

### METRIC Q & A

The last issue presented some basic facts about metric in construction. This issue answers the most common questions we receive.

**Is the federal government really serious about metric?** Metric is mandated by federal law and presidential executive order. Although some agencies are moving faster than others, they all are in the process of converting. Without a doubt, government is "going metric."

**How does this affect the construction industry?** The buying power of the government is enormous. By the mid-1990s, most federal construction as well as state and local work tied to federal grants and programs will be designed and built in metric.

**The construction industry is primarily a domestic industry. Why does it have to convert?** The federal law is intended to increase America's competitiveness. Some basic construction products like brick, block, and concrete are made and used locally, but a surprisingly large number are or can be exported (e.g., glass, coatings, finishes, fasteners, structural steel, wood and wood composites and most electrical, HVAC, mechanical, plumbing, and conveying equipment). American A/E/C services, which have been exported worldwide for decades, also represent an important part of the industry's revenues.

**If construction goes metric, won't that eliminate one more barrier to imported products?** Yes, but the alternative is restricting our products and services to within our own boundaries while the rest of the world goes about its business and excludes us.

**What is the construction industry's response to metric?** In general, it is positive. After all, we all read the newspapers and know we have to improve our inter-national competitive position. So the message from the industry is: "We understand the need to change--just don't drag it out."

**How about the trade unions?** They are not yet really involved in metric, but when we talk to the individual trades, they say, "Tell us what you want and we'll build it!"

**Do designers like metric?** Most prefer it, especially those who have used it. No more dimension strings made up of fractions, inches, and feet; with metric it's all millimeters. And no more dealing with a multitude of conversion factors. For example, which has a higher thermal output, a 22 million Btu/hour boiler or a 1000 ton chiller? With metric, you can tell instantly: the boiler is 6.4 MW and the chiller is 3.5 MW.

**Does the Council have a policy on construction documents?** One was adopted by consensus last fall. For construction drawings, only metric units may be used. Placing both inch-pound and metric units on drawings increases dimensioning time, doubles the chance for errors, makes drawings more confusing, and delays the learning process since people "see" only the units they know. Our policy on specifications is similar except that wherever the use of an inch-pound measure serves to clarify an otherwise unfamiliar metric measure, the inch-pound unit may be placed in parentheses after the metric.

**Can metric be used on rehab projects?** People who have used metric in rehab work say it's essentially no different from using foot-pound units. Tradesmen still must install new products in spaces not built for them. And metric has one advantage--making field measurements is faster and less error-prone because unit conversions are eliminated.

**Where are we with product manufacturers?** About 95% of construction products will not need to change since they are not modular or panelized. They simply will be "soft converted"--re-labeled in metric. A 2-3/4 x 4-1/2 inch wall switch face plate will be re-labeled 70 x 115 mm and a 10 horsepower motor, 7460 W.

**But how about modular products?** Most will undergo "hard conversion"--their dimensions will change to new rounded metric numbers. Suspended ceiling grids will convert to 600 x 600 mm or 600 x 1200 mm. Drywall, plywood, and rigid insulation will change to 1200 mm widths, but their thicknesses will remain the same to eliminate the need for recalculating fire and acoustic ratings and U-values. Raised access flooring will go to 600 x 600 mm. Brick will become 90 x 57 x 190 mm and block will become 190 x 190 x 390 mm; both will use 10 mm mortar joints and be laid in 600 mm modules.

**What happens to the traditional 2-by-4 wood stud?** As we all know, "2-by-4" is a nominal name, not a finished size. Neither wood studs nor other framing lumber will change in cross-section, but they will be spaced at 400 mm instead of 16 inches--about 1/4 inch closer together. Batt insulation installed between studs might not change in width; instead, there will be more of a "friction fit."

**Are there other products in the same category?** Yes. A 2-inch pipe has neither an inside nor an outside diameter of 2 inches. A 24-inch I-beam contains no actual 24-inch dimension. These products won't change sizes either; they'll just be re-labeled. Perhaps they eventually will get new nominal names such as 50 mm pipe or 600 mm beams but it's too early to tell. With or without new names, the metrication process won't be affected.

**Does the Council have a policy on product conversion?** Our policy is that each product manufacturer must decide if and when to change its products to rounded or "hard" metric numbers. Some never will need to change. For instance, current dimensions of freestanding plumbing fixtures are just fine for metric bathrooms. Hard conversion or soft, if you design in metric, label in metric and build in metric, you're metric.

**So "going metric" in construction won't be so bad?** Everyone who has gone through the conversion process says it was much easier than expected. Still, there will be problems and we shouldn't minimize them. Construction, however, is a problem-solving process and, on a scale of construction problems from one to ten with ten being the hardest, metric conversion is about a two.

**Are there resources to help me out?** See the back page of this newsletter for a list or call the Council with specific questions. Remember though, few resources beyond a thorough knowledge of the conversion process and a firm commitment to "go metric" are needed.

**FEDERAL METRIC PROJECTS REACH  
\$1 BILLION**

Federal metric projects with a total estimated cost of about \$1 billion are being readied for design award or are in the design or construction stage now.

The **General Services Administration** is conducting a variety of new and rehabilitation projects approaching \$700 million:

- **Arizona**--border station
- **Colorado**--federal warehouse, Denver
- **District of Columbia**--GSA headquarters, Southeast Federal Center
- **Florida**--federal courthouse, Tampa
- **Maryland**--Social Security Administration operations building, Woodlawn; appraisers store, Baltimore
- **Missouri**--federal courthouse, Kansas City; federal courthouse, St. Louis
- **New Jersey**--U.S. courthouse, Trenton
- **Pennsylvania**--Department of Veterans Affairs regional headquarters, Philadelphia; Byrne/Green Federal Complex, Philadelphia; mechanical/electrical upgrade project, Philadelphia; federal building, Harrisburg
- **Vermont**--border station
- **Virginia**--federal building in Richmond, U.S. courthouse, Richmond; Federal Executive Institute, Charlottesville
- **West Virginia**--federal building, Beckley

The **Department of Health and Human Services** is investing approximately \$2 million in various projects for the National Institutes of Health and the Indian Health Service.

The **Department of State** has under way various foreign embassy projects totaling approximately \$200 million.

The **National Aeronautics and Space Administration** is undertaking various projects throughout the United States with a value of \$14 million.

The **National Institute of Standards and Technology** is in the process of awarding a large multiyear A/E services contract for various projects at NIST facilities in Gaithersburg, Maryland, and Denver Colorado. Work is planned to be in metric and design fees be as high as \$50 million. More about this project in the next issue.

The **Office of the Secretary of Defense** is planning up to \$1 million in various projects in Arlington, Virginia.

The **U.S. Army Corps of Engineers** has eight projects in Arizona, Arkansas, Kentucky, Louisiana, Maryland, New York, and Virginia with a total value of \$30 to \$40 million.

The **Smithsonian Institution** is planning a \$40 million collections research center in Suitland, Maryland.



## METRIC RESOURCES

- Available from the Publications Department, National Institute of Building Sciences, 1201 L St., N.W., Washington DC 20005; phone 202-289-7800 (bulk orders are available at a discount):

**Metric Guide for Federal Construction** (34 pg, \$15). Written specifically for the construction industry and reviewed by metric experts throughout the country. Includes a background on the federal metric laws, facts on metric in construction, an introduction to metric units, a primer on metric usage for architects, engineers, and the trades, requirements for metric drawings and specifications, guidance on metric management and training, and a listing of current metric construction references.

**GSA Metric Design Guide**, second draft edition (78 pg loose-leaf, \$8, \$5 if ordered with above guide). Interim design guide developed by GSA for use by federal project managers and their A/Es. Contains practical architectural, civil, structural, mechanical, and electrical design information, a list of available "hard" metric products, sample drawings, and related reference information.

- Available from the AIA Bookstore, 1735 New York Ave., Washington, DC 20006; phone 202-626-7475:

**Nufert Architect's Data**, 2d International Edition (\$52). The European equivalent to the **AIA Graphic Standards**. All measurements in metric.

**The Architect's Studio Companion; Technical Guidelines for Preliminary Design** (\$44.95). Includes dual units.

- **Wiley Engineer's Desk Reference** (\$54.95). John Wiley & Sons, Professional Reference and Trade Group, 605 Third Ave., New York N.Y. 10158; phone 1-800-225-5945, Ext. 2497. Includes dual units.

- **Metric Practice Guide for Surveying and Mapping** (\$10). American Congress of Surveying and Mapping, 5410 Grosvenor Lane, Suite 100, Bethesda, Md. 20814; phone 301-493-0200.

- Available for \$114 each; American Society of Heating, Refrigeration, and Air-Conditioning Engineers, 1791 Tullie Circle, N.E., Atlanta GA 30329; phone 404-636-8400: **ASHRAE 1991 Handbook--HVAC Applications**, SI Edition; **1989 Handbook -- Fundamentals**, SI Edition; **1990 Refrigeration Handbook**, SI Edition; **1992 Handbook--HVAC Systems and Equipment**. All with dual units.

- **ACI 318M-89/318RM-89, Building Code Requirements for Reinforced Concrete and Commentary** (\$70). American Concrete Institute, Box 19150, Detroit MI 48219; phone 313-532-2600. Metric edition of ACI 318.

- Available in draft form for \$10 each; American Institute of Steel Construction, Metric Publications, AISC, One E. Wacker Dr., Suite 3100, Chicago, Illinois 60601-2001; 312-670-5414:

**Metric Properties of Structural Shapes with Dimensions According to ASTM A6M** (92 pg). Metric version of Part 1 of the **Manual of Steel Construction**.

**Metric Conversion: Load and Resistance Factor Design Specification for Structural Steel Buildings** (159 pg). Metric version of the September 1, 1986 LRFD Specification.

- **Metric-X.** Orion Development Corporation, Box 2323, Merrifield, VA 22116-2323; phone 1-800-992-8170; single user copies \$24.95; site/network copies available, discounts for bulk orders. Quick and friendly metric conversion software for use with any IBM-compatible computer. Converts length, area, liquid and dry volume, mass, force, energy, velocity, pressure, power, temperature, acceleration, and wavelength.
- **1992 Means Building Construction Cost Data, Metric Edition** (\$65). R. S. Means Company, Box 800, Kingston MA 02364; phone 617-585-7880). Prototype metric edition of Means' cost estimating handbook. Complete metric edition for 1993 should be available this fall. Means also offers metric cost estimating seminars.
- **All About Metric** (\$500) MMEI Corp., 2247 Lexington Pl., Livermore CA 94550; phone 510-449-8992. Three-tape video training package by the U.S. Metric Association and MMEI Corp. Covers the background of the metric system, government/industry transition, everyday metric units, and rules for metric usage. Accompanying reference manual includes conversion tables and other information. Instructor's manual contains lesson tips, test questions, illustrations suitable for use as masters for overhead projector transparencies.
- **SI Metric for the Workplace** (\$2195). Workplace Training, 520 North Arm Dr., Orono MN 55364; phone 612-472-2564. Six-tape video/workbook courseware. Provides in-depth metric training for business and industry professionals. Includes an introduction to metric, units of measure, reading/ writing rules, limits/fits/tolerances, metric conversion.

**SI FACTS: Length**

Where would engineering be without a good definition of length? Probably caught somewhere short of inventing the wheel. The SI system offers a unit for length called the meter (m). The meter has been defined as the wavelength of the radiation from a krypton-86 atom and is equal to 3.2808398 ft. For conversion, the factor 3.28 can be used. For shorter lengths, the meter is divided into 1000 parts or millimeters (mm); 25.4 mm = 1 inch. For *nontechnical* purposes, centimeters (1 m = 100 cm) may be used, but decimeters (1 m = 10 dm) should always be avoided. For larger dimensions, use kilometers (1000 m = 1 km), not hectometers (100 m = 1 hm) or dekameters (10 m = 1 dam). There are 1.609344 km in a U.S. statute mile.

**Problem:** A boiler tube has a 3-inch diameter. What is its diameter in millimeters?

**Solution:** 3 in. x 25.4 mm/in. = 76.2

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*Metric in Construction* is a bimonthly newsletter published by the Construction Metrication Council to inform the building community about metrication in U.S. construction. The Construction Metrication Council was created by the National Institute of Building Sciences to provide industry-wide, public and private sector support for the metrication of federal construction and for the adoption and use of the metric system of measurement as a means of increasing the international competitiveness, productivity, and quality of the U.S. construction industry.

The National Institute of Building Sciences is a nonprofit, nongovernmental organization authorized by Congress to serve as an authoritative source on issues of building science and technology.

The Council is an outgrowth of the Construction Subcommittee of the Metrication Operating Committee of the federal Interagency Council on Metric Policy.

The Construction Subcommittee was formed in 1988 to further the objectives of the 1975 *Metric Conversion Act*, as amended by the 1988 *Omnibus Trade and Competitiveness Act*. To foster effective private sector participation, the activities of the subcommittee were transferred to the Council in April 1992.

The Council is supported by funds from contributing federal agencies.

Membership in the Council is open to all public and private organizations and individuals with a substantial interest in and commitment to the Council's purposes. For membership information, call the Council at the above phone number.

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