

## Dear Editor:

**I**N READING AND REVIEWING BOLT BULLETIN No. 5 (THE EFFECT OF BURRS ON THE SHEAR CAPACITY OF BOLTED CONNECTIONS) in the January 1996 issue of *Modern Steel Construction*, I noticed that no concern was expressed about the adverse effect that large burrs would have on the durability of such connections when used in exposed environments. Presumably, connections containing 1/8-in. burrs would have noticeable gaps between the members of a connection, gaps that probably could not be sealed by usual painting practices. Such unsealed gaps or joints would expose faying surfaces to contaminants not only detrimental to slip resistance, but also and ultimately to the destructive effects of pack rust corrosion.

Consequently, it seems inappropriate to consider the acceptability and quality of bolted connections primarily on pristine laboratory conditions.

Sincerely,

**Martin P. Burke, Jr., P.E.**  
*Burgess & Niple Engineers & Architects*  
Columbus, OH

**Response from William A. Milek, P.E., secretary of the Research Council on Structural Connections (RCSC):**

**B**ULLETIN No. 5 OF THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS was developed because unwarranted across-the-board total removal of burrs by grinding—a very costly hand operation—is frequently required by contract specifications on the assumption that burrs reduce the strength and slip resistance of high-strength bolted joints. The tests were conducted to provide independent confirmation of earlier tests cited as justification for Commentary, Section C3 Bolted Parts, fourth paragraph of the

Specification for Structural Joints Using ASTM A325 or A490 Bolts. (Incidentally, new LRFD and ASD versions of this Specification were printed last month and can be purchased from AISC for \$10 each by calling 800/644-2400.)

Mr. Burke is correct in pointing out that serviceability concerns must be considered as well as strength and slip resistance in the specifications for design and fabrications of steel structures. Gaps, which painting may not seal between the edges of mating parts in completed bolted joints, may be a source of destructive corrosion.

Corrosion of steel or iron is a chemical process operating on a molecular scale that will continue so long as conditions exist for re-supply of moisture and oxygen to the steel surface. Because the ratio of the specific gravity of iron oxide to specific gravity of steel is 0.67, the products of corrosion of steel occupy approximately 49 percent more space than the steel from which it is formed. As a result, the bulking of the corrosion products between connected parts have the potential for grossly distorting connected parts and even fracturing the fasteners.

### SPACING & EDGE DISTANCE

In addition to the need to provide tightness at bolts for corrosion resistance, as well as strength and slip resistance of joints, the AISC Specifications contain provisions for maximum edge distance and maximum spacing of fasteners in Section J3.5, which is based upon consideration for corrosion effects. Notice in this provision that the requirements apply to parts in contact (rather than parts separated by spacers on the assumption that spacers will provide access for maintenance painting) and that the requirements are different for members in a protected environment within a building or painted than for unpainted members exposed to atmospheric corrosion. Note

that the most restrictive requirements apply to unpainted weathering steel. These spacings and edge distances have been shown by many years of experience to prevent “quilting” of the material between fasteners that would prevent sealing of the joint by paint or would prevent development of the corrosion resistance characteristic of weathering steel.

### GROSS BURRS

Gross burrs were intentionally introduced in the research specimens for the purpose of testing their effect on strength of joints and the reported tests did demonstrate that burrs caused no deleterious effect on structural performance, which confirmed earlier test programs. It must be noted, however, that the Bulletin does not recommend that such gross burrs be adopted as the criteria for good workmanship and inspection. It does not suggest more liberal limits, but rather provides support for the existing Bolt Council's Specification requirements that states that small burrs ( $1/16$ th in. or less in height) need not be removed provided they do not prevent solid seating of the parts. The Specification also requires that in the snug tight condition the material must be in firm contact, but not necessarily continuous contact. Small burrs will be sufficiently flattened by the snug tightening operation and will assure that any gaps that might remain between mating parts will be very small. Also, for slip-critical connections, it is required that special attention be given to the additional tightening to assure that any spring in the parts resulting from the very small gaps at snug tight will be overcome.

The permissible condition in the Council's Specification that material is not always required to be in continuous contact when snug tight is not related to the presence or absence of burrs, but rather in recognition of the fact that with thick material (that

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perhaps is not perfectly flat) it may not be possible to achieve continuous contact at the snug tight condition.

If the requirements of the Council's Specification are adhered to, the design strength and slip resistance will be provided. Any small gaps that might remain at the bolt locations will be small enough that painting will be effective in providing protection against atmospheric corrosion. Further, provided the requirements of the AISC Specification limits on maximum edge distance and maximum spacing are adhered to, any gaps between mating material between fasteners will be small enough that painting will be effective in providing protection against atmospheric corrosion.