# Building Systems -- How Off-Site Fabrication Affects On-Site Inspection

**Presented by Rob Pickett**
**New England Regional Sales Manager**

Distinctively Different
harvest homes
Panelized Construction

NAHB National Association of Home Builders

Building Systems Councils (BSC):
Log & Timber, Panelized, Modular

SBCA Structural Building Components Association

SIPA Structural Insulated Panel Association

# Sources of Information

Building Systems Councils of NAHB

- Log & Timber Homes Council
- Panelized Homes Council
- Modular Homes Council

https://www.nahb.org/consumers/home-buying/types-of-home-construction.aspx

Structural Building Components Association

https://www.sbcindustry.com/

https://www.sbcindustry.com/topical-library/audience/building-official

Structural Insulated Panel Association (SIPA)

https://www.sips.org/

Modular Building Institute (MBI)

https://www.modular.org

Insulating Concrete Forms Manufacturers Association (ICFMA)

http://icf-ma.org/

Harvest Homes, Inc.

www.harvesthomes.com

Superior Walls

https://www.superiorwalls.com/

Code Inspectors Checklist

https://www.superiorwalls.com/api/getFile/413

ESR-1662 - Superior Walls of America, Ltd.

https://www.superiorwalls.com/api/getFile/409

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# What is a Building System?


NAHB®
National Association of Home Builders

# Types of Building Systems

| Building System | Log & Timber | Trusses & Components | Panelized | Modular |
|---|---|---|---|---|
| % Complete on delivery | 20-40% | 5-15% | 15-50% | 60-90% |
| | Timber Frame / Post & Beam | Insulated concrete forms (ICFs) | Structural Insulated Panels (SIPs) | Component roof |
| | Milled, Precut | Prefabricated trusses | Closed Panel | Folding roof |
| | Milled, Random Length | Timber trusses | Mass Timber: Cross-laminated Timber | |
| | Handcrafted | | Precast Concrete | |
| | | | Open frame | |

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# Building Systems Are…

- Fabricated off-site with more streamlined processes
- Built to comply with the residential construction codes effect at the delivery location.
- A better value -- Reduced material waste and greater labor efficiencies.
- Highly customizable based on engineered standards
- Verified by accredited third-parties – modular certification, ANSI/APA standards, log grading per ICC400.
- Installed on permanent foundations.
- Financed like a site-built home on a different draw schedule.

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# Building Systems Councils of the National Association of Home Builders

The NAHB Building Systems Councils (BSC) is the voice of the systems-built housing industry – dedicated to promoting the benefits of systems-built construction to consumers and builders.

Comprised of 6 different councils, the BSC represents manufacturers, builders and suppliers of log, timber frame, modular, panelized and concrete homes.

1960 - Established as the *Home Manufacturers Association*

1985 - First annual conference, the Home Manufacturers Association Showcase

1987 - Became part of NAHB.

The Home Manufacturers Association renamed the *Building Systems Councils (BSC)*

2019 - The BSC's 34th annual conference, now called the Building Systems Housing Summit, held in Pittsburgh, PA.

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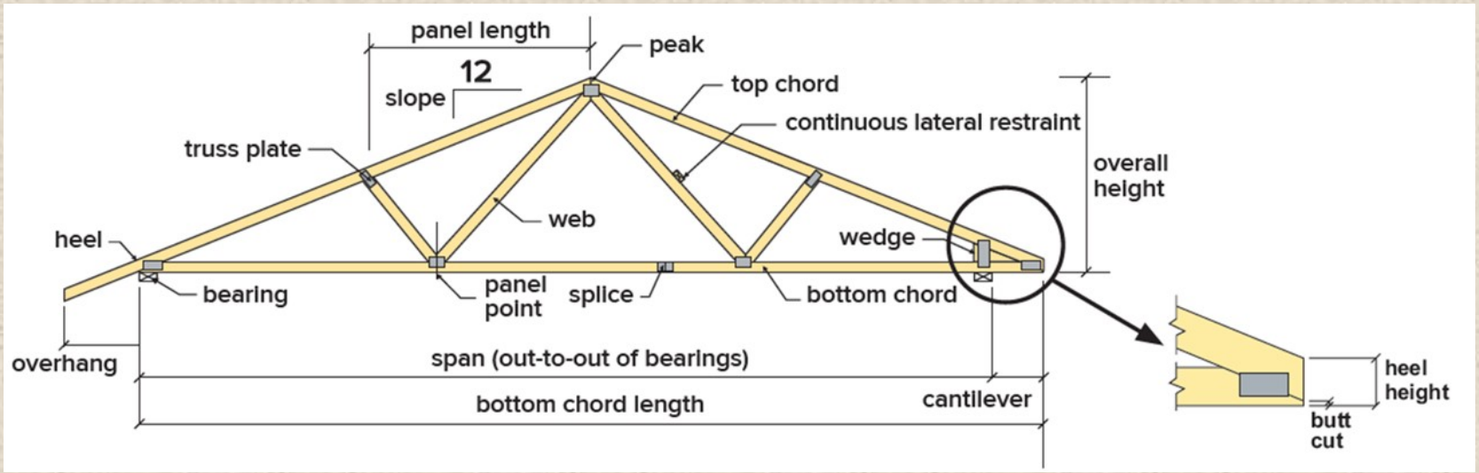
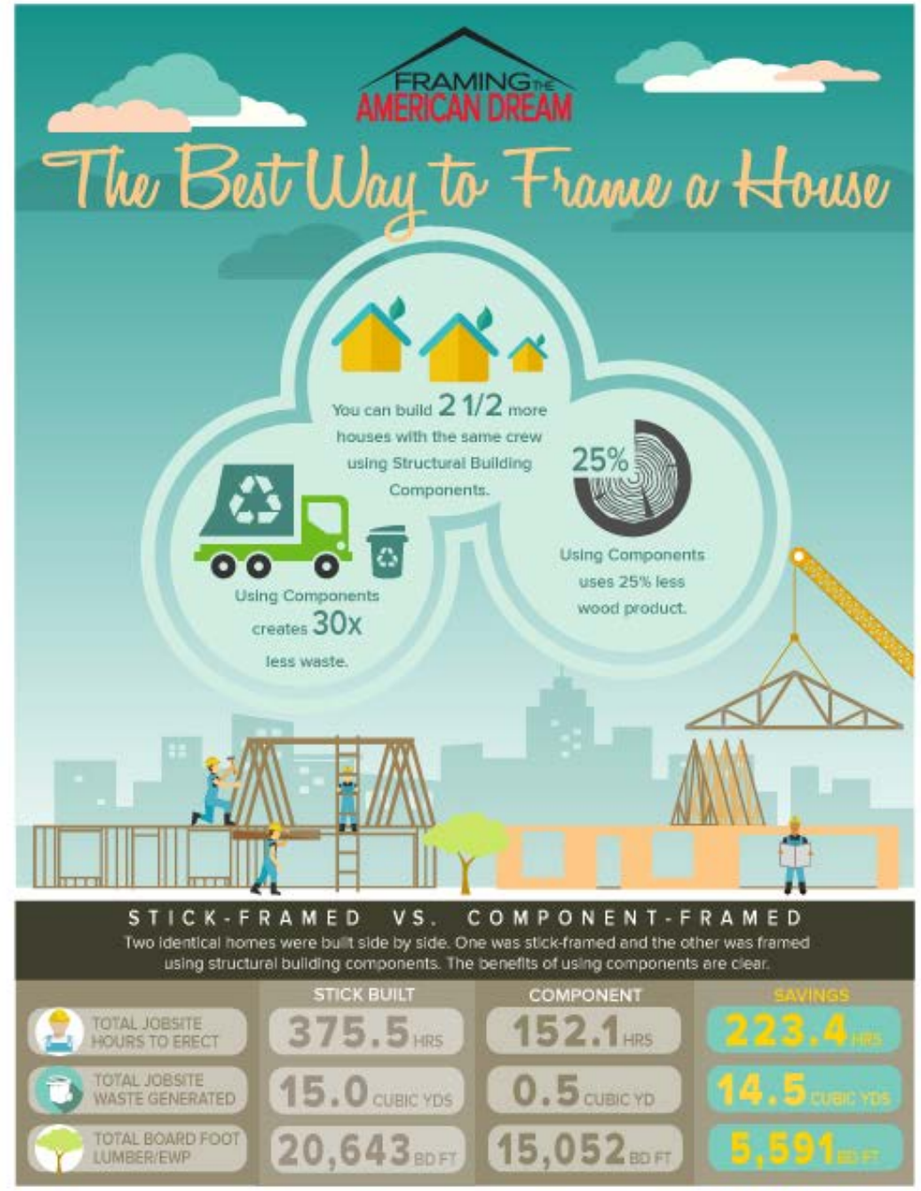
# Structural Building Components Association

- Founded in 1983
- Representing manufacturers of engineered floor, wall, and roof structural components
- Full scale testing
- Research & comparative studies

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SIPA Structural Insulated Panel Association

# Structural Insulated Panel Association

NTA Evaluation Report: NER-1038, FRD031609-25
Reissue Date: 07/19/2019
This report is subject to annual review

9. FINDINGS
All products referenced herein are manufactured under an in-plant Quality Assurance program to ensure that the production quality meets or exceeds the requirements of the codes noted herein and the criteria as established by NTA, Inc. Furthermore, product must comply with the conditions of this report.

*This report is subject to annual review.*

10. IDENTIFICATION
Each eligible product shall be permanently marked to provide the following information:
10.1 The NTA, Inc. certification mark, shown below.
10.2 NTA's NER No. NER-1038 or FRD031609-25
10.3 The name of the report holder
10.4 Identifier for production facility
10.5 Project or batch number, date and shift of manufacture or other means of tracing product to quality documentation

NTA LISTED
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MEMBER

NER-1038 Certification Report 2019-07-19
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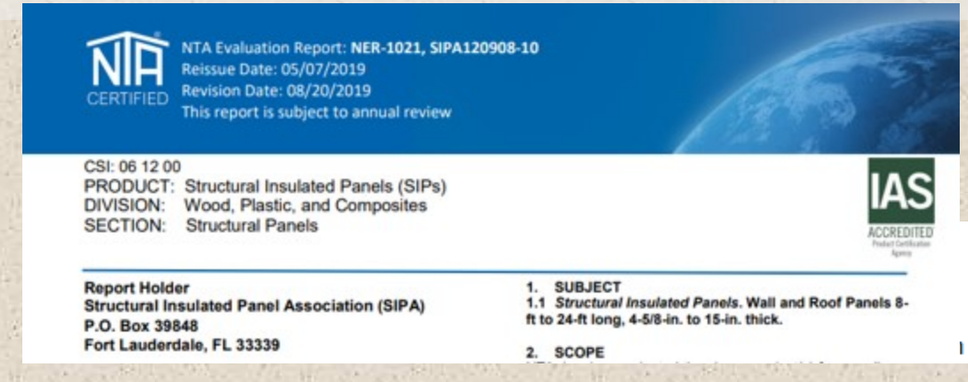
- Non-profit trade association representing manufacturers, suppliers, dealer/distributors, design professionals, and builders
- Founded in 1990
- SIPA members provide recognition of code compliance through evaluation reports issued by the International Code Council Evaluation Service (ICC-ES) or NTA, Inc. SIPA members have access to the SIPA-NTA Code Report, a shared code listing managed by a group of SIPA member manufacturers.



NTA Evaluation Report: NER-1021, SIPA120908-10
Reissue Date: 05/07/2019
Revision Date: 08/20/2019
This report is subject to annual review

CSI: 06 12 00
PRODUCT: Structural Insulated Panels (SIPs)
DIVISION: Wood, Plastic, and Composites
SECTION: Structural Panels

IAS ACCREDITED

**Report Holder**
**Structural Insulated Panel Association (SIPA)**
**P.O. Box 39848**
**Fort Lauderdale, FL 33339**

1. SUBJECT
1.1 *Structural Insulated Panels*. Wall and Roof Panels 8-ft to 24-ft long, 4-5/8-in. to 15-in. thick.

2. SCOPE

SIPA Structural Insulated Panel Association

# Why work with a building systems producer?

Well established businesses, e.g.

- Harvest Homes in 1961 in Delanson, NY
- Superior Wall in 1981 in New Holland, PA

Member of the national trade associations

Dedicated and experienced team

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Building Systems Councils (BSC):
Log & Timber, Panelized, Modular

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# Decades of Combined Experience

- Expert staff provided with knowledge and training regarding current building trends, product innovations, and codes
- Estimators, designers and other team members are effectively an extension of your office
- Regional managers with industry experience
- Reliable, quality-driven workmanship
- Proven product specifications control costs & generate stable pricing
- Labor reduction/less onsite build time

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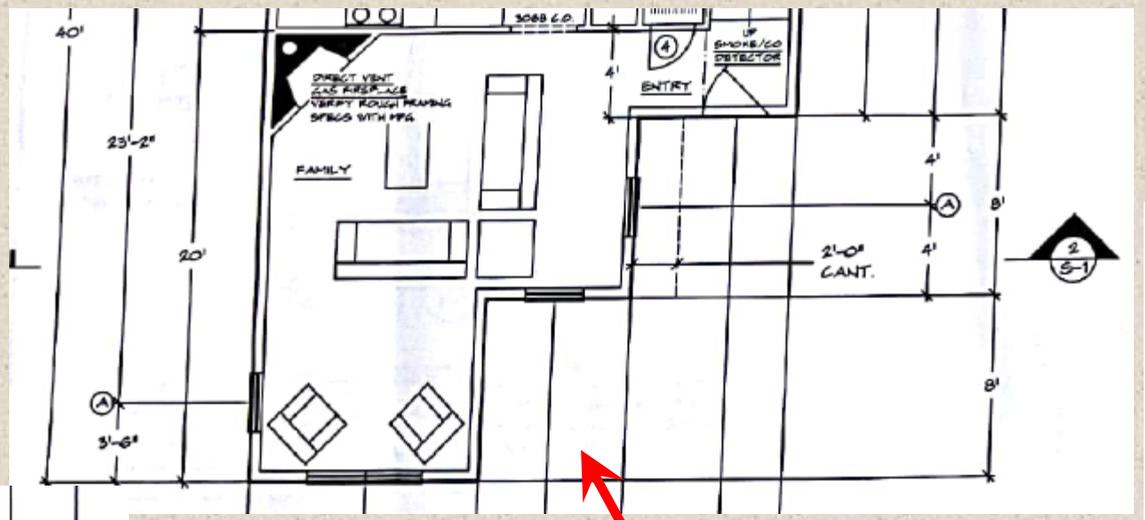
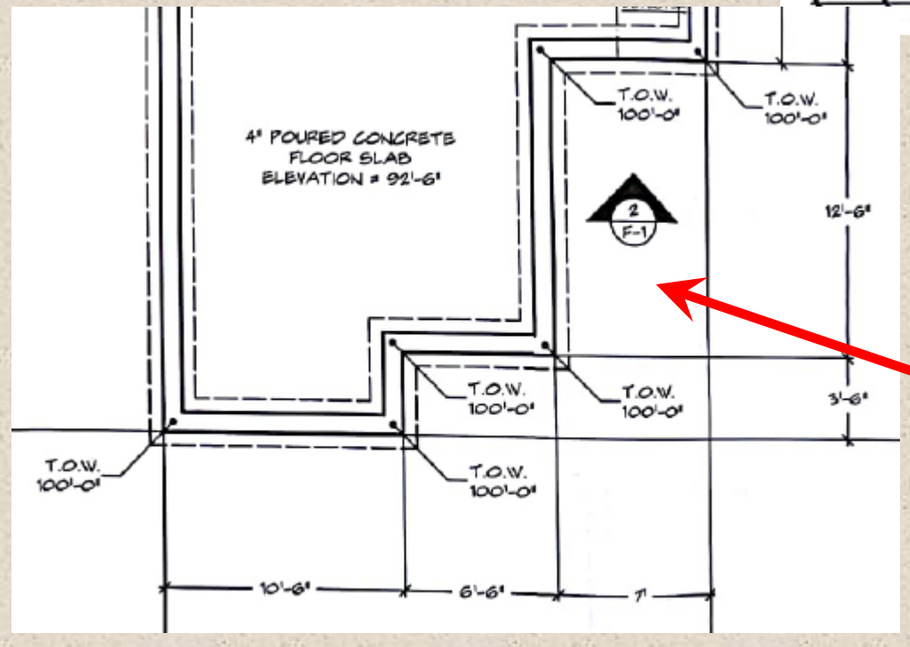
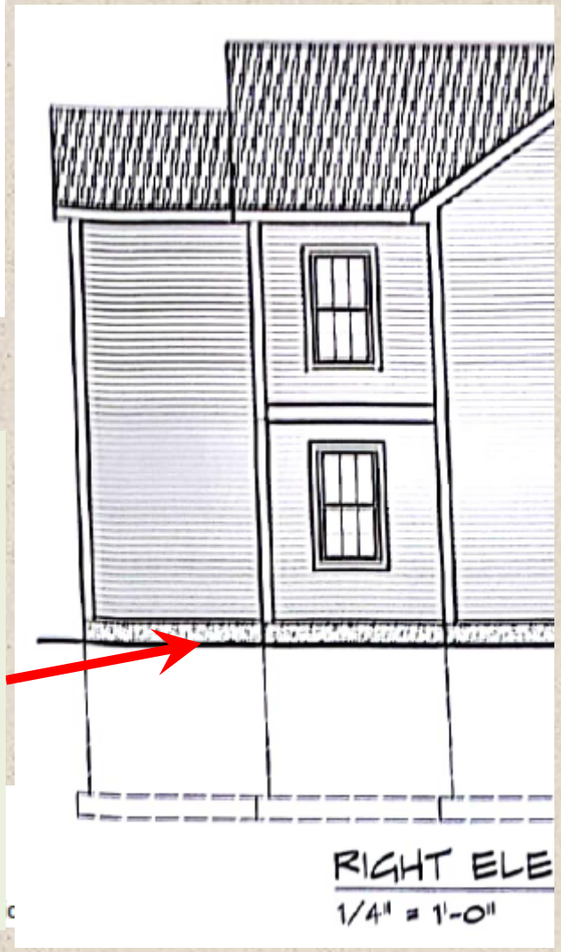
# What Does Experience Mean to You?




Our panels were being built to the floor plan and elevation. Had we not caught the foundation error; the builder would have had an expensive repair.



# Production Design

- Production derived from in-house design or outside design professionals
- Design services backed by years of work with outside engineers
- Programs in place to confirm specification of structural elements
- In-house design services completed to the extent of the package provided
  - Windows checked for egress, tempered glass requirements
  - Smoke detectors may not be shown
  - Electrical, mechanical, plumbing diagrams generally left to local professionals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# Optimal Use

| Building System | Log & Timber | Trusses & Components | Open Panels | Closed Panels | Modular |
|---|---|---|---|---|---|
| 1&2 Family Detached | Primarily custom homes | ICF fdtns/walls | Custom homes | SIP walls, Precast concrete | From 2-box to 20 |
| Multi-Family | Dorms, Lodges | Floor/roof trusses | Commodity products | SIP/Precast tilt-up walls, CLT | Repeatability benefit |
| Commercial | Hotels, Retail, Offices | | | Precast tilt-up walls, CLT | Ideal for hotels |
| Public/Other | NA | Integrate steel framing | | | High value |

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# Why work with a building systems producer? -- A Network of Representatives

- Builder/Dealers provide local contracting services
- Corporate and local marketing support – website, site signs, and more
- Professional feedback
- Building business together
- Coordination & support of an experienced team




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# Occupancy, Use & Type of Construction

The majority of the building systems in use today are wood-based, Residential Group R, Type V Construction.

- IBC requires automatic sprinkler system throughout
- Allowable building height up to 70’ or four stories above grade plane.

Exceptions:

- Lightgage cold-formed steel framing per IRC R603
- ICF: Stay-in-place forms R608 (35’ MRH or 2-stories above grade)
- Precast concrete can be integrated into any Type and Occupancy Group
- Cross-laminated Timber meets Type IV Construction.

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# Structural

| Building System | Log & Timber | Trusses & Components | Open Panels | Closed Panels | Modular |
|---|---|---|---|---|---|
| Design Requirements | ICC400 | Refer to https://www.sbcindustry.com/technical/design-specifying-installation | Light-frame construction; AWC WFCM | Per IRC R610 | Specified prior to factory production and subject to in-plant third-party inspection |
| Quality Assurance | Log Grading per ICC400<br>CLT per ANSI/APA PRG320 | https://www.sbcindustry.com/technical/quality-control | Grade-marked structural panels, lumber, I-joists, beams | Per ANSI/APA PRS 610.1 | |

**Many offer 10-year structural warranties from third-parties to assure compliance with codes and standards.**

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# Fire Protection

| Building System | Log & Timber | Trusses & Components | Open Panels | Closed Panels | Modular |
|---|---|---|---|---|---|
| Fire-Resistance | 1-hour wall when minimum thickness is 6” | Refer to https://www.sbcindustry.com/technical/fire-issues | Site-applied fire protection per code | Specified prior to factory production and subject to in-plant third-party inspection | |
| Separation, Blocking | No concealed spaces in wall | | Site-applied per code | SIPS require a thermal barrier | Site-applied fire separation per code. |
| Draftstopping | Often 2x T&G decking | | Site-applied per code | Per mfr. details | Per mfr. details |

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# Energy Conservation

| Building System | Log & Timber | Trusses & Components | Open Panels | Closed Panels | Modular |
|---|---|---|---|---|---|
| Insulation | Integrated mass & insulation | Site-applied & Integrated (ICF) | Site-applied | Specified prior to factory production and subject to in-plant third-party inspection | |
| Air Barrier | Treat as continuous insulation | Site-applied & Integrated (ICF) | Site-applied | Partially site-applied | Partially site-applied |
| Glazing | Often shipped loose | Not included | Ship loose or tacked in place | Ship loose or tacked in place | Tacked in place |

All building systems require testing on site for air infiltration rate, duct leakage, etc.

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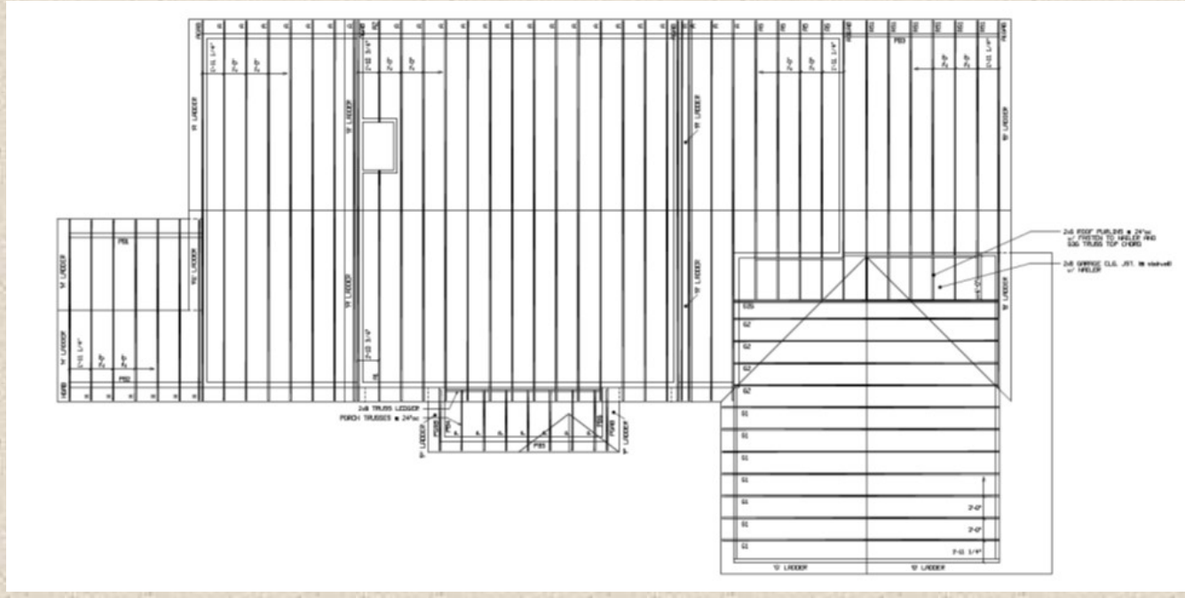
# Benefits to Sustainable Design & Construction

ICC 700-2012, Ch. 6 Resource Efficiency

**601.2 Material usage**. Structural systems are designed or construction techniques are implemented that reduce and optimize material usage.

**601.4 Framing and structural plans.** Detailed framing or structural plans, material summary lists and on-site cut lists for framing, structural materials, and sheathing materials are provided.

**601.5 Prefabricated components.** Precut or preassembled components, or panelized or precast assemblies are utilized for a minimum of 90% for the following system or building…



Building systems provide green points due to their inherent practices – planning, control and utilization of materials, and less on-site waste.

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# Understanding the Scope of Work

| Building System | Log & Timber | Trusses & Components | Open Panels | Closed Panels | Modular |
|---|---|---|---|---|---|
| Foundation | In place prior to delivery | ICF option | In place prior to delivery | Precast option | In place prior to delivery |
| Building systems are produced to plan. Variance between plan and foundation must be rectified at the sill plate. Any modification effecting the building system will be carried up throughout the structure. | | | | | |
| Floor Deck | In place prior to delivery | Floor truss, I-joist or other engineered option | Panel option requires all bearing in place | CLT/SIP option | Girder built into floor, post on site |
| Mechanical, Electrical, Plumbing | 0-10% complete | Wet wall sub-assembly | 0-10% complete | 5-10% complete | 70-90% complete |

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# Receiving a Delivery

Access

- Minimum 20’ radius into driveway
- 20’ wide
- Tractor-trailers are 8’ wide x 70’ long and 14’ tall

Have foundation complete to top of sill plate

- Floor panels will rely on interior bearing being in place.
- Modulars have beam built into floor but need to have support columns per plan.

- Proximity to foundation
  - Crane: Set up close to backfilled foundation on firm, flat ground

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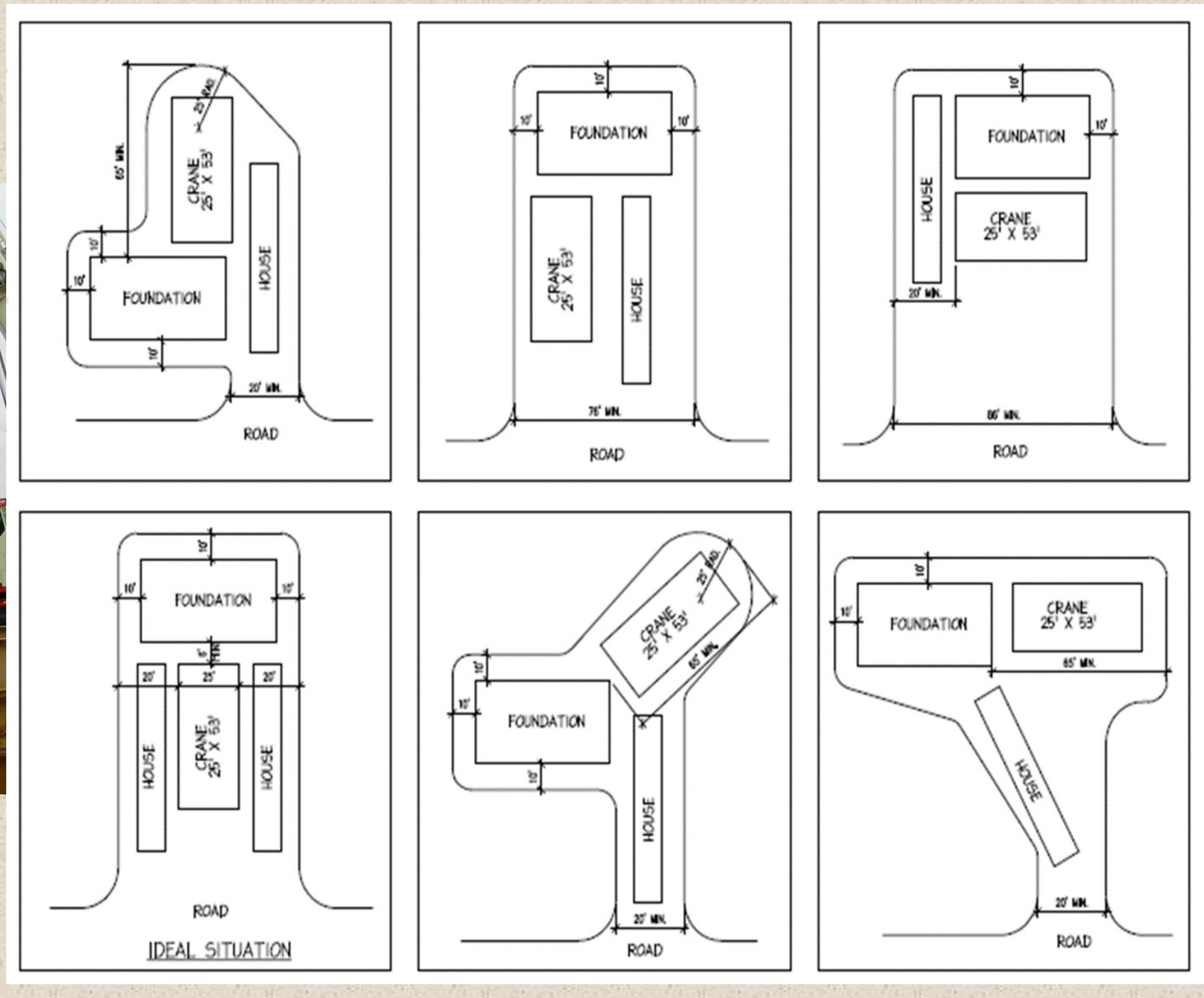
# Modular Delivery

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# Storage & Handling

- Unloading to storage
  - logs or other components for installation later, use an all-terrain lull.
  - Prepare level spot for storage
- Protection from the elements
  - Sticker off grade and puddles
  - Solar degradation?

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# Delivery of Panels

- 30' radius all turns
- Min. roadbed width (>10’)
- Check power lines
- Check overhead (<13')
- 30x70 crane operating area
- 15x70 staging for 2nd truck

Differentiation:

- Drop load or delivery service
- Extent of on-site support with delivery

# Floor Construction

## Floor Panels

- 8’ wide, up to 34’ long
- Joists & Rim – lumber or engineered wood
- Sheathing – ¾” T&G glued and nailed
- Crane-assisted, can average ± 960 sf/hour

## Cross-laminated Timber

- Size limited by mode of transportation, similar to prestressed concrete decks

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# Wall Panels

Size varies with producer

- Typical wall heights using precut studs
- Lengths vary due to anticipated handling limits
- Shorter lengths require more attention to seams

Delivery also varies with producer

- Stacked flat for forklift unloading
- Standing vertically with windows tacked into openings for crane pick

Gables & exterior walls are sheathed

Interior walls frame only, double top plate


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# Roof Systems

Vary with producer…

- Precut or prebuilt timber trusses or prefabricated, engineered trusses
- SIP panels
- Folding or component modular roof
- Precut rafters


# C&D Materials – Reduce, Recycle, Re-use

**Building systems manage material waste in the factory, not on site, reducing costly waste removal, site clean up, even potential theft.**



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# There is a different way to build.

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