Making Arches Work

by Jamie Fisher

"I asked the brick what it wanted to be and it said, "I want to be an arch."
— Louis I. Khan

Every day on my way to work, I drive past a house (see Figure 1A) that has bugged me since it went up. The second floor has two big picture windows flanking an arched opening. While the detailing and finishes are way above average, the place just looks wrong. The problem is with the arch.

No element in the architectural repertoire is more elegant than the arch. Used alone, an arch makes a universally understood formal statement about what is important. Used in repetition, the arch creates a wonderful rhythm.

Unfortunately, no element is so misused as the arch. While this column can't begin to cover all situations, these three rules will help you avoid some common mistakes.

Think Brick

One problem with the arch shown in Figure 1 is that the windows to either side are wider than the arched opening. This flies in the face of our intuitive understanding of the arch's structural origin and role, which was to give unreinforced masonry a way to span a wide opening. Few arches in residential construction these days are structural (if, indeed, many ever were), but the arch's structural origins are at the root of what works and doesn't work visually. In this case, the subconscious mind asks, "If an 8-foot span doesn't require an arch, why does the 6-foot span need one?" The rational mind knows that a hidden lintel can handle any span; but the eye (and the heart!) still wants to see the arch span the longer distance.

Arches Should Soar

The second problem with this house is that the arch's crown lines up with the tops of the flanking windows. Besides making the arch itself squat and puny, this sizing makes the arch subordinate to the larger, higher rectangular windows, which is inconsistent with the form of the arch and with its central location. Rather than something greater than the ordinary, the arch becomes something less than the ordinary.

A better solution is to keep the window heads at or below the arch's spring line, to reinforce the arch's hierarchy

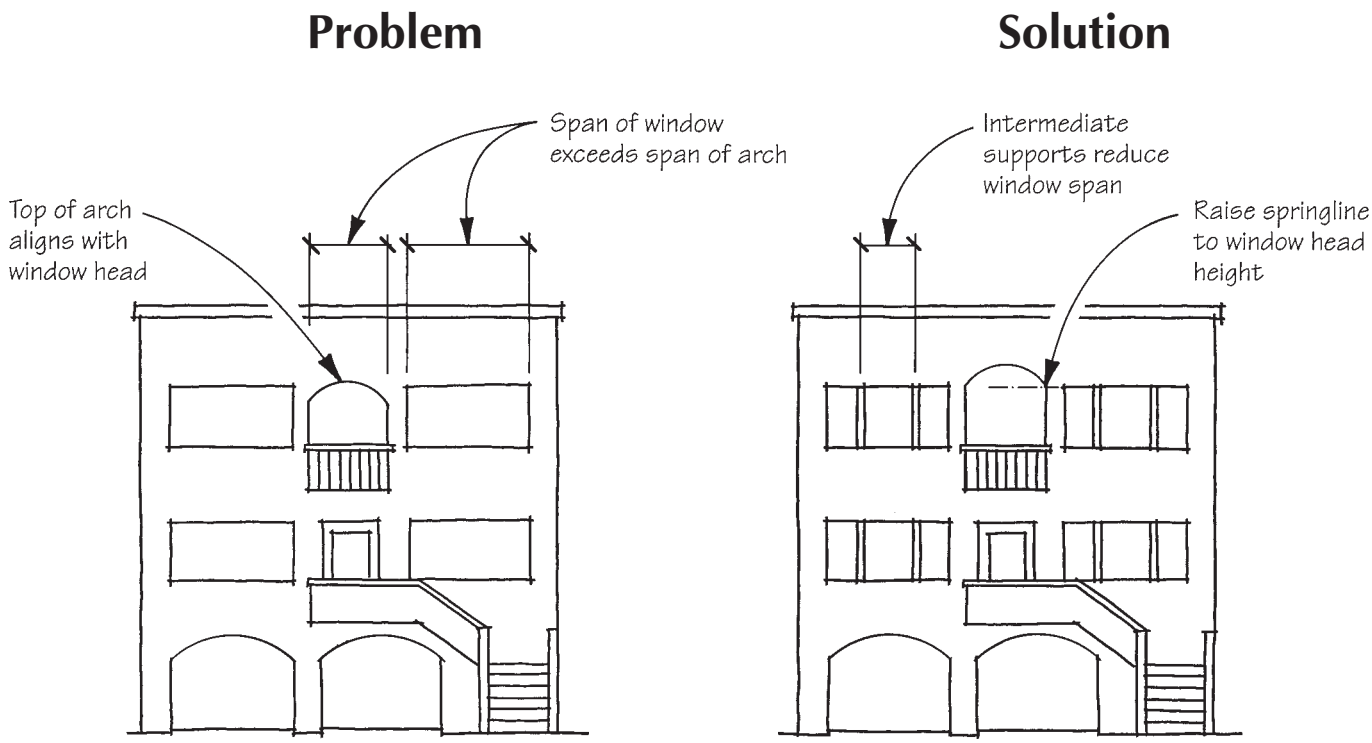

Figure 1. The undersized arch at left makes the entire house look out of whack. Raising the arch (right) and reducing the visual "span" of the flanking windows brings the design into better balance.

Matching Arches of Different Widths

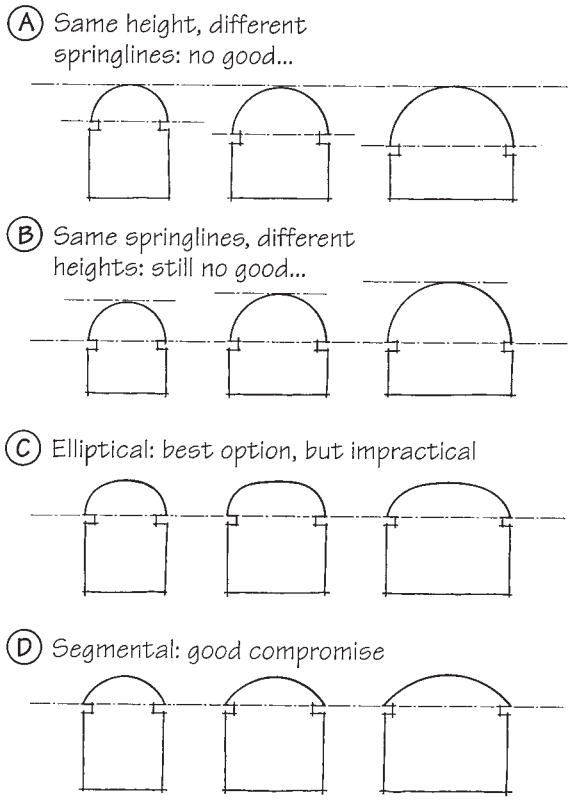

Figure 2. To avoid looking awkward, as in A, arched openings of identical heights but similar spans should have spring lines at the same height. However, half-circle arches rising from the same spring line, as in B, won't work. What's needed is either an elliptical arch (C) or a segmented arch (D).

over the rectangular openings. This solution also harkens to the arch's origin as an alternative to the lintel, since the bottom of the arch essentially assumes the lintel's location.

Match Heights and Springlines

Figure 2 illustrates another problem: What to do with arched openings of different spans? In A, I've aligned the crowns of three arches and let the spring lines fall where they may. This is the worst solution. In B, I've aligned the spring lines and let the crowns rise to where they may, which is only slightly better. In C, I've given the arches a common spring line *and* a common crown height. This is the correct way to go, but it requires an arch with a more sophisticated geometry.

A Roman arch (a half circle as in A and B) obviously can't meet all the constraints. The one arch that can is the elliptical arch (C), which can easily be laid out with a string. (Don't know the string trick? Cut a piece the length of the span, nail the two ends to the spring line far enough apart that the middle of the string, when pulled taut, just reaches the crown. Run your pencil around the inside of the string and you've got it.)

But although the elliptical arch works well for actual openings, don't expect many window manufacturers to have elliptical units in their product line. Fortunately, however, most manufacturers will make a radial segmental arched window (as in D). This looks just as elegant as the elliptical arch, meets the constant-spring-and-crown criteria for different spans, and is much easier to manufacture. Three dimensions will define the window: the width, the overall height, and the height of the rise. You can leave it to the window manufacturer to compute the required radius. As long as the variations in span are not exceedingly severe, the arches will look at home side by side, and it's well worth the custom order to give the arches the elegant proportions they deserve.

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