Is prefab the future? ... again?

Dr John Straube, P.Eng.
Why prefab?

- Cheaper
- Faster
- Greener
- Better Quality
- Less time on site
- Less weather sensitivity
Prefab

→ Media: over-hyped, solves all problems easily
  → “Stacks like Lego”
→ Reality: can be an improvement, requires work, knowledge, experience
  → More design upfront, more detail
→ Future: almost certainly more prefab!

→ Thanks to RDHers: Joe Pinon, Camilo Mendoza, Graham Finch, Brian Hubbs
Forms of prefab

→ Components
  → Windows, cabinets, RTU
→ Panels (aka flat pack)
  → Walls and floors
  → Wide range of degrees of finish
→ Modules (aka volume)
  → Wide range of degree of finish
Prefab cast-iron and glass kit of parts. Used 10in x 49in module, the size of the largest glass sheet available at the time.
Sears Roebuck alone: 70,000 homes 1908-40

BENNETT'S SMALL HOUSE CATALOG, 1920
Ray H. Bennett Lumber Co., Inc.
With 217 Illustrations

1908
BOOK OF MODERN HOMES AND BUILDING PLANS

SEARS, ROEBUCK & CO.
CHICAGO
SCIENCE’S ANSWER IS THE BENNETT-WAY

The best designs and plans have been produced for hundreds to share the benefits—a huge modern mill in the heart of the lumber market has been equipped with labor- and waste-saving machinery of the latest type—and YOU, who want to build a home, reap the advantages and savings of the Bennett-Way in securing one of finer design, greater convenience, and genuine durability.

Perhaps right here it is well to establish the difference between a Bennett Ready-Cut Home and a portable house.

The object of the portable system is to produce a building construction which may be put together to form a temporary shelter—taken apart again—and moved from place to place as desired. Manufacturers of portable buildings cannot and do not represent their products to be permanent.

But Bennett Homes, Better-Built and Ready-Cut, are built for permanency. Once your Bennett Home is completed, there is absolutely no difference between it and any well-constructed home, except, perhaps, that our designs are more attractive and impressive than the average homes one sees.

HOW RENT-MONEY COUNTS

This table shows what rent amounts to in ten and twenty years, with six per cent interest compounded annually, and gives an idea of the value of the house one can pay for by applying rent toward paying for a home.

<table>
<thead>
<tr>
<th>Rent per Month</th>
<th>In 30 Years</th>
<th>In 20 Years</th>
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<td>$ 0.00</td>
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</tbody>
</table>

Tonawanda, heart of the Lumber Market. Great lumber-docks on one side, main trunk-line railroads on the other.
Post-War Britain

Estimated 150,000 homes
1946-1960
Habitat, Expo 67 Montreal, Moshe Safdie
2008 Manser Award for new housing
“mass factory-produced housing, erected in three days, incorporating top technology, top energy performance”, …
“It is radical, innovative and an outstanding step away from the traditional mud and mess of the domestic building site.”
Taylor Wimpey faces £12m repair bill for award-winning estate

Taylor Wimpey must spend millions repairing wet and dry rot at the Oxley Wood development. Andrew Bunter/Alamy

Kathryn Hopkins Property Correspondent
Published at 12:01AM, April 7 2015

It seemed like such a good idea at the time, building an award-winning housing estate with a bargain price-tag, but eight years on Taylor Wimpey’s dreams of prestige and prizes have turned into a £12 million headache.

And it all started so promisingly, too. John Prescott, then the deputy prime minister, launched a competition to produce low-cost, energy-efficient homes and the High Wycombe-based builder won. Rogers Stirk Harbour + Partners, Lord Rogers of Riverside’s architectural practice, designed 122 houses for a site in Milton Keynes that would cost £60,000 — a relatively cheap price even then — and a year later the estate
Claims abound..
“World tallest modular”
“we cracked the code”
“up to 25% cheaper” “half the time”
“Half of the first 39 apartments suffered significant water damage. The first four floors were largely gutted”
Alignment problems / Tolerances
Precast

→ Long history
→ Since 1930’s at least as load bearing
→ Significant progress since the 1960’s
→ Now reliable, known durable system
Case Study at UBC: KPMB/HCMA
Architect & RDH Engineering

Staggered window wall past slab / precast
Panelized Precast w/windows installed
Adjustable connections are key

Design: ABA Architects / Melloul Blamey
Joints

→ Critical to all prefab
→ Simple, robust in precast
→ Tolerances, workmanship QC remain a focus
Panelized GFRC
Cross Laminated Timber
Unitized Curtain Wall
Ideal process of Curtainwall

Possible installation solution

Courtesy: Raynaers

Standard element installation
Modern Curtainwall Stack Joints

- Easy on site
- Complex fab
- Lots of sealant
- Poor thermal performance
This is high tech? Lots of “pookie” for joints
Importance of Joints (Curtain Wall Example)

1/4 in. joint but 5/16 in. nozzle.
1/4 in. +1/16 in./-1/8 in. (10 ft.+ high unitized frames)

→ Could not physically fit in the nozzle to install a reliably watertight structural seal
→ Units were not installed close enough together to compress stack joint gaskets.
Panelized Steel Stud Frames
Prefab Components

Aluminum PREFABRICATED BALCONY SYSTEM

The one and only fully welded aluminum prefabricated balcony system for multi-family properties. Shipped complete.

JUST BOLT ON

24 balconies installed in 5 hours!

Finally, a prefabricated balcony system for multi-family construction to benefit the architect, general contractor, property owner, and resident. These prefab bolt on balconies are the one and only balcony systems made out of aluminum construction, welded complete, and ready to go. Get cost value through fast install times and longevity. Architects like the look and functionality of our prefabricated balconies.
Modular. And when does it make sense

→ Modular is **ideal** for:
  → Repetitive unit (modules)
  → Remote locations - labour
  → Locations where construction is disruptive – inner city

→ Modular may not be ideal for:
  → Open floor layouts such as office spaces
  → Complex floor plans
→ Panels & interior *exposed to weather*
→ Limits factory work of interiors / MEP
Modular Process

→ Only exteriors exposed to weather, lots of interior work and MEP can be done
→ You are shipping air, and redundant ceiling
Joints

→ Key differentiator of prefab ...

→ Must ensure *continuity* of structure, water, air, thermal, fire, vapor, finish etc.
Structure
Interior Finish
Fire?
Access for lapping and fixing, minimize work on site

Exterior finish
Insulation
Air-water-vapor
Exterior finish
Insulation
Air-water-vapor

Allow room for lapping
Account for vapor permeance, durability, thermal bridging

Complete seal near exterior