LOOKING INTO MODULAR

by Thomas Nutt-Powell

Modulars offer design flexibility and economies that builders are just beginning to tap

Set aside, for the moment, any preconceptions you have about modular housing, and consider the following scenario. You're a home builder, focusing primarily on single-family detached and townhouse construction. Perhaps you occasionally build a small-scale, two-story apartment house. Suppose you found a way to beat the price of your competition by 15 to 30 percent—or to sell at the same price and receive the savings as profits.

Suppose, at the same time, you were able to fix 65 percent of your hard costs before construction begins and minimize the complications of site construction and scheduling delays. Do these possibilities sound attractive to you? If so, manufactured housing may be your next step in the building business.

You'd be in good company. In its many forms, manufactured housing has taken over a rapidly increasing share of the U.S. housing market. Needless to say, virtually all U.S. construction today includes some components that are manufactured off site, such as prehung windows. Manufactured housing, with most components built off site, now accounts for roughly half of all U.S. housing production, and modular housing comprises a significant share of that statistic: It accounts for roughly 20 percent of all U.S. housing starts.

What is manufactured housing? The term "manufactured housing" includes any type of housing built, to a substantial extent, off site and brought to the site for final assembly. That includes pre-cut, open- and closed-panel, modular, and specialty homes. Modular housing is the type of manufactured housing that is most completely assembled at the plant. It is three-dimensional when it arrives at the site. Typically, three or four walls, the floor, and the roof are completed. Depending on the preferences of the builder or buyer, some or all of the interior finishes are completed. In most cases, all mechanical and electrical work are completed at the plant, with the exception of hook-up to utilities at the site. The exceptions are hydronic heating and domestic hot water, which are usually installed at the site. (Systems like these are not used often because they usually go in the basement, and modular housing is normally built on a simple foundation.)

What codes apply to modular housing? Modular homes are often categorized as either "HUD-code" or "state-code" homes. Those which belong to the tradition of "mobile homes" are governed by a federally imposed set of construction and safety standards, commonly referred to as the HUD Code

At many home factories, the workers stay in one place and do one job, while the homes move through the factory. Because it's under a roof, work such as insulation can be installed from the exterior.

(U.S. Department of Housing and Urban Development).

All other modular homes are built to state—and sometimes local—codes, modeled on the prevailing regional model codes (SSBC in the South, BOCA in New England, and ICBO in the West). For example, modular homes in New England are built to standards based on the BOCA (Building Officials and Code Administrators International) Basic/National Code. Modular homes arrive at the site in one or more sections. Single-section modular homes are the only type that have all four walls, roof, and flooring intact when delivered to the site.

The only substantive difference between a HUD-code and a state-code modular home is that the HUD-code home is built on a steel frame. Its delivery axle and wheels are attached. This steel frame is integral to the engineering design and is part of the foundation system for on-site erection. State-code modular homes do not have this steel frame assembly. They arrive on "lowboy" transporters.

The largest dollar savings can be achieved with a HUD-code home, because by definition it must be shipped with all systems complete. A state-code home, though, can offer more flexibility with design.

If your customer wants a two-section modular ranch house, he or she should be equally satisfied with HUD or state-code construction. If the floor plans, and exterior and interior finish specifications are identical, there will be no visual or functional difference to the end user. However, as a practical matter, HUD-code homes are limited to a single story, and most manufacturers have fewer variations in design than for state-code homes.

Modular Home Types

The only real limitations to modular housing designs are the imagination of the designer and the willingness of the market to purchase. Most modular housing uses lightweight wood-frame construction, with 2x4 or 2x6 wall studs. Almost any siding material can be used, including plant-applied brick panels. Also, modules can be delivered to the site with no siding, allowing site application of any standard or exotic siding materials.

The most common form of modular house is a ranch or raised ranch. But state-code modulars are also widely available in two-story capes, garrisons, and colonials as well as a wide range of contemporary styles. Virtually any style of housing can be built—with savings realized—if an order of sufficient size is placed.

However, any changes you make from standard plans do add to the cost. Significant revisions can quickly erase the savings on all but the largest orders. If modulars on the market do not come close to meeting your design needs, panelized construction may be a more practical alternative.

Reasons for Choosing Modular Construction.

There are several reasons for the increased popularity of manufactured housing in general, and modular housing particularly. Among them are lower costs, more predictable costs, consistent quality, and a simpler construction process. My firm, On-Site Insight, recently prepared a study for the city of Chicago where we compared all types of construction on an "apples-to-apples" basis. Labor rates and all other variables were taken into account in order to accurately gauge the price differences that could be specifically attributed to each construction technique. We found that modular housing reduced the hard costs of construction, from the sill plate up, by 15 to 30 percent compared with the same house built on site. The largest savings were for HUD-code homes, but overall savings were at least 15 percent for all modular designs. The modules constitute roughly 65 percent of a typical hard-cost construction budget. Since you know the cost of the modules in advance, that 65 percent can be fixed. Many of the uncertainties are eliminated, and risks are substantially reduced.

In addition, construction quality is generally acknowledged to be better on a modular home. There are three reasons for this: (1) The homes are designed to withstand over-the-road stresses. (2) All construction is done inside, eliminating the effects of weather. (3) Construction is done through uniform procedures, with careful controls over production quality and cost. With modular construction, there is less waste and more precise workmanship than with stick construction, and this is most evident in rough framing.

Let's Be Rational

What must a builder think about when considering the use of modular housing? If I gave only one word of advice, it would be "Rationalize." I don't mean rationalize in the sense of making excuses. The more time-honored definition of the word is "to apply modern methods of efficiency."

The economies provided by modular housing exist because the construction process has been rationalized in the plant. For example, the process is sequenced and regulated; there is little waste because the designs are standardized; and there is no learning curve for the builder. The range of parts is limited, so there is a high rate of production line efficiency. To the extent that the builder applies similar rationalization to the site development and construction process, comparable economies will be achieved.

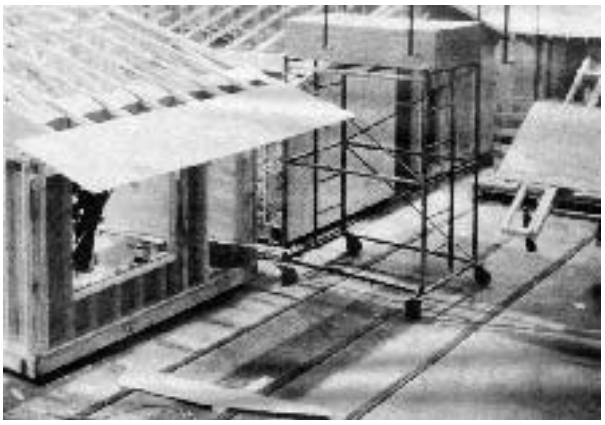
Rapid turnaround is among the principal savings that can be achieved. For example, the careful scheduling of delivery of modules to the site can shorten the total elapsed tie for construction, cutting interest costs. Many of the economies can be lost if the site is not properly prepared when the modules arrive, or if you are not prepared to act quickly to apply the finishing touches.

Regulations

There are a few regulatory barriers to the use of modular housing. Whether it's HUD-code or state-code, all modular housing comes with prior approval of the structure by off-site inspectors in the plant. They review construction materials, methods, and quality for the applicable codes. For state-code homes, a great deal of paperwork may be required in the plant, especially if the plant is in a state other than your own. There are three model codes, and states and localities have their own variations of those codes (see The Journal, 1/89). But the paperwork is taken care of by the manufacturer, not the builder.

Modules cannot be delivered until code approval is obtained. If the builder is proposing a model type that does not already have prior approval, a design-and-approval phase is necessary. This can take up to six months, depending on the backlog of the third-party approval organization.

Virtually any kind of structure can be built with modular housing.



The modules slide on steel tracks shown in foreground. The roof overhang is hinged to fold back during travel over the highways.

Almost any siding material can be used, including plant-applied brick panels. Or modules can be delivered bare, allowing site application of any standard or exotic siding.

Some manufacturers may require that the builder obtain and pay for the crane used in installation.

Either way, prior approval means that the local building inspector has no responsibility for inspecting the module portion of the housing. In areas where modular housing hasn't existed previously, this situation often constitutes a problem. The inspector may take offense and obstruct the process by applying "administrative discretion." In any event, the local inspector does remain responsible for all site work and utility hook-ups. It is advisable to work with local building inspection departments prior to beginning a development using modular housing so that no surprises occur at the construction phase.

Zoning will not present a barrier in the use of state-code modular housing. However, it may present a barrier with HUD-code housing. Many jurisdictions have not yet recognized the contemporary quality of HUD-code housing, and some may have a negative image of it. These negative perceptions developed during the 1950s, '60s, and early '70s, when mobile homes were primarily single-section, metal-sided, flat-roofed, aesthetically limited forms of housing.

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A substantial body of literature and wisdom has built up that encourages municipalities to treat HUD-code housing more sensibly. Perhaps the most useful document regarding this is a publication called "Regulatory Manufactured Housing," issue by the American Planning Association's Planning Advisory Service, 1313 E. 60th St., Chicago, IL 60637.

Construction

There are several construction issues that require careful attention by the builder. The first of these is foundation construction. Because the structure is built off site, with set dimensions, the most critical on-site construction concern is that the foundation be plumb, level, and dimensionally accurate. There is little tolerance for variation.

A second site responsibility is accurately locating utilities, so that connections can be efficiently completed. The specifications should make it possible to make connections for water and sewer, electricity, and gas at the locations that are most convenient on the site.

Typically, utility connections must be completed by licensed electricians and plumbers. Be prepared for the possibility of premium charges for these services, since much of the plumbing and electrical work that would otherwise be handled by the local trades is already completed at the plant. However, if the builder offers a consistent volume of work, any premiums will most likely disappear over time.

Actual installation of the modular units is best done by the manufacturer. In addition, by having the modules installed and "buttoned up" by the manufacturer, you can keep warranty responsibility for the performance of the structure with the manufacturer. The manufacturer, however, may require that the builder obtain and pay for the crane, if that is the method used to install the modules.

Trim-out work is most efficiently completed by the local builder. This includes any trim, carpentry work, and painting of the exterior. It also includes interior trim, such as passageways between two adjoining modules.

The builder may also choose to do extensive interior finish work. Most buyers wish to specify certain finish items like carpeting and wall finishes. They will have more choices if the builder does this work and uses his own crew or local subcontractors. However, interior finish work is cheaper if it is done at the plant, because of volume purchase and available specialty crews.

Design Considerations

Though virtually any type of structure can be built using modular housing, there are some structural constraints. In general, a module can be no more than 14 feet 6 inches wide, as it must be transported over the highway. The maximum practical length for HUD-code housing is 70 feet. State-code modules typically have a maximum length of 58 feet. The cost of transporting each module will be the same—about $2.50 per mile—regardless of its dimensions. Therefore, one consideration in laying out your design is to use the fewest possible modules.

For example, suppose you are constructing townhouses. Each is to be two stories, with 1,000 square feet of living area. There will be three units in each building. The first design that might occur to you might be to use six modules per building. Each module would be 14 x 36 feet, and it would serve as one story of a unit.

The cost of transporting each module will be about $2.50 per mile, regardless of its dimensions. Therefore, in laying out your design, use the fewest possible modules.

However, a more efficient layout would include four modules, each 14 x 54 feet, set next to each other lengthwise. Also it is best to keep all plumbing within one module. Extending the plumbing into additional modules adds a great deal to construction costs. People who build modular housing refer to the modules with bathrooms and kitchens as the "wet side," and the rest of the structure as the "dry side." The wet side is by far the more expensive. Finally, if your objective is affordability, select a model type from existing manufacturer plans. This will eliminate the need to pay professional design fees, other than for the foundation.

When possible, a nearby manufacturer should be chosen. The advantages of this go beyond the savings in transportation costs. The builder can see the various house plans close by, have easy access to the plant, review construction quality, and develop a working relationship with the key engineering and production staff. An easy way to identify home manufacturers in your area is to obtain the Redbook of Housing Manufacturers, published by LSI Systems, Inc., 11A Village Green, Crofton, MD 21114.

Does modular housing make sense for the residential builder? The answer is a resounding yes. Modular housing can yield cost, quality, and efficiency benefits. With careful planning and sensible design, there are no limitations to aesthetic characteristics and market acceptance. ■

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Diagram I. *Inefficient use of modules.*

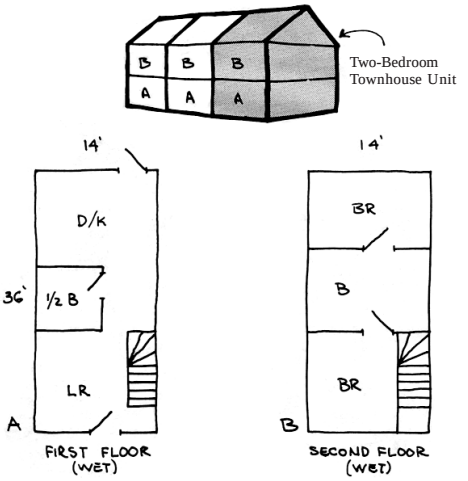
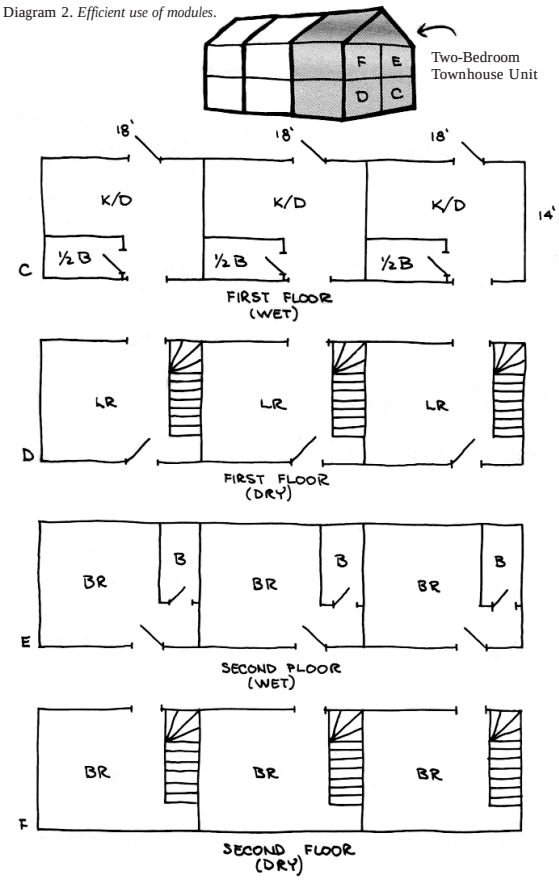


Diagram 2. *Efficient use of modules.*



In Diagram 1 (top), two modules (A and B) are used for each 1,000-square foot townhouse. Both are "wet" modules (with plumbing), far more expensive than "dry" modules. A far more efficient arrangement is shown in Diagram 2 (bottom). Four modules (C,D,E and F) are used for a three-unit, two-story building. Two are wet, and the other two are dry.