SIPs (first floor), Stick Framing (roof)

Image credit: CHWC

2013 ACS 5-Year Estimates				
	State	County	City	Tract
Population	2,868,107	158,348	146,581	788
Median Income	$51,332	$39,402	$38,293	$9,889
Owner Occupied Housing	67.52%	60.26%	59.50%	3.79%
Detached Single Family Homes	72.66%	70.40%	70.44%	14.85%
Median Owner Occupied House Value	$128,400	$93,800	$90,400	$101,600
Homeownership Expenses as % of Income	18.20%	22%	22.10%	25.80%
Median Gross Rent	$732	$740	$740	$246
Rent as % of Income	28.10%	31.70%	32%	27.20%

Case Study

Overview

- First home constructed using SIPs by CHWC
- Built on small urban infill lot
- Development costs exceeded predictions
- Single finished floor with open-floor style plan for living space
- Second unfinished floor can be converted into more livable space
- SIPs chosen over full-modular construction due to proximity of suppliers and infill constraints

Case Study

Goals

- Adaptable to different neighborhoods and potential buyers
- Replicable and scalable for future production
- Better performance at a comparable price, or comparable performance at a lower price
- Efficient use of limited space
- Affordable over lifespan

Case Study

Positive Outcomes

- Seen by CHWC as a successful first attempt
- Building envelope is much tighter
- Less susceptible to thermal bridging
- R-factor for these SIPs is 27, compared with R-factor of 13 (stick-built homes)
- Noise insulation
- Despite higher price, home “would be affordable to a family of 3 at 80-100% AMI... given the projected lower operating costs.”
- Healthier home
- High interest in design
- Actual construction took only three months to complete, compared with six months for stick-built

Case Study

Challenges

- Unusual site-specific costs associated with lot
- Difficult to get bids - “not a system that most residential builders work with.”
- Thin subcontractor market prompted hiring of outside general contractor
- Construction costs amounted to $113/square foot, while identical house built using traditional stick-built framing would cost only $110/square foot
- Biggest overall challenge was supply chain
- Major issues with contracts

Case Study

Lessons Learned

- CHWC will continue to pursue SIPs
- Reusing existing design with in-house builders
- CHWC believes that if they were to build this house on the exact same lot a second time, it would cost $165,665, well below the as-built cost of $215,607.
- If built on traditional lot, estimated cost for house would be $140,630 (however, this is still more than the estimated $134,076 it would cost for stick-built framing)
- Developing new relationships and gaining experience
- Shorter construction time will yield savings and accelerate production
- Building multiple homes at once will save production and shipping costs

Case Study

Lessons Learned

- Mixing construction typologies proved to be costly
- Converting existing plans to SIPs plans
- Strong relationships with all parties involved is one of the biggest requirements for successful modular and panelized construction
- CHWC recommends allocating plentiful time when pursuing new technology
- Pursue experienced SIPs architect and integrated services package if possible

Case Study

179 Scranton St., New Haven, CT

Developer: NeighborWorks New Horizons
Architect: Yale School of Architecture

Primary Unit:
Bedrooms: 1
Bathrooms: 1
Square feet: 500

Secondary Unit:
Bedrooms: Studio
Bathrooms: 1
Square feet: 300

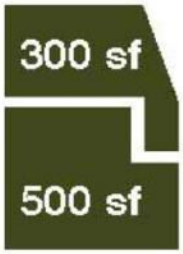
Construction Cost: $220,000
Sales Price: $155,000
Subsidy: Donations (materials and labor)
Construction Typology: Stick-Built

Image credit: Neighborworks New Horizons

2013 ACS 5-Year Estimates				
	State	County	City	Tract
Population	3,583,561	862,611	130,338	3,986
Median Income	$69,461	$61,996	$37,428	$30,230
Owner Occupied Housing	67.82%	63.71%	31.07%	20.48%
Detached Single Family Homes	59.32%	53.74%	20.97%	11.85%
Median Owner Occupied House Value	$278,900	$256,900	$209,300	$114,700
Homeownership Expenses as % of Income	23.80%	24.50%	26.60%	40.40%
Median Gross Rent	$1,056	$1,060	$1,090	$1,040
Rent as % of Income	31.80%	36.90%	34.20%	41.60%

Case Study

The homeowners - perhaps a young couple - live in the larger unit and rent the upstairs studio to a tenant.



The tenant moves on to a larger apartment elsewhere; the owners install one door to convert the building to a 2-bedroom house to accommodate their growing family.

As their resources grow, the young family moves to a larger house and sells the building to a first-time homeowner who lives in the upstairs studio and rents the larger downstairs unit for extra income.

Eventually, the homeowner moves downstairs to the larger unit, and the cycle begins again.

Image credit: Neighborworks New Horizons

Case Study

Overview

- Two units within house
- Built by students of the Yale School of Architecture
- Innovative design enables multiple configurations of units
- Secondary unit can provide rental income
- Built on small infill lot in residential urban neighborhood

Case Study

Goals

- Develop a “microhome” available for a buyer in New Haven
- Attract new and different buyers
- Flexible enough design to adapt to difficult infill parcels
- Offer rental income to primary tenant

Case Study

Positive Outcomes

- House can be adapted to meet different needs
- Can provide rental income, alleviating the burden of high homeownership costs
- Interior designed for efficiency
- Lot placement
- Neighborhood embraced the design and development of vacant lot
- General design can be easily modified to fit irregular parcels
- Low-maintenance native plantings and garden
- Indoor/Outdoor strategies

Case Study

Image credit: Neighborworks New Horizons

Case Study

Case Study

Image credit: Neighborworks New Horizons

Case Study

Challenges

- Didn’t meet goals of size or affordability
- Explored modular but did not pursue
- Certain flexible features too expensive
- Adding a second kitchen is costly
- Building house without Yale inputs would increase cost

Case Study

Lessons Learned

- Potential buyers weren't those anticipated - still trying to figure out the market
- Relationship with students is progressing
- Moving forward with a grant to build 7 more for an estimated TDC of $135,000 each
- Made adjustments to original design to improve efficiency and affordability

Conclusion

Final Takeaways

- There is no silver bullet. Markets are unique and can necessitate a combination of techniques and volume.
- Changing perceptions can be beneficial to affordability.
- Building strong, positive, communicative relationships at every step of the process is paramount.
- There are learning curves, but it is important to be persistent.
- CDCs are investing in learning. While mistakes are made while building prototypes, these mistakes can inform others who are exploring new techniques. It is crucial to learn from each other and share best practices.