A Better Base

By Paul A. Rouis, III, P.E.

As the old adage goes...*the devil is in the details*. This article will focus entirely on one of the most frequently used, yet least thought about details — the column-to-foundation/slab intersection.

Approximately 20 years ago, a typical detail for this condition might well have been similar to *Figure 1*. This detail was used for a variety of reasons, including the ability to block-out the slab pour for subsequent erection of structural steel and to accommodate the larger dry cut saws used to install the contraction joint which could not get too close to the column if it was already installed.

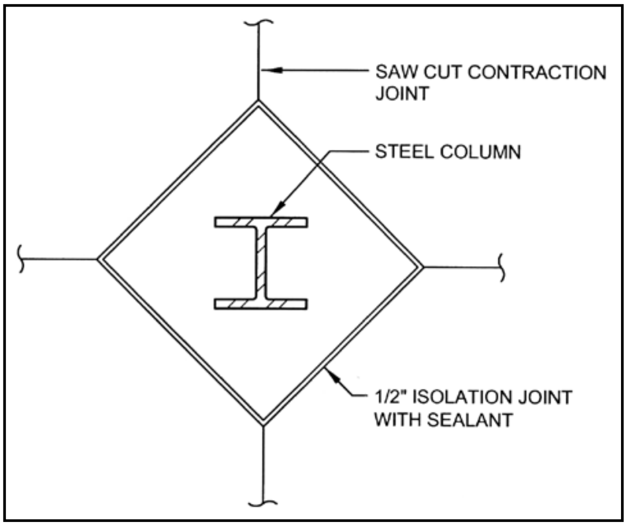

Figure 1: Plan View

Use of this detail often led to problems with floor finishes over the isolation joints since they usually were outside of the column enclosure and also raised concerns from building owners about foundation settlement after noticing a vertical displacement at the isolation joint. In actuality, this was usually the slab curling upward, not the footing settling. Another concern with this detail is the likelihood that rainwater can flow into the slab blockout and saturate the slab subbase, leading to moisture-related flooring problems. After experiencing these types of problems, many designers moved the isolation joints inward to the column face and required column erection prior to slab placement. (*Figure 2*)

The revised detail solved several of these problems. With the use of early entry saws (i.e., Soff-Cut™), the contraction joints could be installed closer to the column and the last few inches generally crack fairly straight into the isolation joint material. For floor slabs that will be covered, most of the complaints stopped; but for exposed slabs, increased cracking was evident near the column even if reinforcing bars were installed in the slab. Investigation by the author attributed this to column anchor rods projecting into the slab pour. (*Figures 3a* and *3b*) With structural steel erection standards requiring the use of four anchor rods, the rods are typically offset far enough from the column that they are well beyond the isolation joint location. It is important that the column base plate elevation be lowered such that the projection is below the underside of the slab. Since the bottom of the column and the base plates will be in contact with the subbase, it is important to consider appropriate measures for corrosion protection. The following three types of protection are commonly used: passive, barrier, and cathodic depending on the anticipated potential for corrosion.

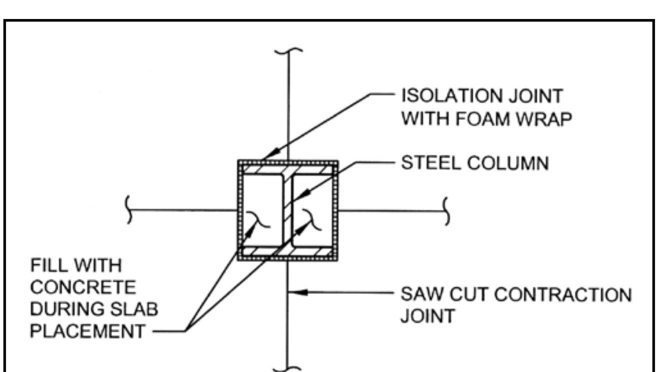

Figure 2: Plan View

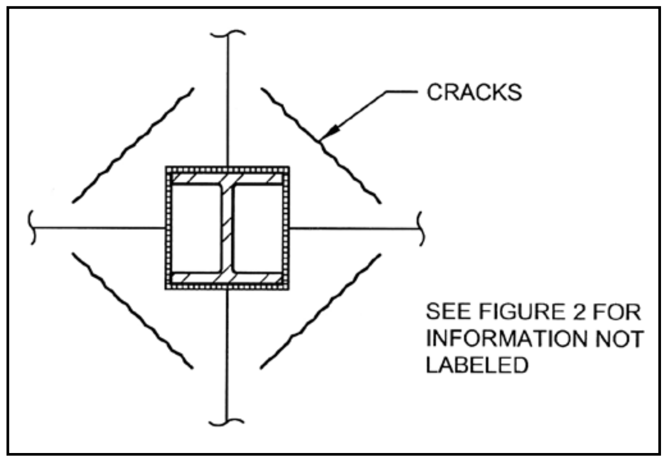

Figure 3a: Plan View

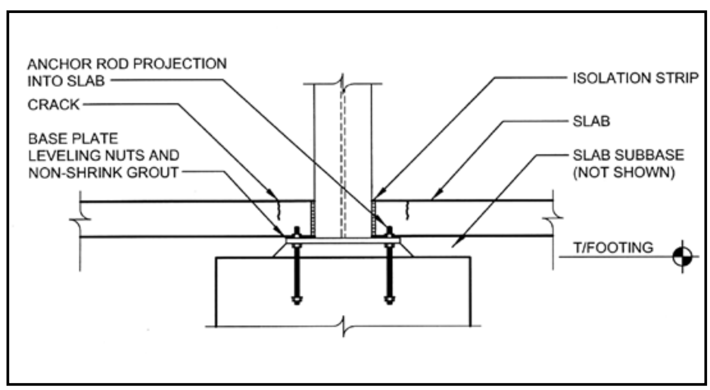

Figure 3b: Section View

Passive Protection

An example of passive protection would be encasement of the base plate, anchor rods, and bottom of the column shaft in a lean concrete collar that is not bonded to the slab on grade. (*Figure 4, page 14*) The naturally high pH of the concrete encasement will provide some passive protection to the slab. This may be suitable for use on interior columns where groundwater or a wet use on the slab above is not anticipated. A significant disadvantage is the additional labor required to form and install the collar.

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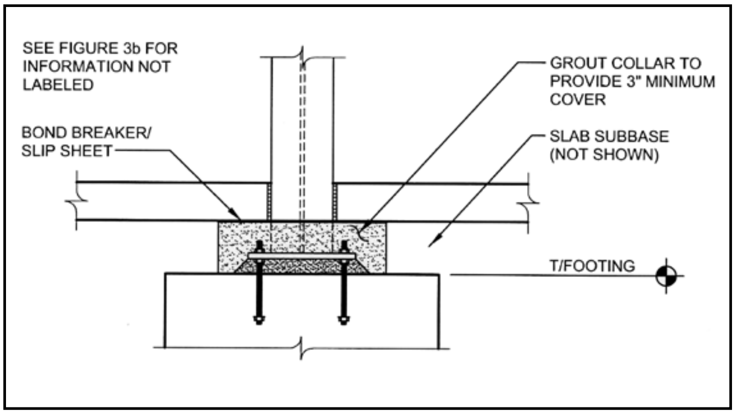

Figure 4

Barrier Protection

Barrier protection involves coating the base plate, anchor rods, and bottom of the column shaft with a protective coating. The coating keeps moisture from coming into contact with the steel surface and starting a corrosion cell. Inexpensive mastics were historically used for this purpose. Their use has all but disappeared since they had such high concentrations of volatile organic compounds (VOCs).

Figure 5

Today, high performance, two-component polyamide or coal-tar epoxies are being used for this application. These coatings are fairly expensive, and some may not comply with VOC limits, which are becoming even more stringent. These coatings are typically applied by laborers and not a coating specialty contractor, often with minimal surface preparation well short of the manufacturer's requirements. In order to realize the protective benefit of these coatings, proper surface preparation is critical. The coating manufacturer will typically include the required surface preparation referencing the Steel Structures Painting Council (now The Society for Protective Coatings) Standard Surface Preparation Numbers as follows: SSPC-SP#.

Many of the coatings available for use with moderate surface preparation that can be accomplished in the field (SP3-Powertool Cleaning) are not intended to be used without a top coat. This is rarely done in practice.

Figure 6

As an alternative, the author has utilized a spray-applied, automotive undercoating material for this application with good success. It requires minimal surface preparation, offers good adhesion, and to a degree, a flexible isolation joint between the slab and column face.

Barrier coating systems usually perform adequately despite the installation shortcomings in interior applications. Exterior columns at porches and canopies or columns in more aggressive environments such as pools or chemical processing facilities are much less forgiving. (*Figures 5* and *6*) In these environments, use of a cathodic form of protection is suggested.

Cathodic Protection

Cathodic Protection involves the application of a zinc-rich coating or hot-dip galvanizing the column. In addition to providing a barrier, the zinc will sacrifice itself and react with moisture penetrating any breaches in the coating, thus protecting the underlying steel from corroding. When using zinc-rich primers and field-applied topcoats, it is important to carefully select and specify the coating materials and monitor the installation.

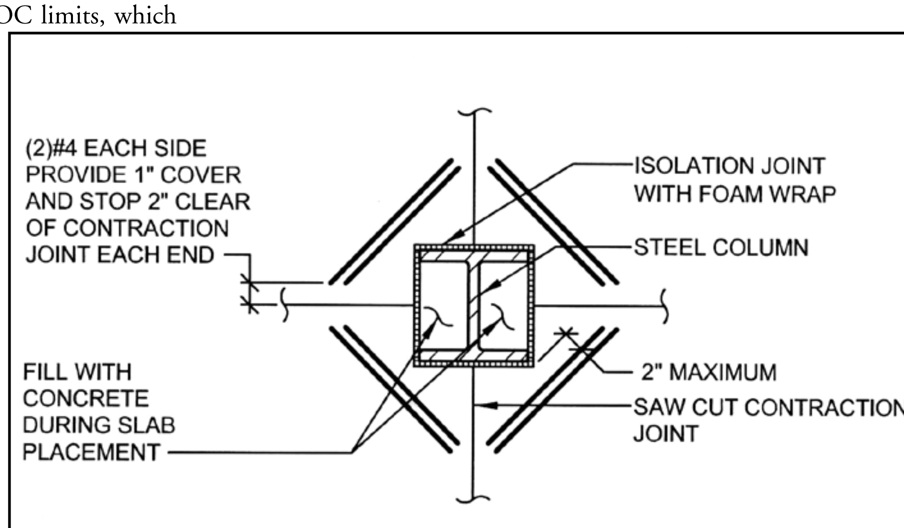

Figure 7a: Plan View

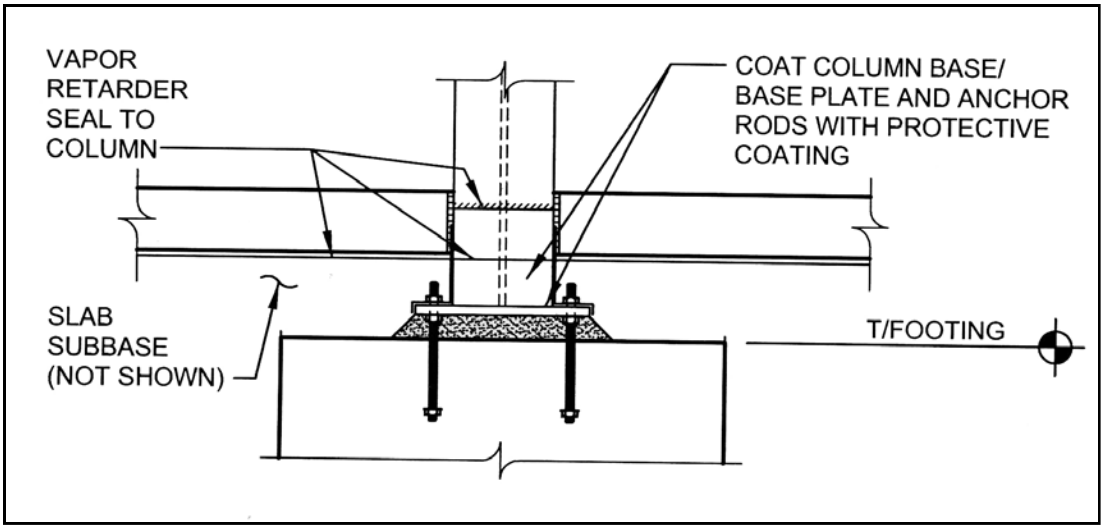

Figure 7b: Section View

Moisture-related flooring problems have become much more prevalent since adhesives were also modified to reduce VOCs. To help mitigate these problems, the installation of a good quality vapor retarder below slabs that will be covered is needed. It is important that the retarder be detailed properly where it is penetrated at the column base/slab intersection to prevent moisture problems from occurring with the flooring or gypsum wall board column enclosure if one is used. The retarder should be sealed to the column with the manufacturer's approved tape or mastic. Care should be taken to avoid puncturing the retarder with the anchor rod projection.

Suggestions for Isolation and Reinforcing

The use of a thin (⅛ inch +/-) foam isolation strip is suggested at the column face to ensure a bond break and to allow for some differential shrinkage.

The use of a pair of short reinforcing bars located diagonally at the reentrant corner of the isolation joint is suggested to keep any cracks that form tight, and to prevent them from migrating into the slab panel. For best performance, the bars should be located high in the slab and within 2 inches of the column. They should not extend past the contraction joints at either end or they will "short-circuit" the joint and cause cracking of the slab.

Consider the revised detail shown in Figures 7a and 7b. With some tweaking from the previous details, a marked improvement in performance can be gained.▪

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