



Green Construction

Developed by Paul Francisco and his team at the Indoor Climate Research & Training program of the University of Illinois at Urbana-Champaign

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Learning Objectives

At the end of this module, students will be able to:

- Define Green Construction
- Discuss Green Construction Fundamental Principles
- Explain customer benefits of Green Construction
- Describe advanced framing
- Describe career pathways related to Green Construction



Outline

- Introduction
- Information about Standards
- Growth trends in Green Construction
- Benefits
 - Incentives and tax rebates
 - Resilient New Construction
 - Advanced framing techniques
- Careers, professional certifications, & trainings
- Business opportunities
- Resources
- Summary



Introduction to Green Construction (GC)

- Also known as green, sustainable, or high-performance building
- It is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle.
- Environmentally responsible
- Resource efficient

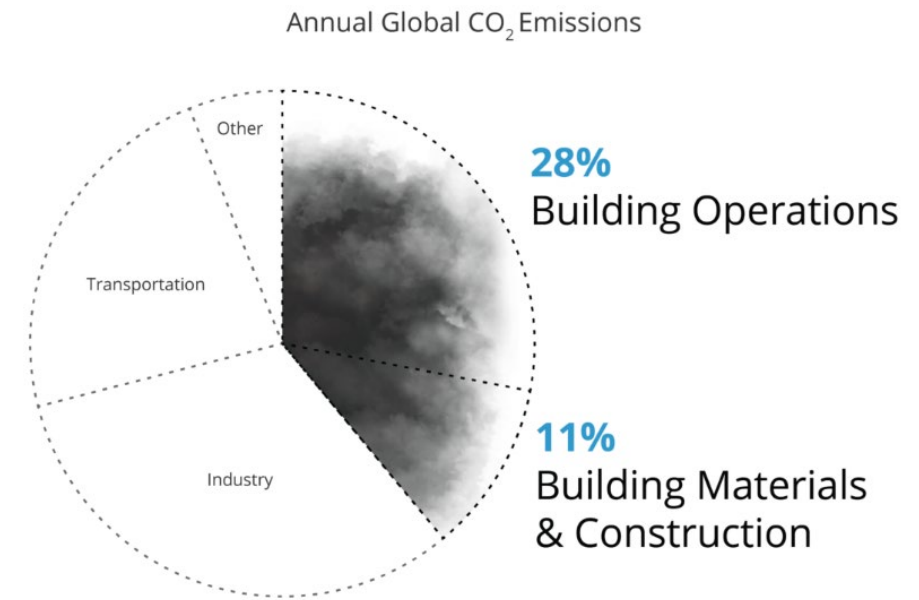


GC Fundamental Principles

- Use less materials
- Choose materials with lower negative impacts
- Design buildings that will be efficient to operate
- Build resilient structures that can adapt and will survive

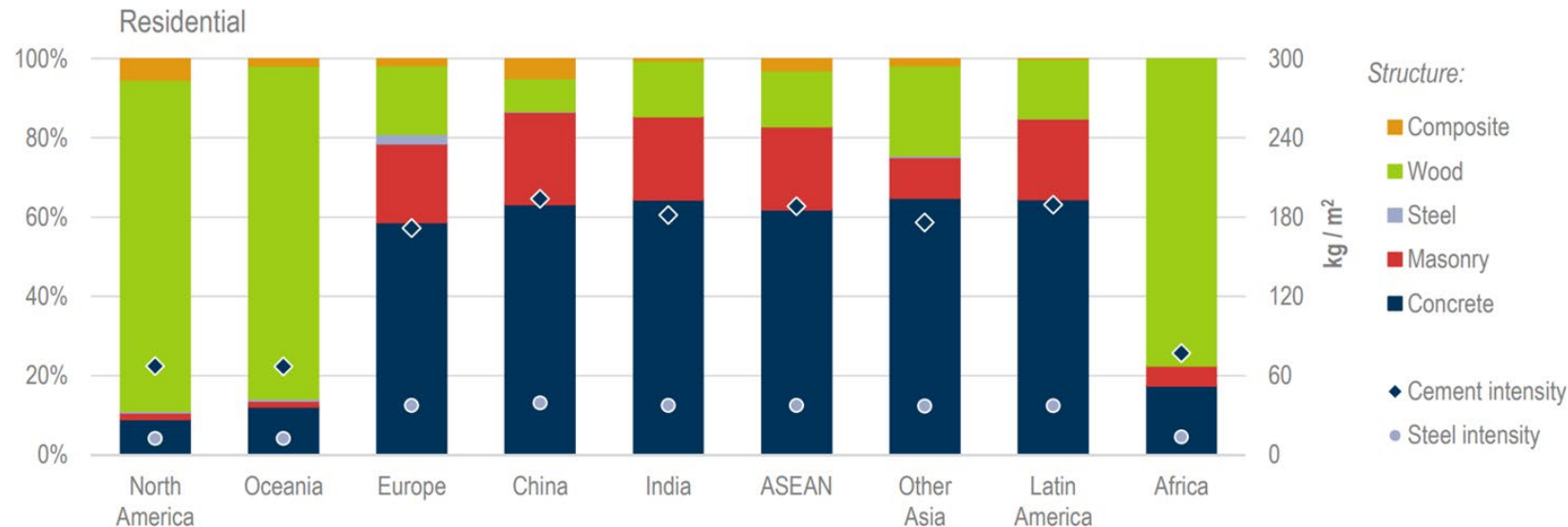
Materials

- Houses are made from:
 - Wood-US & Africa
 - Cement-Asia & Europe



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Data Sources: Global ABC Global Status Report 2018, EIA

Figure 19 • Global residential building structure material and material intensity, 2017



SOURCE: IEA Global Alliance for Buildings and Construction 2018 Global Status Report

Materials – Embodied Energy

- Aluminum



- HIGH MJ/kg
- light
- Moderate usage

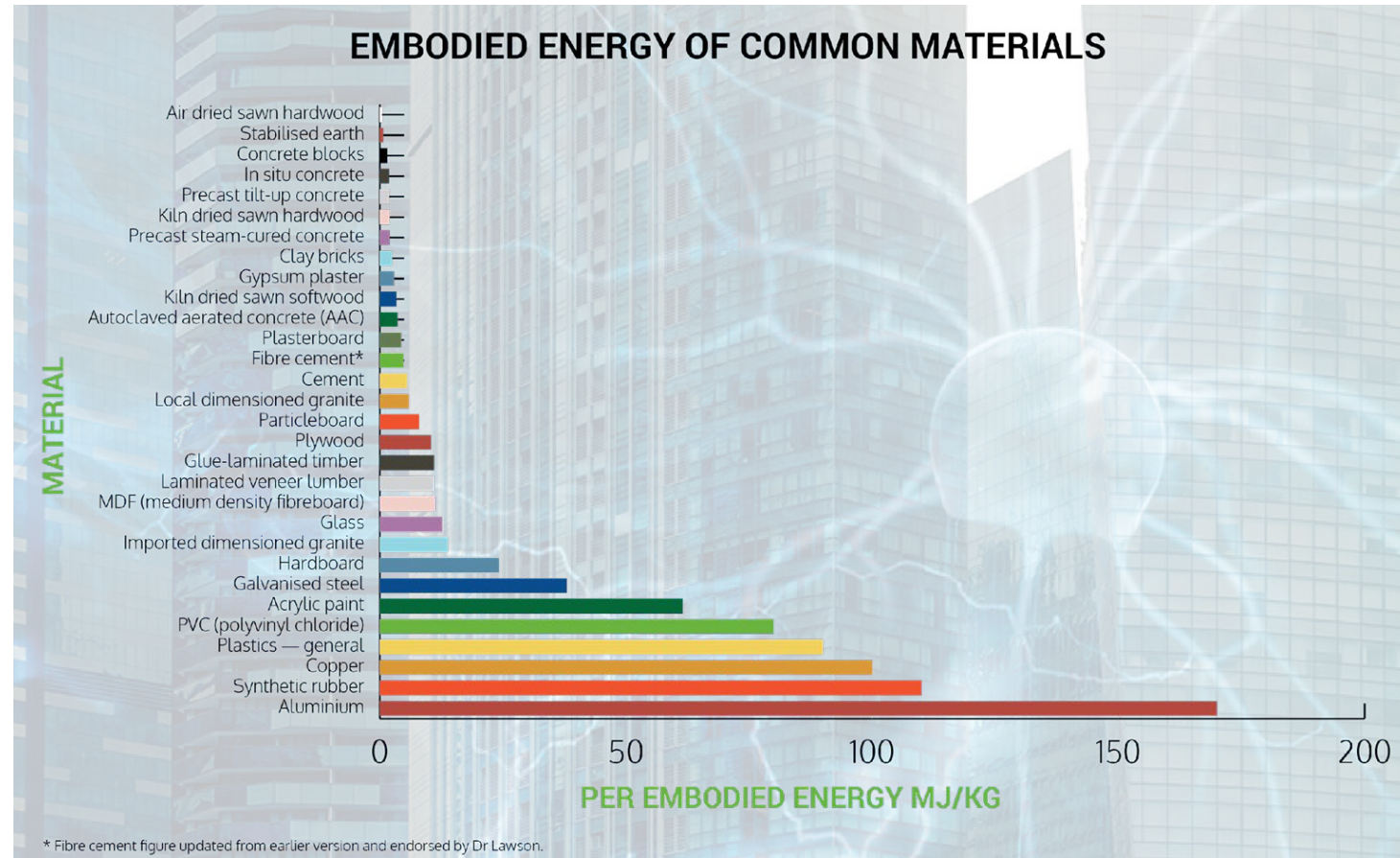
2% of
Global
GHG
emissions

- Concrete



- LOW MJ/kg
- **HEAVY**
- Ubiquitous

11% of
Global
GHG
emissions



SOURCE: mysmart.com (image); Lawson 1996 (data)



GC Standards

LEED (1993)



WELL (2013)



RESET (2013)



FITWEL (2016)

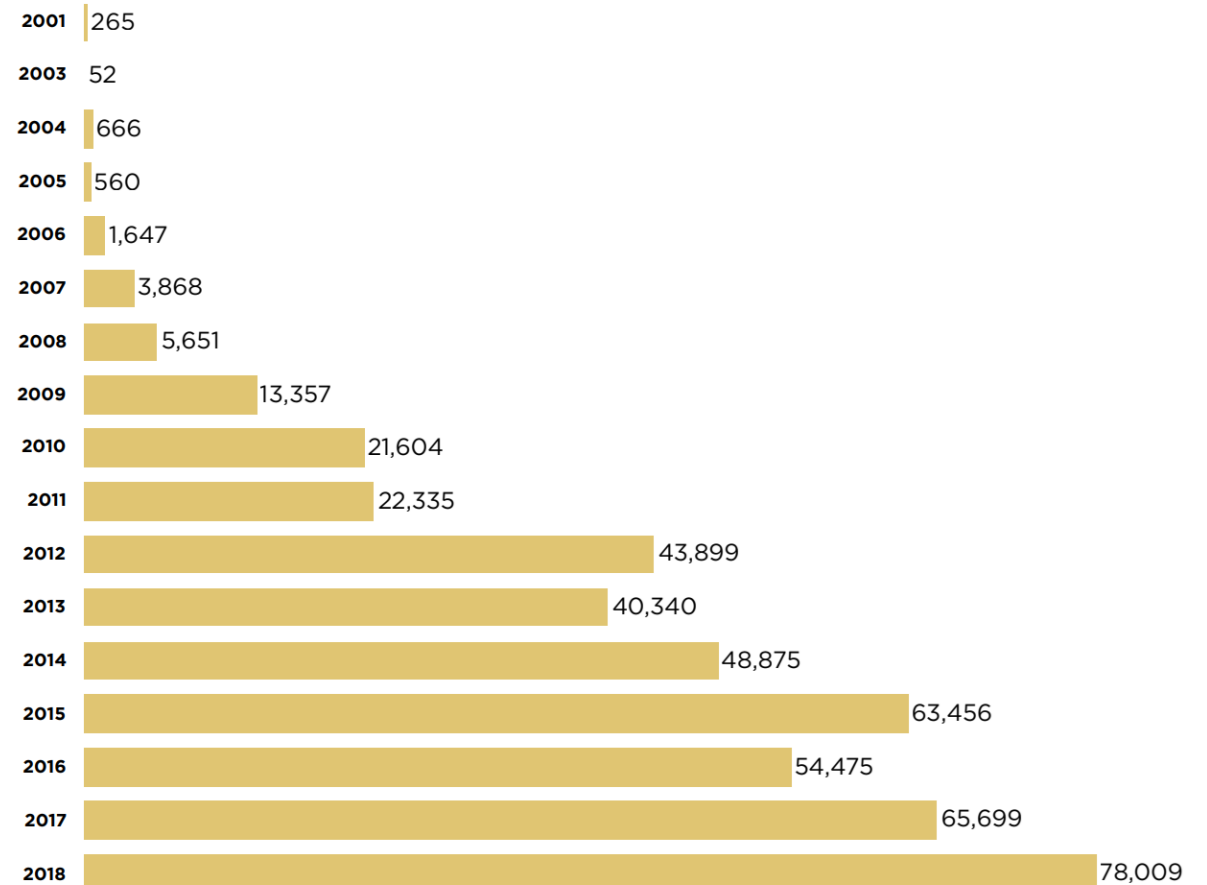


GC Growth Trends

- Strong growth curve through 2018
- 24,000 units in 2020
 - ~1/3 of 2018 level

As of June 2019

LEED-certified Residential Units on the Rise

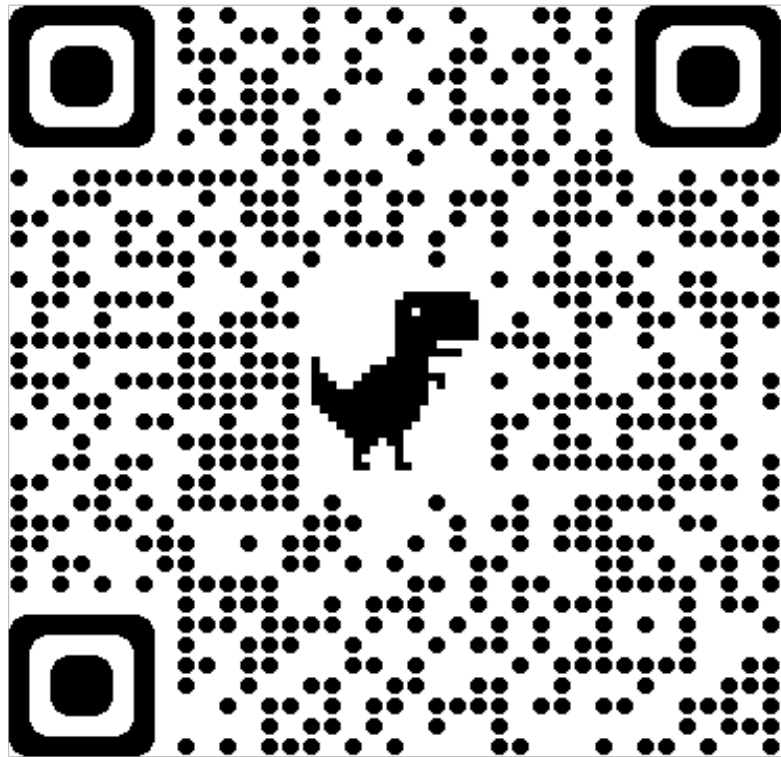


SOURCE: US Green Building Council – *LEED In Motion*, 2019



Case Study

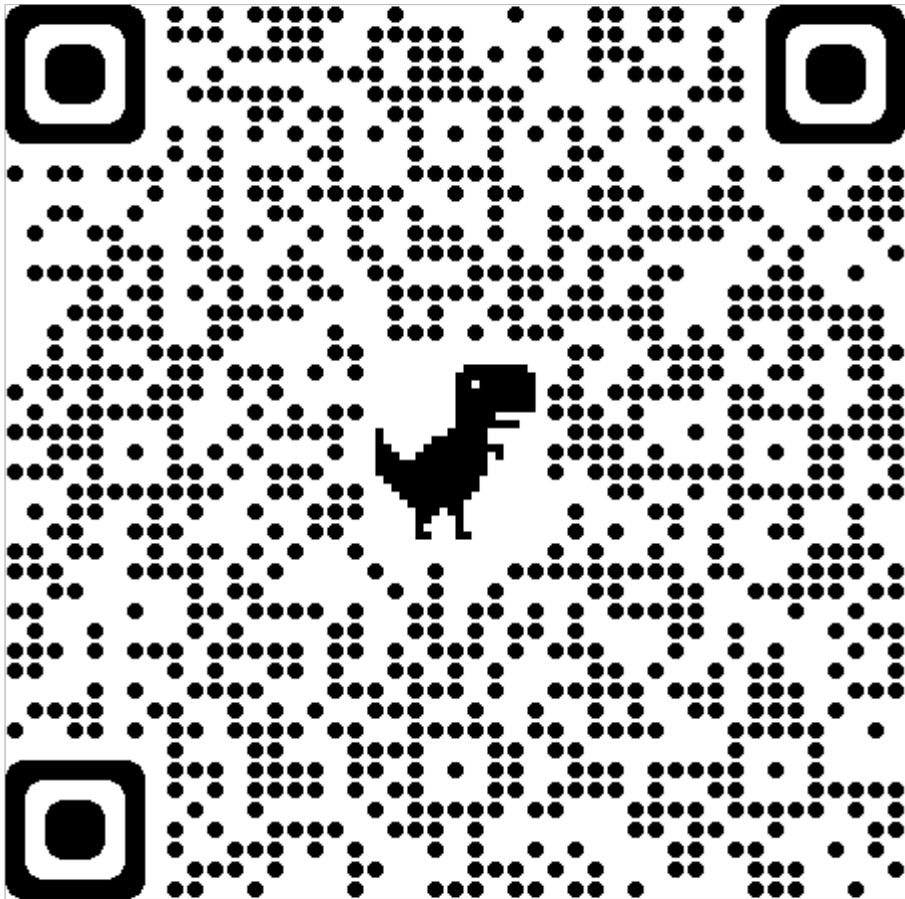
- [Mirabella](#)





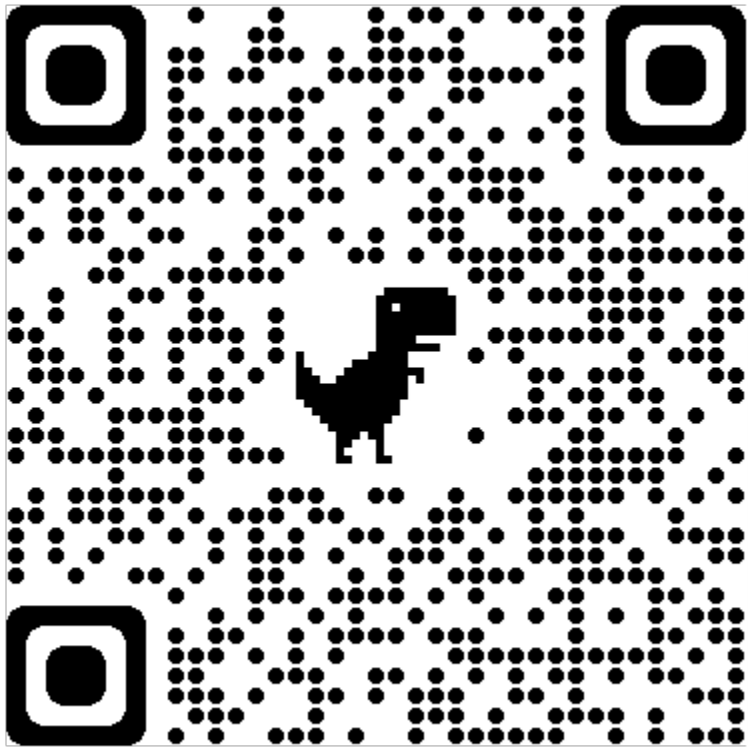
Case Study

- [Building Academic Skills & Experience](#)



Case Study

- [Edelweiss House](#)



LEED in IL



USGBC State Market Brief: Illinois

Ranked 2nd among the 2019 Top 10 States for LEED

last updated on 5/2/2022 7:21:06 PM

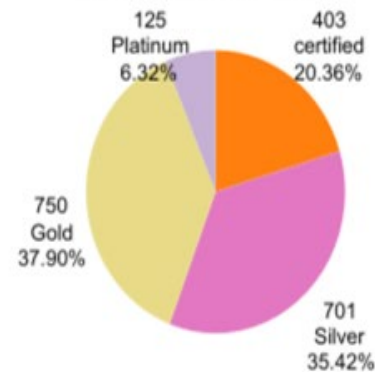
Number of Certifications

1,979

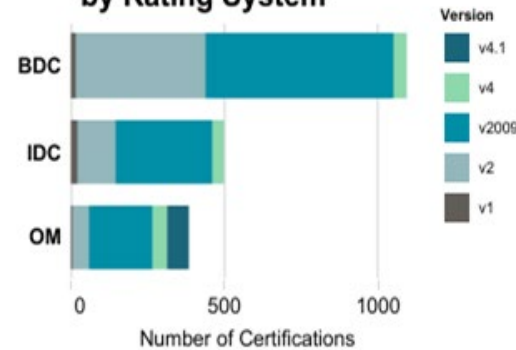
Gross Square Footage of
Certifications

520,688,532

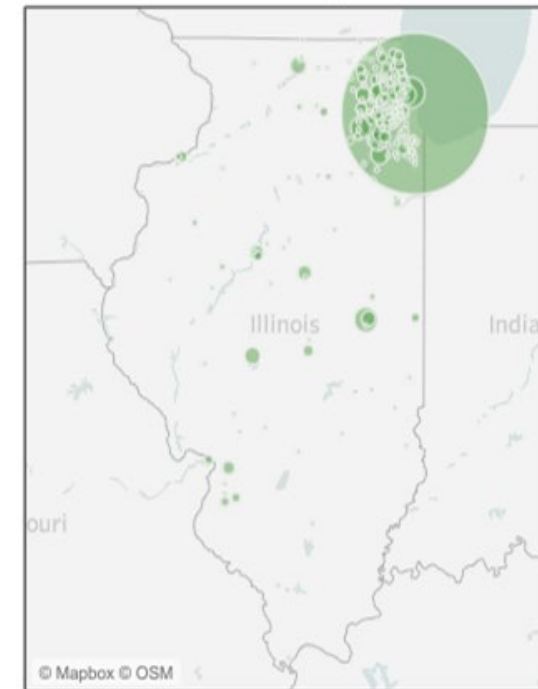
LEED Achievement



LEED Certifications by Rating System



LEED Certifications by City

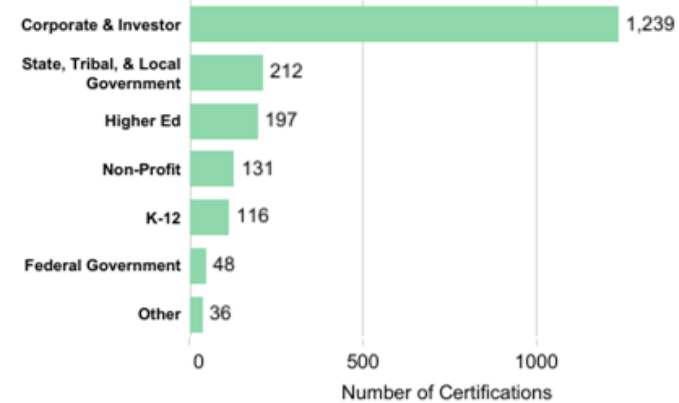


LEED in IL

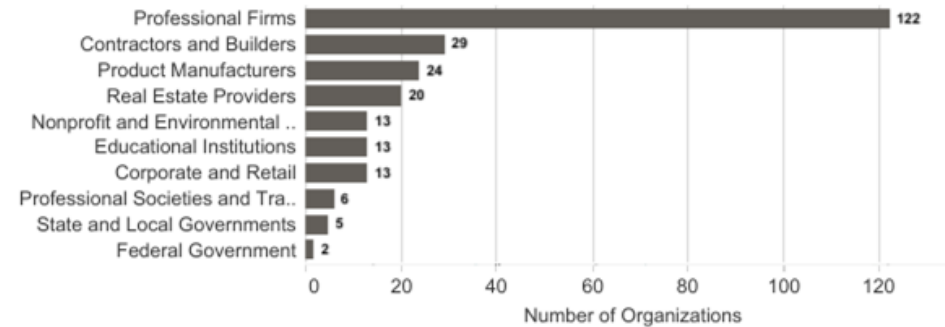
Top 10 Space Types for Certifications



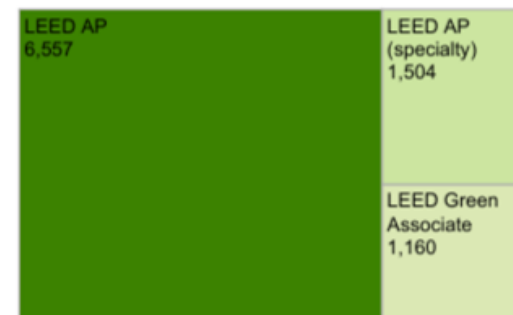
Certifications by Owner Sector



USGBC Member Organizations Located In Illinois





Professionals with LEED Credentials



LEED project data only includes commercial rating systems. The underlying data does not include LEED ND or LEED for Homes projects. LEED®, and its related logo, is a trademark owned by the U.S. Green Building Council®.

LEED Economics

- Fees
- Costs vs standard bldg. (2018)
 - +7.4% **LEED Gold** 
 - +9.4% **LEED Platinum** 
- Gains
 - 21.4% higher sale price /ft²
 - 11% higher rents

Residential Fees

Note: Additional fees will be charged by the verification team – contact your team for more information.

Residential Fees	Silver, Gold and Platinum Level Members	Organizational or Non-members
Single Family (per home)		
Registration (1-25 homes)	\$150	\$225
Registration (>25 homes)	\$50	\$125
Certification (1 home)	\$225	\$300
Certification (per batch submittal)	\$175 per batch	\$225 per batch
	plus \$50 per home	plus \$75 per home
Expedited review (reduce from 20-25 business days to 10-12)	\$1,000 per project	
Appeals	\$175 per project	
Formal Inquiries (Project CIRs)	\$220 per credit	

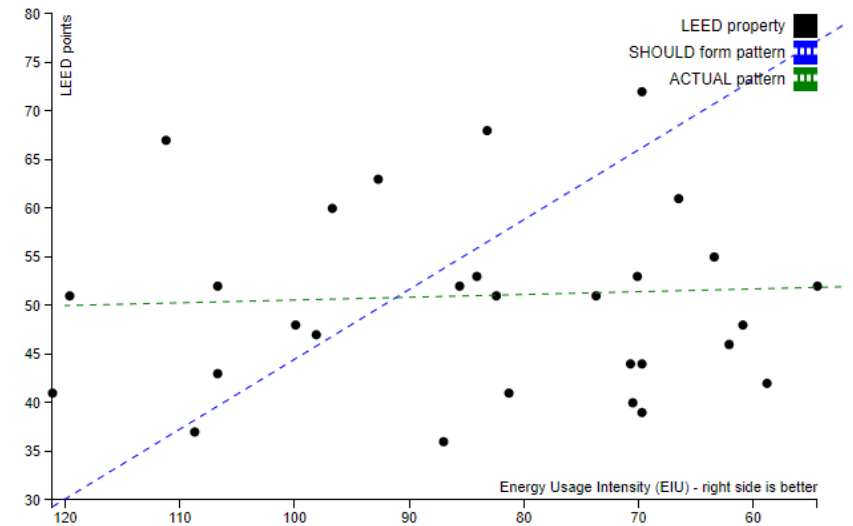
LEED - Criticism

- 2005, *LEED is Broken; Let's Fix It*

- 2013, [USA Today](#)

- 2013, [Washington Examiner](#)

“LEED gives out points to applicants for taking different actions. Get enough points and you'll be certified silver, gold or platinum, or, if you don't score high enough, you won't be certified. But is there actually any relationship between a high LEED score and using less power? If so, these dots would approximately follow the shape of the blue line, with energy metrics getting better as points got higher. Instead, they largely appear random.”



WELL



NOURISHMENT

- Selection/Availability
- Serving Size
- Information



AIR

- Quality
- Purification
- Humidity



FITNESS

- Fitness Centers
- Stairs
- Bike Room
- Incentives Programs



WATER

- Quality
- Treatment
- Drinking Promotion



COMFORT

- Ergonomics
- Sound Reduction
- Olfactory Comfort



LIGHT

- Natural Access
- Color
- Dimming/Circadian Rhythms



MIND

- Collaboration
- Quiet Rooms
- On-site Child Care
- Health & Wellness Library

fitwel



RESET

Embodied



1. RESET Materials

Establish transparency and risk management of what goes into your spaces.

Operations



2. RESET Air

Make visible the invisible factor that impacts all indoor spaces in regards to health, productivity, and sustainability.



3. RESET Water

Generate awareness around water conservation and improve water use efficiency and water quality.



4. RESET Energy

Bring to the forefront the carbon operating costs of the built environment and leverage the faster feedback loops to improve.



5. RESET Circularity

Track and understand the lifecycle input and output of waste; where and how much it is generated and consumed.



GC Benefits

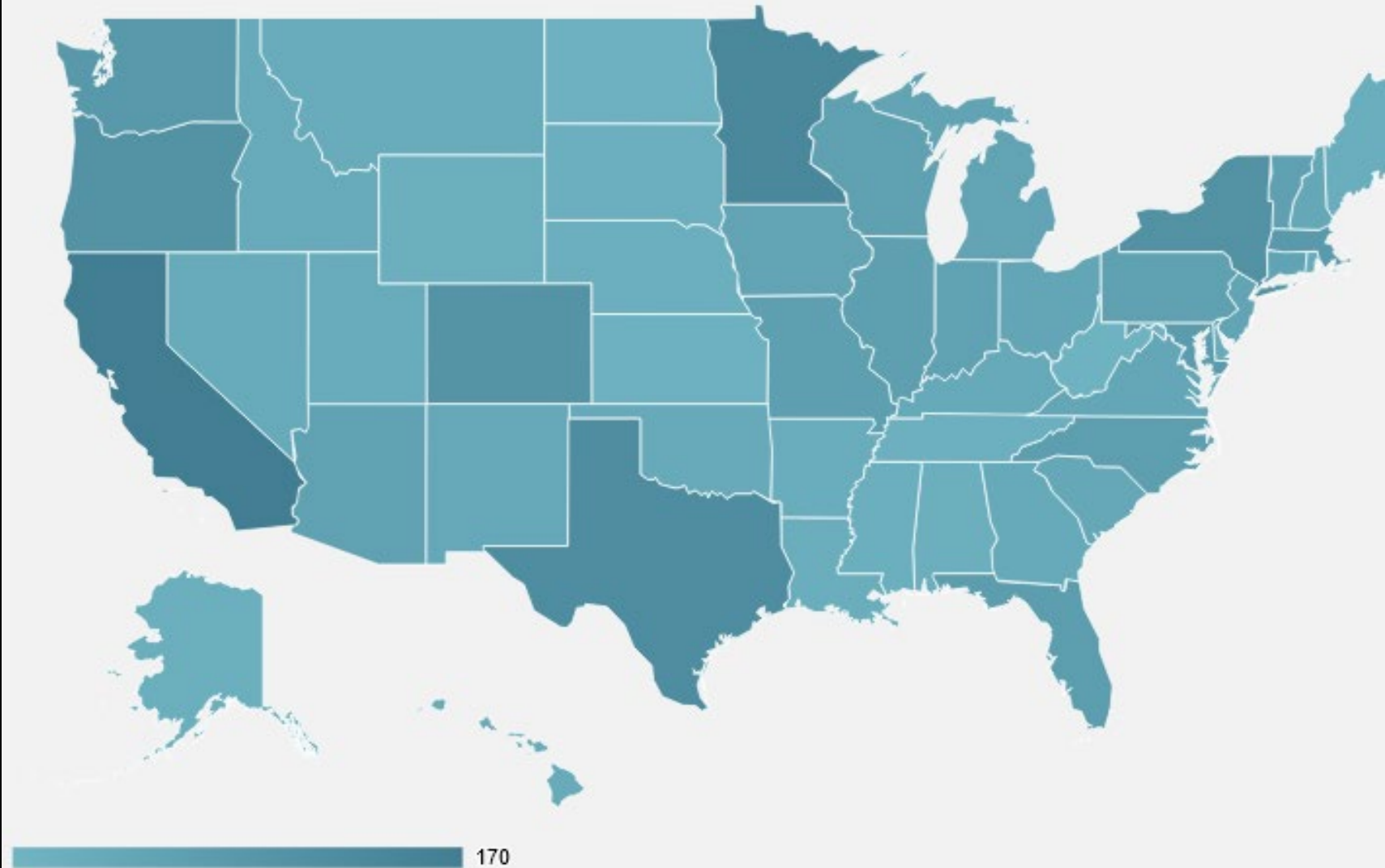
- Less material waste
- Efficient buildings
- Healthier homes

US Incentives and Rebates

Database of State Incentives for
Renewables & Efficiency

<https://www.dsireusa.org/>


Find Policies & Incentives by State



T US Territories >

DC District of Columbia >

 Federal >



United States Renewable Energy Systems Tax Rebates

Existing Home and New Construction Qualifying Systems

- Geothermal Heat Pumps
- Small Wind Turbines Residential
- Solar Energy Systems
- Fuel Cells
- Biomass Fuel Stoves

Tax Credits

- ~~30% for systems placed in service by 12/31/2019~~
- 26% for systems placed in service after 12/31/2019 and before 01/01/2023
- 22% for systems placed in service after 12/31/2022 and before 01/01/2024



Photo credit Dennis Schroeder, NREL

Solar Rebates

Federal Solar Tax Rebate:

- 26% tax credit for systems installed in 2020-2022
- 22% tax credit for systems installed in 2023-2024



Insulation and other Energy Efficiency Upgrade Rebates-Expired

In previous years residents could deduct home expenses related to energy efficiency upgrades. These tax credits expired in 2021. Congress has not renewed these tax credits in 2022.



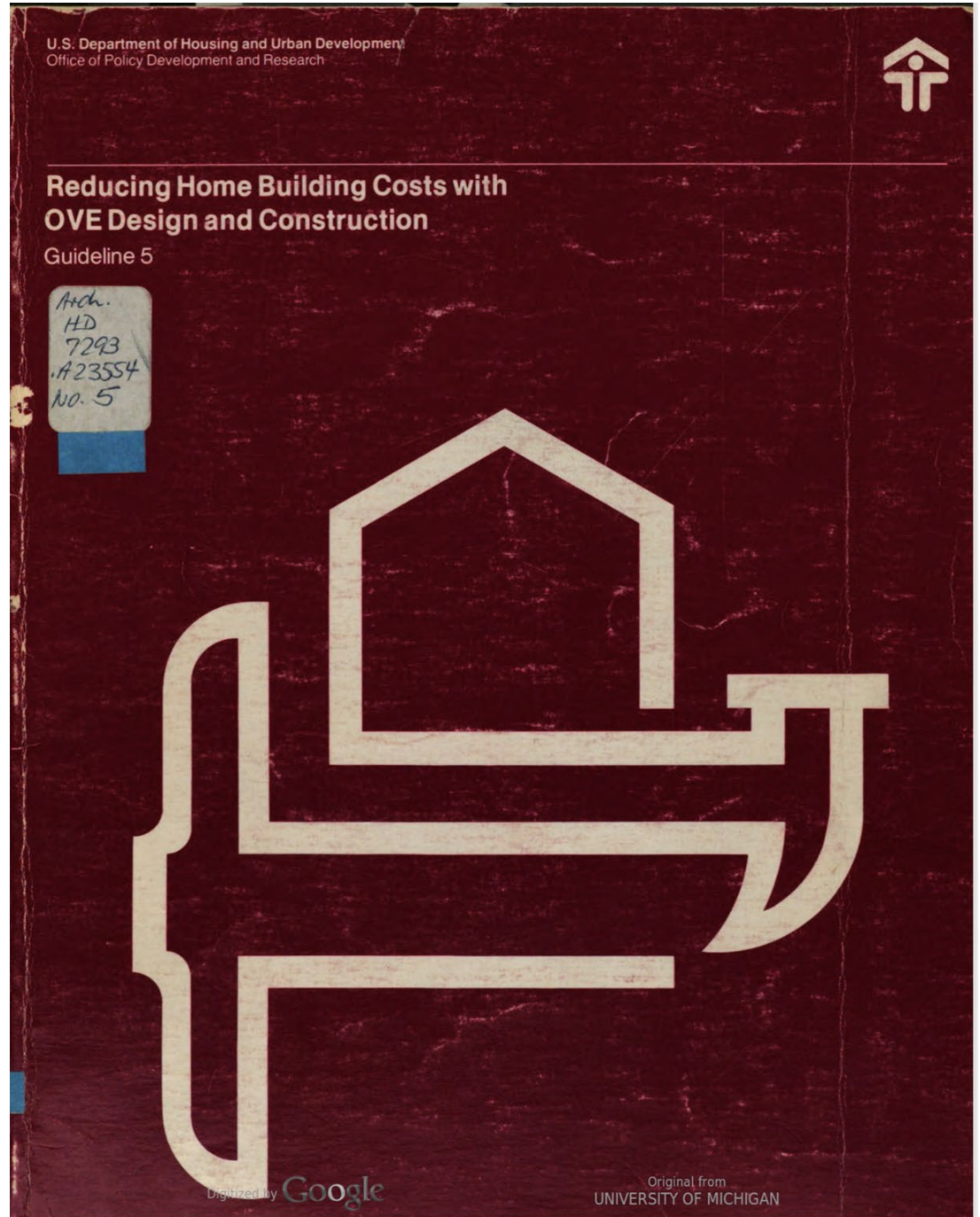
Illinois Incentives and Rebates

- Utility Residential Incentives
- Utility Commercial and Public Sector Incentives
- Solar Incentives
- Electric Vehicle Incentives

Resilient New Construction

Advanced Framing

- September 1978





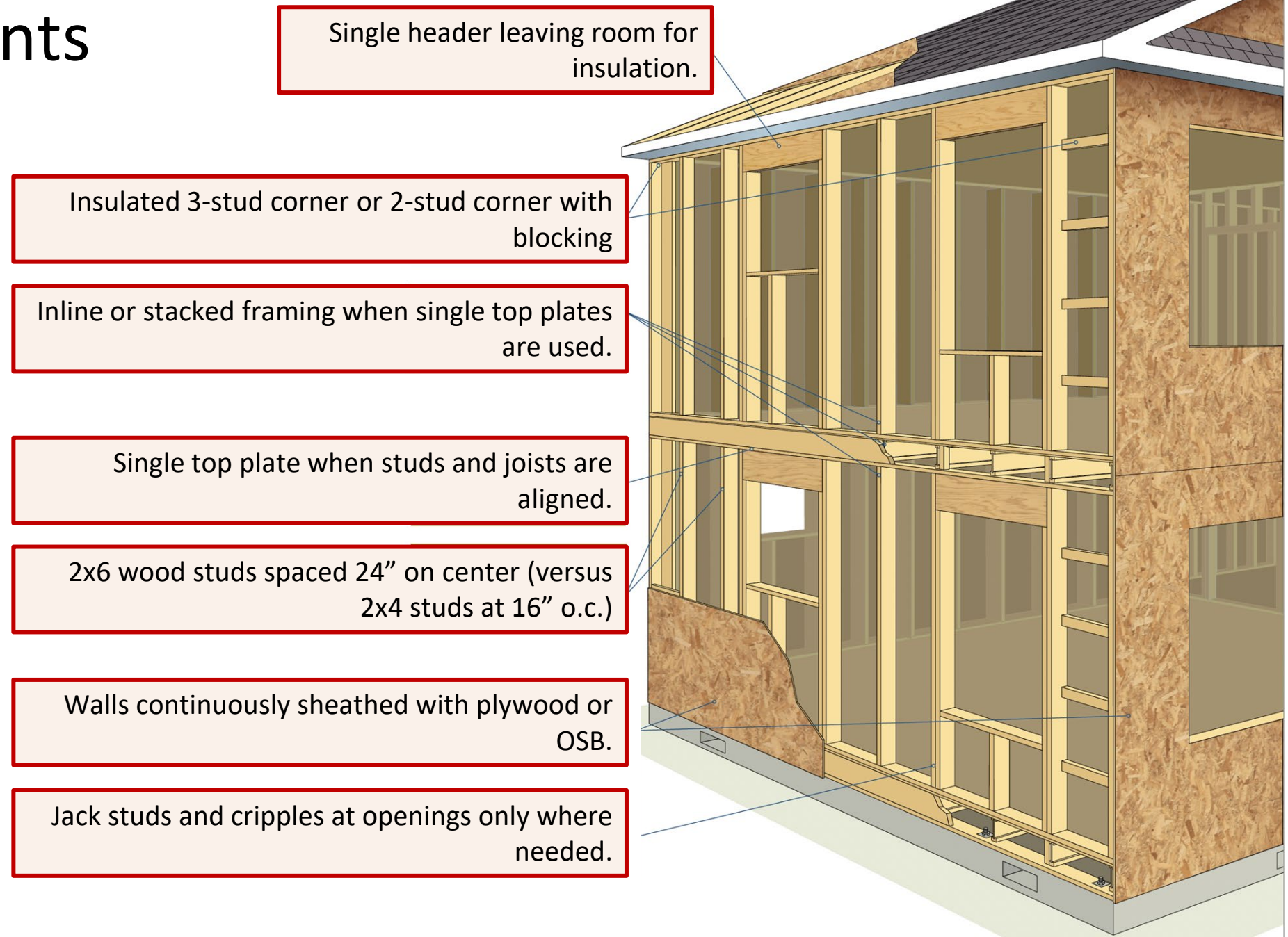
Advanced Framing—What is it?

- Techniques to reduce the amount of lumber in wood frame construction.
- Began as Optimum Value Engineering (OVE) in 1978. Research was done by the National Association of Homebuilders Research Center, under contract to US Dept. of Housing and Urban Development (HUD)

. The table below highlights the differences between conventional framing and advanced framing techniques

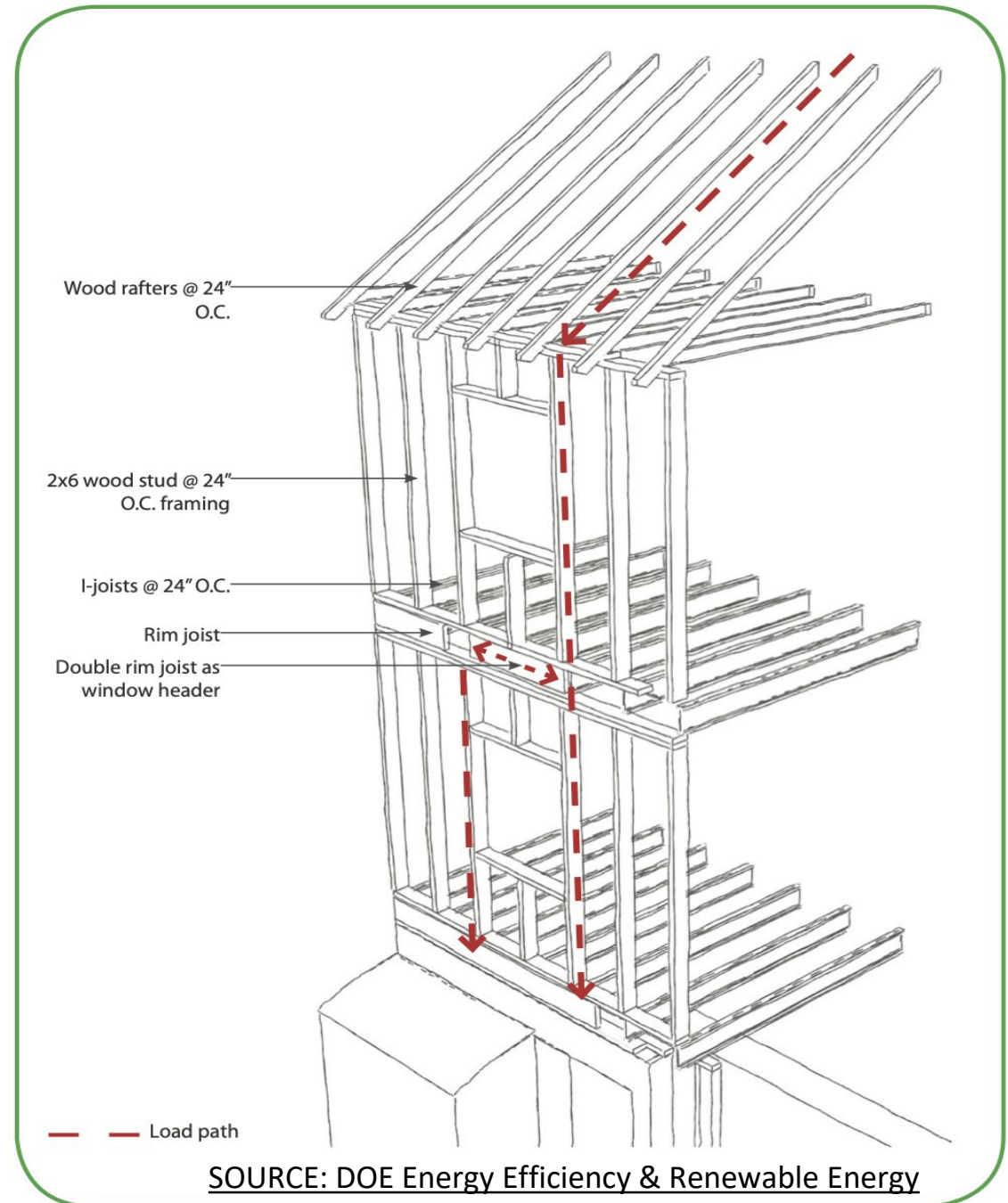
CONVENTIONAL FRAMING	ADVANCED FRAMING
2x4 or 2x6 wood framing spaced 16 inches on center	2x6 wood framing spaced 24 inches on center
Double top plates	Single top plate
Three-stud corners	Two-stud corners
Multiple jack studs	Minimal jack studs
Double or triple headers	Single headers
Multiple cripple studs	Minimal cripple studs

Typical elements



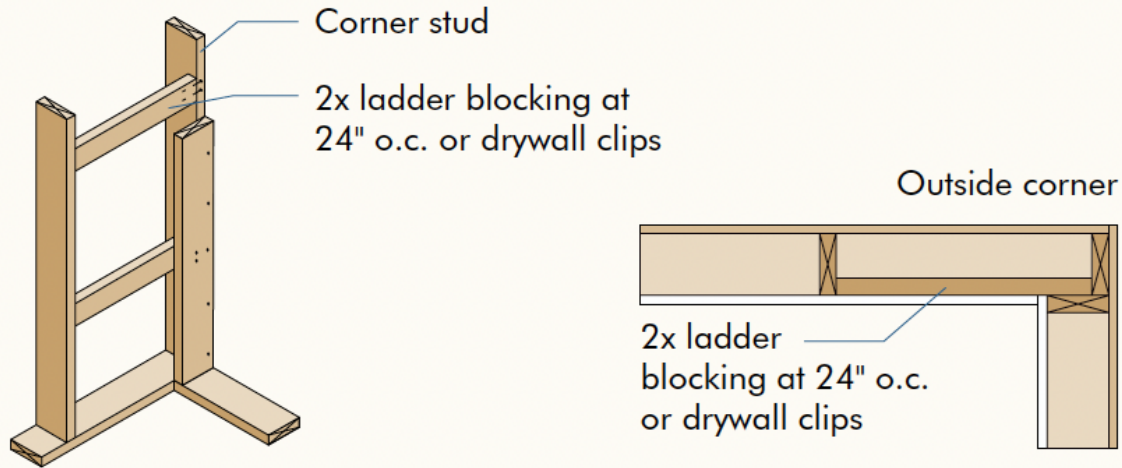
Stack Framing

IN-LINE FRAMING : DIRECT LOAD PATH

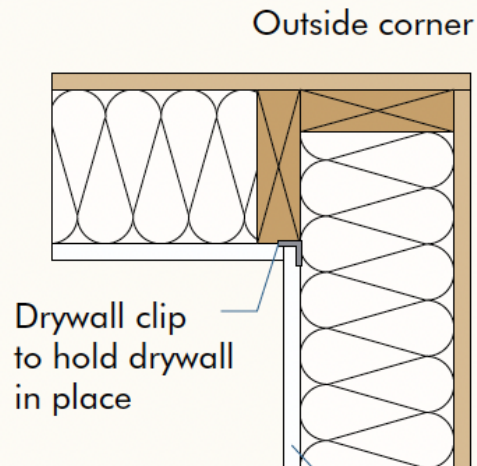


Outside Corner and Partition Lead

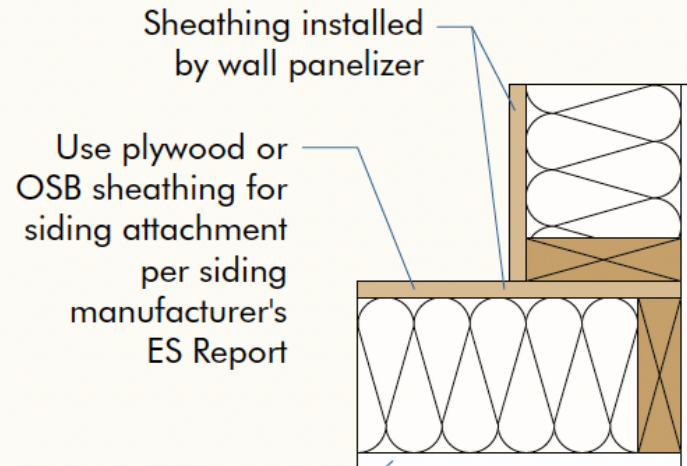
TWO-STUD CORNERS



TWO-STUD CORNER (WITH DRYWALL CLIPS)



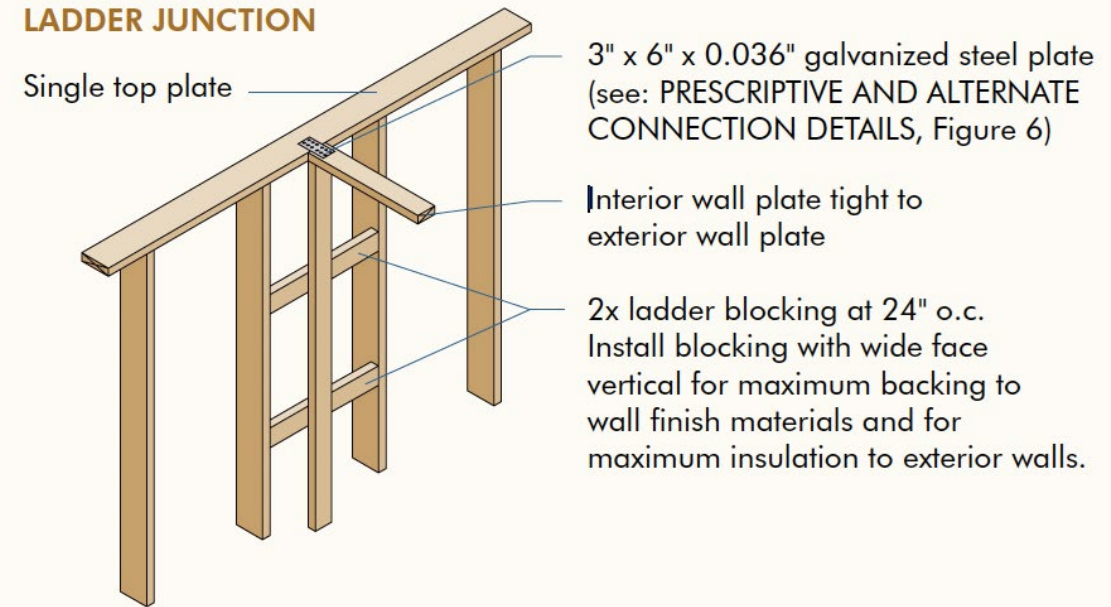
TWO-STUD INSIDE CORNER (FOR WALL PANELIZATION)



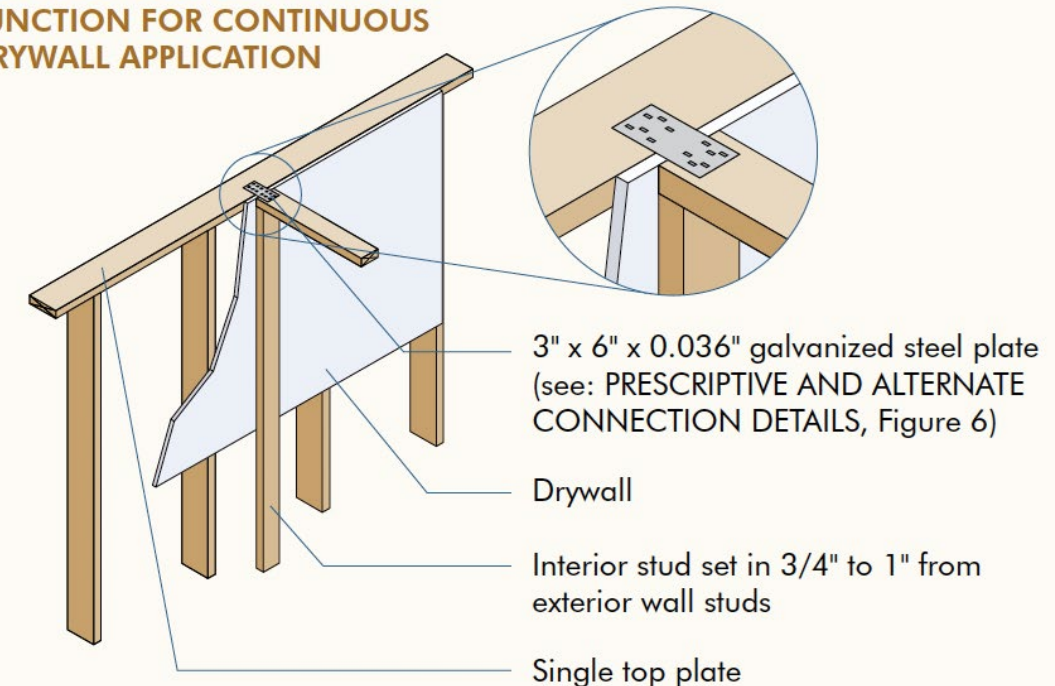
<https://www.apawood.org>
advanced-framing

INTERIOR WALL INTERSECTION OPTIONS

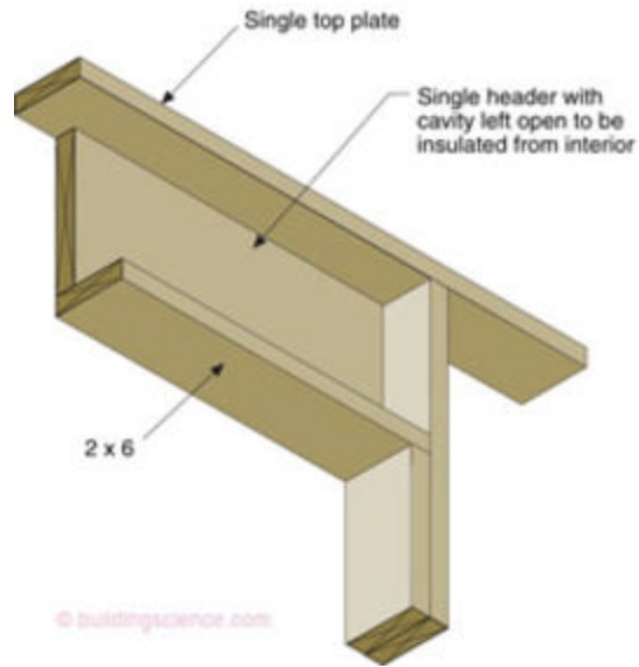
LADDER JUNCTION



JUNCTION FOR CONTINUOUS DRYWALL APPLICATION

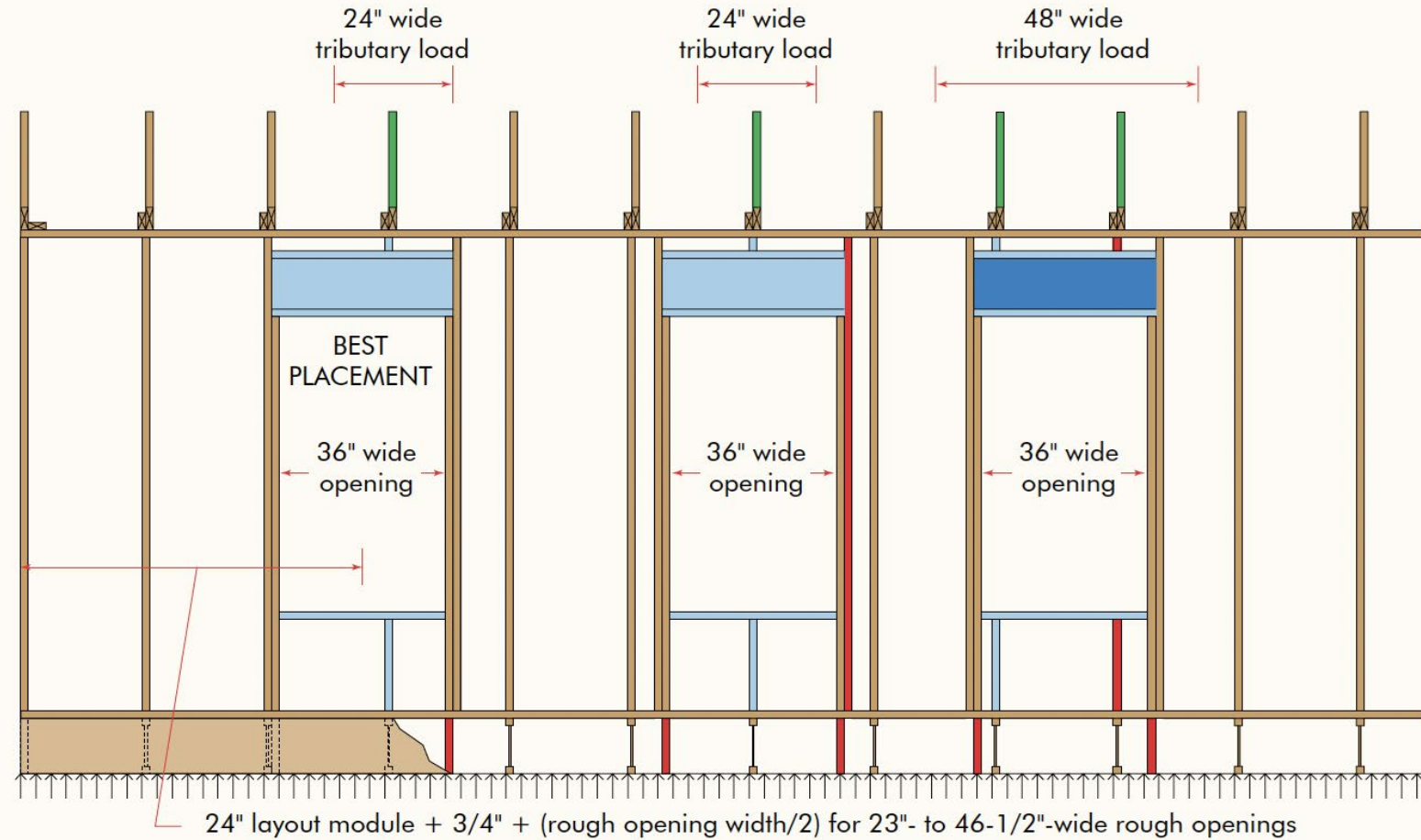


Insulated Header & Window Framing



ROUGH OPENING PLACEMENT

The placement of openings in load-bearing walls and the layout of framing members above openings have significant impact on header sizing for advanced framing.



Continuous bearing as provided by load-bearing sill beam or foundation wall.

- Minimum required materials to frame rough opening
- Structure above imposing tributary loads on header
- Potential increased header size—increased load from structure above
- Excess materials due to inefficient opening placement



References (Advanced Framing)

- American Plywood Association *Advanced Framing Construction Guide*
<https://www.apawood.org/advanced-framing>
- Green Building Advisor 2010. *The pros and cons of advanced framing*. M. Holladay.
<https://www.greenbuildingadvisor.com/article/the-pros-and-cons-of-advanced-framing>
- Building Science Corporation 2010. *Advanced Framing*. J. Lstiburek.
<https://www.buildingscience.com/documents/insights/bsi-030-advanced-framing>
- US Department of Housing and Urban Development 1978. *Reducing Home Building Costs with OVE Design and Construction*.
- US Department of Energy. *Advanced Wall Framing*.
https://www.energystar.gov/ia/home_improvement/home_solutions/doeframing.pdf



GC Careers

- Sales
- Consultants
- Developers
- Design
 - Architects
 - Engineers
 - Urban Planners
- Construction
 - Construction Management
 - Tradespeople



GC Certifications

- LEED AP
- LEED Green Associate
- NCCER – Sustainable Construction Supervisor Training & Cert. Program
- Professional Engineer (PE)
- Trades licensing
- BPI: Building Analyst (BA), more
- RESNET – Home Energy Rater

GC Business Opportunities

- Differentiate yourself and grow your business by being a green builder
- Become known as a specialist for green building
- Consult on building designs to make them greener
- Educator

Summary-Green Construction...

- ...creates structures that are environmentally responsible and resource-efficient throughout a building's life-cycle.
- ...can be certified by multiple agencies that have established specific criteria for, and evaluation of, all aspects of a building's design and construction.
- ...benefits include less material waste, better energy efficiency, and healthier building occupants.
- ...is encouraged by national and state rebates and incentives.
- ...encompasses the use of advanced framing.
- ...offers many career opportunities.