



2023

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CONFERENCE**

**Innovative Iowa
Approaches to Increasing
Housing Supply**

Pete Evans

Iowa State University



2023

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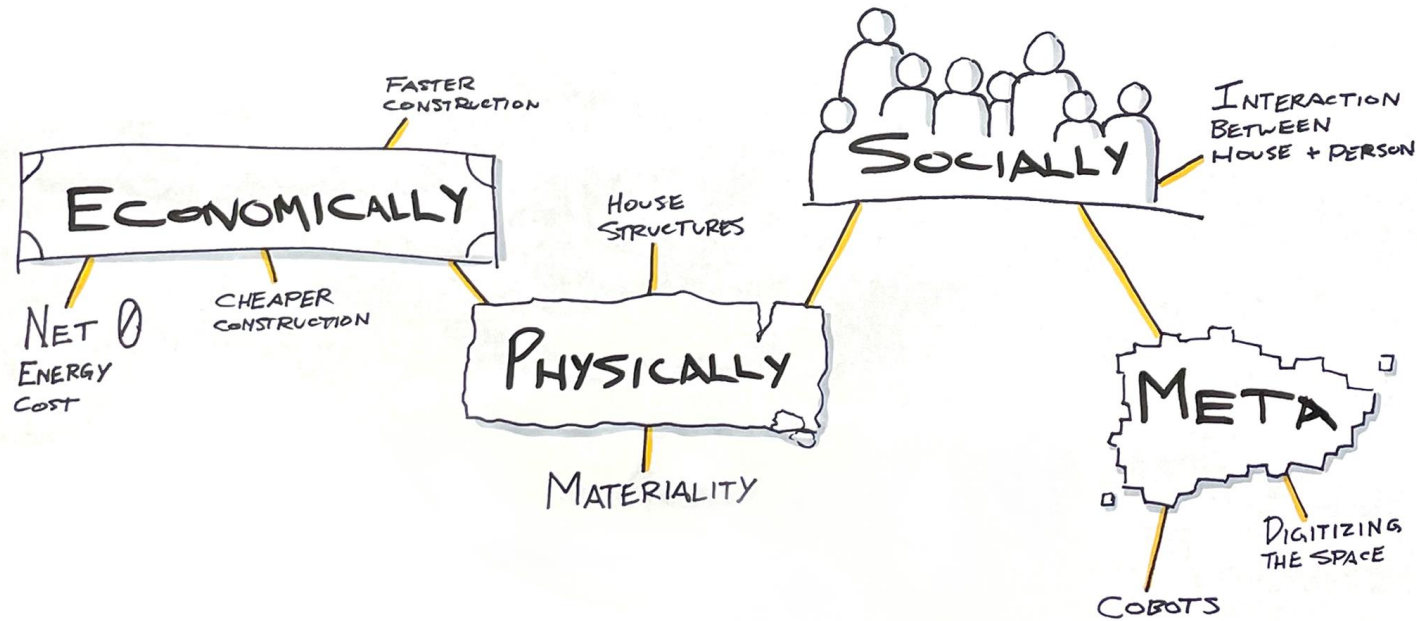
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**3D Affordable Innovative Technologies
Housing Project**

September 6, 2023

3D Affordable Innovative Technologies Housing Project







2020

Riverhead, New York

First 3D printed house for sale.

Bedrooms	Bathrooms	Area
3	2	1,407 ²

3x

Faster than traditional

40%

Reduction in total

6k+

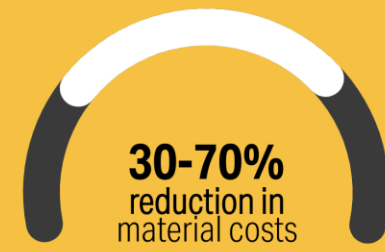
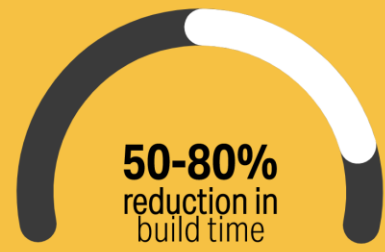
PSI results of compressive

3

Total laborers required for

Why 3D Printing

3D printing is revolutionizing the world in many ways. We focus upon construction of single to four story buildings and structures to save time, resources, labor, and overall cost.



Start-to-finished homes in 30 days.

5x faster than traditional home construction today. 9x faster tomorrow.



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Create a collaborative in-state ecosystem for high performing affordable housing through innovative and emerging 21st century technologies and strategies.

Other specific goals:

Zero energy

Housing affordability

Resiliency and sustainability and longevity

Ability to respond to disaster

Streamlined processes for quicker to market affordable homes

Workforce development (capacity building in formal and informal environments)

Retain Iowa talent to supply future communities in need

Local community policy (codes/ordinance/acceptability of 3D technology)

Collaboration with local parties and partners

Advanced technology educational opportunities in academic setting

Schedule

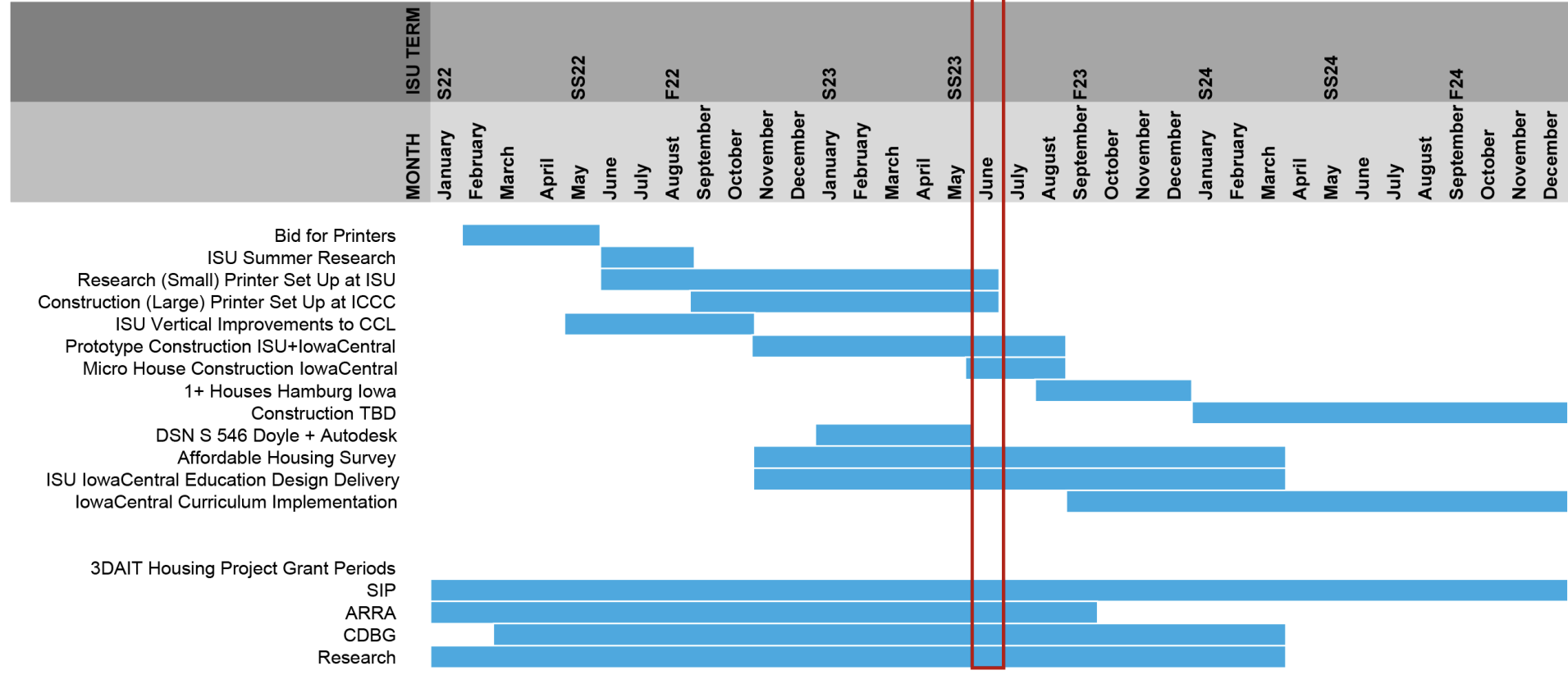
Core Partners

- Iowa Economic Development Authority
- Iowa State University
- Iowa Central Community College
- Brunow Contracting
- BNIM
- McAnally Consulting

Additional Partners

- Alquist 3D
- CT Creek
- Pella Corporation
- Hubbell Realty
- Iowa Association of Realtors
- Iowa Dept of Public Safety
- Iowa Habitat for Humanity

- Iowa Housing Partnership
- Iowa League of Cities
- Matthew 25
- Muscatine, Community Foundation & Community College
- The Element Group
- Vermeer Corporation
- Vaproshield
(and more interest)



We Are Here

ARCC 2023 International Conference, Dallas. April 12 – 15, 2023 (research publication) Energy Simulation Comparison: Wood Frame VS 3DCP



2 X 6 wood stud EUI: 115 kWh/m²

3DCP EUI (6" insulation): 110 kWh/m²

* Energy saving came from difference in R-value

Conclusion

- Removing thermal bridges through design and material choice.
- Without thermal bridges, the R-value of 3DCP walls is primarily determined by the thickness and insulation.
- 3DCP can achieve the same or better energy performance compared to conventional wood frame.



The International Code Council is the leading global source of model codes and standards and building safety solutions that include product evaluation, accreditation, technology, training, and certification. The Code Council's codes, standards, and solutions are used to ensure safe, affordable, and sustainable communities and buildings worldwide.

The International Building Code (IBC) is a model building code developed by the International Code Council (ICC). It has been adopted for use as a base code standard by most jurisdictions in the United States.

Model building codes rely heavily on referenced standards as published and promulgated by other standards organizations such as ASTM (ASTM International), ANSI (American National Standards Institute), UL (Underwriters Laboratories), and NFPA (National Fire Protection Association).

ICS > 25 > 25.030

ISO/ASTM CD 52939

Additive Manufacturing for construction – Qualification principles – Structural and infrastructure elements

General information

Status : Under development Preview

You can **comment** on this draft international standard by contacting your **national member**

Edition : 1 Number of pages : 36

Technical Committee : ISO/TC 261 Additive manufacturing

ICS : 25.030 Additive manufacturing

SUSTAINABLE DEVELOPMENT GOALS

This standard contributes to the following Sustainable Development Goal:

Life cycle

Now

Under development
ISO/ASTM DIS 52939
Stage: 40.20 ^

00 10 20 30 40 Enquiry 50 60 90 95

Consulting

01 Materials and Testing

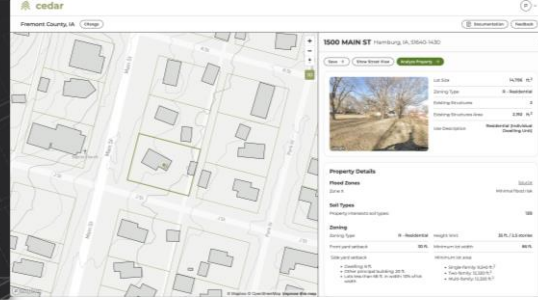
02 International Standard Compliance (ISO/ASTM 52939)

03 Operational and Workforce Protocols

04 Education, Training, and Workforce Development

05 Traditional vs AC Comparable Analysis

... plus numerous network interactions and introductions



cedar

Home About My Portfolio The Forest

1711 Main St, Hamburg, IA, 51640

Zoning & Permitting

- Local zoning requirements checked
- City election review potentially required
- Special Preservation Order potentially required
- Local Board/Commissioner potentially required
- Wildland-Urban Interface adjacency
- Aviation location potentially advantageous
- Preventive location verification potentially required
- Right of way verification potentially required
- Neighborhood plan requirements met
- Ally location potentially requires review
- Street easements
- Permitting permits
- Address is not in a water district
- Site does not intersect with 100-year floodplain

Assets
If you have any supporting documents and would like to add them here for your records, you can upload them below. Your documents will never be shared with anyone unless we request permission from you directly.

Support Documents
PHOTO, VIDEO, PDF

Property Risk Profile

Zoning Analysis

Zoning type	R-Residential	Front yard setback	30 ft
Use type	Individual Dwelling Unit	Side yard setback	
Special incentives	N/A	8 ft Dwelling	20 ft Other
Height limit	35 ft 2 stories		
Minimum lot width	66 ft	Rear yard setback	
Minimum lot area	9,240 sf		35 ft Dwelling
Minimum developable area	640 sf		45 ft Other

Baseline zoning requirements	Wildland-Urban Interface adjacency
Site grading excessive slope	Railroad right-of-way adjacency
Water available	100-year floodplain intersection
Sewer available	25-year floodplain intersection
M district adjacency	Soil suitability

Neighborhood Analysis

Feasibility Scenarios

Each site planning scenario is developed with various optimization strategies in mind to help you find the right field, unit mix and development outcomes that works the best for you.

Scenario	Structure count	Parking Count	Cross developed area	Impervious area
01 "Fremont"	2	3	16,225 sf	16,225 sf
02 "Sidney"	2	3	16,225 sf	16,225 sf
03 "Shenandoah"	1	2	16,225 sf	16,225 sf

Options: 01 "Fremont" 02 "Sidney" 03 "Shenandoah"

Uses

- Covered Parking - Carport
- Covered Parking - Carport
- Basement

Development Totals

Dwelling unit count	1
Parking Count	3
Bedroom	3
Bathroom	2
Gross area	2,39 sf
Floor area ratio	0.26
Building coverage	16,225 sf 21%
Impervious cover	13,450 sf 12%

IRC Code Review

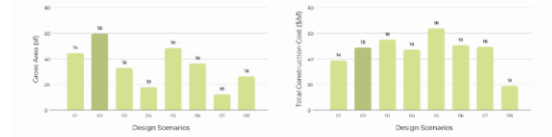
Construction Type	Type V
Assembly Type	Stock Frame w/
Performance Level	High
Accessibility	+
Occupancy	+

01 | Option Name

View 3D

Feasibility Metrics

Cedar brings a data driven approach to the site optimization process and provides you with the metrics to help you better evaluate each site planning scenario.



Project Costs

Costs	% / Project	Cost / SF	Total Cost	% / Total
Property Acquisition			\$600,000	21.2%
Design / Engineering	5.9%	\$55,000	\$937,750	4.4%
Finished Construction	5.9%	\$275	\$43,888	9.3%
Unfinished Construction	5.9%	\$125		3.3%
Overhead (% of Construction)	10.0%		\$136,163	8.9%
Misc. (Non-Financeable)	10.0%		\$21,500	2.9%
Financing (Interest + Fee)	5.5%		\$83,440	7.0%
Marketing / Brokerage	6.0%		\$75,440	6.1%
Closing - Financing	1.0%		\$12,500	0.9%
Total			\$1,690,681	100%



Training, Curriculum Development and Survey

Project Scope: Prepare the future workforce by introducing the technologies and equipment across wide spectrum

- Formal Component: Development of a community college curriculum that will support workforce being trained in building industry.
- Informal Component: Focus on existing suppliers in the construction industry and deliver community level workshops and demonstration activities
- Supporting activities: Introduce 3D technologies curriculum at the K-12 level to support the future interest development
- Survey and interview work



K-12 Curriculum Development Goal

Develop of a series of engaging activities that promote the core concepts and skills being used to design and fabricate affordable, innovative housing with upper elementary (3-5) and middle school (6-8) students.



MODULES

1. Introduction to Engineering Design
2. Introduction to 3D Design
3. Introduction to 3D Printing
4. Affordable and Durable Design
5. Design, Robotics, and the Environment
6. Interaction of Physical and Digital Design Environments





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3D Affordable Innovative Technologies Housing



Thank you!

Pete Evans AIA IDSA
Assistant Professor, Industrial Design
pmevans@iastate.edu

Julie Robison
IDRO, Interim Director
Instructor, Community & Regional Planning
jrobison@iastate.edu

Kevin Kane
Director, ISU GIS Facility, IDRO
Adjunct Assistant Professor, Landscape Architecture
kkane@iastate.edu

... more to be published at:
<https://iowainnovativehousing.design.iastate.edu/>

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

IOWA
economic development

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Matt Johnson

Cedar Valley Bank & Trust

COMMUNITY COLLABORATION



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[HOUSINGIOWACONFERENCE.COM](https://housingiowaconference.com)



Anderson Creek
ESTATES

HOMECOMING CT.

Homes

Lots

Financing

Contact

ERLY DR.



Matching Need with
Resources





ECICONG

Identifying Key Players



Cedar Valley Bank & Trust



**VINTON-SHELLSBURG
COMMUNITY SCHOOLS**



Tick Tock

**How fast can we get houses built
and TIF payback started?**

Affordable Housing

- Roughly 1/3 of the development to hit max TIF
- 20% Down Payment Program Options
- Incentivizes Builders
- Creates Excitement and Demand

Down Payment Partners

- FHLB \$7,500 First-Time Home Buyer
- ECICOG Housing Trust Fund Options
- City, Developer Match Funding





Community Bank Relationship



COMING SOON

10 BRAND-NEW, 1,200+ SF
SINGLE FAMILY HOMES



CITY OF
VINTON
Vernon S. Flechner
Trust

*Dedicated to providing affordable housing
and growing families in Vinton*











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THANK YOU!

Matt Johnson, Cedar Valley Bank & Trust

Steve Davis

Switch Homes

Mike Norris

Homes for Iowa

Homes for Iowa “Elevator”



Homes for Iowa trains incarcerated individuals in building trades by building single family homes, then sells the homes to pay for the training.



Homes for Iowa Results



Since 2020:

68 homes moved to 35 Iowa counties

113 Incarcerated Individuals entered the program

78 Incarcerated Individuals have earned training certificates

6.7% three-year recidivism rate from all crew members



Homes for Iowa Structure

A Public-Private Partnership

Public: Iowa Prison Industries

Builds and moves homes, trains men, manages site

Private: Homes for Iowa, Inc.

A 501c3 organization, sets program policies, orders homes from IPI, takes home orders, sells homes to buyers/developers, pays for home building and training costs through sales

Homes for Iowa Structure



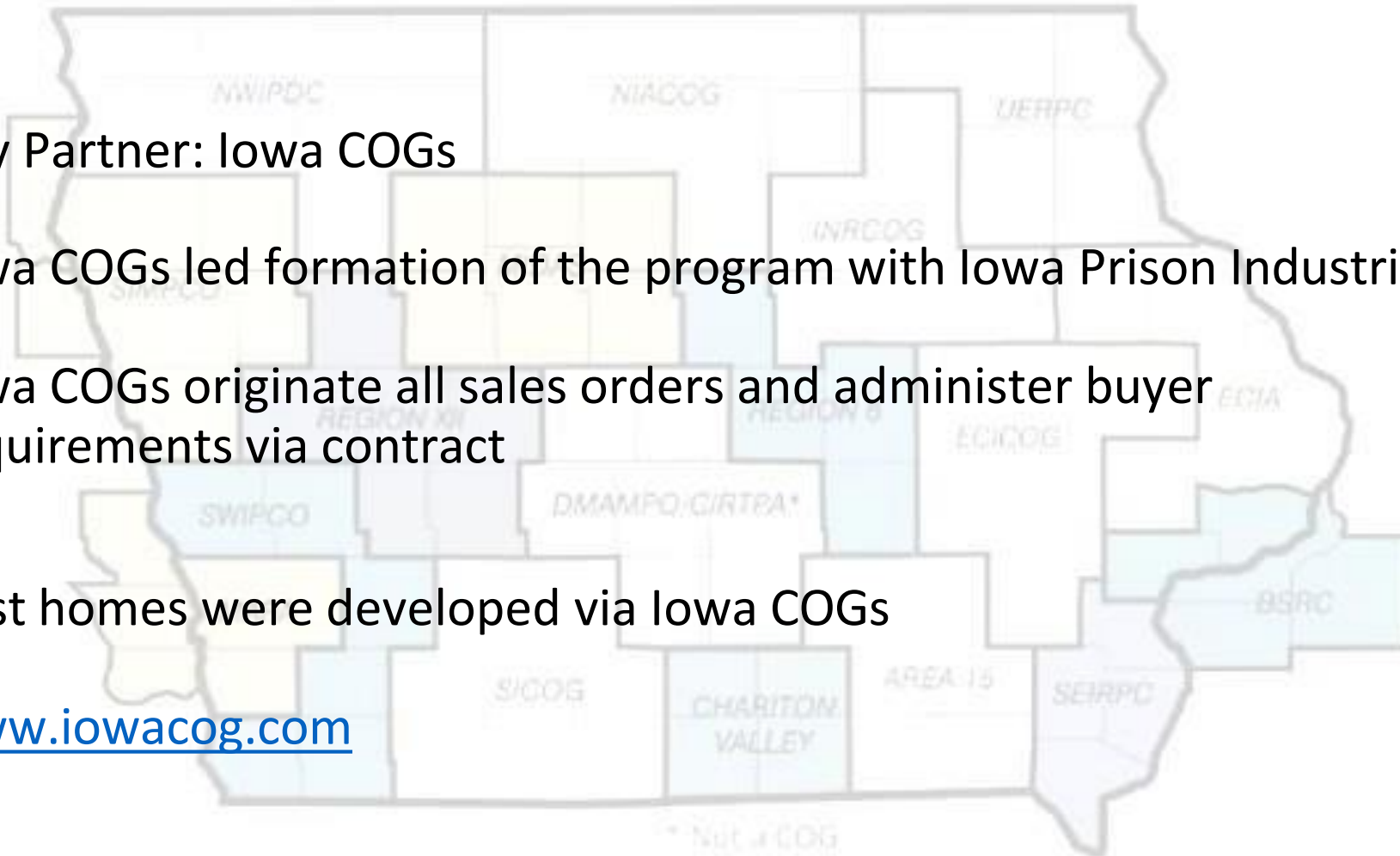
Key Partner: Iowa COGs

Iowa COGs led formation of the program with Iowa Prison Industries

Iowa COGs originate all sales orders and administer buyer requirements via contract

First homes were developed via Iowa COGs

www.iowacog.com



Homes for Iowa Training



Crew members voluntarily apply to the program and are minimum-security level.

Crew members transfer into the program from other minimum-security facilities to participate.

HFI has a full-time recruiting/placement coordinator that helps with resumes and job connections and many other items.

HFI partners with DMACC to instruct courses and uses onsite professional staff.

HFI currently has 50 crew members onsite.

Homes for Iowa Training



Classroom:

Flagger Certificate
OSHA 10 Certificate
NCCER Construction Craft Laborer 1 Curriculum
Apprenticeships: Plumbing, Electrical, Home
Performance Laborer

Building homes:

Framing, Roof, Windows, Siding
Electrical
HVAC
Plumbing
Drywall hanging/finishing
Interior trim, cabinets, doors

Homes for Iowa Homes



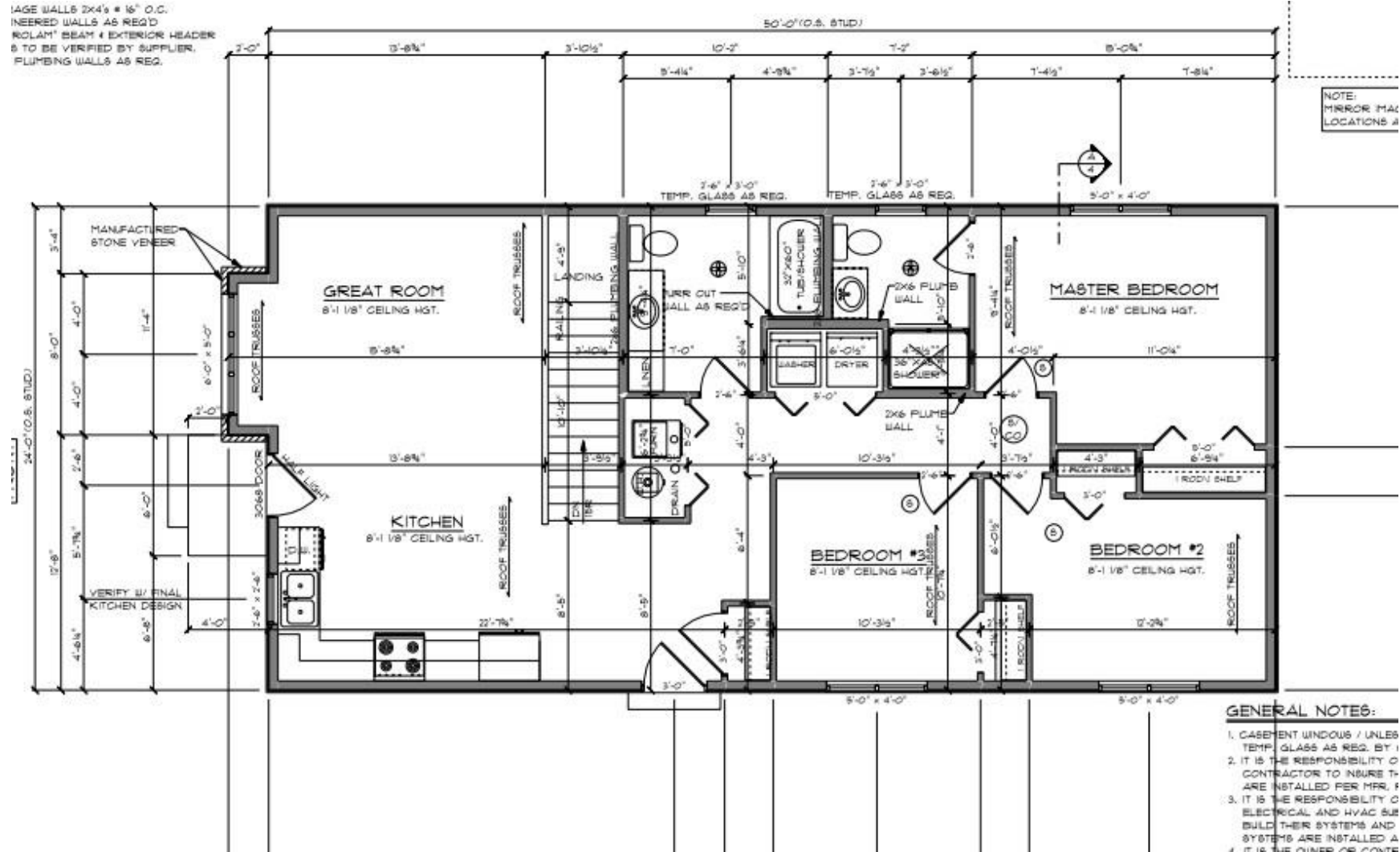
- Quality: 2x6 construction, attention to detail, good materials
- Code: Homes are built to adopted State Building Code (2015 IRC) and rigorously inspected.
- Efficient: R60-attic, R-29 walls, thermal break, air sealed, heat rec. ventilation
- Flexible: Main floor living w/ laundry, or expand into a basement
- 2BR 1BA 1,000sf (narrow only) or 3BR 2BA, 1,200sf (one narrow style, three wide styles)
- 3BR Cost Delivered: \$95,000 (2024)
- 2BR Cost Delivered: \$80,000 (2024)
- Anyone can develop the home: Private, public, non-profit, individual

Homes for Iowa Homes



Springfield Narrow 3BR in West Burlington, IA

Homes for Iowa Homes



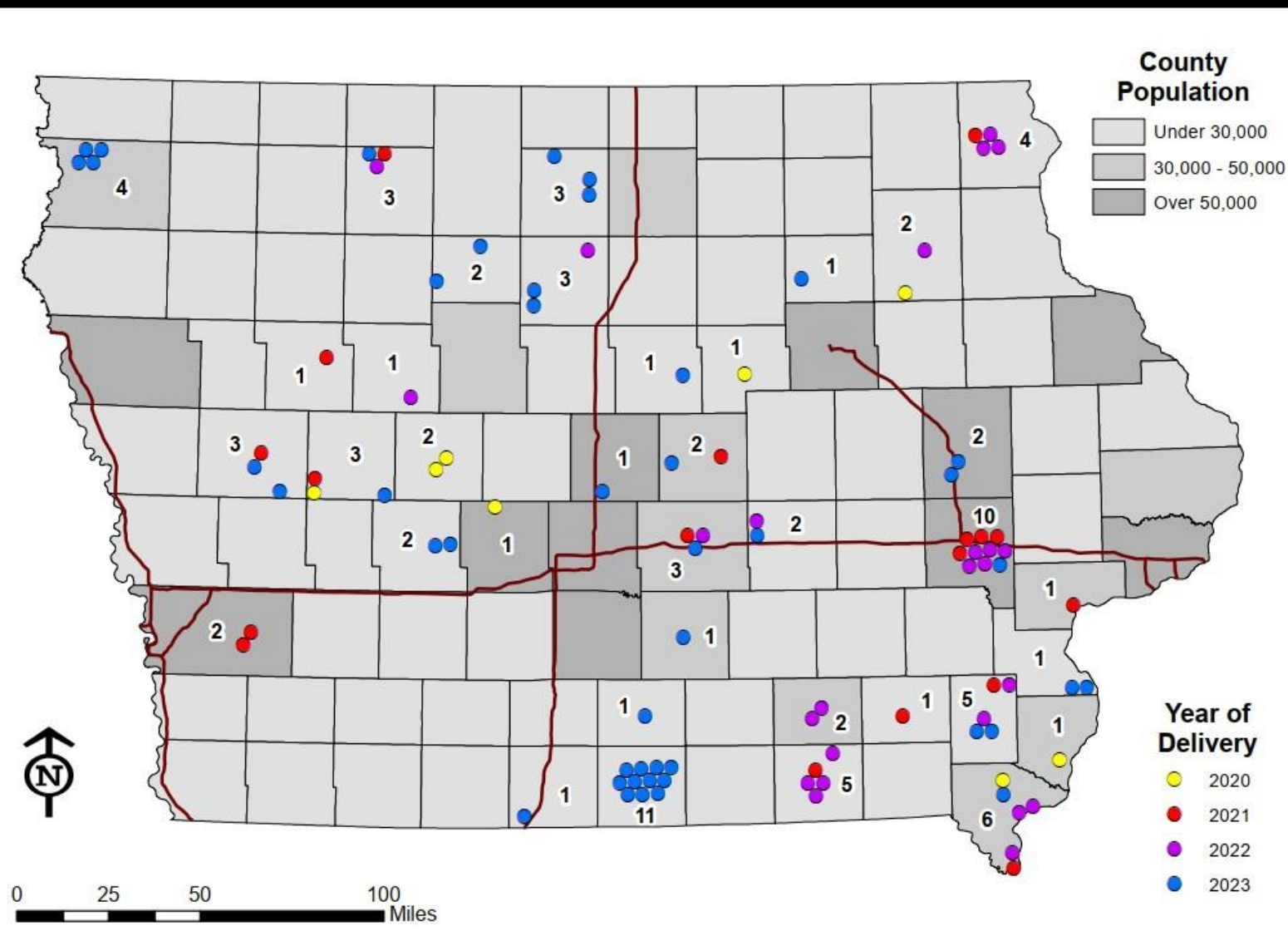
Homes for Iowa Moving



Homes for Iowa moves its own homes and sometimes partners with private movers. A home can safely travel 200+ miles in a day.

Homes for Iowa Towns

Homes for Iowa - Full Statewide Inventory, 2020-2023



Thank you.



**HOMES
FOR IOWA**

www.homesforia.com

Mike Norris

Executive Director, Southeast Iowa Regional Planning Commission

Board President, Homes for Iowa, Inc.

mnorris@seirpc.com

Jennifer Pratt

City of Cedar Rapids
Community Development

Cedar Rapids ReZone for Affordable Housing

Missing Middle Housing



Accessory Dwelling Units (ADUs)



▲ Accessory dwelling units (or ADUs) come in many shapes and styles.

Accessory Dwelling Units (ADUs)

- NOT a boarding house or single-room occupancy (SRO)
 - Must meet building codes as stand-alone residence
- Allowed in all residential zoning districts
 - Must meet set-backs and lot coverage requirements
 - One on-site parking space per unit

Accessory Dwelling Units (ADUs)



Additional Zoning Tools

- Mixed-Use Zoning Districts
 - Single/Multi-Unit without additional approvals
- Form-Based Zoning Districts
 - Focus on the building design – allows variety of uses
- Developer outreach to neighbors

Change is Hard

- Predictability is valuable – zoning code and approval processes
- Keep the focus on the desired outcome and lean into concerns
- We are all in this together – City officials, developers, lenders, and neighbors

Presented by:

Jennifer Pratt, Director
Community Development & Planning
j.pratt@cedar-rapids.org
319-286-5047