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National Research Council
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HOUSING NOTE NO. 22

**HOW WILL PREFABRICATION AFFECT
YOUR HOUSE BUILDING BUSINESS?**

ANALYZED

By

R. E. Platts

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FIGURE 2 — The simple prefab package brings order to the site. (Engineered Homes Ltd., Calgary).

How will prefabrication affect your house building business?

The builder who is concerned with year-round production, better programming, quality control, handling and costs control, and better use of a permanent labour crew, is a builder who is also concerned with prefabrication. He may argue about its present importance, but he will agree that the factory has a growing part to play in the modern business of house production. He will read the signs of prefabrication trends as carefully as he can.

Some of the clearer signs can be seen by assessing the situation in other countries where present conditions are similar to anticipated conditions in Canada. Sweden and the Midwest United States are most useful examples. Dissimilar in many ways, these two areas are uniquely similar in that the majority of their single-family housing stock is now prefabricated, and they share these key attributes that apparently have spurred their prefabrication over the past ten years and more:

- (1) Very high wages, particularly for on-site work as compared to factory work.
- (2) Uniform public or private "model" codes.

- (3) Public or private schemes of immediate financing of the factory package.

These conditions are coming to the fore in Canada and elsewhere, and they are accelerating the shift of house construction from the site to the factory. Prefabricated houses now comprise about 15% of our annual production of single-family houses, compared to about 6% just a few years ago. The effects of these and other factors have been studied by the Division and are reported more completely in the publication NRC 7856, "Prefabrication in Canadian Housing". This note and the next two in this series will attempt to relate this study directly to the builders' present interests.

How can prefabrication help the housebuilder now? Even the simple wood-frame prefab shop and the incomplete package that it produces can apparently do a great deal to rationalize the construction of houses for volume markets.

Figure 1, very roughly derived from discussions with larger builders and prefabricators across Canada, shows that the project builder, using his own central prefab shops, appar-

ently can double the productivity achieved by builders working on the site.

The large site builder may have as many as 20 small crews working at the same time over a scattered area, each needing the right materials, jobs, and supervision at the right time if they are to produce consistently and well. According to building materials dealers, in such operations a house may require 20 to 30 separate deliveries of materials. In comparison, where the central prefab shop is the operations base, the bulk of the house shell is prefabricated under one roof, at convenient stations, with the right materials and supervision convenient to each worker. When the package goes to the site, it goes in one to three loads with both fabricated and loose items marshalled together. The big sections allow the house to be closed-in the same day, and other materials are safe and at hand. Simple though the package may be, the whole operation is visibly improved and organized (**Figure 2**).

As wages rise and the wage differential between factory and field increases, over-all costs will become the prime reason for shifting to prefab-

rication in Canada, as is now the case in some other areas. At present, the more important aspects are turnover and ease of year-round building. In the last few years it has become apparent that the project builders who are most successful at steady, year-round building are the ones with central prefabrication shops, or who use other prefabricators. They can close in the house in one day rather than in the three to five needed by site-builders, and they greatly reduce and simplify the material delivery and protection problems in bad weather. In winter and in summer their turnover can be sharply increased while their supervisory headaches are reduced. Their costs are better known and therefore better controlled: the package costs are known, inventory and handling are simplified, labour content is known, wastage is down, and things fit.

The prefab shop is a tool that allows a good builder to gain all the advantages mentioned, but the shop

carries with it the one big disadvantage of loss of flexibility in volume of production. The shop and equipment must be fed work as steadily as possible if operations are to be competitive. The prefabricator assumes much of the fixed overhead that is usually distributed among many in site-building, and he cannot very well close shop for the winter.

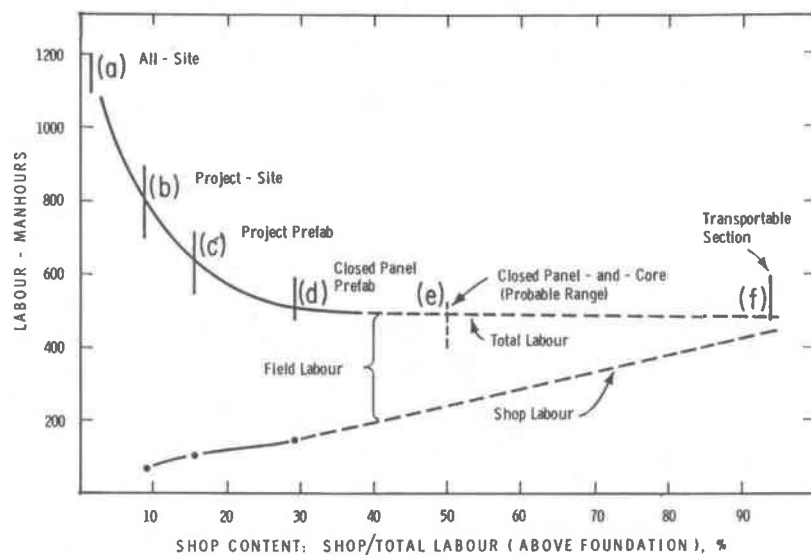
Factory house production does not result in larger total overheads than does site-building, although this is sometimes suggested. It can be stated as an approximation that the "overhead content" in the complete chain of house production does not vary greatly with changes of method, but is merely distributed differently. It can be at its highest when it is thought to be at its lowest: when the "one man builder" is the final part of the production chain. He may think that his overhead is "only the telephone" but in paying for materials he pays several overheads: taxes, accounting, and plant running and rental (in ware-

housing) of local retailers and regional distributors. These must stock a great variety of materials over long periods for the many small builders who want a little at a time. And the small builder may use little that can be called "plant", but he pays "plant rental" for the house and site while building, either in interest or in the loss of sale or rental income during the long period of construction. Larger builders and particularly prefabricators can cut their material and labour costs quite sharply but they then assume the overheads of warehouse and plant.

Large project builders in Canada, usually with land development planned for some years ahead, have generally set up central prefab shops and have accepted the fixed overheads and loss of flexibility in volume of production that these shops entail. Prefab shops for wood-frame houses are relatively simple in comparison with other factories but they must be roomy to allow proper handling of bulky parts and materials. The step to a good central shop is a costly one that should not be taken lightly. The third article in this series deals with the wood-frame house factory and its equipment.

Medium and smaller builders—producing say 100 houses a year or fewer—cannot readily take such a step. Their total volumes cannot properly "feed" their own prefab shops, and seasonal and other fluctuations can leave them with high fixed charges and little production. They can still use prefabrication quite well, and in some cases they are already doing so, by buying from others. The medium builder can tie in with an "open-market" prefabricator, procuring from him the house package, transportation and handling service, and sometimes even financing and selling services.

In the past, these open-market prefabricators have sold their house packages and services primarily to individual buyers and owner-builders in rural areas, but this is a difficult market and a seasonal one: individual buyers rarely consider building in winter. For this reason the older prefabricators, and some building supply dealer groups who have entered the



General

A bungalow, 1000 sq ft in area and using no masonry, is assumed

Stage (a) -- All Site

Little precutting, little prefabrication except windows (window shop labour not counted here)

Stage (b) -- Project Site

precut frames
shop trusses
shop cabinetry

Stage (c) -- Project Prefab

Add to (b):
shop walls) clad one side
shop partitions)
shop doors (hanging)

Stage (d) -- Closed Panels

Add to (c):
shop walls and partitions (closed both sides)
some wiring in
shop gables
some shop plumbing, heating

Stage (e) -- Closed Panels-and-Core

Add to (d):
shop roof section
shop ceiling sections (sometimes)
more wiring in, wiring "harness"
plumbing wall and subassemblies
kitchen cabinet-walls
closet walls
heating "kits" and subassemblies

Stage (f) -- Transportable Section

FIGURE 1 APPROXIMATE LABOUR CONTENTS
OF PRESENT STAGES OF WOOD-FRAME HOUSE PREFABRICATION

business, have turned to arrangements with builders with some success, particularly in southern Ontario and the West. This reduces risks and retains flexibility for the builder since he has no plant to carry and it increases and steadies the production volume for the prefabricator since he supplies several builders.

How much prefabrication should a builder use? What portion of the house should he build in the factory, and what portion in the field? Although it is often pointed out that the typical prefab operation does all too little in the factory, **Figure 1** shows clearly that few find it worthwhile to

bring much more of the house operations into the shop, at least where wood-frame systems are involved. Wood-frame construction is not readily amenable to highly mechanized production. The surprising gains in productivity shown by the simple prefab shops, compared with on-site operations, are primarily attributable to materials handling and sheltered, organized, working conditions rather than to mechanization. These factors help greatly in the rough shell work, but help little in the great amount of trim and finishing work that remains as a tedious, hard core in house production, difficult to improve.

Project builders doing all their work in one area will tend to favour Stage (c) and possibly Stage (d) of **Figure 1**, since the servicing and finishing trades can work under cover in the house on the site, and may not be too scattered for good organization and supervision. Those doing a good volume in several areas, and selling to others too, will favour Stage (d) and may work toward Stage (e). As discussed in some detail in the main report, "Prefabrication in Canadian Housing", Stage (e) may represent the optimum shop approach for both wood-frame production and some promising newer systems.