Plant Building System™ Overview

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Introduction

Plant Prefab was founded to make it easy and efficient to build custom, sustainable, and extremely durable homes. While most prefabricators build standard homes that they design, Plant was created specifically to empower individuals, developers, and architects with a better way to build their custom designs.

The Plant Building System™ (PBS) accommodates just about any style of architecture, allowing us to efficiently prefabricate all housing typologies. We've had the privilege of building high-end spec homes, multi-family developments, affordable housing solutions, tiny homes, resort homes, and everything in between. Ray Kappe, KieranTimberlake, Yves Béhar, and Brooks + Scarpa are among the many talented architects and designers who have entrusted their projects to Plant.

The purpose of this guide is to provide an overview of PBS and how it can be utilized to build your project to your exact design specifications quickly, precisely, and sustainably. We welcome your questions and look forward to supporting your project, so please don't hesitate to reach out!

This 2,372-sf single-family home designed by Toby Long was built as six Plant Modules and installed in one day.

PBS System Overview

The Plant Building System™ (PBS) combines specialized components, Plant Panels™ and Plant Modules™, with advanced software tools to achieve maximum efficiency from design, to manufacturing, installation, and completion.

- Flexible component design enables project-specific construction to meet your design goals and budget needs, transportation and site access requirements, industry-leading energy performance and durability standards, and all local code requirements.
- Advanced engineering translates architectural plans into virtual building instructions faster, and far more accurately, than traditional methods. The Plant Virtual Build Process checks and confirms desian, structural, and manufacturing compliance before a single board is cut.
- Precision manufacturing provides rigorous quality control, ensuring high-quality craftsmanship, an efficient and reliable production schedule, and minimal waste.
- Detailed installation instructions ensure precise and efficient assembly and finish work.

PBS is an end-to-end system, optimized to the specific needs of custom, residential homebuilding.



Installation Instruction

PBS Components

PBS utilizes a combination of specialized panels and modules, both designed and patented by Plant.

Plant Panels

Plant Panels are an entirely new form of panelized building technology. Other leading panel products (like SIPs) only incorporate framing and insulation, requiring a significant amount of labor on the jobsite to assemble, wire, plumb, and finish. Plant Panels incorporate plumbing, electrical, and finish materials, and are custom-built to achieve maximum efficiency, durability, and performance for each specific project.

Panel dimensions are optimized to each project's design and installation requirements. Panel design is regionally code-driven by air, water, and heat transfer analysis, coupled with local structural and seismic requirements, ensuring optimal thermal performance and durability for the specific local climate.

Plant Modules

Plant Panels are used to construct Plant Modules, which can be large, fully-volumetric modules (for entire sections of a home), or smaller "core" modules (for kitchens, baths, mechanical areas, or combinations of them all).

This flexibility enables the efficient construction of almost any design, in any climate, for any kind of residential project, from single-family homes and multifamily developments, to accessory dwelling units (ADUs) and remodels (room or floor additions).



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PBS Component Detail

Component Families



Floor Panel Construction



Wall Panel Construction







"Core module" with integrated kitchen, bath, and mechanical

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PBS Component Configurations

Because Plant's focus is solving design challenges for custom, architectural projects, we developed PBS to offer much greater flexibility than other prefabricated systems.

PBS allows us to create an optimal construction solution for each unique project design, budget, and site access requirements (including transportation and installation restrictions). We work with you and your architect to determine the most efficient combination of PBS components:

- All Plant Modules: Large, fully-volumetric modules, smaller "core" modules, or combinations of both
- All Plant Panels: Panelized components of varying sizes and construction
- Hybrid: A combination of Plant Modules and Plant
 Panels

Clarifying the best approach occurs after the completion of a feasibility analysis and during the schematic design phase, when developing a sense for the overall project design. See page 13 for a detailed explanation of the entire project lifecycle.



System Benefits

PBS achieves significant advantages over other building methods—both traditional, on-site construction as well as other prefabricated systems.





Time & Cost Efficiency

Time is money, and PBS is engineered to minimize both. PBS reduces labor hours and provides an accelerated, reliable construction schedule that's up to twice as fast as onsite construction. Page 8

Access & Feasibility

PBS greatly reduces the transportation and installation barriers of traditional modular construction, meaning more sites are accessible and more projects are feasible for prefabrication with Plant. Page 9



Design Flexibility

PBS was created specifically to solve the challenges of custom, residential architecture, so it allows for much greater design flexibility than other methods of prefabricated construction. Page 10



Quality

PBS engineering systems and advanced factory processes provide a level of precision and quality control that's difficult, if not impossible, to provide on a traditional job site. Page 11



Health & Sustainability

Our health and sustainability standards ensure that your project will be built responsibly. PBS was designed to minimize the toxins, waste, and carbon footprint of every project, regardless of spec. Page 12

Time & Cost Efficiency

Our integrated processes drive increased efficiency at all stages of the project, providing a reliable schedule that's much faster than traditional construction:

- Fabrication at Plant is conducted concurrent with site work, reducing the construction timeline by 20-50%* over traditional, on-site construction (in which the foundation must be finished before vertical construction can even begin).
- PBS shop drawings integrate utilities and structure to prevent any conflicts during fabrication.
- Trades work concurrently, and components that would otherwise need to be sequenced, such as building the first and second floors of a home, happen simultaneously.
- Labor productivity itself is increased, as crews are equipped with precise tools and machinery, and work in an all-weather facility designed to provide ideal conditions for each building function, enabling them to achieve higher-quality deliverables, faster.
- Close coordination with the on-site general contractor can achieve further time savings, depending on the complexity of the project and/or the level of customization. The more work that can be completed off-site, the greater the savings (\$850 or more** per day of site work reduced).
- A best-in-class datum structure for alignment, coupled with the use of quick connect/sealing features and precise virtual instructions (P-FID), ensure efficient installation on the job site.

Project Timeline: PBS Versus Site-Built



PBS projects enter production at Plant as soon as site prep begins. Precise factory processes and quality control measures facilitate an efficient, predictable schedule that's 20-50* shorter than that of site-built projects.

*McKinsey & Company. "Modular Construction: From Projects to Products." 18 June 2019. Confirmed by multiple Plant clients. **Cotrell, Glenn. "What Is the Cost of Quality Construction?" 29 March 2017.

Access & Feasibility

In California (and most other states), prefabricated homes can be built anywhere—that is, they can't be excluded from a site because they are prefabricated, and banks cannot deny financing because they are factory built. (Note that cities and banks can and do exclude manufactured/mobile homes from many sites and methods of financing.) There is no disclosure requirement on title for prefabricated homes, and the resale value of factory-built homes is consistent with site-built homes.

However, conventional modular construction comes with several limiting factors that severely inhibit its use: Not every job site can be accessed by the large trucks required to ship huge modules, or the large cranes required to install them. Plus, trucking big, empty boxes is expensive, so shipping distance can render modular construction financially impractical for many project locations and designs.

PBS provides the means to build your project in a way that reflects its unique challenges and opportunities: Variable component design allows us to determine the optimal dimensions, combination, and configuration of Plant Panels and Plant Modules for your specific site conditions, access and installation requirements, project design, and budget. For example, if site access and/or transport distance are an issue, we can build your project entirely as Plant Panels, which require much smaller cranes to install and are less expensive to transport than larger modules.



A combination of Plant Modules and Plant Panels of varying sizes and finish made it fast and cost-effective to prefabricate this residential project.

Design Flexibility

We know design matters. We founded Plant Prefab a decade after launching an award-winning design studio, and that same talented team now drives design innovation at Plant. We've had the esteemed privilege of partnering with some of the industry's top architects and designers, including Ray Kappe, Yves Béhar, KieranTimberlake, M-Rad, Sagemodern, Toby Long, and Brooks + Scarpa, to name a few.

This experience and passion for world-class design is what drove us to create a new kind of building system; one that delivers the efficiencies of prefabrication, without the usual design barriers.

PBS' flexible component design enables architects to address diverse architectural styles that could not be built using conventional modular construction. And because PBS components are custom-built for each project, they are tailored not only to the project's climate and zoning requirements, but also to your architect's exact finish specifications.

PBS includes a clear set of design guidelines written by architects, for architects, specifically for PBS components and processes. We engage your architect early in the process, ensuring that PBS works with—not against your design goals. In this way, your project's production at Plant is an integral part of your architect's overall design approach.



This 5,400-sf custom Ray Kappe LivingHome was prefabricated as ten Plant Modules with panelized decks and trellises.

Quality

PBS utilizes the efficiencies and controls of highly evolved manufacturing processes to ensure quality and precision throughout the project lifecycle:

- The Plant Virtual Build Process engineers your architect's creativity by virtually constructing your project before it enters production. This ensures design, structural, and manufacturing compliance before a single board is cut, facilitating faster production and a higher-quality deliverable.
- Construction work is conducted in a monitored manufacturing setting using precise fabrication tools such as CAD/CAM. This allows Plant to automate processes, facilitating a consistent, high level of quality control. The precision fabrication of exterior wall components also produces a much tighter building envelope with fewer air leaks.
- All MEP systems are tested for function before shipping, minimizing the use of expensive trade labor on the job site. This quality control is especially beneficial for the installation of sensitive, high-tech components, such as smart home equipment, fire and security systems, and sensor-based environmental controls.
- Building components are produced and stored in an enclosed facility, reducing exposure to humidity and other environmental factors that cause moisture-related damage, and in turn, decrease the durability of the components and increase the potential for mold growth that's harmful to occupant health.



With all trades in house, Plant is able to install all finishes and fixtures to exacting quality standards, including cabinetry, millwork, flooring, and tile.

Health & Sustainability

Sustainability is core DNA for Plant, so regardless of your finish spec, building with PBS will minimize the toxins, waste, and carbon footprint of your project:

- The factory production of PBS components provides optimal control of material use, drastically reducing material input and waste. Framing cut lists are produced with shop drawings to minimize lumber overages, and the majority of surplus material and fall-off are captured for use.
- Precision manufacturing processes produce a tight building envelope, increasing thermal and energy performance for the life of the home.
- We source the most sustainable materials possible to meet your architect's specification, including mold-resistant drywall and zero-VOC paints, stains, and sealants. These strict standards, coupled with our operational efficiency, climate-specific component design, and enhanced logistical value engineering, minimize the negative health impacts and embodied carbon of our material use.
- On-site finish of PBS projects generally requires less workers, vehicles, and material storage, minimizing site disturbance and noise pollution.

If you engage Plant as your architect, your project will also be designed to meet net-zero standards, following our rigorous health and sustainability program, Z6. Learn more about Z6 and our carbon pledge on plantprefab.com.



We use the most sustainable materials possible to minimize negative impacts on the planet and your building inhabitants.

Process

These are the detailed steps involved in building your project with PBS. Note that a number of these tasks can occur in parallel.



Feasibility

Project Bid

You'll share your project and we'll prepare a rough order of magnitude (ROM) bid that specifies anticipated costs, inclusions, and exclusions. Time: 1 - 2 weeks

Site Feasibility

We'll evaluate your lot, and the route from our factory to your lot, to make sure it's feasible to deliver and install prefabricated components. In general, if a foundation can be engineered, we can install prefabricated components on it. However, impediments like overhanging trees and power lines, low bridges, narrow roads, severe curves, and steep slopes along the route will determine what we can build and deliver. We'll perform an initial analysis for free, using Google Maps. If no major impediments are found, we'll execute a full, detailed, paid analysis. This analysis is required in order to move forward. *Time: 1 - 3 weeks*

Initial Design Review

You'll share your plans and we'll make sure they can be prefabricated at Plant. We'll give you and your architect a sense for what kind of changes may be required, if any, to make your design work with Plant Modules and/or Plant Panels. Time: 1 - 2 weeks



Engineering

Design

We'll work with you and your architect on any changes that may be required to make your design efficient for prefabrication. You should connect with us before your plans have been engineered, as the requirements for offsite construction vary from those for site-built projects. If you're still developing your design, we'll help you optimize it for prefabrication and advise the most cost-effective, healthy, and sustainable options for finishes, fixtures, and other materials. *Time: 12 - 16 weeks*

Engineering & Approvals

Engineering and approvals for prefabricated components are governed by state authorities. Engineering and permitting for the foundation and site work is governed by local authorities. The site general contractor (GC) will coordinate engineering and local permit submittal. Plant will submit the architect-prepared package to the state. Plant can also support you or your GC as needed by recommending engineers who are experienced in prefabricated construction. *Time: Varies by jurisdiction*

Process (continued)



Pre-Construction

This is when you will finalize finish specifications, and when we'll work with you to determine the scope of work between Plant and the site GC. We'll create production drawings using our 3D virtual build process, and we'll finalize pricing for the production of your design. This is also when we'll submit the supplied, complete ASMEP drawing package for the prefabricated components to state authorities for approval. *Time: 8 - 16 weeks*



Fabrication

& Sitework

Fabrication

Your project will be built in our all-weather facility in parallel with site work. All required inspections will be completed in our factory, so we'll be able to deliver your project with the walls sealed and finishes installed! You will be invited to tour the project in production. *Time: 8 - 16 weeks*

Site Work and Foundation

Plant does not perform site work, but we collaborate with your site GC on the preparation of the lot and foundation, maintaining oversight and quality control. Time: 8 - 16 weeks



Delivery & Installation

You or your site GC will secure installation resources and a transportation company, then schedule delivery of the prefabricated components. (If needed, Plant can recommend providers.) The transport company will secure any necessary permits (for things like police escorts or parking), pick up the components at Plant, and truck them to the job site.

Installation to Move-In

Then for the fun part! A crane is typically used to lift the components off the truck and lower them onto the prepared foundation, where they are bolted together. Depending on the size and complexity of the design, most projects are fully assembled in a matter of hours—not weeks or months. You're invited to spectate! Time: 1 - 3 days (depending on size of the project and balance between Plant Modules and Plant Panels)

Finish Work

Once the building is assembled, your GC will connect the water, sewer, electric, and appliances, and apply the finishing touches (like exterior siding where the components were connected). Since most Plant modular projects ship 90% complete, with drywall, paint, millwork, tile work, and even the appliances in place, on-site finish work is generally minimal. Landscaping is also typically done at this time. *Time*: 6 - 16 weeks

Final Inspection

The local authority will perform the final inspection on the structural and utility connections, along with any other non-factory-produced site work, and issue the certificate of occupancy. The project is officially complete!

Sample Project

Architect: The Brown Studio Location: Olympic Valley, CA

- 2,630-sf single-family home with 600-sf garage | 4 beds, 3.5 baths
- Built as four finished Plant Modules (majority of living area) and 35 Plant Panels (garage, roof overhangs, and hallway areas between modules; indicated by red arrows on photo)
- Components set and installed in 15 hours
- 25 additional variants to be produced over 2020 and 2021



"We had a firm deadline and tight budget tied to the grand opening on January 3. We considered several partners, but ultimately concluded that we could only do this with Plant, because of their building and engineering technology. —Developer





Sample Project: Module and Panel Configuration



The first floor consists of two modules (red), seven wall panels (green), and three floor panels (blue).

Sample Project: Installation Day



As is always the case with Plant projects, PBS components are constructed in our factory while the foundation and utility connections are completed by a general contractor at the job site. On installation day (pictured), a crane or other specified setting equipment is used to lift and set the components in place. The components are then secured to the foundation and one another, and utility connections are then completed by the site general contractor. All components of this project (four large Plant Modules and 35 Plant Panels) were set in roughly 15 working hours.

Sample Project: Interior Finish



The hallway area (stairs photo) was constructed as Plant Panels, while the adjacent areas were constructed as finished Plant Modules. Joints between mods and panels can either be "stitched" (finished) for a seamless flow or "celebrated" (exposed) as an intentional design element. In this project, the joints and intersections were stitched together to create a seamless aesthetic.



Next Steps

We would love to give you a reliable, efficient way to build your custom design.

If you have a project you'd like us to assess for construction with PBS, please submit a project inquiry on <u>plantprefab.com/contact</u> or email your project details and plans (ideally at a schematic level, but can be further along) to info@plantprefab.com. We will perform a complimentary review and answer any questions you may have about working with Plant.

Prior to production we're available to serve:

- As a consultant, to optimize your drawing set for prefabricated construction and coordinate with your SMEP consultants;
- As an executive architect, to complete the drawing set and state approval package based on your schematic design and specifications;
- Any combination of the above.

Thank you again for your interest in Plant Prefab. We look forward to supporting your project!

This custom-designed development of four 2,200-sf, LEED Gold-certified town homes was prefabricated as sixteen Plant Modules and installed in just two days.



plantprefab.com

375 S Cactus Ave. Rialto, CA 92376

