

Group C

Market Opportunities in Factory-Built Housing

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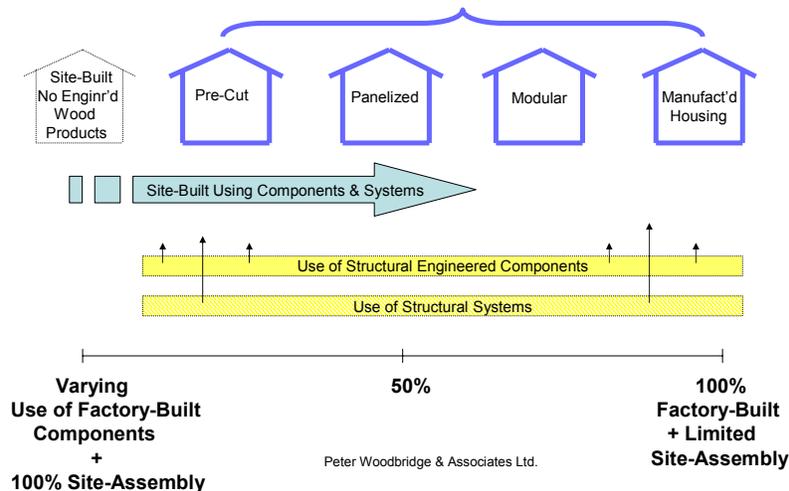
Group C. Market Opportunities in Factory-Built Housing

The factory-built housing industry in North America comprises two principal product groups: "HUD-Code" manufactured homes and other prefabricated homes, comprising pre-cut, panelized and modular (Chart 66). Both of the main product types involve production of the majority of a home in the controlled environment of a manufacturing plant, and transported in one or more sections to a site.

Both groups use a variety and substantial volume of primary and engineered wood products and building components. Ontario supplies softwood lumber, OSB, engineered wood product, building components and other wood products to this industry.

Chart 66

Products Manufactured by the Factory-Built Housing Industry



HUD-code homes (formerly known as mobile homes, now referred to as manufactured homes) are built to the Manufactured Home Construction and Safety Standards and display a red certification label on the exterior of each transportable section. All HUD-code sections are built onto a permanent metal chassis. HUD-code homes can be installed on leased land in communities or on permanent foundations on private land.

Prefabricated homes can be modular, panelized or pre-cut. This type of factory-built home is built to local or state building codes and usually is placed on a permanent foundation, unlike traditional mobile homes. Owners of prefabricated homes usually own the land on which their homes are located. Three major prefabricated technologies include:

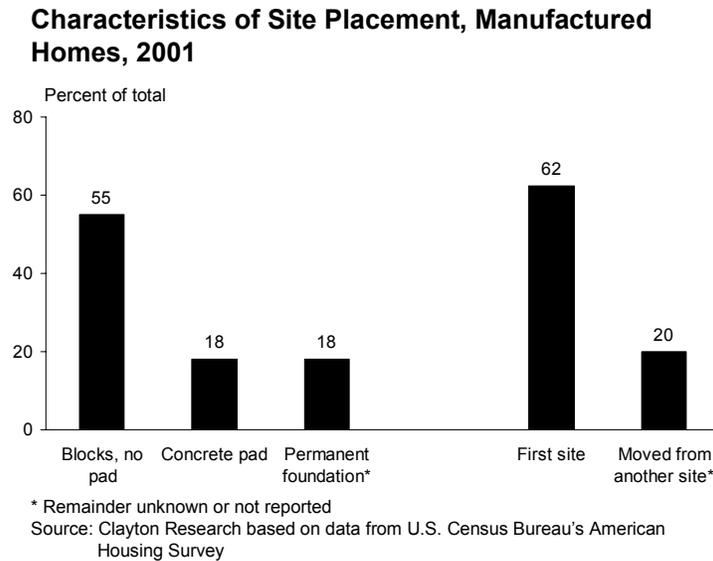
- **Modular Homes:** Factory-built homes that are built to the state or local building code where the home will be located. Modular homes begin as components and are designed, engineered and assembled in a factory and then transported in "3-dimensional" form to the site and installed on a permanent foundation.

- **Panelized Homes:** Factory-built homes that are made up of large, factory-made panels that will make up a whole wall and include windows, doors, wiring and outside siding. These panels are then transported to the site transported as 'kits' "2-dimensional" on a flatbed truck and assembled on site. These panels are usually 8 feet high and up to 16 feet long. The panels are designed to be installed immediately, along with the roof, and be completed within a few days of arrival.
- **Pre-Cut Homes:** Factory-built homes whose building materials are factory-cut to design specifications and transported to the site to be assembled. Some types of pre-cut homes include kit, log and dome homes. These homes must meet local, state or regional building codes.

While pre-cut and panelized housing production is a small but growing niche in the new housing construction sector, HUD-code manufacturing and state-code modular housing production represents the vast majority of housing production from a factory setting. Traditionally, HUD-code homes are placed on concrete blocks and are rarely moved from their initial sites. According to the American Housing Survey, over half of occupied manufactured homes in 2001 were placed on concrete blocks with no permanent foundation or concrete pad, but two-thirds of homes were still on their original site.

Slightly fewer than one-in-five occupied manufactured homes are placed on permanent foundations (Chart 67). However, as presented in this report, the current trend is decidedly toward increased permanent placements – one of the factors which we believe will drive up demand for this product in the years ahead.

Chart 67



How Significant are Factory-Built Technologies?

It is widely known that factory-built housing dominates total new housing supply in countries such as Japan and Sweden, where it accounts for 75%-80% of new single family home construction. In other countries too, such as Switzerland (16% of single family starts in 2002), Australia and the UK, factory-built methods are gaining market share. The shortage of skilled site-labour and trades people (carpenters, framers, bricklayers, electricians) are forcing these changes.

How significant are factory-built methods in the United States?

Schuler and Adair⁴² have estimated that site-built, or “stick-built”, accounted for nearly 69% of US conventional housing starts (i.e. excluding manufactured homes) in 2001, down from 80% in 1997. Over that period, factory-built panelized wood walls increased in market share from 7% to 15%, while modular (excluding HUD) declined slightly in volume and percentage market share from 3% to 2%. Thus, the decline in stick-built (within conventional starts) was more than offset by panelization methods.

Schuler and Adair note that concrete and steel are increasing their market share and that the “wood loss” due to this growth is the equivalent of about 15,000 starts per year. Perez⁴³ concludes that panelization also is gaining in popularity because the quality of these components has improved vastly.

Pulte⁴⁴ notes that the ability to ensure precise dimensions of building foundations, achieved in some cases by factory-built concrete foundations, avoids errors on site that have to be corrected through site-based adjustments in the framing. The result is a ‘true’ structure that facilitates system building throughout. In our view, this approach is fundamental to realizing the potential cost and quality gains that lie in prospect for factory-built vs. site-built construction methods.

Placement of HUD-Code Manufactured Homes

Placements are a measure of demand for factory-built houses and are counted when the new unit is placed on a temporary or permanent foundation. The placement of HUD code manufactured houses across the United States has varied considerably over the past three decades, most recently falling to approximately 170,000 units placed in 2002, and to an annualized 130,000 units in the first quarter of 2003. These recent placements are down from the peak of 375,000 units in 1998 (Chart 68).

Moreover, manufactured home placements as a share of all housing units have also declined in the past four years. At its peak in 1998, HUD placements represented over 23% of all housing starts in the U.S., a proportion of which fell to 10 percent in 2002, and under 8% in the first quarter of 2003. HUD-code placements in 2002 reached a 40-year low.

In contrast, the consumption of factory-built homes other than HUD code has been rising. The number of prefabricated homes shipped from U.S. producers rose from around 60,000 units in the early 1990's to nearly 80,000 units in 2002. On a seasonally adjusted basis, the estimated number shipped in Q1 2003 was as high as 84,000 – a rise of 6% over 2002.

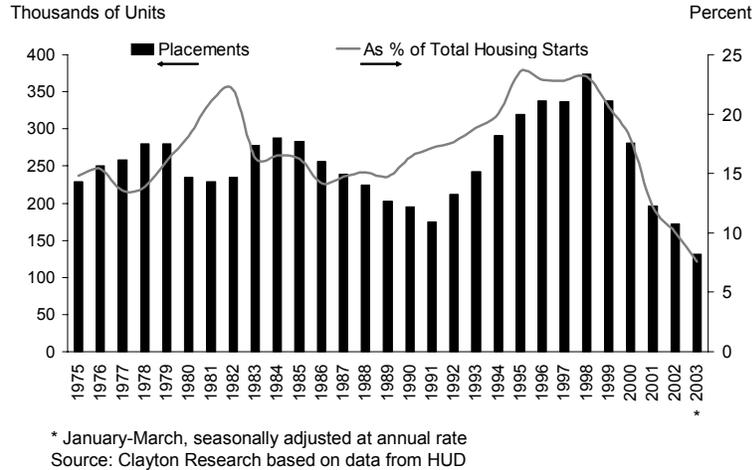
⁴² Demographics, the Housing market and Demand for Building Materials. Al Schuler and Craig Adair. Forest Products Journal Vol 53, No 5. (May 2003).

⁴³ Cited in Schuler and Adair, *ibid*.

⁴⁴ Conversation with Alan Laing, V-P Supply Chain & Customer Satisfaction. Pulte Homes.

Chart 68

Placement of New HUD-Code Manufactured Housing Units, U.S., 1975-2003



Prefabricated product, mostly state-code modular sections, is becoming a more prevalent component of overall factory-built production – rising from about 16% in the early 1990's to between 30%-40% in recent months based on Clayton Research Associates calculations.

Consumption of Factory-Built Homes

Factory-built housing units in the U.S. are a fairly substantial component of new housing production, accounting for 1 out of every 5 new housing units in the 1990s.

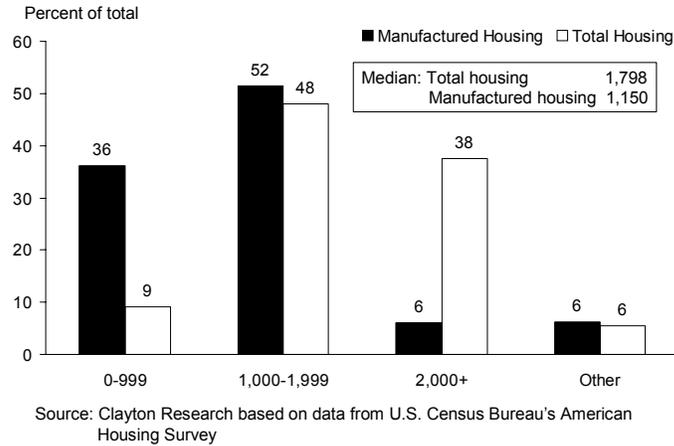
- Manufactured housing placements have ranged from a low of 174,000 in 1991 to 374,000 units in 1998, with an annual average of 282,000 units in the 1990-2000 period. Since 1998, there has been a significant decline in manufactured housing consumption in the U.S., both in absolute and in relative terms.
- In addition, an estimated annual average of about 70,000 prefabricated housing units, mostly state-code modular sections, were placed across the US through the period 1990-2000.

Traditionally, factory-built homes, particularly HUD code homes, have garnered some of their appeal due to their affordability relative to comparable site-built homes. Some of the decline in factory-built demand (as evidenced by the decline in manufactured home placements since 1998) is due to improved affordability across all segments of the housing market in recent years.

This is connected to a strong U.S. economy (up until 2001) and low interest rates (which have persisted through to the present), which have allowed many would-be factory-built home consumers to buy site-built homes. As a result, the overall housing market has been very strong recently, while the factory-built home segment has been somewhat weaker.

Chart 69

Square Footage as Share of Total Owner Occupied Housing Units, 2001

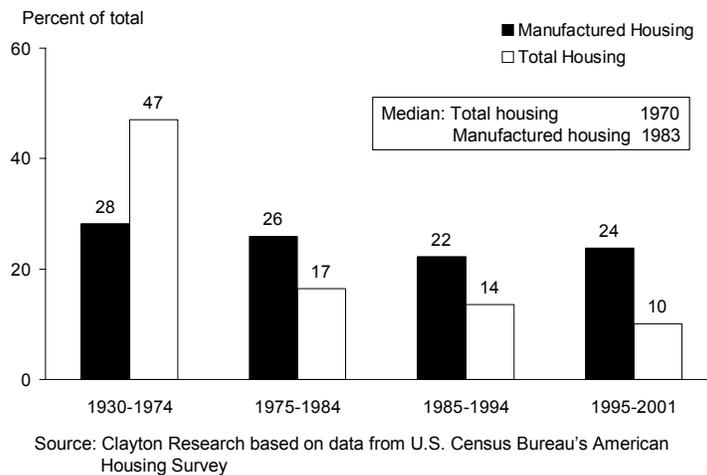


Approximately half of occupied manufactured homes across the U.S. in 2001 were between 1,000 and 2,000 square feet in floor space. This proportion is similar to all types of housing, of which just under half fall into this category (Chart 69). However, the bulk of the remainder of the factory-built stock is smaller than 1,000 square feet in floor space, whereas across all types of ownership housing, it is larger than 2,000 square feet. Overall, owner-occupied homes in the US tend to be about 1,800 square feet, whereas owner-occupied factory-built homes are closer to 1,150 square feet.

Overall the stock of manufactured homes in the US tends to be newer than across all housing units. Almost 50 percent of occupied manufactured homes in 2001 were built after 1985 compared to about 25 percent of all occupied homes.

Chart 70

Year Structure Built as Share of Total Housing Units, 2001



Recent Declines in Placements are Due to the Economy and Financial Issues

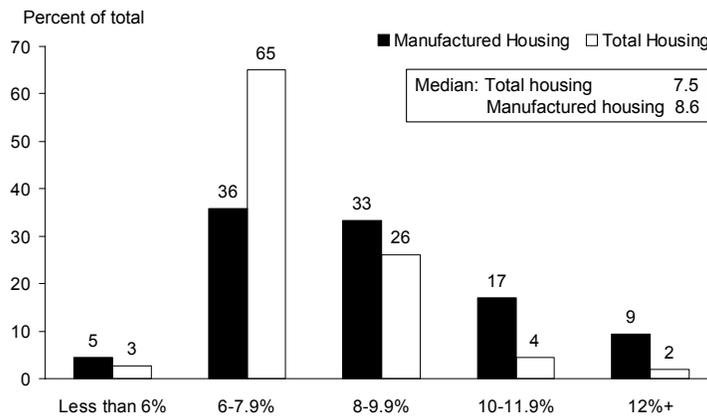
Demand for new HUD-code homes has been particularly hard hit by recent events in the financial sector. Traditionally, HUD-code home purchases are financed with a chattel mortgage – a personal property loan.

The interest rate on this type of financing can be 2-8 percentage points higher than for a real property mortgage (financing which is available to a buyer of a site-built home, or a factory-built home placed on a permanent foundation on private land). Several recent developments have dried up the available financing for chattel mortgages on HUD-code homes:

- Interest rates of all types have declined in recent years. As a result, the spread (or difference) between a real property mortgage rate and a chattel mortgage rate is relatively higher – increasing the relative attractiveness of site-built housing. In 2001, according to the American Housing Survey, nearly 60 percent of manufactured home owners were paying 8% or above on their mortgages – about twice the proportion of owners across all types of housing (Chart 71).

Chart 71

Current Interest Rate as Share of Total Owner Households with Mortgage, 2001



Source: Clayton Research based on data from U.S. Census Bureau's American Housing Survey

- In December 2002, Conseco Finance, the nation's largest lender to the HUD-code home sector with over \$25 billion dollars worth of outstanding loans – filed for Chapter 11 bankruptcy. This move followed several years of poorly performing loan portfolios which had roots in a lacklustre US economy in 2001 and 2002, on top of several years of over-aggressive lending to buyers with questionable credit (both Conseco, and its predecessor Green Tree Financial). Other lenders are viewing the Conseco experience as a lesson, and chattel mortgage finance for HUD-code homes has become relatively scarce. The mobile home portfolio has recently (June 2003) been sold to another company, which will likely bring some stability to the situation.

- In part due to the Conseco situation, and in part to general economic malaise in the U.S. since 2001, the number of HUD-code chattel mortgage defaults has risen sharply. This has had the effect of further constricting the amount of finance available for new buyers, and has also increased the number of resale units on the market as financial institutions attempt to liquidate repossessed housing units. Both of these effects have reduced the demand for newly fabricated HUD-code housing units.

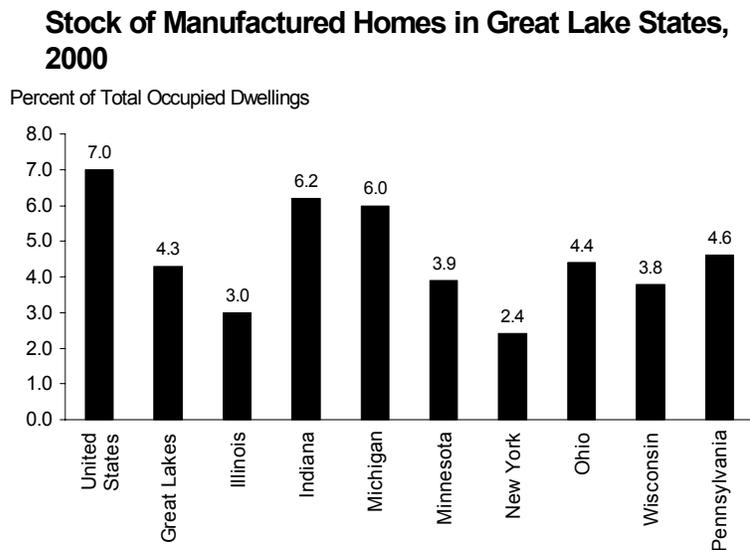
It will likely take more time to work through the backlog of repossessed homes on the resale market, and for confidence to return to the chattel mortgage sector in the U.S. In the meantime, it is expected that the demand for HUD-code units destined for rented land will remain relatively soft.

Demand for Factory-Built homes in Great Lakes States Lags the National Average

Consumption of manufactured housing in the Great Lakes States is somewhat weaker than across the U.S. as a whole, according to the distribution of households by dwelling type in the 2000 Census (Chart 72).

- All the states in the region have consumption rates below the national average of 7% of total housing.
- The Great Lakes region falls significantly below the Southern and Mountain regions of the U.S. – the two regions of highest consumption of manufactured housing.
- Michigan is the only Great Lakes state to be listed as one of the top 10 states (which contain 50% of all mobile units in the country). Michigan houses 228,000 households in mobile dwelling units (3.1% of all housing). Other states range from New York at 2.4% of total housing to Indiana, with the highest proportion in the region, at 6.2%.

Chart 72



Source: Clayton Research based on data from the U.S. Census Bureau

Trends in Factory-Built Housing

As technology advances, changes have been made to the features and materials used in most factory-built homes. Notwithstanding the cyclical decline in product demand since 1998, these factors are setting the stage for long-term growth in the use and acceptance of factory-built housing in U.S. markets.

Consumer Acceptance is Rising

In general, factory-built homes are becoming more accepted among home buyers because:

- Quality and aesthetic characteristics are now standard in these homes. For example, more spacious floor plans, vaulted or tray ceilings, drywall throughout, a variety of exterior siding, walk-in closets, fireplaces, brand-name appliances, pitched roofs with shingles, larger eaves and gabled ends, and various options that are customized specifically to meet the needs of the consumer.
- In many cases, today's factory-built homes no longer have the "house-in-a-box" image they used to have, and this fact is being recognized by potential home-buyers. The new look of modular factory-built homes including second storeys, cape-cod gables, and various portico treatments have all helped to make this type of home indistinguishable from a site-built home.
- The characteristic look of "mobile homes" has disappeared from the industry. Virtually all HUD code homes are now built with steep, peaked roofs, rather than the flat or "bow" roofs of the industry 30 years ago. The increased use of multi-section placements allows a home owner to assemble dwellings with wings, setbacks and other such architectural features.
- Well installed factory-built homes are indistinguishable from "site-built" homes from a visual perspective.
- Factory-built home owners tend to be very satisfied with their homes. In the Census Bureau's 2001 American Housing Survey, about two-thirds of factory-built homeowners were highly satisfied with their homes – a proportion similar to satisfaction across all housing types.

Integration with site builders is rising

The factory-built housing industry is becoming more integrated with traditional site-builders.

- Due in part to the concentrated efforts of larger factory builders such as Champion Enterprises, which is steadily growing its "Genesis" operations which customize homes and components directly to builders and developers, the builder channel continues to develop. Champion sold 3,100 homes through their Genesis channel in 2002 – about 11% of total sales, and up 15 percent over 2001.
- Most of the factory homebuilders surveyed in this study actively pursue relationships with builders and developers, and on average, about 15-25 percent of recent sales were direct to builders or developers.
- Use of factory-built homes or components allows site builders to lower their unit costs substantially. In the 1990s, construction costs per square foot (excluding land development and below-grade excavation) were roughly 30-50% lower for factory-built components than their equivalent site-built product. While builders in the late 1990s were

generally able to compete due to the affordability of their product (connected with low interest rates), as rates rise through the forecast period, more builders are expected to seek options such as prefabrication to continue to drive costs out of their production and preserve their margins.

- Building code harmonization will help promote prefabricated product. Factory home builders who produce modular or other prefabricated product (i.e., non HUD code) are required to have certification from each state in which they sell. A movement underway to harmonize building codes across multiple states will reduce these costs, making modular homes even more competitive against site-built. At present, 43 states (and the Department of Defense) adhere to the International Building Code.

Modular Home Demand is Rising

A shift within the factory-built industry away from HUD-code and toward prefabricated homes will continue.

- Through the 1990's, prefabricated homes represented about one-in-six factory-built homes produced in the U.S. In recent years, it is clear that this ratio is rising. Among the firms surveyed in this study, most traditional HUD producers also produced modular product. On average, about 30-40 percent of production from these firms is modular.
- From a production standpoint, factory home builders can easily shift from HUD to modular. Most of the firms surveyed in this study produce both product lines sometimes on the same production line using mostly the same production techniques. This production flexibility provides an easy transition into the modular industry for existing HUD producers whose markets may temporarily be sour.
- As the modular product is better suited for installation on permanent foundations, there is greater acceptance of this product among financial institutions. In many cases, purchasers of HUD code homes resort to chattel financing, and an elevated wave of defaults in the late 1990s and a subsequent credit crunch are partially to blame for recent declines in HUD code demand. There is a greater availability of more secure financing for modular product.

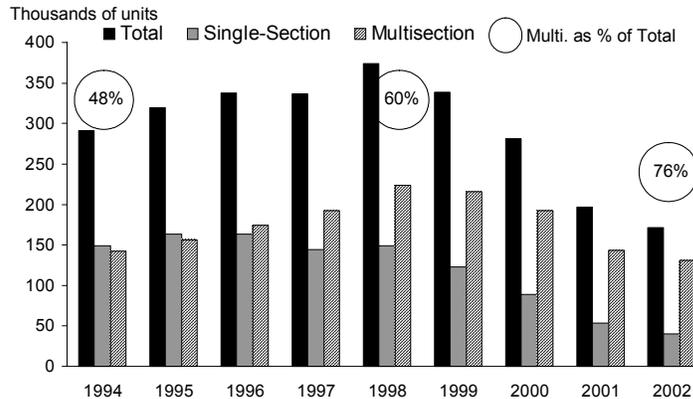
Overall, the factory-built housing sector is in transition across the US and in the Great Lakes States. There are promising demand and supply side factors which will continue to see a boost to the sector, but the composition of that sector is likely to continue to shift.

Multi-Section Demand is Rising

Multi-section units have been steadily growing as a share of the total HUD code shipments over the past few years (Chart 73). Even though total shipments have been on the decline since 1998, multi-section units have been increasing in relation to the total. Thus, shipment values have not declined by as much as the "headline" number of homes shipped. This switch to multi-section units is indicative of a greater focus of the manufactured housing industry on "permanent" housing units.

Chart 73

**New HUD-Code Manufactured Home Placements
 U.S., 1994-2002**



Source: Clayton Research based on data from the US Census Bureau

A majority of the new multi-section homes are double-section. In 2002, 130,900 multi-section homes were in place, which included 4,200 homes with three or more sections.

Prospects for Factory-Built Housing

While the industry continues to face its challenges coping with issues that have dampened production volumes since the mid-1990s, the fundamentals remain in place for a rebound in growth in the years ahead, and a gradually increasing presence of factory-built housing within the new home industry in the US over the decades ahead.

There are several factors which suggest that factory-built housing will capture larger shares of total new housing activity in the U.S. over the next two decades, including:

- The continued ability of the factory-built sector to drive costs out of the production process and compete head-to-head with the site-built sector;
- The increased presence of factory-built product use within the site-built sector through partnership deals between factory-builders and site builders and developers;
- The increased presence of factory-built product in multi-family projects;
- The increased presence of land-house deals which is eroding traditional stereotypes about the product and moving the product up-market (in terms of demographics);
- The superior and more stable financing sources available to the land-house deal, which will provide greater stability to the factory-built sector through finance-cycles;

However, there remain cautionary factors which present growth risks for this sector. The ability of the industry to address these risks will be critical in order to realize its potential growth. These include:

- As the industry continues to move its product up-market, it risks abandoning its traditional niche in the housing industry. As manufacturers move to expand their presence in the

mid-market product, including modular homes, "drywall" homes⁴⁵ and multi-section homes, there is a risk that the supply of single-section HUD-code units priced in the under-\$25,000 range will dry up. Depending on the ultimate success of the industry to compete more head-to-head with the site-built sector in the middle and upper markets, the factory-built sector risks losing its presence in both markets.

- Loss of rental communities. There are some 50,000 manufactured home rental communities across the U.S. However, there is evidence that owners of these communities are moving to shift toward land-house deal developments. The risks going forward to the industry is that there will be less rental space available for the traditional single-section affordable manufactured homes, and thus, demand for this product will also decline.

Nationwide demand in the U.S. for factory-built housing, including HUD-Code manufactured homes (single-section and multi-section) and panelized, modular and pre-cut homes, is predicted to increase to 440,000 units annually by 2010 and over half a million units annually by 2020. Prefabricated housing is expected to outpace site-built homes over the forecast period, accounting for nearly 8 percent of all housing starts by 2020 compared with about 4 percent recently.

The cost advantages of factory production of houses, including better labour productivity, improved scheduling, bulk purchasing of materials, lower waste disposal and better recycling practices and insulation from weather related delays, will push up U.S. demand for factory-built homes in the future.

According to NAREIT (the National Association of Real Estate Investment Trusts) the future of the factory-built housing industry looks promising:

- The reduced production and shipments of new housing units have alleviated some of the excess inventory problems.
- Tighter credit standards have improved credit performance, which should reduce the number of consumers defaulting on their loans in the future.

This is expected to move the factory-built housing sector back to a profitable position within a couple of years. Future demand will be driven by improving the quality of factory-built homes, better overall consumer image of the products available, and better affordability compared to site-built homes. The aging of the population as well as the baby boom cohort reaching retirement age is likely to increase demand for factory-built homes.

Industry Structure

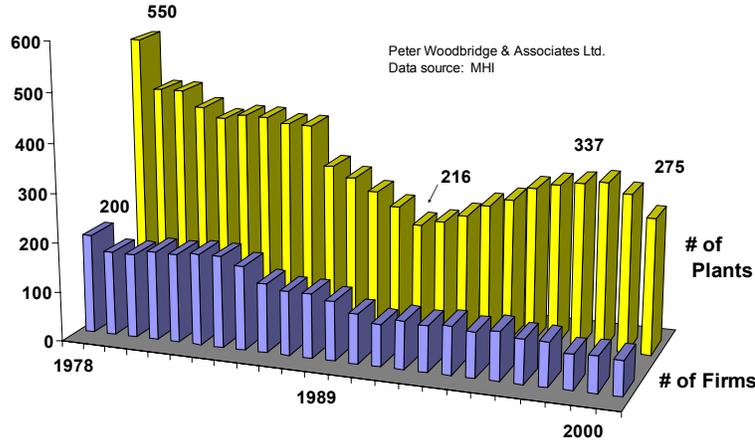
At year-end 2002, there were 66 corporations producing manufactured homes (HUD-code and often modular from adjacent lines within the same plant) out of 235 plants across the United States. There has been considerable consolidation in the industry through the 1990's, with the number of corporations declining, mostly through amalgamations from 100 in 1990 to 70 firms by 2001.

The total number of plants in operation has varied largely with market conditions, with the number of plants rising from 216 in 1991 to 337 in 1997, then falling again to 235 in 2002 (Chart 74).

⁴⁵ Another indication of the up-marketing of factory-built homes is the proportion which are built with finished drywall interior walls, as opposed to the traditional vinyl-coated wall board or wall paneling more typical of lower-end manufactured homes.

Chart 74

Manufactured Homes: # of Firms and Plants in Operation in the US



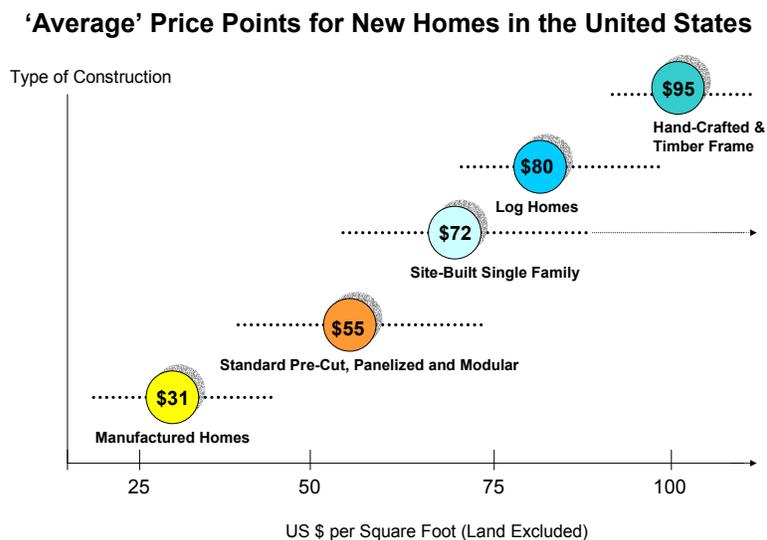
The structure of the industry is a significant driver of regional competitiveness, notably in terms of unit production costs and the extent to which national dealership-networks can dominate regional and national markets. In Volume 4, *the Opportunities Report*, we discuss in the context of Ontario and the US Great Lakes states how this can affect the competitiveness of smaller, single-plant manufactured housing producers and can force them to focus solely on custom markets.

Technology and Building Products

Construction cost per square foot for a new factory-built home compared with site-built varies. Except for customized factory-built, which serves a higher price point in the market, typical averages indicate that factory-built can vary between 25% and 55% less than a comparable site-built home. In spite of this, the homes are often sounder than many site-built dwellings and are becoming indistinguishable from site-built homes as a diversity of profiles and designs hit the market.

Chart 75 provides a comparison between average selling price points for various types of housing in the United States. Site-built single family housing averaged US\$72 per square foot in 2001, but had a wide range of pricing from around US\$50 per square foot to highs well in excess of US\$150 per square foot. In contrast, manufactured homes averaged US\$31 per square foot and other factory-built single family homes averaged US\$55 per square foot.

Chart 75



Peter Woodbridge & Associates Ltd.

The key to the affordability of factory-built homes is the buying power of large-scale factory builders, and the efficiencies of the factory process. These costs are driven by the following factors:

- All aspects of the construction process are controlled;
- Weather, trades delays, and other problems which can plague productivity on a construction site do not interfere with construction and cause delays;
- All technicians, craftsmen and assemblers work as a team and are professionally supervised;
- Inventory is better controlled and materials are protected from theft and weather-related damage;
- Building inspections are carried out in-plant. The factory seal precludes the need for usually more expensive on-site inspections.
- Blending of traditional wood frame with engineered wood, and the ability to move the job through the materials storage areas, reduces overall costs.
- Significant efficiencies can be achieved with automated setting of large sections of drywall (avoiding the need for tape), optimizing the use of foam as adhesive and using vacuum sanders.
- The factory setting can improve the performance of certain materials – such as the use of gas-fired heaters to assist in curing the asphalt on roofing shingles;
- The use of stations along the production line ensure that specialized labour, machinery and tools are continuously employed on specialized tasks;

- Factory-built housing producers can access bulk purchasing of construction materials, finishes and appliances for additional savings to the home-buyer;
- Factory builders are able to save time and gain efficiencies by bulk production of major components like interior wall sections. Some builders have developed innovative techniques, such as foam-adhering drywall to interior stud walls (a completely screw-less procedure);
- Large jigs are used for the assembly of floor, wall and roof components which speed up the assembly process and avoid the sort of injuries that can occur on construction sites as workers clamber about on unfinished frames;
- Large-scale use of pneumatic tooling linked to central compressors save on time, fuel and electricity; and
- Costs of interim construction financing is significantly reduced or even eliminated, and there are high quality control procedures in place.

Building materials used in factory-built homes today are, in many cases, the same as those used in site-built homes. Whether HUD-code or modular (state code), the same precautions are taken when building factory-built homes, and they are engineered for wind safety and energy efficiency regulations in the region where they are sold. There are many federal safety laws applicable to factory-built homes, such as smoke detectors, escape windows, and combustible materials.

Wood is a Dominant Building Material in Factory-Built Homes

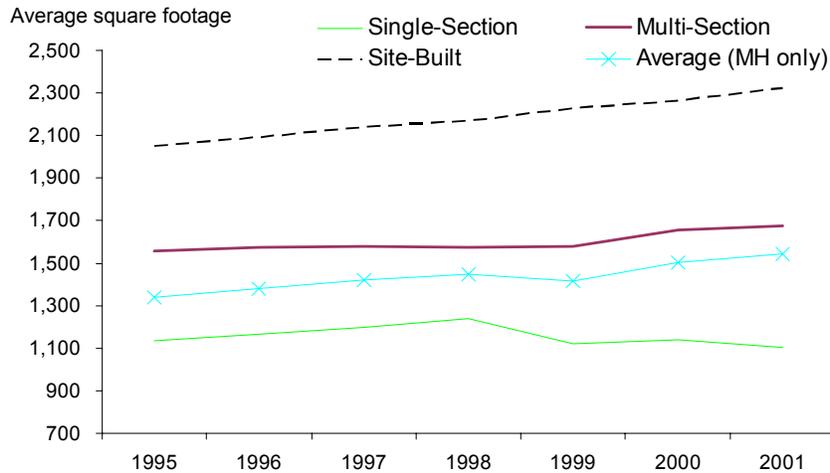
The residential factory-built sector is very wood-products focused. Trends in wood usage in this sector may be diverging from the site-built sector. There are a number of areas in which wood's traditional role in residential construction is being supplanted by alternative building materials such as light-weight steel studs, above-grade concrete walls and floor systems (particularly using insulated concrete forms (ICFs) and increased use of vinyl in millwork, exterior decking and other traditional wood-product applications.

In the factory-built sector, by contrast, construction practice has taken a significant shift over the past two or three decades from a product which in many respects resembled travel-trailers, including the use of metal frameworks, siding and roofing, to a product which is virtually indistinguishable from traditional wood-built site-built housing. This includes the use of wood wall studs (both interior and exterior) wood rafters and trusses, wood floor systems and wood cabinetry.

The apparent net usage of wood products in a typical factory-built home is only modestly on the rise despite the increasing size of the typical factory-built home. This has remained much the same over the past 6 years from 1,345 square feet in 1995 to 1,388 square feet in 2001(chart 76).

Chart 76

Average Square Footage of Manufactured Homes vs. Site-Built Homes



Source: Clayton Research based on data from the Manufactured Housing Institute

There has been a pronounced upward trend in the sizes of site-built homes compared to factory-built homes. In 1995, the average site-built home was just over 2,000 average square feet according to the Manufactured Housing Institute (MHI). In 2001, it was over 2,300 average square feet – a 13 percent increase. This is compared to a 15 percent increase in size in average factory-built homes.

On the basis of the factories surveyed in this study, the apparent usage of wood products in a 2,000 square foot factory-built home is about 12,700 board feet of dimensional lumber and additional 7,000 board feet of panel product. This is somewhat lower than estimates of lumber usage in site built homes produced by NAHB carried out in the early 1990s – which may be largely due to the reduced amount of waste lumber in the construction process.

Factory-built homes are getting larger and increasing in presence in the overall industry, so the apparent usage of wood products is likely to rise in the years ahead for factory-built, at the same time as competition from alternative building materials is likely to erode the apparent usage of wood products among site-built homes.

Use of Value-Added Wood Products in Factory-Built Housing

The use of value-added wood products in factory-built housing varies considerably between manufacturers. In addition to OSB, value-added products include engineered products (wood I-Joists, TimberStrand, floor and roof trusses) and millwork (wood windows and doors).

The greatest use of value-added wood products in the manufactured housing sector is panel products. OSB use is extremely common, especially as roof sheathing, exterior wall sheathing (generally 7/16") and, in some cases, floor sheathing.

OSB is used as spacers in assembled doors and window headers, backers for drywall at sheet seams, etc. OSB is the preferred sheathing on roofing and exterior wall sheathing because of the

quality of its strength rating. The stresses that the framing undergoes during transportation is a particular concern in these homes – particularly the drywall homes.

Producers are happy with the ability of OSB to withstand that stress. In our field research, most producers were generally happy with OSB, when asked. The only complaints related to the price.

Other panel products that we observed to be in common use include:

- ¼ laminated panel stock was used by a couple of producers on interior walls between the drywall and studs. This ensured a stiffer wall, and helped avoid drywall cracking during shipping;
- MDF and particleboard, along with plywood, were all in use as floor sheathing by various manufacturers. One company, manufacturing a higher end product, ensured a more solid flooring by employing a double sheathing upon joists: a foundation layer of 7/16 OSB, then topped by 1/2 inch particleboard, adhered and nailed together.

Engineered roof trusses are used on virtually every manufactured home. The major innovation in this field has been the hinged truss, which allows producers to incorporate steeper pitches, but hinged the roof down for transportation in order to maintain roadway guidelines.

Engineered floor systems are used widely among many factory builders, but this varies between plants and price points being served.

Some producers employ a system of dimensional floor joists on LVL stringers for additional strength. Producers who use open web trusses in modular homes valued the ability to run heating and plumbing through the joist, thus avoiding the need for a duct belly below the floor. HUD homes have a natural belly in the chassis, reducing the need in this regard.

Several higher end producers used I-Joists, depending on the cost differential with dimension lumber. Generally, the unique feature of the I-Joist is its ability to span larger open sections, which is making this a product of increasing popularity among site-builders who are aiming to create homes with large open spaces. The factory-built home section is limited to 16 feet due to roadway regulations, so no floor is large enough in width to warrant the superior spanning qualities of an I-Joist. Even so, some manufactured home and pre-cut and modular producers favour them for dimensional stability.

Fingerjoint Lumber Use

There is considerable use of fingerjointed lumber in the manufactured home industry. At least half of the producers surveyed used fingerjointed lumber – usually 2X3s – for interior partition walls. Fingerjointed lumber was also used in load bearing applications such as exterior walls or around doors and windows.

Users of fingerjointed lumber valued its dimensional stability, consistency and reliability *in situ*. Also, they valued the reduced waste from the move from solid dimension. Some producers commented that waste among pallets of 2X3 and 2X4 dimensional lumber would be upwards to 30% - generally from pieces which were too crooked for use. In addition, most producers mentioned moisture content in dimensional lumber as a particular issue, especially since most of these operations are set up to receive supply “just in time” for production – so there is little time to allow stock to dry on site.

Users of fingerjointed lumber valued its dry and ready-to-use quality. Those manufacturers who did not use fingerjointed lumber generally either felt that its benefits would not warrant the additional cost, or felt that “something new” might be questioned by the customer. This suggests the need for better promotion and dispersion of product information by fingerjoint producers.

TimberStrand posts are employed by some producers at large openings in the marriage wall to help bear the load of the ridge beam. Generally, these are not used extensively by HUD code builders even though site builders extensively use this type of product for load-bearing headers and other applications where code requires a doubling up of dimensional lumber.

The use of 1/4" laminated panel stock behind the drywall on the marriage wall is used to give rigidity to the wall and avoid drywall cracks in transit.

Laminated timbers were used in most of the manufactured homes surveyed. The most common use of a laminated timber was as the ridge beam above the marriage wall of a multi-section home. Usually this was an LVL beam. Some producers used LVL timbers as floor stringers on modular units. One producer used a laminated 2X3 stock for interior walls.

Several producers offer some models with high-end interior finishes, including extensive use of hardwood cabinetry, trim and other features. Many homes include crafted oak beam finishes, extensive cabinetry design and use of solid oak paneling above the pass-throughs.

Materials Procurement

Factory-built housing producers are generally operating within a highly competitive structure, producing a low-cost affordable product. Without exception, all of the producers that were surveyed in connection with this study emphasized the need to be cost-effective in their procurement. Nonetheless, a number of different procurement strategies appear to have emerged amongst the different companies operating in this industry:

- Most producers make at least some use of wholesale distributors of building materials. These distributors are often located locally, and have a sufficient distribution network to keep supplies reliably delivered to the various plants in the area. Most plants operate on a just-in-time framework for major materials, and tend to keep very little stock warehoused on site;
- Some producers discussed the long-term relationships that they have with wholesale or primary suppliers, sometimes going back for decades. Local wholesale suppliers are able, it seems, to adapt to the needs of the producers through particular means. Some suppliers store dimensional lumber in a warehouse for customers one month in advance, in order that the moisture content would be low when delivered and brought on line;
- Large-scale producers, such as Fleetwood, make use of corporate-owned suppliers for many products. In both the Fleetwood plant, and the Champion plant that we surveyed, however, it was clear that that local plants have a fairly wide discretion to procure outside of the corporate channels where price, timing or quality are issues;
- Some producers have engaged in purchasing or establishing subsidiaries to produce components. One producer had purchased an independent cabinet shop, for example, to avoid purchasing cabinets on the open market and keep better control over inventory and delivery;
- Most producers indicated that their procurement contracts were often reviewed for adherence to cost, timeliness and quality objectives, and that new and existing procurement needs were periodically placed on open tender in order to support the bottom line;

- Some companies procured dimensional lumber and laminated stock directly from producers;
- Engineered wood trusses were procured from local truss producers. The timeliness of delivery, and the ability to produce custom specifications on tight time frames, were qualities that factory builders felt local truss fabricators were in the best position to satisfy.

Regulatory Issues and Environment

All HUD-Code manufactured homes are constructed in accordance with the Federal Manufactured Home Construction and Safety Standards that have been in effect since June 15, 1976. This building code is administered by the U.S. Department of Housing and Urban Development (HUD). The HUD code regulates manufactured home construction and design, durability and strength, fire resistance and energy efficiency.

In the early 1990's, the HUD code was revised slightly to focus more on energy efficiency and ventilation standards and to improve wind resistance for prefabricated homes in hurricane-prone regions. Wind-code uplift strapping is apparent at the corners of many HUD-code homes.

The national Manufactured Housing program is designed to protect the health and safety of the occupants of manufactured homes. HUD issues, enforces and monitors Federal manufactured home construction and safety standards. The purpose of this program is to not only reduce personal injuries, deaths, property damages and insurance costs, but to also improve the quality and durability of manufactured homes.

These federal standards automatically overrule any state and local laws regarding manufactured homes that are not identical to the national standards. Under HUD regulations:

- Homes are required to be inspected at one stage of production by an inspection agency approved by HUD;
- The manufacturer has an approved quality control program in place throughout the production process;
- A HUD label must be applied to each home section by the manufacturer to indicate that it is in compliance with the HUD code;
- There exists certain procedures that manufacturer/retailer must follow should they become aware of a problem with a home after it has been shipped from the manufacturing facility.

Affordability

Construction costs for factory-built homes can range anywhere from 35 to 50 percent less than a comparable site-built home. Various studies performed on comparing costs of factory-built and site-built homes have confirmed that factory-built homes installed on permanent foundations, particularly in land-home deals, appreciate in value similar to other forms of housing.

Since the Fair Housing Act was introduced in 1968, great strides have been made towards providing equality of housing for all citizens in the U.S. However, obstacles to minority participation in housing practices still exist today. A recent study in the U.S. showed that minorities traditionally have been given less information, less assistance and less favourable terms and conditions when applying for a home mortgage than non-minorities. This is changing, however, and many of the housing 'giants' are now strongly targeting minority groups as prime markets for housing demand growth.

President Bush recently stated that he wishes to increase the number of minority homeowners by 5.5 million by the year 2010. To achieve this goal, HUD has been granted \$50 million in the 2004 budget to put towards fair housing – a 9 percent increase over 2003 funding. As well, HUD, in collaboration with the Education Department and the Treasury Department, is trying to educate families about home ownership through counseling programs and financial literacy efforts.

HUD is also working to increase the amount of accessible housing for citizens with disabilities. This type of housing is likely to be concentrated in factory-built housing, as the overall costs are lower, and Federal departments can therefore reach more citizens.

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