

**METRICATION ACTIVITIES IN U.S.
CODES, STANDARDS, PROFESSIONAL, AND TRADE ORGANIZATIONS**

The Construction Metrication Council recently asked a broad sample of U.S. codes, standards, professional, and trade organizations--including all of the major ones--to report on their current metrication activities.

Here is a summary of their reports. The term "hard metric" denotes the conversion of inch-pound units to new, rounded, easy-to-use metric measurements. "Soft metric" denotes the mathematical conversion of inch-pound units to metric measurements with little or no rounding. References to "SI" denote "Standard International," the formal term for what the Council simply refers to as "metric."

American Association of State Highway Transportation Officials (AASHTO).

In June, AASHTO published the *Guide to Metric Conversion* for use by states in meeting the Federal Highway Administration's (FHWA) mandate that all federally aided highway projects after October 1996 be built in metric. An AASHTO metric task force, with funds provided by the federal Transportation Research Board, is establishing a metric information clearinghouse and an electronic bulletin board to help the states set uniform metric procedures and standards.

Recently, AASHTO requested additional funds from the Transportation Research Board for converting its technical standards and computer software to metric.

- **Air-Conditioning and Refrigeration Institute (ARI).** ARI's metric policy states that each ARI section is to adopt an international standard within one year of publication or explain why such a standard cannot be adopted. To assist in this process, ARI has issued a new guidance document, *Use of SI Units in ARI Standards*.

- **American Consulting Engineers Council (ACEC).** At ACEC's Fall Conference, a new metric policy was proposed that includes the development of an active program for encouraging members to prepare for metrication and empowering staff to support member metrication needs. The conference included a special session on metrication. ACEC has printed numerous articles about metrication in its publications, sells the NIBS *Metric Guide to Federal Construction*, and promotes the *Metric in Construction* newsletter to its members.

- **American Concrete Institute (ACI).** ACI has supported the voluntary conversion to metric since 1987. Two of its principal publications, *Building Code Requirements for Reinforced Concrete* and *Building Code Requirements for Plain Concrete*, are available in metric editions. ACI is considering a timetable for converting its remaining documents to hard metric as early as 1998.

- **American Concrete Pipe Association (ACPA).** The concrete pipe industry has been involved in metrication since the early 1970s. To date, 22 American Society for Testing and Materials (ASTM) standards on concrete pipe have been issued in metric units. ACPA is revising its design manuals, handbooks, software, and marketing materials to include metric by 1996. Meanwhile, it is encouraging concrete pipe manufacturers to develop new design drawings, revise promotional materials, modify purchasing, update records, and train plant personnel to mark products in metric units.

- **American Congress on Surveying and Mapping (ACSM)**. ACSM first published the *Metric Practice Guide for Surveying and Mapping* in 1978. To date, about 20 states have adopted legislation to permit the use of the metric system as the basis for their state plane coordinate systems. The recent FHWA mandate to produce surveys and maps for highway design and construction in the metric system has heightened interest in metric. The September-October 1993 *ACSM Bulletin* carried two articles about metric conversion.

- **American Forest and Paper Association (AFPA)**. AFPA is about to issue a new edition of the *Metric Planning Package for the Wood Products Industry*. First published in the 1970s, it includes industry recommendations for metric conversion. The 1996 edition of the *National Design Specification for Wood Construction* will include metric units as will the *LRFD for Engineered Wood Construction*. Metric units will be added to other AFPA publications as appropriate.

- **American Institute of Architects (AIA)**. AIA's policy supporting metric goes back to the 1940s. It is now printing an *AIA Pocket Metric Guide* to promote metrication in the architectural field. A metric version of *MASTERSPEC* is virtually complete and will be available by the end of the year. Metric units are being added incrementally to *Architectural Graphic Standards* and a complete metric edition is being considered for the tenth edition, which could be published as early as 1996.

- **American Institute for Hollow Structural Sections (AIHSS)**. AIHSS recently completed two metric guides for use by its members: *Summary of Presentation Factors and Procedures for Determining Properties of Square and Rectangular HSS/Structural Steel Tubing from U.S. Customary Units to Metric Units* and *Recommendations for Soft Conversion of Dimensions of Square, Rectangular, and Round HSS/Structural Steel Tubing from U.S. Customary Units to Metric Units*. Both documents apply to structural steel components specified in ASTM A500.

- **American Institute of Steel Construction (AISC)**. AISC recently published the *Metric Properties of Structural Shapes with Dimensions According to ASTM A6M*, first issued last year in draft form. A complete metric edition of the *LRFD Manual of Steel Construction* will be available in late 1994.

AISC is working with the Industrial Fasteners Institute to develop a policy on the metrication of structural steel bolts.

- **American Iron and Steel Institute (AISI)**. AISI members who ship mill products to the construction market support the activities of the Construction Metrication Council. Basic steel mill products are available today in metric sizes and voluntary consensus standards for these products are available through ASTM and other organizations. AISI is working closely with allied trade organizations to help implement metric and is developing metric engineering aids for steel bridge design as well as adding metric units to its design manual for coldformed steel structures.

- **American Public Works Association (APWA)**. APWA has adopted a policy in support of metric conversion that reflects a growing interest in metric among its members. A session on metrication was held at the Public Works Congress and Exposition in San Francisco last spring and was well received. APWA has

included two major articles on metric in its monthly magazine and presently is drafting *A Public Works Guide to Metrication* that provides a background on the metric system, reasons for converting, metric conventions, and guidelines for a smooth transition.

- **American National Standards Institute (ANSI)**. In October, ANSI adopted a policy stating that units of the modernized metric system (SI) are the preferred units of measurement in American National Standards. To facilitate implementation of this policy, ANSI has formed a Task Group on Metrication to encourage and assist ANSI member organizations in converting their standards. The task group first met in September and is open to interested parties.

- **American Society of Civil Engineers (ASCE)**. ASCE has supported use of the metric system since 1876. Its most recent metric policy, adopted in 1991, states that ASCE will actively support the metrication of civil engineering practice and research, implement the use of metric units in all ASCE publications, and encourage civil engineering schools to stress the use of metric in instruction. Since January 1993, ASCE has mandated that metric be included as the primary unit in all new and revised standards with no other units being required. ASCE regularly includes metric articles in its periodicals, provides metric literature at its conferences, and has a Committee on Metrication with over 90 members.

- **American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)**. ASHRAE's four handbooks are available in both inch-pound and metric editions. Its 80-plus standards contain metric units as do the proceedings of its semiannual meetings and conferences. Goal 15 of ASHRAE's strategic plan states that ASHRAE will implement a policy on and promote utilization of metric units by the HVAC&R and allied industries. Objective 15.1 is to develop and implement a plan that will promote and assist the HVAC&R and allied industries in implementing the use of metric units by the year 2000 and Objective 15.2 is to develop and implement a plan to use only metric units in ASHRAE publications by the year 2000.

- **American Society of Mechanical Engineers (ASME)**. ASME supports a national program of metric conversion. All ASME standards contain metric units except the *Boiler and Pressure Vessel Code*, which is being converted now. ASME has set a target date of 1998 for the publication of its codes and standards only in metric. ASME provides staff support to the Mechanical Task Group of the Construction Metrication Council.

- **American Society for Testing and Materials (ASTM)**. ASTM requires the use of metric in all its standards. Currently, 38 technical committees are developing standards in hard metric and another 7 are in the process of converting to hard metric. In total, approximately 1600 ASTM standards use only metric units, 3500 use metric as the primary unit, and the remaining 3000 use metric as the secondary unit. Recently, ASTM and the Institute of Electrical and Electronics Engineers (IEEE) have begun negotiations to merge their two metric standards, ASTM E380-93, *Standard Practice for the Use of International Units*, and ANSI/IEEE 268, *American National Standard Metric Practice*.

- **American Water Works Association (AWWA)**. AWWA has undertaken a program to convert its publications and other documents to metric by January 1997. Metric units have been added to many of AWWA's 120 water supply product and

procedural standards, whose increasing usage on an international basis makes metrication a timely issue.

- **Architectural Precast Association (APA)**. APA supports the Precast/Prestressed Concrete Institute's recommendations on metric conversion. APA members, who make nonstructural architectural precast cladding, view metrication favorably and generally foresee no problems in producing in metric.

- **Associated Builders and Contractors (ABC)**. ABC is using its national publications and training programs to inform and educate members about metric. During the past year, all ABC's publications--*Monthly Regulatory Update*, *ABC Today*, and *Heavy/Highway Report*--have carried articles on metric. ABC's craft training manuals for electricians, millwrights, pipefitters, welders, carpenters, plumbers, sheet metal workers, metal building assemblers, and instrumentation control mechanics incorporate metric in their core curricula.

- **Associated General Contractors of America (AGC)**. AGC formed a metric task force in 1992. Many AGC members are large contractors who have experience in metric and foresee no problems in using it. AGC regularly provides copies of the *Metric in Construction* newsletter to two of its large committees and several AGC chapters. Two sessions on metric were held at AGC's annual conference in Las Vegas last spring.

- **Brick Institute of America (BIA)**. BIA has adopted a metric policy stating that it: (1) supports conversion to metric units of measure as an inevitable action; (2) will continue to provide information in both metric and inch-pound units, as it has since 1978; (3) encourages all brick manufacturers and distributors to publish their product literature and other design data in equivalent metric versions or with both inch-pound and metric units; (4) will work with brick manufacturers to promote the use and manufacture of modular metric sizes through its technical, marketing, and informational publications; (5) will continue to work with the federal government and within the codes and standards organizations to provide masonry codes, standards, and specification in correct metric units; and (6) encourages the training of bricklayers in vocational programs in the use of the metric system as it relates to brick masonry. In addition, BIA anticipates the publication of a new *Technical Notes* on modular metric brick.

- **Concrete Reinforcing Steel Institute (CRSI)**. CRSI has undertaken several metric initiatives during the past year. It presented 20 seminars in key cities across the United States on the metrication of reinforced concrete design and construction. Four more seminars are planned for the first half of 1994. CRSI has initiated the development of several metric design and detailing aids including printed metric bar cards and a computer program, DEVLAPM, for determining development and lap splice lengths for metric reinforcing bars. Metric versions of a wall bar chart will be completed by the end of this year and a metric version of the *CRSI Manual of Standard Practice* is being prepared. CRSI will begin converting its other technical publications and design aids in 1994. Lately, CRSI staff has been responding to a significant number of inquiries about metric.

- **Construction Specifications Institute (CSI)**. In February 1992, CSI instituted a policy of adding metric units to its new and revised documents

and publications, although *SPECTEXT*, the Master guide specification owned by the Construction Science Research Foundation (CSRF), has always contained metric units. Last year, metric units were added to CSI's *Manual of Practice* and they are now being added to CSI's *SpecGUIDEs*. CSI is encouraging manufacturers to convert their *SPEC-DATA* and *MANU-SPEC* product data sheets to metric. CSI's magazine, *Construction Specifier*, began using metric as the primary unit in June 1992 and features a monthly column on metrication. CSI's monthly newsletter, *NEWSDigest*, regularly features metric updates.

- **Council of American Building Officials (CABO)**. CABO is made up of the three model code organizations--BOCA, SBCCI, and ICBO. The BOCA *National Codes* have included metric units since 1975. SBCCI added metric units to its *Standard Building Code* in 1991 and will add them to the balance of its codes 1994. ICBO will add metric units to its *Uniform Codes* in 1994. Metric will be added to the *CABO One- and Two-Family Dwelling Code* in 1995. CABO is secretariat to the ANSI A117.1 accessibility code, which has contained metric units since its inception. All three model code organizations support the Construction Metrication Council and have published articles about metrication in their magazines.

- **Gypsum Association**. The Gypsum Association has no policy on metrication but notes that many of its member manufacturers can provide hard metric gypsum products now.

- **Hardwood Plywood and Veneer Association (HPVA)**. Last year, HPVA revised its *Interim Voluntary Standard for Hardwood and Decorative Plywood* to include metric units. Now it is adding metric to its other two standards, ANSI/HPMA LHF, *American National Standard for Laminated Hardwood Flooring*, and DFV-1 *Voluntary Standard for Sliced Decorative Wood Face Veneer*.

- **Institute of the Ironworking Industry (III)**. III reports that the International Association of Bridge Structural and Ornamental Iron Workers recently published a 100-page apprentice and journeyman student guide titled *Metrics for Ironworkers*.

- **Instrument Society of America (ISA)**. ISA produces instrument and control systems standards for the HVAC and industrial process industries in the United States and abroad. ISA supports federal metrication efforts and believes that the country's adoption of metric will increase its global competitiveness. All new and recently revised ISA standards express measurements in metric units.

- **International Association of Plumbing and Mechanical Officials (IAPMO)**. IAPMO is incorporating metric units in its standards and other publications and is adding metric to the 1994 edition of its plumbing code, published by ICBO as the *Uniform Plumbing Code*.

- **International Concrete Repair Institute (ICRI)**. ICRI regularly informs its members about the progress of construction metrication through its *Concrete Repair Bulletin* and uses metric units in its publications.

- **Kitchen Cabinet Manufacturers Association (KCMA)**. KCMA supports metric conversion and encourages its members to add metric to their product

literature. Its cabinet standard, ANSI/KCMA A161.1, *Recommended Performance & Construction Standards for Kitchen and Vanity Cabinets*, includes metric units.

- **Mechanical Contractors Association of America (MCAA)**. MCAA publishes information about metric conversion in its newsletter and participates in the Mechanical Task Group of the Construction Metrication Council.
- **National Association of Architectural Metal Manufacturers (NAAMM)**. NAAMM is adding metric units to its standards and does not foresee any significant problems in the conversion of architectural metal products to metric.
- **National Fire Protection Association (NFPA)**. NFPA codes and standards have included metric units since the 1970s. Converting measurements to hard metric will require the submittal of proposals through the standards-making process.
- **National Glass Association (NGA)**. The glass industry is international and most NGA members work in metric now. Since the making of float glass is computer controlled, it can be produced in any size and thickness. NGA's *Glass Magazine* published one of the first construction industry articles on metric in February 1992.
- **National Particleboard Association (NPA)**. NPA recently issued a revised version of its standard, ANSI A208.1-1993, *Particleboard*, in hard metric. During the conversion process, the number of particleboard grades was reduced from 19 to 12.
- **National Roofing Contractors Association (NRCA)**. NRCA has approved a policy to support metric conversion in the roofing industry and to implement the use of metric units in all NRCA publications, manuals, programs, research, and instructional materials. NRCA's metric committee has made the following recommendations: get news of federal metrication activities into the hands of members, emphasize that metric conversion will not be as difficult as it may seem, and implement metric educational programs. The committee also is exploring the kinds of metric tools and devices it should recommend to its members.
- **National Society of Professional Engineers (NSPE)**. NSPE has supported metric conversion since the 1970s. After passage of the 1988 amendments to the *Metric Usage Act*, NSPE extended its support to federal metrication efforts and instituted a program to increase metric awareness among its members. NSPE routinely answers queries about metric received through its state chapter computer network.
- **National Stone Association (NSA)**. NSA has an active information program to help its members prepare for metric conversion. After discussing metrication in several forums, NSA has concluded that there will be no significant impact on the stone industry. Stone products are typically specified by gradations determined through sieve analysis. Testing sieves are in metric sizes now with nominal inch-pound names provided for current use; therefore, the gradation of products will not change, just the units in the specification. The industry's equipment suppliers are for the most part international and their equipment is predominantly metric. The only remaining task is the conversion of computer software used by quarry operators for weighing and invoicing trucks so their weights can be recorded in kilograms and metric tons.

- **North American Insulation Manufacturers Association (NAIMA)**. NAIMA regularly sends its member companies information on federal metrication activities. Many NAIMA members have international operations and make metric products now.

- **Portland Cement Association (PCA)**. PCA's metric policy states that all publications, videotapes, slide sets, and computer programs will be developed to include metric units. Metric has been added to most of PCA's recently updated publications and its concrete design computer programs have metric capability now.

- **Precast/Prestressed Concrete Institute (PCI)**. PCI supports the FHWA's metric conversion policy as it applies to precast/prestressed concrete bridge products. PCI advocates an initial soft conversion by rounding all dimensions to the nearest 5 mm, followed over time by a hard conversion. All new PCI publications include metric units and a metric edition of PCI's *Design Handbook* is being considered for publication in 1996.

Metric in Construction is the newsletter of the Construction Metrication Council of the National Institute of Building Sciences, Washington, D.C. Reproduction and distribution of its contents is encouraged provided the Council receives attribution. Copies of previous newsletters are available upon request.

METRIC FACTS: MASS

For everyday purposes, *mass* means *weight*, but there is a difference. Weight is a relative term, dependent on the force of gravity (that is, weight is really a measure of force) and mass is an absolute term. Thus, on the moon you would only weigh about a sixth of what you do on earth, but in both places you would have exactly the same mass.

Is the difference between mass and weight important in construction? No, except in some aspects of engineering. Still, the proper metric term is **mass** and the metric unit for expressing mass is the **kilogram**.

There are 2.205 pounds in a kilogram. The metric ton (t) is 1000 kilograms.

Problem: What is the mass in kilograms of a 27 pound casting?

Solution: $27 \text{ lb} \times 1 \text{ kg}/2.205 \text{ lb} = 12.24 \text{ kg}$

Metric in Construction is the newsletter of the Construction Metrication
Council of the
National Institute of Building Sciences, Washington, D.C. Reproduction
and distribution of its contents is
encouraged provided the Council receives attribution. Copies of
previous newsletters are available upon request

CONSTRUCTION METRICATION COUNCIL

National Institute of Building Sciences
1201 L Street, N.W., Suite 400
Washington, D.C. 20005
Telephone 202-289-7800; Fax 202-289-1092

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 to promote 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.

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. The Council meets monthly in Washington, D.C.; publishes the *Metric Guide for Federal Construction* and this bimonthly newsletter; and coordinates a variety of industry metrication task groups. For membership information, call the Council at the above phone number.

Chairman--Thomas R. Rutherford, P.E., Department of Defense

Board of Direction--William Aird, P.E., National Society of Professional Engineers; Gertraud Breitkopf, GSA Public Buildings Service; Ken Chong, P.E., National Science Foundation; Dave Geiger, Federal Highway Administration; James Gross, National Institute of Standards and Technology; Les Hegyi; Ivan Johnson (Vice Chairman), American Society of Civil Engineers; Byron Nupp, Department of Commerce; Arnold Prima, FAIA, Department of Defense; Martin Reinhart, Sweet's Division/McGraw-Hill; Rodger Seeman, P.E., Corps of Engineers; Dwain Warne, P.E., GSA Public Buildings Service; Gerald Underwood, American National Metric Council; Lorelle Young, U.S. Metric Association; Neil Zundel, American Institute of Steel Construction

Executive Director--William A. Brenner, AIA

The Council is grateful to the following private contributors: The Kling-Lindquist Partnership; Smith, Hinchman, and Grylls Associates; and Raytheon Engineers and Constructors.