

in the table show those operations that are most significantly affected by weather. Therefore, in these examples, the reason for the extra labor hours is bad weather.

The table essentially shows that for the house started in January there are 153 man-hours extra. That is, there were actually 153 more hours spent than had been estimated for the operations of grading, restaking, weather labor, digging in the crawl space, pads and piers, setting footings, foundation walls, backfilling and insulating the foundation and laying the vapor barrier and setting the beams, whereas on the house started in April the difference was a negative 9 hours, which was within the estimated tolerance and is not consequential. The house started in late January referred to in the table represents merely the extreme weather that called for this labor.

Three of the similar homes started in mid or late March had extra times of 37, 62, and 77 man-hours respectively.

I think it is significant to note that at this builder's average cost of \$5.50 per hour, including pension, welfare insurance, social security, unemployment compensation, and related fringe costs, the extra 153 hours amounts to a little over \$840.

Weather labor is time allowed for items such as breaking frost, excavating mud and replacing with sand, setting up heaters, covering the site to thaw frozen ground prior to foundation construction, covering concrete against freezing, plowing snow, extracting equipment from mud, and related items.

We started building research houses some 13 years ago and one of our goals was to try to improve productivity in bad weather and reduce cost. We have just completed the seventh research house. For the first four dwellings, panels and components were developed to allow the houses to be "closed in" faster to minimize the effect of weather. Today the state of the art is such that except during extreme weather conditions, builders can "close in" a dwelling in 1 or 2 days, if they decide that they need to.

In our fifth research home, we used components, developed an all-weather foundation system, and utilized prefinished exterior materials. This home was started during the winter, and the ground was frozen. Pier holes were dug with a post hole digger attached to the back of a small tractor. The light gage steel foundation frame, beams, and columns were set and suspended over the pier holes, and a small pad of concrete was poured into the bottom of each pier below the frost line.

We covered this with a little straw. The next day we removed the straw and backfilled with earth which allowed the foundation to be put in so that the rest of the house could proceed at one of the worst times of the year.

The system would probably be in widespread use today except for the fact that a satisfactory economic coating for the galvanized steel has not yet been developed.

In our sixth research home, prefinished exterior surfaces of a different type were used along with components to speed construction. In our last and just completed research house project, the Research Foundation developed a prestressed, lightweight aggregate concrete panel system that accomplishes our other objectives and minimizes the effect of weather.