



When Panelization Makes Sense

*A Homeowner's Guide to Prefabricated High-Performance
Construction*

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About the authors

Passive House Accelerator

Passive House Accelerator exists to speed the transition to a zero-carbon built environment by putting building science knowledge in more hands. Through its publications, live events, online community, and educational programming, PHA connects the architects, builders, engineers, and homeowners driving high-performance construction forward, and makes the tools and expertise behind it easier to find, understand, and use. The mission is straightforward: the more people who understand how a healthy, durable, low-energy building comes together, the faster that becomes the way we build. You can learn more at passivehouseaccelerator.com.

Bauen Build

Bauen Build is a Boulder-based custom home builder specializing in Passive House and ultra-high performance homes. The company pairs rigorous building science with a deeply collaborative process, focusing on what actually determines how a home performs over its lifetime: airtightness, insulation, durability, and the way systems work together. Bauen builds both panelized and site-built, and brings the same standard to each: do it right the first time, and make the reasoning behind every decision clear to the homeowners and architects it works with. You can learn more at bauenbuild.com.

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Introduction

Panelized construction is often presented in extremes: either as the future of homebuilding or as an inflexible form of prefab. Neither description is particularly useful to a homeowner deciding how to build a specific house.

This paper is for homeowners trying to figure out whether panelization makes sense for their project. Not whether it's good or bad in the abstract, but whether it fits the house they're trying to build, on their site, with their priorities. An educated homeowner makes better decisions, and better decisions lead to better houses. That is the mission.

Passive House Accelerator exists to spread building science knowledge, and Bauen Build spends every day applying it on Passive House and high-performance jobsites across Colorado's Front Range. We came together on this paper because we saw the same gap from two different vantage points. Homeowners hear about panelized construction, get curious, and then struggle to find objective information about whether it fits their project. What they find instead is often marketing from companies selling panels or skepticism from people who have never used them.

To understand when the method works, and when it does not, we interviewed B.PUBLIC Prefab and Collective Carpentry, two high-performance panel fabricators; Shape Architecture, who has designed both panelized and site-built homes; and Bauen Build's field leaders, who have built both ways. We asked about performance, location, schedule, cost, constraints, and when site-built construction remains the better choice.

What we found is that panelization is most compelling when high performance, schedule certainty, limited local labor, or a short building season outweigh the need for design flexibility (after construction has started) and the costs of transportation and site logistics.



What a panelized home is (and isn't)

A panelized home is a custom home whose structural shell, the walls and often the roof, is built in a factory as large sections, trucked to your site, and set in place with a crane. In closed-panel construction, the version this paper focuses on, those sections arrive with framing, insulation, exterior weather barriers, and interior air sealing already complete. Sometimes the windows are already installed. What would take a site crew months happens in a controlled facility in weeks, and the house is weathertight within days of the panels arriving. Alternatively, open-panel construction arrives to the site with just the structural framing and sheathing in place. The rest of the wall system is assembled on site (see page 7).

Panelized construction often gets confused with modular housing. A modular home arrives as a finished three-dimensional box, built to a manufacturer's catalog, with your choices limited to the options on the order sheet. A panelized home starts with your architect, your design, and your builder. The factory builds the components of that specific design. It's a component-based approach that supports the local team rather than replacing it. Your architect still designs the house. Your builder still builds it. The factory handles the part of the job that benefits most from precision and controlled conditions.



"People understand the difference between building a toy house out of LEGOs versus popsicle sticks. You know the engineering of the LEGOs, how far you can stack them. There are endless variations of what you can build with those tools. We help people understand building with prefab is something they can grasp and learned as kids."

Edie Dillman, B.PUBLIC Prefab

A useful comparison: very few people build kitchen cabinets on the jobsite anymore. A cabinet shop with proper tools, jigs, and a dry, well-lit workspace produces better cabinetry than the most skilled carpenter working on sawhorses in a garage. The same logic now applies to the building envelope, the assembly of framing, insulation, and air sealing that determines how your home performs for the next hundred years.



OFF-SITE CONSTRUCTION	OPEN VS. CLOSED			
	OPEN	HYBRID	HYBRID	CLOSED
TYPE	OPEN BOTH SIDES	CLOSED EXTERIOR (NO SIDING) OPEN INTERIOR	CLOSED BOTH SIDES (NO DRYWALL/SIDING)	CLOSED BOTH SIDES (INCL. FINISHES & MEP)
 SPEED ON SITE				
 COST				
 DESIGN FLEXIBILITY				
 ENERGY EFFICIENCY				
 INSPECTABILITY ON SITE	 FRAMING  SHEATHING  MEP	 FRAMING  SHEATHING  MEP	 FRAMING  SHEATHING  MEP	 FRAMING  SHEATHING  MEP
DRYWALL				
MEP INSTALLED				
NON-STRUCTURAL SERVICE CAVITY				
VAPOR RETARDER				
STRUCTURAL FRAMING INSULATION				
STRUCTURAL FRAMING				
STRUCTURAL SHEATHING				
EXT. CONTINUOUS INSULATION				optional
HOUSEWRAP				
RAINSCREEN STRAPPING			optional	not typical
SIDING				
WINDOWS IN		optional	optional	

Not all prefabricated panels are the same. Some are open on both sides, some are closed on both sides, and some are a hybrid between the two. The above illustration, courtesy of Collective Carpentry, displays some of the key differences between different types of panels.

Why choose panelization

Predictable performance. The single most important and least visible quality of a high-performance home is airtightness. Air leaking through the walls carries heat out and moisture in. It drives energy bills, comfort problems, and the slow moisture damage that shortens a building's life. On a jobsite, airtightness depends on the skill and attention of the crew doing the work. A builder who has mastered these details gets it right in the field. But that outcome rests on craft and vigilance that not every crew has. In a factory, airtightness becomes a documented, repeatable process at a designated station.

The distinction is quality assurance versus quality control. Site building leans on quality control: inspect the work after it's done, find the problems, fix them. A strong builder does this well. Factory fabrication builds quality assurance into the process itself, so many of the problems don't arise in the first place. Site framing is skilled work performed in changing conditions; factory work follows a documented process, with instructions, materials, and tooling ready at every station.

Part of what makes this possible happens before any material is cut. A panelized house is modeled in 3D ahead of fabrication, down to individual framing members and fasteners. Modeling the house to the fastener means the cut list, the materials, and the assembly sequence are resolved up front, which is what lets the factory hit its tolerances every time.



"Framing and building on site is kind of like jazz. The melody and instrumentation are set, but there's room for interpretation and substitutions, for better or for worse. A prefab shop is more like a classical orchestral piece: composed, precise, and repeatable without much variance."

Craig Toohey, Collective Carpentry

Speed. Panel fabrication can run in parallel with the tail end of your permitting process. Once the jurisdiction's initial comments confirm the size and layout of the house, the fabrication drawings can proceed while the paperwork finishes. Panels then go up immediately after the foundation cures. Depending on the project, this saves three to four+ months of construction time, and the house is dried in, protected from weather, within days rather than months. Speed and cost are inextricably linked here. A shorter build means fewer months of a site supervisor and project manager coordinating trades, fewer months of general conditions and insurance, and less schedule risk overall. It's the reason a panel package that looks far more expensive than a framing bid can land at parity once the time-driven costs are counted, a point the cost section returns to in detail.



Protection from the elements. Every month a partially framed house stands open to rain and snow adds risk: wet lumber, damp insulation, the conditions that invite mold before you ever move in. Factory-built panels are never rained on. The rapid dry-in means the sensitive parts of the assembly go from climate-controlled facility to weathertight structure with almost no exposure in between. High quality builders know how to manage through weather and take it seriously, but not all builders are created equal.

Less waste. Precision cutting in the factory uses material efficiently. Site framing generates dumpsters of offcuts; panel fabrication generates a fraction of that.

Budget protection. This one is underappreciated. When a project's budget tightens midway, something gets cut, and in conventional construction the performance items are often first on the chopping block: the upgraded wall insulation, the air sealing details, the things you can't see in the finished house. A standardized panel assembly takes those decisions off the table. The performance is built into the system. It can't be value-engineered out in a stressful mid-project meeting, which means the home you move into is the home you designed.



Panelization at a glance

Panelization is more likely to fit when...	Site building may fit better when...
Airtightness and envelope performance are priorities and skilled builders are not locally available	The design is likely to change during construction
Skilled high-performance labor is limited	Capable local labor is readily available
Rapid enclosure has schedule or financial value	Shipping distances make delivery expensive
The design can be resolved early	Truck, staging, or crane access is difficult
The builder and fabricator are aligned	The project is small, irregular, or still evolving

This is a starting point, not a formula. A project may have conditions on both sides. The right decision depends on which conditions carry the most risk or value for your home and which method gives the team the clearest path to managing them.



When panelization makes sense: five conditions

You want verified high performance. If your goal is a Passive House or a home built to similar standards, airtightness isn't an aspiration, it's a set number measured by a blower door test and required for certification. Panelization makes that number predictable. This matters most when the available builders in your area have limited high-performance experience: the factory delivers envelope quality that would otherwise depend on finding a rare crew. Compact, efficient forms, which Passive House design favors anyway, panelize especially well.

Your site is remote, or skilled labor is limited. Tanya Savas of Collective Carpentry describes a community center built for the Doig River First Nation, 70 kilometers outside Fort St. John, British Columbia, where specialized labor was limited. She also points to a Passive House in Paonia, Colorado, where certification would have been difficult with the trades available locally. B.PUBLIC worked with a North Carolina couple who had been turned away by multiple builders who were not willing or unable to build to their desired performance before they shifted to panelization, which made their high-performance home feasible.

You have a tight schedule. Construction time creates costs that do not always appear in a panel or framing quote: construction-loan interest, rent, an existing mortgage, and the disruption of living between homes. Panelized custom homes routinely finish in six to twelve months (depending on size and complexity of the finishes), converting construction financing to a permanent mortgage faster. When a hard deadline exists, panelization can help hold both schedule and performance—but only when the team is ready for the faster sequence.

Your building season is short or your weather is hostile. In mountain climates, an early snow can stall a framing crew for weeks and soak everything they've built. On a high elevation Rocky Mountain project, the risk of early snow can make months of on-site framing and weather-barrier work a gamble. Panels installed in days substantially reduce that risk.

Your budget needs protecting. A panelized envelope can lock in the part of the home that will be difficult and expensive to improve later. It requires earlier financial commitments, but moves core enclosure decisions out of the late-stage competition with visible finishes.

Some municipalities are leaning into this. Fort Collins, Colorado is developing a program of pre-approved panelized designs that qualify for expedited permitting, an early sign of how local governments may treat prefabrication as a housing and efficiency tool.



When it doesn't make sense

You want the option to change your mind. Once panels are fabricated, moving a window means undoing engineered work: insulation, air barriers, structural connections. In a stick-built house, a good framer can move that window in an afternoon. If you know yourself to be a mid-project reviser, or your design process tends to run into construction, panelization may not be the right fit.

Your design won't panelize, or was optimized for another method. Curved and sculptural forms don't translate to flat panels. Designs that depend on spray foam insulation to solve their geometry are a poor fit; spray foam is often a shortcut around design decisions that should have been made differently. That said, the design limits are narrower than most people assume. Shape Architecture has panelized homes with large glass spans, floor-to-ceiling windows, and complex roof forms, and fabricators like Collective Carpentry accommodate glue-laminated beams, exposed steel connections, custom shutters, and genuinely complicated framing. On difficult topography, hybrid approaches work well: panelize the upper levels, build the lower levels to suit the site.

Your site can't take the logistics. Panels arrive on trucks and go up by crane. A site that can't accommodate either, whether from access roads, overhead lines, or terrain, takes the option off the table.

The project is too small to pencil. Crane mobilization and design costs are relatively fixed, so ADUs and guest houses often can't absorb them. Sometimes speed or neighborhood disruption tips the math anyway (an occupied lot where two weeks of noise beats five months) but small projects deserve skeptical arithmetic.

Your builder isn't bought in. Projects where the general contractor is skeptical of prefabrication rarely go well. The schedule advantage evaporates if the builder isn't prepared for the rapid dry-in, and the coordination process required doesn't happen if the builder resents it. If you're panelizing, hire a builder who has done it and wants to do it again.

The regional economics don't work. Shipping costs and local labor rates vary enough that the same house pencils in one region and not another. A market with inexpensive, skilled framing labor and long shipping distances from the nearest fabricator may never make the numbers work, while mountain regions with scarce trades and reachable factories often do.



What it costs: how to think about the number

The most common budgeting mistake is comparing a panel package quote with a framing bid. A panel package may include framing, insulation, air and weather-control layers, engineering, shop drawings, and installed windows. A framing bid may cover only lumber and labor. This “apples-to-oranges” comparison is a common source of insufficient prefab budget analysis.

A more accurate comparison should take into account total installed envelope cost, including design and engineering; materials and fabrication; freight, crane, and installation; site-completed joints, transitions, penetrations, and flashing; schedule and financing effects; risk and contingency; and any effect on heating and cooling equipment.

Compared properly, panelized construction runs from roughly 20% less to 20% more than site building, depending on the region, labor rates, project, and market. One fabricator’s 16-month study found finished panel pricing fell 13% even as lumber and membrane costs rose sharply because factory productivity improved faster than material costs.



"For us, bang for your buck is probably site building. But for a builder that's not familiar with high performance and could mess a lot of air-sealing details up, it's worth the money to panelize, because you're getting better air sealing from someone less familiar with that aspect."

Michael Wilks, Bauen Build

The contract is not the whole financial picture. A faster build can reduce construction-loan interest and the time spent paying for two residences. Better coordination may reduce field rework and envelope-related surprises. A high-performing enclosure may allow smaller heating and cooling equipment, although a qualified professional should size those systems.

There is no universal answer. An experienced builder and fabricator should price both approaches against the same scope. That comparison—not a generic cost per square foot—is the number on which to base the decision.

What it demands of you (the homeowner)

Panelization asks two things of a homeowner. The first is decisiveness. Key design decisions happen earlier and become final when fabrication begins. It's like ordering windows or buying a car: once the order is placed, there's no going back. Every home requires the same fundamental choices; panelization requires more of them before fabrication, when changes are less expensive.

The second is assembling the right team early. One of the most common pieces of advice shared with Passive House Accelerator is that early engagement reduces the need to make late-stage changes to design, which become increasingly costly as the project progresses. The builder and fabricator should participate before construction documents are complete. Preliminary engineering and fabrication feedback can confirm feasibility, improve details, and make pricing more reliable. When the architect, engineer, builder, mechanical team, and fabricator coordinate through models and shop drawings, conflicts can be resolved on screen, where they cost an hour or two revision, instead of in the field, where they may cost weeks.



"The most important piece is a collaborative spirit. Understanding that this is a different approach to construction, and that getting it right needs buy-in and upfront planning. You want collaborators who are excited to learn a new way of doing things."

Tanya Savas, Collective Carpentry



Questions to ask before choosing panelization

- What is included—and excluded—from the panel price?
- Who owns panel joints, penetrations, flashing, airtightness, and site completion?
- When must the design be 100% complete?
- What truck, staging, crane, and installation conditions does the site require?
- How many comparable projects has my builder completed?
- What schedule savings are realistic for this project?
- Can both options be compared using total installed envelope cost?
- How will enclosure quality and airtightness be tested?
- What happens if a panel arrives damaged or does not fit?

Why this matters beyond your house

Building codes establish essential minimum requirements, but compliance alone does not necessarily deliver the comfort, resilience, indoor air quality, or energy performance homeowners expect from a high-performance home.



"Panelization may cost more up front than code-minimum site building, but a high-performance envelope reduces your need for expensive mechanical systems, solar, [and] battery backup, especially as energy costs get more volatile."

Edie Dillman, B.PUBLIC

The contributors to this paper believe sound building-science fundamentals— assemblies designed to manage moisture, reduce mold risk, control air leakage, provide healthy indoor air, and use substantially less energy—should be ordinary features of new homes rather than a luxury tier.

Panelization is one practical way to move the industry in that direction. It can make high-performance assemblies more repeatable and extend access to places without specialized crews. But it is not right for every home. Its greatest value appears when controlled fabrication, rapid enclosure, and reduced dependence on scarce field labor solve real project constraints.

The goal is not to choose the newest method. It is to choose the method that gives the team the best chance of delivering the home as designed: durable, comfortable, healthy, and aligned with the homeowner's schedule and budget.

For the homeowner, the best building method is the one that fits the project—not the one with the persuasive label.



"What we love most about high-performance panelized is that it broadens the reach of high performance generally. These companies are helping accelerate that. Those walls are incapable of supporting mold growth, and the way they come together and become airtight leads to better health outcomes and lower energy use."

Steve Scribner, Shape Architecture

When Panelization Makes Sense was written by Bauen Build and published by Passive House Accelerator.

Passive House Accelerator hosts live events and podcasts, publishes case studies, and reports on the people and projects defining the world of high-performance buildings.

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