Unit-Pricing Pitfalls

by Sal Alfano

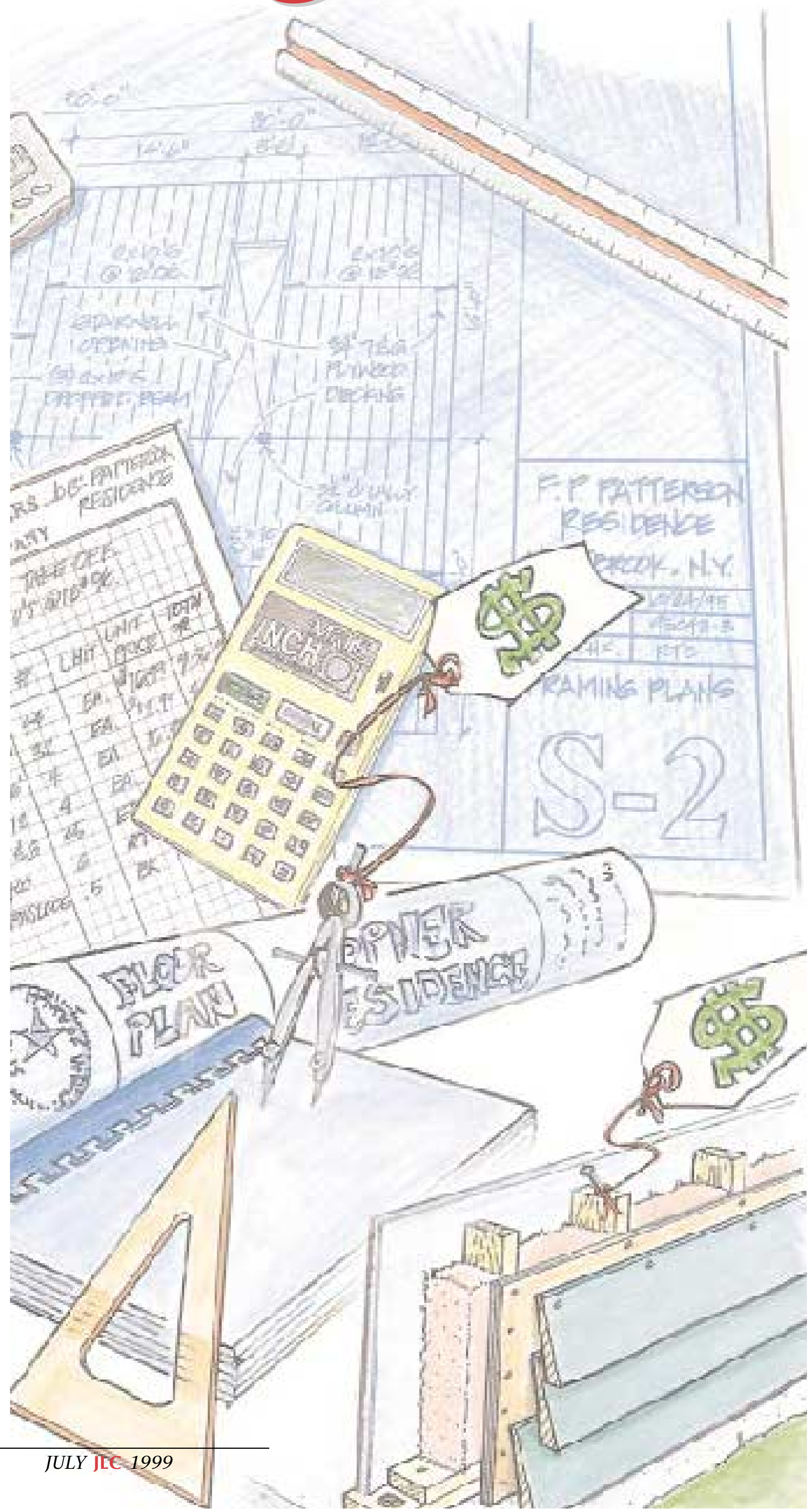
Whether you estimate by hand or with a computer, you probably use square-foot unit prices to calculate some costs. In other words, you use square-foot area scaled off the floor plans to come up with the total cost of construction. Even "stick" estimators, who laboriously count joists and rafters, use unit prices for roofing, drywall insulation, flooring, painting, and other parts of an estimate.

Unit-price estimating is fast, but it's not always as accurate as it needs to be. The method is least accurate when it's applied to the overall square footage of an entire building, but it still

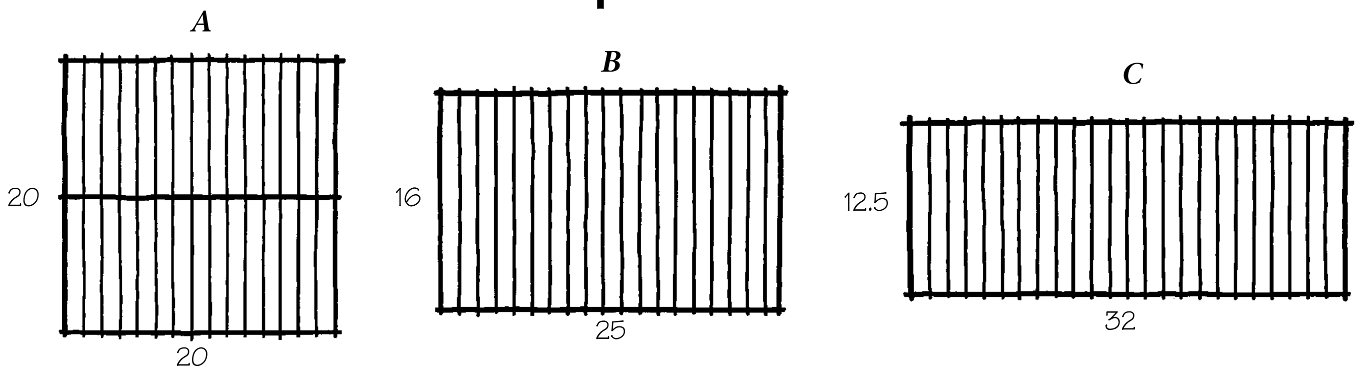
A building's shape affects square-foot costs

falls short when you break a job down into smaller parts and estimate each one separately. The problem is that unit pricing based on floor area doesn't account for the shape of the structure you're estimating.

To illustrate what I mean, let's look at an example. The three simple floor plans shown here all cover 400 square feet (see Figure 1, next page). Their shape, however, varies from a perfect square (A) to progressively longer and narrower rectangles (B & C). Estimating by the square foot, the cost to build each of these floor plans would be the same. A closer look reveals,



How Shape Affects Cost



	Plan A			Plan B			Plan C		
Perimeter	(20+20)x2 =	80 LF		(16+25)x2 =	82 LF		(12.5+32)x2 =	89 LF	
Square Footage	20x20 =	400 SF		16x25 =	400 SF		12.5x32 =	400 SF	

Floor Framing

Beam	6 2x10-10	100 BF	$66		none			none	
Columns	2 @ 3" std	16 LF	30		none			none	
Labor	Crew of 2	2 hrs.	100		none			none	
Joists 2x10@16" o.c.	32 @ 10' =	533 BF	350	20 @ 16' =	533 BF	$350	25 @ 14' =	583 BF	$391
Labor	Crew of 2	2.6 hrs.	133	Crew of 2	1.6 hrs.	80	Crew of 2	2.1 hrs.	105
		Subtotal	$679		Subtotal	$430		Subtotal	$496

Less labor required in B & C because there are fewer joists and no beam or columns

Wall Framing (8' tall)

Plates (3 2x6)	240 LF	240 BF	$123	246 LF	246 BF	$128	267 LF	267 BF	$138
Studs (2x6 precuts)	44 ea.	352 BF	174	45 ea.	360 BF	178	49 ea.	392 BF	194
Sheathing (1/2 CDX)	23 ea.	736 SF	370	24 ea.	768 SF	386	25 ea.	800 SF	402
Labor	Crew of 2	4.1 hrs.	205	Crew of 2	4.3 hrs.	215	Crew of 2	4.6 hrs.	230
		Subtotal	$872		Subtotal	$907		Subtotal	$964

More studs and plywood in C, slightly more labor.

Roof Framing (simple gable roof)

12/12 pitch	22 2x10-16	587 BF	$384	28 2x10-14	653 BF	$437	34 2x10-10	567 BF	$371
Sheathing (5/8 CDX)	20 ea.	640 SF	402	16 ea.	512 SF	321	20 ea.	640 SF	402
Labor	Crew of 2	5.3 hrs.	265	Crew of 2	6.5 hrs.	325	Crew of 2	8 hrs.	400
		Subtotal	$1,051		Subtotal	$1,083		Subtotal	$1,173

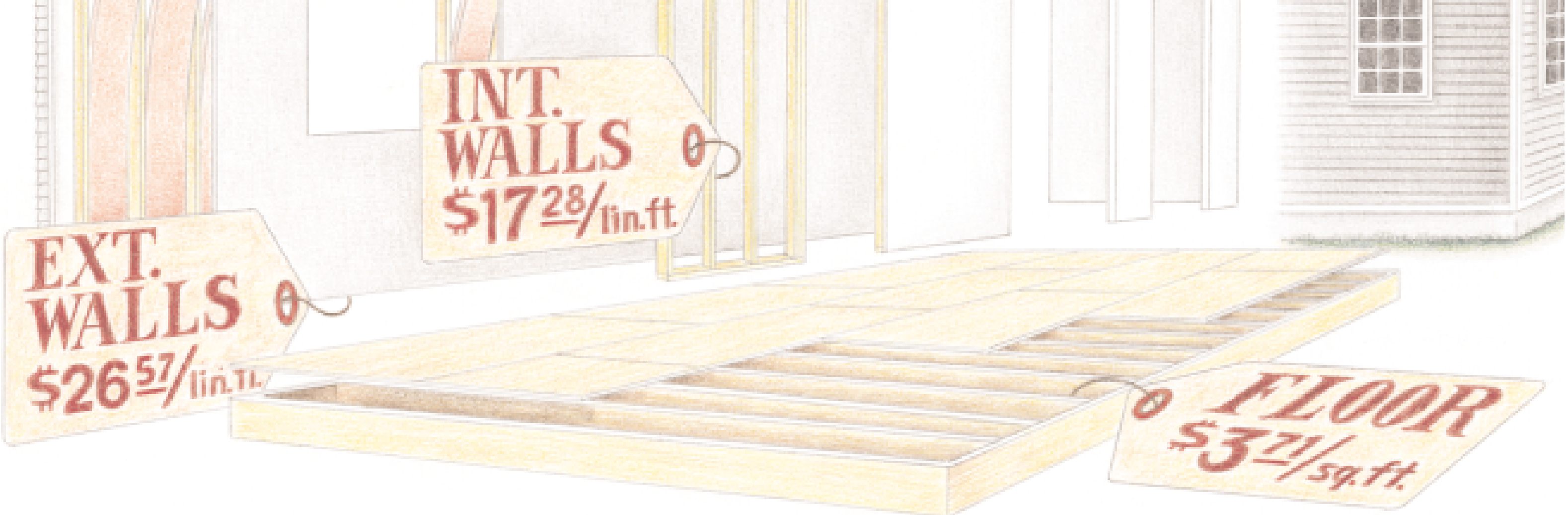
More labor required in B & C, because there are more rafters to install. Less plywood in B.

Insulation	1040 SF	$520	1056 SF	$528	1112 SF	$556
Drywall	1040 SF	780	1056 SF	792	1112 SF	834
Siding	1040 SF	1,560	1056 SF	1,584	1112 SF	1,668
Int./Ext. Painting	1040 SF	3,120	1056 SF	3,168	1112 SF	3,336
	Subtotal	$5,980	Subtotal	$6,072	Subtotal	$6,394

Different perimeter dimensions makes for larger surface area in B & C.

Grand Totals	**$8,582**	**$8,492**	**$9,027**

Figure 1. The square footage is the same in all three partial floor plans. As the sample takeoff shows, however, the cost to build them differs, depending on the shape. (Note: Takeoff is not complete and is intended only as an example.)



however, that the cost actually varies quite a bit, and the difference is a result of the shape.

To see how much the price could vary, let's look at the quick and dirty takeoff, also shown in Figure 1. As we do so, keep in mind that the three shapes we're looking at could be just a small part of a larger floor plan for a two-story building. In that case, any cost differences between them could be five or ten times higher than the figures we'll come up with.

Floor framing. To frame Plan A with conventional joists, we'd need to build a beam at midspan and install columns to hold it up. Since Plans B & C can be framed with 16- and 14-foot joists, respectively, right off the bat Plan A requires extra material and labor to build. (If we flush-frame the beam and use joist hangers, the floor system in Plan A will cost even more.)

When it comes to the joists, Plan A is also more expensive. Even though the joists differ in length in the three plans, the total board footage is about the same, so material costs won't differ much (plywood subflooring is the same for all three, too). But it will take more time to handle, cut, and install the 32 10-foot-long joists in Plan A than it does the 20 16-footers in Plan B or the 25 14-footers in Plan C.

Wall framing. Because the three floor plans are different shapes, the perimeter dimension varies. This affects the linear footage of wall plates we'll need, as well as the number of studs and sheets of wall sheathing. The material and labor differences are small but remember, these shapes could represent just one of several similarly sized rooms, so the total difference in the cost to frame all of the walls could be much higher.

Roof framing. The cost is also different if we estimate simple 12/12 gable roof framing with conventional rafters. Assuming the ridge runs left to right in the illustration, Plan A requires the fewest number of rafters, but the board footage is the highest because each rafter is 16 feet long. Plan B has six additional rafters, which, although only 14 feet long, will require proportionately more labor to install. Plan C has 12 additional rafters that will take half again as long to cut and install as in Plan A. In addition, Plan B requires 25% less plywood roof sheathing than the other two plans. Taking material and labor together, the cost to frame the roof is about the same for Plan A and Plan B, but 8% to 12% higher for Plan C. (Roofing costs are nearly identical — a little over 6 squares for each plan.)

Finishes. Insulation, drywall, siding, and painting are also affected by the different perimeter dimensions. There are an additional 15 square feet to cover in Plan B and an extra 72 square feet in Plan C. Compared with Plan A, the installed cost for all of this work is about 1 1/2% higher for Plan B, and 7% higher for Plan C.

It all adds up. Now that we've got our three floor plans framed and dried in, let's see how these incremental differences in cost add up. Plan B comes in low at $8,492; Plan A is just 1% higher at $8,582. Plan C, however, is 6% more expensive, at $9,027, than Plan A. That difference in cost is just about what we'd take home in profit on the job — and we've only estimated part of the work, so there's still more money to lose. Plus, if we consider that these plans may represent only one part of a more complex structure, the differences in cost are even greater. If the building had a second floor, for example, the dollar differences would be almost double.

Shape Affects Finishes

One final example further illustrates how shape affects cost when using unit prices based on floor area. The three "rooms" in Figure 2 (next page) all contain exactly the same square footage, but they differ radically in shape. Looking only at the cost of running baseboard, we again find that shape affects cost.

Room A is a simple rectangle with four inside corners. A good finish carpenter could run the base in 20 minutes. Plan B is a bit more complex. The short walls on the left side introduce four additional inside corners and four outside corners, plus another 8 linear feet of straight baseboard. The alcove on the right adds another two outside and inside corners as well, plus 10 linear feet of additional baseboard. The carpenter trimming out Room A will take a little longer in Room B and will use more material.

Room C is even worse. It requires 16 linear feet more baseboard than Room A, and its eight inside and four outside corners are going to chew up more of our trim carpenter's time.

The exact difference in cost to run the baseboard will vary — you can do the math. But the point is, if you use a

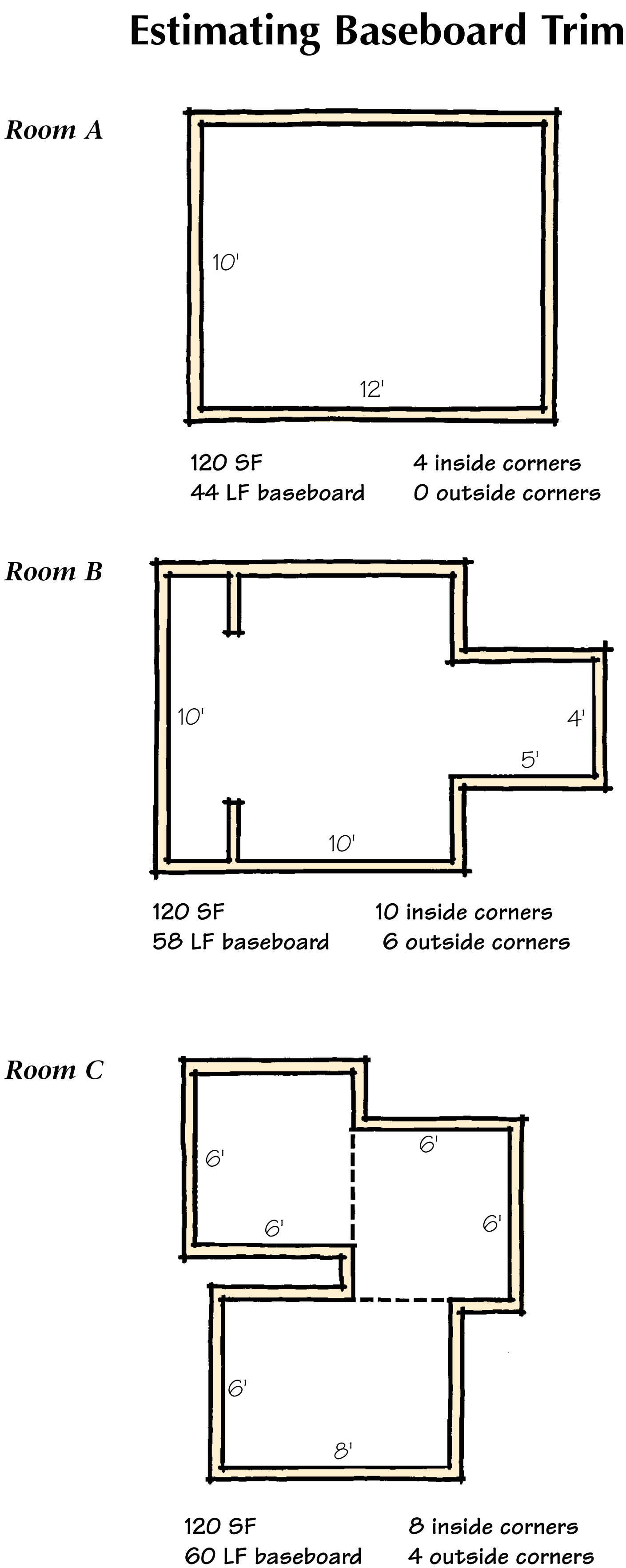


Figure 2. The cost to run baseboard in these three rooms varies, even though the square footage is the same. The more complex shapes increase the linear feet of material needed, and add to the number of inside and outside corners that need to be trimmed.

straight square-foot unit price to estimate the base mold for these three rooms, you'll lose money on Rooms B and C. A linear-foot unit price would be better, but the outside and inside corners — which is where the work is in running baseboard — will still throw off your price. You'll lose even more if the rooms call for crown or wainscoting, both of which are more labor-intensive than baseboard.

Tweak Your Formulas

It's fairly easy to account for these kinds of cost differences if you estimate stick by stick, whether manually or by computer, but you purchase accuracy with the time it takes to laboriously take off the material, item by item. Unit prices are faster, but to improve their accuracy, you need to tweak your formulas to account for small cost differences that accumulate into prices that are either too high or too low.

To solve the problem of running baseboard in oddly-shaped rooms, for example, you might add a step to your unit-price formula that takes into account the number of inside and outside corners. You could either assign a dollar value to "extra" corners or bump the square footage up by a percentage. Likewise, for the floor plans in Figure 1, you need either several formulas or several different unit prices to account for varying shapes. You probably do something like this now for circular structures or off-angle corners, both of which are more expensive to build than rectangular, square-cornered buildings.

As with any unit-price estimating system, the only way to develop and check the accuracy of these new formulas is to compare job-cost data from completed projects. Over time, you should be able to tweak your pricing so that the 5% or 10% additional cost to build an oddly-shaped building comes out of your client's budget, not your profit.

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