Sizing Arbor and Pergola Framing

Q In Bobby Parks' recent article about the design and construction of arbors ("Tips for Building Arbors," May/June 2013), his guidelines for sizing beams and rafters seem to be based mostly on aesthetics. But what does the building code have to say? After all, some plants in full leaf can be quite heavy, and in some parts of the country, snow loads could be an issue.

A Contributing editor Glenn Mathewson, a building inspector in Westminster, Colo., responds: There are no prescriptive structural standards for shade structures, so local jurisdictions are left to fend for themselves or require engineering, especially for elaborate and large designs. Here is how my office handles it, though keep in mind that the article's author lives in Georgia, where there are no snow loads to deal with.

When a deck structure has slats on top that are closer together than 3 inches, we require it to be designed for the full 30-psf snow load in our region. This is based on the International Residential Code (IRC) plumbing requirement of a minimum 3-inch diameter for a rooftop vent that's subject to snow closure; if snow can bridge over a small pipe, it can also bridge an opening between closely-spaced slats.

When the slats are 3 inches or more apart, the structure must be designed for a 20-pound live load. This is the IRC live load requirement for "attics with limited storage," a fair comparison to the load on a pergola supporting vegetation, snow accumulation, a hanging swing, hanging potted plants, and the like. Depending on the design (some structures have minimal material overhead), the live load requirement may be reduced to 10 psf, the IRC requirement for "attics without storage."

As for dead loads, it's also fair to use less than the standard 10 psf provided in most span tables (the American Wood Council has a nice online span calculator at awc.org that provides for many different species of lumber, live and dead loads, and spans). It's hard to find pre-engineered references for sizing beams, however. While the AWC's prescriptive deck-construction guide DCA 6 (also at awc.org) provides beam spans for various timbers and species, those spans are based on 40-psf live loads.

Ultimately, few pergolas are engineered, and most building departments are relaxed about the subject, relying on experience and comparisons to similar structures to determine sizing. More often than not, shade structures are designed with oversized framing to begin with; when the members are overspanned, it's likely going to lead only to excessive deflection, not catastrophic failure.

Handrails for Wide Stairs

Q My clients would like a very wide stairway — more than 8 feet wide — leading up to their deck. Will the stairs need more than one set of handrails because of the width?

A Glenn Mathewson responds: The short answer is no. Under all editions of the International Residential Code (IRC), only one handrail on one side is ever required, regardless of the width of the stairs.

In comparison, the International Building Code (IBC) — which regulates public buildings — requires handrails on both sides of any stairway. Why care about the IBC? Because certain homeowners may choose a greater level of safety and refer to the IBC, in which case it helps to have an understanding of how the same feature in a public setting would be handled.

Under the IBC, there must also be an intermediate handrail for every 60 inches of stair width — at any place on a set of stairs, a handrail must be no more than 30 inches away. Required stair width, in turn, depends on the number of occupants expected to exit the building. Public buildings (and every space inside them) have a maximum occupant load, based on the size and occupancy type of the space (business, residential, mercantile, storage, and so on). For a non-fire-sprinkled building, the IBC requires 0.3 inch of stair width for every occupant. What this means is that even in a public facility, the occupancy load would need to be more than 100 occupants before the IBC would require a stairway wide enough to call for an intermediate handrail.

In a private home, an intermediate handrail would rarely, if ever, be needed under IBC requirements. To illustrate why: The rating for a "residential" occupancy in the IBC is one occupant (not visitors) per 200 square feet. A home and deck would need to be more than 20,000 square feet to have a large enough occupancy load to require a stairway that was 60 inches wide and needed intermediate handrails. It's not impossible to have that many occupants in a home, but it's not the norm. If your clients are entertainers, and the house or deck is very large, maybe it's worth providing additional handrails, but that's a personal choice and not a requirement under either the IBC or IRC. ❖