

New rib floor system for residential construction

Cast-in-place concrete to compete with wood joist construction

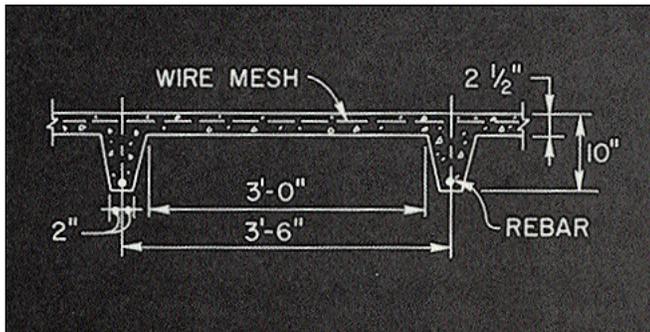


Figure 1. Cross-section of the rib floor system shows standard 3 foot-6 inch rib spacing which permits 3-foot-wide foundation wall forms to be used as deck forms.

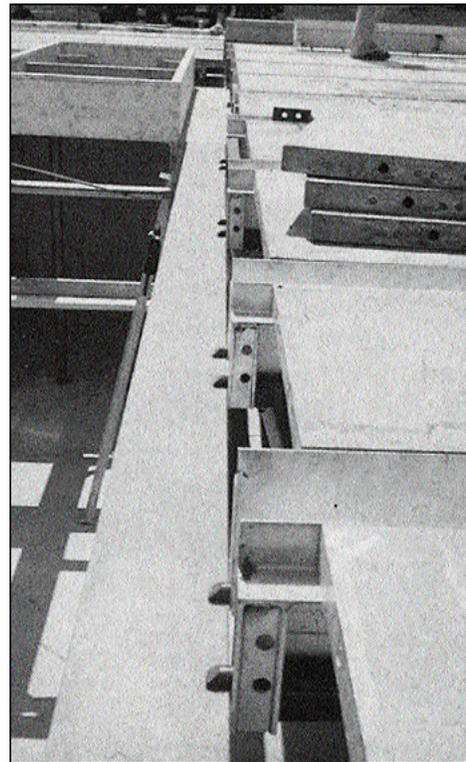


Figure 2. Deck forms are supported on collars of the rib forms, while rib forms are supported by retractable pins that bear on the foundation wall and on a steel center beam.

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A new concrete rib floor system is under development at the Portland Cement Association. Intended for use on the first floor over a basement, the system can span up to 16 feet and is designed to be competitive with wood joist construction. Ribs are spaced 3 feet 6 inches on center and have tapered sides as shown in Figure 1. The 2½-inch-thick slab is reinforced with 6x6—W1.4xW1.4 wire mesh and rib reinforcement consists of one Number 6 bar placed with ¾ inch of clear cover at the bottom of the rib. Concrete compressive strength required is 3000 psi.

Rib forms compatible with wall forms

By spacing the ribs 3 feet 6 inches

on center, the wall contractor can use his 3-foot-wide foundation wall forms as deck forms. The aluminum rib forms were made for PCA by an aluminum form manufacturer. As shown in Figure 2, the deck forms are supported on collars of the rib forms. The adjustable rib form is supported by retractable pins bearing on the foundation wall and on a steel center beam. Length of the rib form is adjusted by setting two end sections that rest on an aluminum joist, then placing a slip filler between them. One shore post used at the midspan of each rib form provides support during concrete curing.

Structural tests prove adequacy of rib floor

“Building Code Requirements for Reinforced Concrete (ACI 318)” currently permits a maximum clear spacing between concrete joists of 2

feet 6 inches. In order to gain code acceptance of the 3 foot-6 inch spacing used in this system, structural tests were conducted at the Construction Technology Laboratories, a division of the Portland Cement Association. The tests showed that for normal residential loading, the rib floor system had more than adequate structural capacity. Additional tests are being planned to evaluate thinner slabs and wider rib spacings.

First pilot project constructed

Last May the new rib forms were used by Concrete Contractors, Inc. of Dunkerton, Iowa, to construct a floor over basement in the Robert Speed residence. The project permitted observation of formwork erecting, reinforcement placing, concrete placing, and formwork stripping under field conditions. The sequence of formwork erection

is shown in the box.

Problems encountered included nonstandard rib spacing at edges and nonstandard formwork around the stairwell. In these areas, the 3-foot-wide aluminum wall forms couldn't be used on the deck. Field constructed wood forms solved most of the problems since units made out of 2x4's laid flat with 1/2-inch-plywood sheathing attached had the same thickness as the aluminum wall forms.

Reinforcement and concrete placement went smoothly. Muddy site conditions made it necessary to place concrete with a crane and bucket, as shown in Figure 3, instead of depositing it directly from the truck mixer chute.

After curing of the concrete, forms were stripped. First shore posts and bulkhead forms were removed and the deck forms were



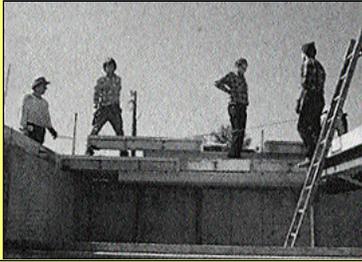
Figure 3. Because of muddy site conditions concrete was placed with a crane and bucket.

temporarily shored. Then each rib form was stripped in the same sequence: first the aluminum joist, then the rib-end sections and finally the slip filler section. Once these were removed the deck forms were easily stripped.

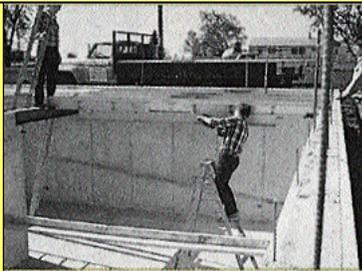
Since many bolts were used in the system, and since some areas on this project were formed in wood, formwork erecting and stripping took more time than expected. Improvements are being made in the form system to decrease erecting and stripping time. These will be tested in future pilot projects.

Formwork erection

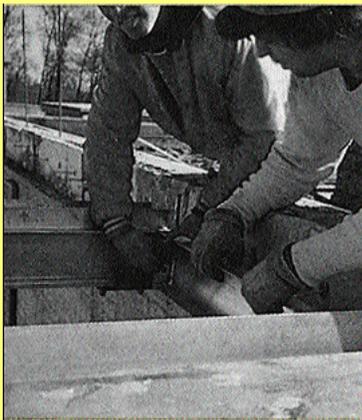
Rib forms consist of two end sections, a slip filler, and an aluminum joist on which the end sections ride.



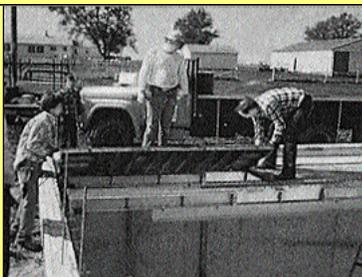
The rib form is adjusted for length, and the slip filler is inserted between the two end sections.



Bolts are tightened, securing the bearing pins and the aluminum joist to the end sections.



Bulkhead forms are placed at the outside wall and bolted to the rib forms. Angle brackets are bolted to the rib forms at the interior beam to maintain spacing.



Wall forms used as deck forms are dropped into place, resting on the collars of the rib forms.



Shore posts are placed at midspan under each aluminum joist.

The process is repeated until the floor is completely formed. Nonstandard areas are formed with aluminum wall form fillers or with 2x4's laid flat and attached to 1/2-inch-plywood sheathing. To retain the floor concrete, perimeter edges are formed or a ledge cast in the wall is used.

Form loan program to promote advantages

The new concrete rib floor system offers many advantages to the homeowner, such as no vibration or squeaks, thermal mass for solar energy storage, and better fire and storm resistance than wood joist construction. The concrete contractor would also benefit from higher profits by placing more concrete in each house.

To promote these advantages the PCA has purchased rib forms to be used in a form loan program for contractors who want to try the system. The forms are available at no rental charge by contacting the author at the Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077; phone 312-966-6200.

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