ESTIMATING CONCRETE WORK - VI

By Edward G. Le Jeune*

The material requirements for forming column footings is simple. If 2-inch material is used, figure 2 board feet of lumber per square foot for the 2-inch plank. See Figure 1. Then figure one-half board foot of lumber for the stakes and bracing. So figure 2 1/2 board feet of lumber per square foot of form. When I figure lumber I use a straight 12 cents per board foot for all material. Two and one-half times the 12 cents a board foot would total 30 cents per square foot of form if the form was used only once. When I figure form usage for column footings and wall footings I figure on five uses of the material. To determine the cost per square foot, divide 5 uses into 30 cents per square foot. The answer, of course, is 6 cents per square foot of form for material cost. This applies whether the lumber is to be used up on one job or six separate jobs. The erection labor output on column footings will vary from 120 to 200 square feet per day depending upon the size of the footings.

When forming footings under average conditions, allow one hour of carpenter's time to set up each footing. In other words, a footing that is 5 feet by 5 feet by 1 foot would be 4 sides by 5 feet, or 20 square feet per footing times 8 hours, or 160 square feet of forming per day. When there are various sizes of footings in a job, base your production output on the average size footing. This production output per day (160) is entered in the column marked L per D, for future conversion to a unit price based on a carpenter and one-half day's labor rates. This is picked up from the wage rate scale when all labor outputs are entered. I allow 600 square feet per day for laborer time to strip, clean, stack or move column footing forms. Stripping time is figured in one item at the end of the forming, as an average for the entire job. Whenever I use labor output per day from my tables, I am considering average production which you will only get on a fairly good-sized job.

If the total quantity for column footings was less than a day's work—say, 100 square feet—I wouldn't bother to look at how many column footings there were in the job, I'd call it 100 square feet per day for erection.

Forms for wall footings

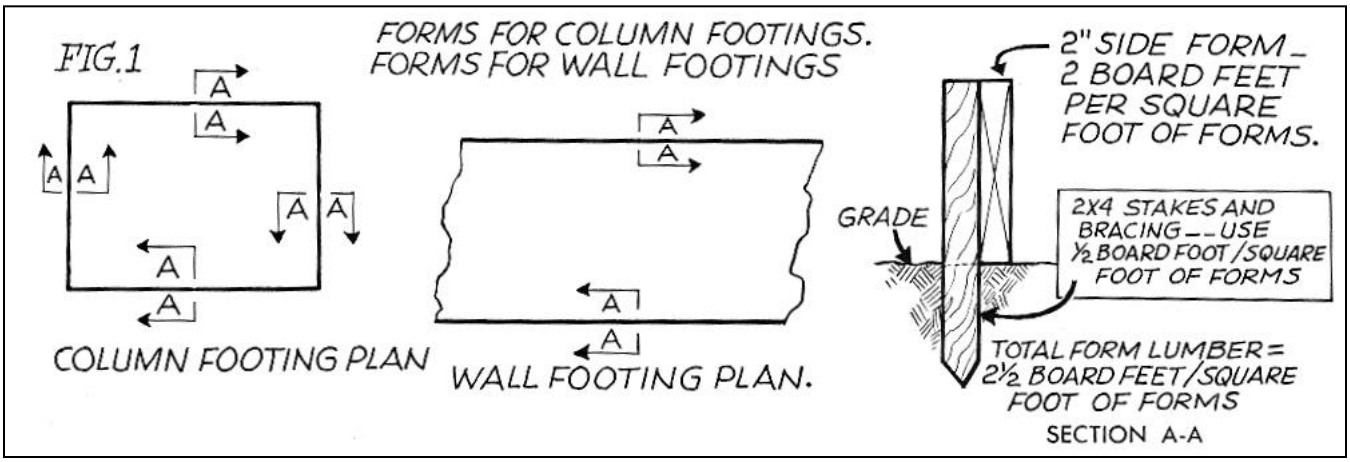
The material requirements for wall footings are developed the same as for column footings. (See Figure 1.) In other words, figure on 6 cents per square foot of contact area. For erection, I figure 350 square feet per day. For stripping and cleaning, I figure 600 square feet per day. You should also list 2 by 4 keys under wall footing forms. The 2 by 4 material is worth 8 cents per lineal foot and since it is scrap material when dug out of the footing, figure on only one use. The labor of installing and removing the 2 by 4 keys should be figured at 500 lineal feet per day.

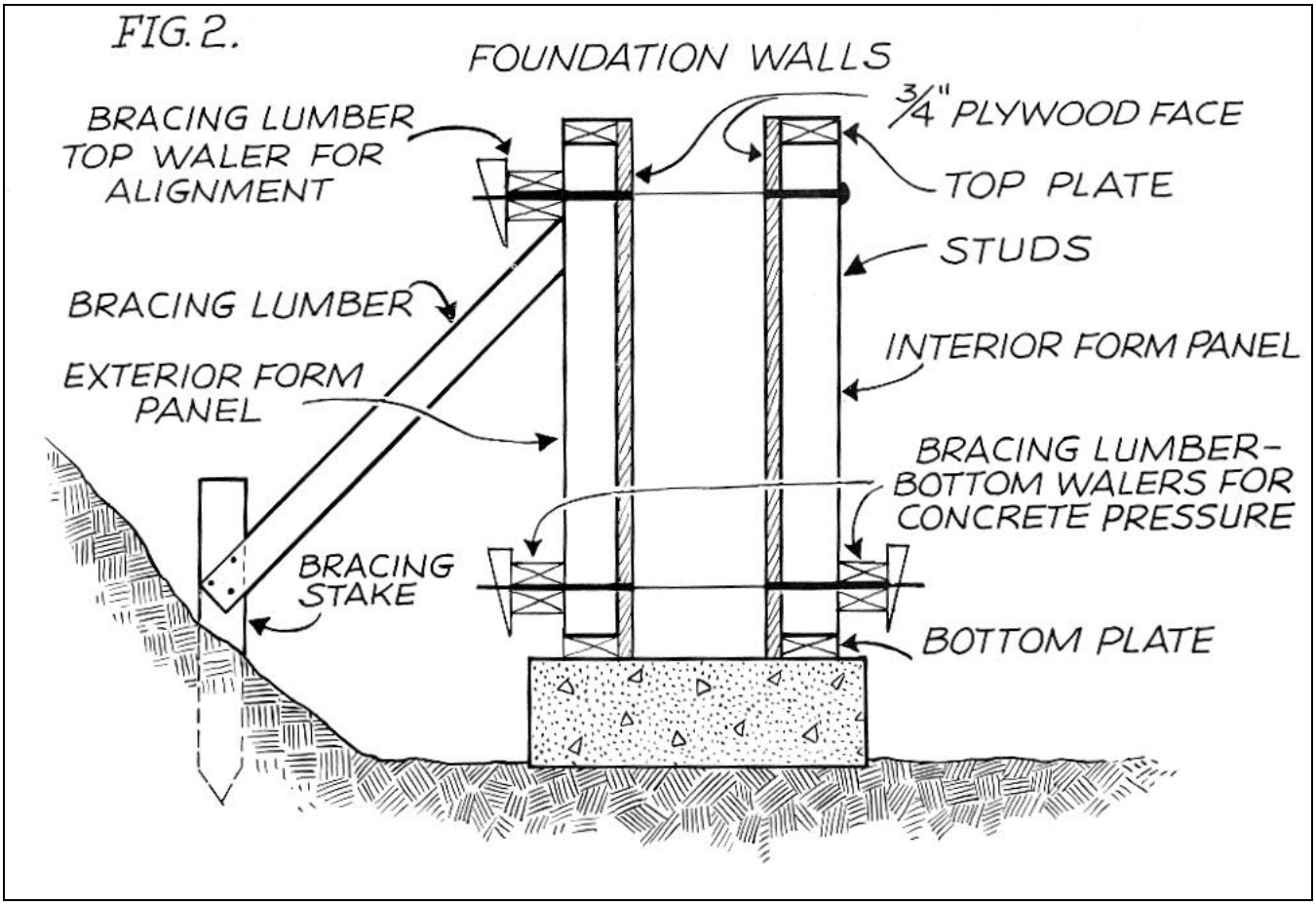
Foundation wall forms

I figure 21 cents per square foot per month rental on wall forms. See Figure 2. Bracing lumber will be about 1/2 a board foot for walls under 8 feet high and 3/4 of a board foot for walls 8-16 feet high. Material form costs for walls under 4 feet high on footings will be rental of 21 cents per month plus 6 cents for 1/2 board of bracing lumber, or 27 cents for three uses. This is 9 cents per use plus 1 cent for ties, nails and oil, or 10 cents per square foot of wall forms.

Material form costs for walls 4 feet to 8 feet high on footings are figured at a form rental rate of 21 cents per month plus 6 cents for 1/2 board foot of bracing lumber, or 27 cents. For three uses, this is 9 cents per use plus 2 cents for ties, nails and oil or 11 cents per square foot of wall forms.

I figure material form costs for walls 8 feet to 12 feet





The square feet of forms includes plywood face, top and bottom plate and studs. The bracing lumber includes walers, diagonal bracing and stakes which are figured to support two sides of the wall forms, and divided by two to get the correct average figure for one side of the forms.

The bracing lumber varies with the height of the wall as follows:
Under 8 feet high = .5 board foot per square foot of forms.
8 feet to 16 feet high = .75 board foot per square foot of forms.
Over 16 feet high = 1.0 board feet per square feet of forms.

high on footings at a form rental rate of 21 cents per month plus 9 cents for 3/4 of a board foot of bracing lumber, or 30 cents. For three uses, this is 10 cents per use plus 2 cents for ties, nails and oil or 12 cents per square foot of wall forms.

For walls 12 feet to 16 feet high on footings, I figure the materials cost the same as 8 feet to 12 feet high walls except I add 3 cents for ties, nails and oil, or 13 cents per square foot of wall forms.

Material form costs for walls over 16 feet high on footings will be a form rental of 21 cents per month plus 12 cents for 1 board foot of bracing lumber, or 33 cents. For three uses, this is 11 cents per use plus 3 cents for ties, nails and oil or 14 cents per square foot of wall forms.

The erection labor for wall forms on footings should average as follows:

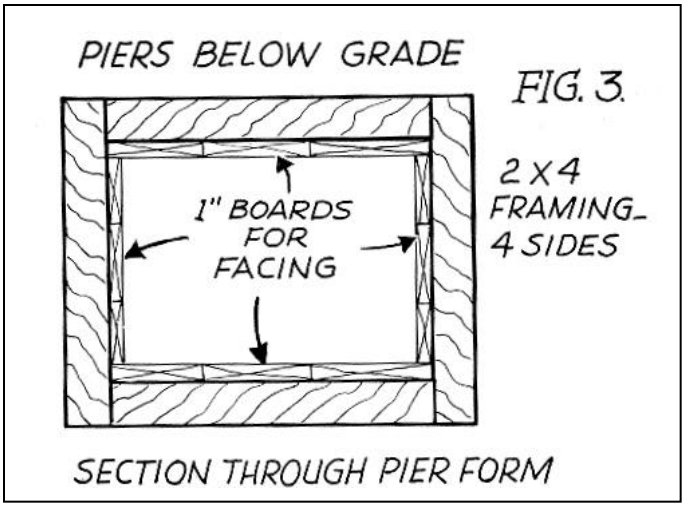
0 feet to 4 feet high—300 square feet per day
4 feet to 8 feet high—250 square feet per day
8 feet to 12 feet high—160 square feet per day
12 feet to 16 feet high—110 square feet per day
Over 16 feet high—100 square feet per day

The stripping and cleaning labor on wall forms should average as follows:

0 feet to 4 feet high—500 square feet per day
4 feet to 8 feet high—450 square feet per day
8 feet to 12 feet high—400 square feet per day
12 feet to 16 feet high—300 square feet per day
Over 16 feet high—200 square feet per day

The above figures are averages for standard conditions. They will vary with each job depending upon its special problems.

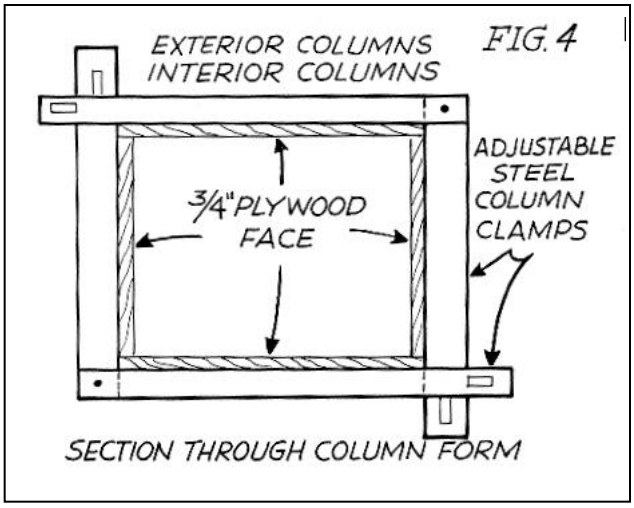
I vary these costs for wall forming in accordance with the following procedure: If a wall has pilasters in it spaced about 10 feet to 20 feet center to center, I include the forming of the pilasters with the wall form totals. I figure it will cost about 10 percent more to form these pilasters in with the wall forms than it would cost to form a straight wall form. Therefore I increase the cost of wall forms with pilasters by 10 percent for both material and labor above the cost of straight wall forming.



Use 1 board foot per square foot for facing

Use 1.5 board feet per square foot for framing and bracing

Total material = 2.5 board feet per square foot of forms.



Figured for average size 12 x 12-inch column

Exterior column or interior column

1 square foot plywood per square foot of forms

1 1/4 board feet bracing and miscellaneous lumber per square foot of forms.

If a wall has no concrete footing under it, the wall forms must be set on a 2 by 6 mud sill. This type of wall is called a grade beam. The cost of this mud sill must be included. It can be done on a lineal foot basis for the material and labor required. However, I prefer to include the cost of the 2 by 6 mud sill in the square foot price of the wall forming. For wall forms on mud sills (or grade beams) I increase the cost of wall forms on footings by 10 percent for both material and labor.

For seat bearing box-outs in the wall for slabs, I price the lineal feet of slab bearing on the wall. The material cost is about 10 cents per lineal foot and the labor output is about 200 lineal feet per day. No stripping on seat bearing is figured since this comes down with the wall stripping.

I figure a carpenter and one-half of a laborer's rate for wall forming on all jobs except residential foundation work. Because of the small size of most residential foundations I eliminate the one-half laborer's rate. In other words, I figure the same labor output per day as given above but I use the rate for straight carpenter time when I set my labor price for erection. This assumes that carpenters will erect residential foundations with the same production per day and not need laborers to handle forms and bracing lumber for them.

Piers below grade

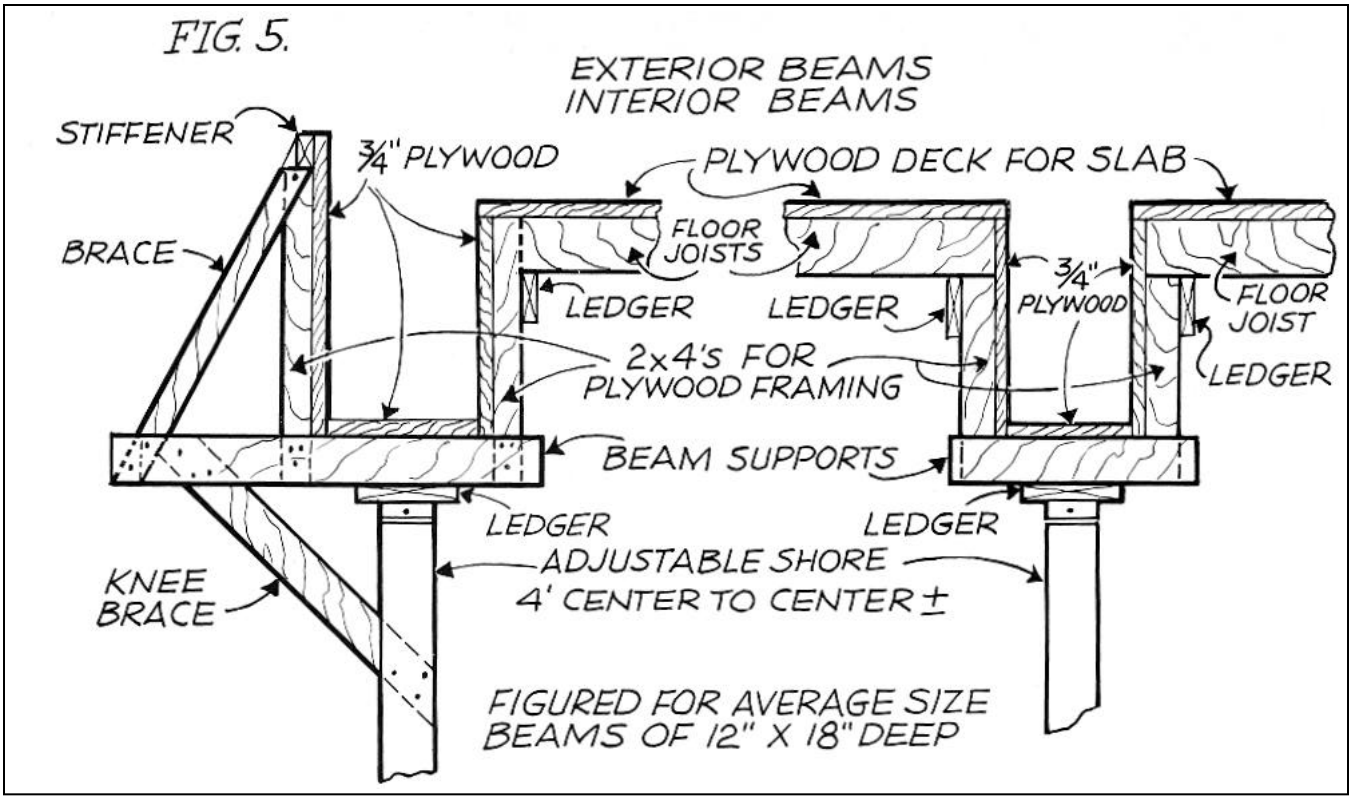
On piers below grade (see Figure 3), I figure regular lumber for forms—1 by 6 or 1 by 8—because they are not going to be exposed. The material, then, works out to be 2 1/2 board feet of lumber. Two and one-half board feet at 12 cents per board foot would figure out to be 30 cents divided by three uses or 10 cents for material plus 2 cents each use for nails and ties or 12 cents per square foot of forms. Forms for piers below grade should be erected at the rate of between 100 and 150 square feet per day. The important thing is the square feet of forming in each pier. A man will only average about one pier per hour. Piers have to be set up on an individual basis. Small stub piers may have only 10 square feet of forms in each one. Ten square feet times eight hours is only 80 square feet per day. Larger piers, 1 foot square by 5 feet high, have 20 square feet per pier. At one of these per hour, a man could make and erect 20 square feet times 8 hours, or 160 square feet per day.

I'm trying to point out here when to look at square footage and when to look at the individual item. On piers below grade I figure 500 square feet of stripping per day.

Exterior-interior columns

For columns I always figure a plywood facing. See Figure 4. Additionally 1 1/4 board feet of lumber per square foot of form is used for bracing. Now, I figure plywood at 24 cents per square foot. Add 3 cents per square foot for adjustable clamps. The total is 27 cents for plywood and clamps, 15 cents for lumber for a total of 42 cents a square foot per use. On columns I generally figure an average of three uses for material. But check the columns out carefully. If you're bidding on a small building with only one story and perhaps only 10 or 12 columns in it, it may be necessary to form up all 10 or 12 columns at once. When the job is over the lumber may have scrap value only. In this case figure 42 cents a square foot for material and only one use for it.

Nails, oil and chamfer strips must also be figured into this estimate. Nails and oil will cost about 2 cents per square foot with no re-uses. If there are chamfers at each



Exterior Beam Forms

1 square foot plywood per square foot of forms

2 board feet lumber per square foot of forms

1 shore per 16 square feet of forms

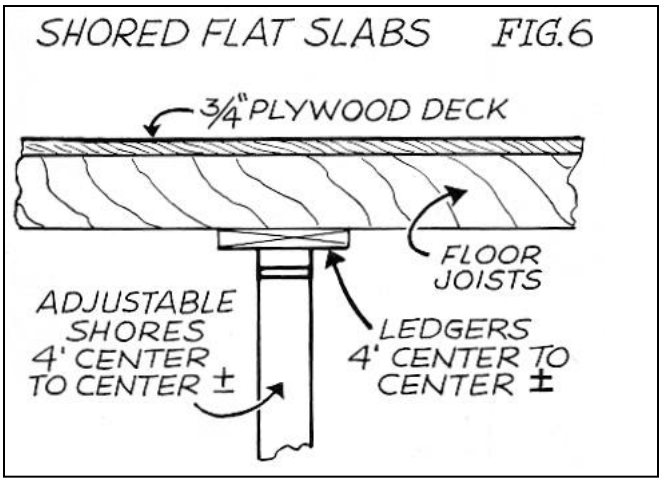
(4 feet center-to-center by 4 feet beam girth)

Interior Beam Forms

1 square foot plywood per square foot of forms

1 board foot lumber per square foot of forms

1 shore per 16 square feet of forms



All slabs = 1 square foot plywood per square foot of forms

All slabs = 1 shore per 16 square feet of forms (4 feet by 4 feet)

Joists—Ledgers and miscellaneous bracing lumber

10 to 12 feet floor to floor, under 8-inch slabs: 1.5 board feet per square foot of forms.

10 to 12 feet floor to floor, 10-inch to 12-inch slabs: 2.0 board feet per square foot of forms.

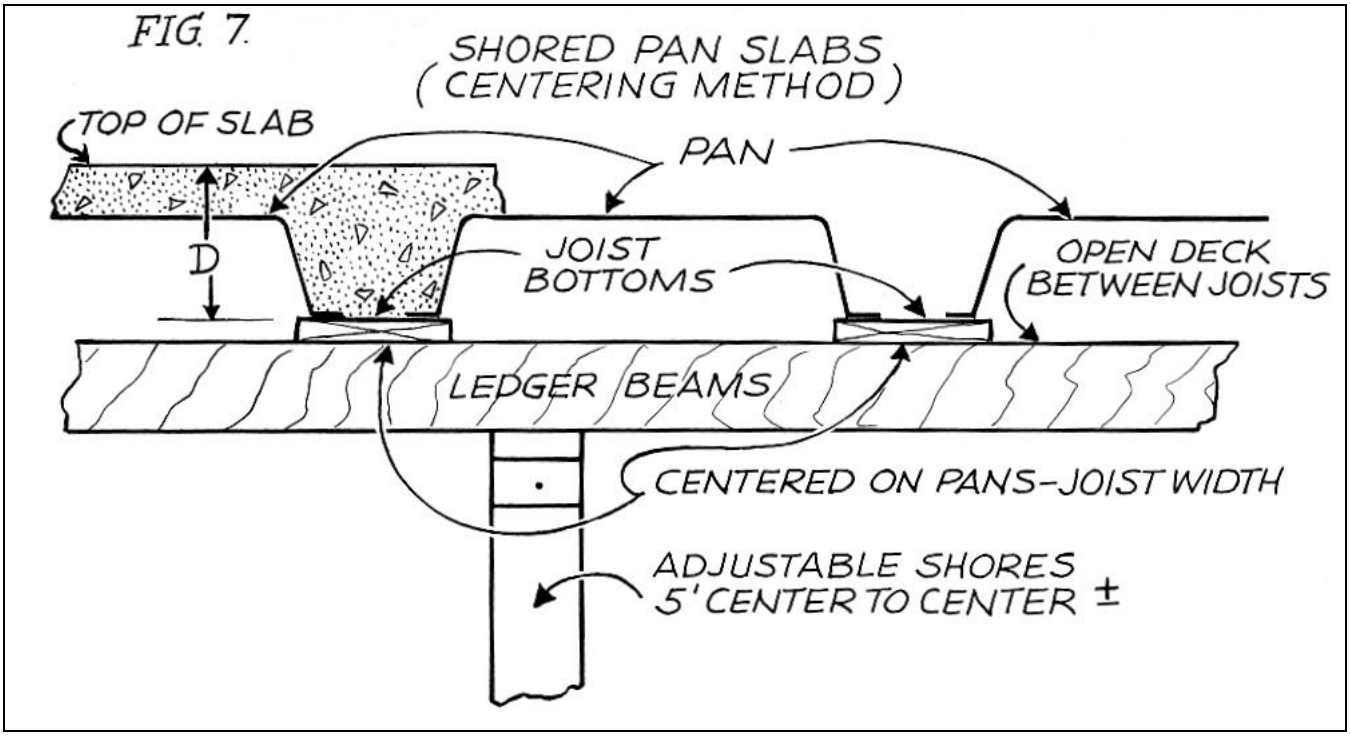
14 to 16 feet floor to floor, under 8-inch slabs: 2.0 board feet per square foot of forms.

14 to 16 feet floor to floor, 10-inch to 12-inch slabs: 2.25 board feet per square foot of forms.

corner of the column, the cost will go up another 2 cents per square foot of form. The material cost for columns including nails, oil and chamfer strips for corners would therefore be 18 cents per square foot of form based on three uses for material (42 cents for form materials divided by three uses equals 14 cents plus 2 cents for nails and oil plus 2 cents for chamfer strips). If the material can be stored and reused sometime in the future on another job, figure three reuses. Do not try to charge everything off on one job.

When I estimate labor costs on exterior columns, I figure a man can make and erect 80 square feet of column forms per day for the first use. If the forms can be reused, I figure a man can re-work and re-erect the same column forms at a rate of 110 square feet per day. Now, if I'm going to use the forms three times, I add up 80 for the first use and 110 for the second and third use when they are re-erecting the same columns. This gives me a total of 300 square feet of column forms for three uses. I divide this by three uses and come up with 100 square feet per day for each use.

On many high-rise structures—particularly apartment buildings where the height often remains constant from floor to floor—it is possible to figure many reuses. And if the columns can be used without re-making them, they'll be reused a lot more than the normal three times.



Open deck = shores and centering only for metal pans

All slabs = 1 shore per 25 square feet of forms (5 feet by 5 feet)

All slabs = Forms figured as total slab area

Joist bottoms, ledger beams and miscellaneous bracing lumber

10 feet to 12 feet (floor to floor) D = 8 1/2 inches to 16 1/2 inches = 1.5 board feet per square foot of forms

14 feet to 16 feet (floor to floor) D = 8 1/2 inches to 16 1/2 inches = 1.75 board feet per square foot of forms

This method of forming for pans is cheaper than solid plywood decking, both for material and labor. However, some contractors always deck solid with plywood for metal pan forms. The reasons are greater safety for workingmen, and the metal pans can be set in place more quickly from a solid deck.

For interior columns, figure a man can make and erect 90 square feet per day the first time because it is easier to work around interior columns of a building than around exterior columns on the outside edge of the building. I figure a man can rework and re-erect the same columns at 120 square feet per day. For three uses, the average is 110 square feet per day.

Exterior and interior beams

The cost of forming exterior beams is considerably greater than it is for forming interior beams. (See Figure 5.) When I estimate exterior beams, I figure 1 square foot of plywood per square foot of beams. The cost then would run 24 cents per square foot for the plywood. The forming and bracing lumber is 2 board feet per square foot or, again, 24 cents. The adjustable shore rental is worth 4 cents per square foot of forms, and all of this totals out to 52 cents per square foot of forms for one use. For three uses this is about 17 cents plus the cost of nails, oil and possibly chamfer strips. Including all of these the cost would run about 20 cents per square foot of forms. I figure a man can make and erect 75 square feet of exterior beam forming per day. If the forms can be reused, I figure, for three uses, a man can make and erect an average of 90 square feet per day.

On interior beams, figure that a man can make and erect these the first time at a rate of 90 square feet per day. Since exterior beams are more difficult to form than interior beams, it will take a man 20 percent longer to form an exterior beam. Remember that an exterior beam will require outriggers and knee-braces as supports.

On interior beams a man should be able to rework and erect an average of 110 square feet per day for three uses.

Now on stripping and cleaning beam forms, a man ought to be able to handle 250 square feet of exterior and 300 square feet of interior beam forms per day.

Shored flat slab

When figuring forms for flat slabs break these up into groups of 10- to 12-feet floor-to-floor, 14- to 16-feet floor-to-floor, and 18- to 20-feet from floor to floor. (See Figure 6.) Very few jobs go over 12 feet, floor to floor.

Break the forming down to show whether a slab is 6 inches, 8 inches, 10 inches or 12 inches deep. Shoring and bracing has to be a lot closer together for a 10- to 12-inch slab than it does for a 6-inch slab. The cost of

material for a 6-inch slab—figuring a square foot of plywood, 1.5 board foot of lumber and shores—is 45 cents a square foot per use. A 12-inch slab will run 51 cents per use.

On a 6-inch slab, figure a man can erect 140 square feet of formwork a day. On a 12-inch slab, cut that down to 120 square feet a day. Figure 240 square feet a day for stripping either slab.

Shored pan slabs

On pan joist construction (see Figure 7), figure 2- by 8-inch centering supports for pans. Solid plywood decking is fine but the cost of materials gets to be too expensive. Figure the lumber for centering at 1 1/2 board feet of lumber per quare foot. And figure 25 feet of floor per shore. The shore rental is about 60 cents per month divided by 25 square feet or about 3 cents per square foot of floor forms. One and one-half board feet of lumber costs 18 cents plus the shores at 3 cents comes to 21 cents per square foot of floor for one use. Three reuses would come to 7 cents per use plus 1 cent for nails makes 8 cents per square foot of forms. You don't have to add anything on for form oil. I figure 240 square feet of pan forms can be erected in a day, and 600 square feet can be stripped in a day. This will vary to lesser amounts for heavier slabs, and greater floor-to-floor heights.

The erection of formwork for 10-inch slabs with 16-foot floor-to-floor heights should be accomplished at the rate of 220 square feet per day. Stripping should proceed at the rate of 500 square feet per day.

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