Noncombustible building construction

by Tom Bollnow

Designing steep-slope roof assemblies for new buildings or additions encompassing Type I or Type II construction and certain occupancy groups can present problems with no apparent solutions. Building code requirements often present obstacles that are difficult to overcome. The following is an example of such a challenge and is based on an actual situation encountered by NRCA's Technical Services Section through its technical assistance program.

A real-life example

An existing building complex serves as the campus of a small Midwestern liberal arts college established more than a century ago. The buildings are masonry constructions and vary in height from three to five stories. The dormitories are four- and five-story buildings with steep-slope roof assemblies, which consist of steel structural members, wood board decks and slate roof coverings. The institution wants to build additional dormitory space and match the existing historical design elements.

However, matching the existing roof system using recommended industry best practices *and* complying with current building codes poses a problem.

The *International Building Code, 2006 Edition* (IBC) classifies the occupancy of the dormitory as Residential Group R-2. The structure is classified as Type I or Type II construction per Chapter 6 of IBC.

Section 602.2 states, "Type I and II construction are those types of construction in which the building elements in Table 601 are noncombustible materials, except as permitted in Section 603 and elsewhere in this code."

The building elements referenced in Table 601 contain roof construction, including supporting beams and joists. An exception to the noncombustible materials requirement is allowed where every part of the roof construction is 20 feet or more above any floor immediately below. As designed, the dormitory structure does not meet the exception.

Code-compliant alternatives for supporting beams, joists and a roof deck would include steel structural members and noncombustible deck materials. Noncombustible steep-slope deck materials include metal, gypsum plank, cementitious wood-fiber panels and nailable concrete plank.

NRCA recommends installing a panel wood deck or batten system on noncombustible decks to support a finished steep-slope roof system. Unfortunately, the introduction of any wood or combustible components is not allowed per a strict interpretation of the code.

At the risk of appearing simplistic, there are unrealistic and impractical solutions. The new structure could be constructed leaving the top two floors (20 feet) unoccupied. This would comply with the exception allowing combustible materials—including fire-retardant-treated (FRT) wood—if the roof is more than two stories high and vertical distance from the upper floor to the roof is more than 20 feet. However, this solution surely is economically unfeasible.

Another solution would be to bypass accepted industry good practice and create a clip, hook or wire-tie system directly over a noncombustible deck. Wire-tie application of slate is used sparingly for small cut pieces in valleys and around penetrations but not recommended for a whole roof system. Clip or hook installations would depend on using noncombustible battens and generally are limited to size and thickness of slate pieces. These noncombustible systems risk fastener and mechanical damage problems, leading to shorter life expectancy.

To solve these problems, alternative design configurations would need to be evaluated on a job-by-job basis by local jurisdictional building code officials for compliance variances. Possible configurations include:

1. Steel roof deck: layer of approved fire-resistant board, layer of minimum ⅝-inch-thick CDX or FRT plywood, layer of approved fire-resistant gypsum board—all fastened to the steel deck

2. Noncombustible roof deck: layer of minimum ⅝-inch-thick CDX or FRT plywood, layer of approved fire-resistant gypsum board—both fastened to the noncombustible deck

Evaluation

The alternative design configurations offered should be evaluated and tested for fire-resistance properties by an approved testing laboratory, such as Underwriters Laboratories Inc. Although the scenario presented is for a specific building construction, similar design parameters can exist for new construction intended to achieve a particular architectural goal.

Tom Bollnow is an NRCA senior director of technical services.