Open-Built Systems:
New House Rules

Strategies and Innovations
for
21st Century Homebuilding

Open-Built Strategy #1:
21st Century Skills, Old World Craft Attitude

- Program, Service, Culture
- Operating System
  - 3D software automation
  - CNC cutting and shaping
  - Open-Built disentanglement
- Lean Manufacturing
  - Constant improvement
  - Custom production
  - Mass Customization
- High skills/craftsmanship
  - Discipline, Pride
- Building Science
  - High performance
  - Net Zero capable

Old World Craft Attitude
Open-Built Strategy #2:
Disentangle and Reorganize Layers and Systems and Process

- Increase inhabitant control
- Improve functionality, durability, value

Open-Built Layers

Foundation, Structure and Skin make up the Thermal Envelope.

Services, Space plan and "Stuff"

Optimize, Maximize, but no Compromise

Optimize, Maximize, but no Compromise
Open-Built Strategy: Disentanglement for High Performance

- High performance code
- Tax incentives
- Low interest, long-term financing

- Health and Safety code
- DIY systems & finishes
- Second hand market
- Higher interest, short-term financing

Shell
Impact: Public control, regulation
Intent: Long term durability, sustainability
Players: Architects, Engineers, Public agencies

Infill
Impact: Private, freedom
Intent: Easy change, modification
Players: Inhabitants, interior designers, semi-professionals.

BENSONWOOD® OBPlusWall™ system

More efficient ways to build more efficient buildings

Best performance with optimized use of resources

New House Rule
Fat is hot! And Cool.

BENSONWOOD® PushUP™ floor system
Open-Built Strategy #3: Apply Regulating 3D Grid

- Empowering, not limiting
- Predictable
  - detail
  - dimensions
  - cost
- Parts, components, and patterns can be "built to rule."
Structure:
- 2 ft.
- 2 ft. x 4 ft.

Infill:
- 3 in.
- 6 in. x 1 ft.

Vertical:
- 7.5 in.

Divisibles
Multiples
Margins, etc.

Open-Built Kit of Parts

Open-Built Strategy #4:
Design Assemblies, “Compose” Designs

- Use proven library:
  - Design patterns
  - Building systems and components
- Structure and connections fixed, details variable
- Assure quality, variety, cost and fit

OpenBuilt compositions

Cost implications
Standardized vs. Customized

- 100% standard elements
  - Cost factor = 1.00
  - Time = X months

- 80% standard
  - 20% custom
  - Cost factor = 1.25
  - Time = X+2 months

- 40% standard
  - 60% custom
  - Cost factor = 2.04
  - Time = X+4 months

From our components and patterns

Slide adapted from Skanska Inc.
Open-Built Strategy #5: Build it Twice: Virtual before Actual

Power of BIM
- Design = Simulated building
- Automated PM information—costs, supply chain, shipping, etc.
- Automated cutting and shaping machine code.

BIM information fed directly to CNC machines (our tireless workers)

Open-Built Strategy #6: 50,000 to 50 (Distilling Parts and Pieces into high value Building Elements)

Building Element Fabrication New Normal for Industry?

Bensonwood CoreWall
Concentrated Mechanical System Element
- Vertical mechanical chase
- Stacked plumbing
- Combine subsystems for added assembly value
- Design and build efficiency

CoreWall Installation
Open-Built Strategy #7:
Site for assembly only; avoid cutting and shaping

- Site is the worst place to attempt to control
  - Quality
  - Efficiency
  - Cost
  - Time
  - Job satisfaction
Open-Built Strategy #8
The Master Builder era is gone. Play the whole team
- Integrate all disciplines in entire process
  - Architectural design
  - Engineering
  - Building specialists
  - Trades

Open-Built Strategy #9: Good Jobs
- Good houses can only be built in a culture of discipline, training and pride
- Higher expectations in skills, efficiency, values, integrity
- Better wages
- High involvement – Experience, craft, knowledge trumps hierarchy

Open-Built Strategy: 10: Solutions! Get in a wedge; we need you in eight.
- Fuel Switching
- Nuclear
- Biomass Fuels **
- Wind **
- Solar **
- Natural Sinks ***
- Efficiency ***
- Carbon Capture & Storage ***

To get on track to avoiding dramatic climate change, the world must avoid emitting about 200 billion tons of carbon, or eight 25 billion ton wedges, over the next 50 years.

A "wedge" is a strategy to reduce carbon emissions that grows in 50 years from zero to 1.0 GtC/yr. The strategy has already been commercialized at scale somewhere.

Cumulatively, a wedge redirects the flow of 25 GtC in its first 50 years. This is 2.5 trillion dollars at $100/tC.

Carbon Mitigation Institute, Princeton University & BP
Billions of Tons Carbon Emitted per Year

Stabilization Wedges

Fuel Switching

Substitute 1400 natural gas electric plants for an equal number of coal-fired facilities

Nuclear Electricity

Triple the world's nuclear electricity capacity by 2055

Biofuels

Scale up current global ethanol production by ~12 times

Wind Electricity

Install 1 million 2 MW windmills to replace coal-based electricity, OR Use 2 million windmills to produce hydrogen fuel

Solar Electricity

Install 20,000 square kilometers for dedicated use by 2050
**Natural Sinks**

Eliminate tropical deforestation

OR

Plant new forests over an area the size of the continental U.S.

OR

Use conservation tillage on all cropland (1800 Mha)

Conservation tillage is currently practiced on less than 10% of global cropland

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**Efficiency**

Produce today’s electric capacity with double today’s efficiency

Average coal plant efficiency is 32% today

Double the fuel efficiency of the world’s cars or halve miles traveled

There are about 680 million cars today, with 2 billion projected for 2055

Use best efficiency practices in all residential and commercial buildings

Replacing all the world’s incandescent bulbs with CFL’s would provide 1/4 of one wedge

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**Carbon Capture & Storage**

Implement CCS at

• 300 GW coal electric plants or
• 1600 GW natural gas electric plants or
• 180 coal synfuels plants or
• 10 times today’s capacity of hydrogen plants

Graph courtesy of Alberta Geological Survey

There are currently three storage projects that each inject 1 million tons of CO₂ per year–by 2035 need 3500.

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**The New House Rules**

Standard

Architecture + Craftsmanship + Technology + Innovative Building Systems

High performance structure and shell + Fast & Affordable + Carbon Consciousness

Better Living