METRIC HIGHWAYS REVISITED

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A standing-room-only crowd gathered at a recent national conference to hear a session on the metrication of U.S. highways. The session panel included representatives from the National Institute of Standards and Technology, the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the authors of the *AASHTO Guide to Metric Conversion.*

But was this hot topic new? No—a serious conversion effort has been under way since 1988. As recently as the July–August 1991 issue of *TR News,* Donald G. Fohs of FHWA outlined the issue and emphasized the fact that direct federal and federal-aid construction contracts will be awarded only to projects designed in metric units after September 30, 1996. Federally funded road building will convert, and it is assumed that highway agencies at all government levels will also convert their nonfederal projects to metric, rather than design them in different measurement units.

September 30, 1996, is getting closer, so let us review the issues and events that are leading to metric highways in the United States.

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Why Convert?

Three of the most pertinent reasons for our nation to convert to the metric system are as follows:

- International trade competitiveness. All of the United States' major trading partners use the metric system. Our goods are not as desirable to other nations if they are not manufactured to metric specifications. Many U.S. companies have already seen the writing on the wall: General Motors and IBM are metric companies, and Caterpillar is 80 percent metric.
- Ease of use. The metric system is simpler and, once learned, more efficient than the U.S. customary system. Anyone who has worked a drainage problem and converted from inches per hour to acre feet to cubic feet per second to gallons per minute knows that there must be a better way. There is—metric has only one set of units and no such conversions are required.
- Federal mandate. The federal government is initiating the conversion of the U.S. highway community. The next section describes the legislative and executive actions that led to the conversion.

Legal Requirements for Conversion

Congress and President Bush both took action requiring the metrication of federal government agencies. The U.S. Department of Transportation (DOT) and FHWA responded, and that is how FHWA set 1996 as the deadline for highway conversion.

The U.S. Congress recognized the increasing economic disadvantage and the consequent need to move toward the metric system. The 1988 Trade and Competitiveness Act (Pub. L. 100-418) was adopted to amend the Metric Conversion Act of 1975 (15 U.S.C. 2056). The 1988 act designated the metric system as the preferred system of weights and measures for U.S. trade and commerce. It also stipulated that each federal agency convert and use the metric system in its procurements, grants, and other business-related activities to the extent economically feasible. In taking this action, Congress obviously intended to use the considerable buying power of the federal government as a catalyst for the change.

In July 1991 the President signed Executive Order 12770, Metric Usage in Federal Government Programs. The order required all federal agencies to adopt metric conversion plans by November 30, 1991, and directed the U.S. Department of Commerce to coordinate the metrication effort.

U.S. Department of Transportation

As a federal agency, DOT responded to the legislation and executive order. A DOT Metric Coordinator was appointed, and U.S. DOT Order 1020.1C was issued in May 1990 to establish policies and administrative procedures for the transition.

FIGURE 1 FHWA Metric Timetable

TARGET DATE	ACTIVITY
10/31/91[a]	FHWA metric conversion plan.
1991[b]	Revision of pertinent laws and regulations that inhibit metric conversion.
1994	Full metric conversion of FHWA manuals, documents, and publications.
1995	Full metric conversion of FHWA data collection and reporting.
9/30/96	Newly authorized federal lands highway and federal-aid construction contracts in metric units only.

[a] Completed.

[b] Initiated.

The FHWA Metric Transition Plan was approved by the Secretary of Transportation on October 31, 1991. The plan provides a methodology for the systematic conversion of the highway industry to metric. Figure 1 lists some of the major program elements associated with the FHWA timetable. The key date is September 30, 1996: all construction contracts advertised for bids after that date for federal lands highways and federal-aid construction must contain only metric measurements. Highways at the state, city, and county levels will all be affected.

Other Organizations

FHWA intends to work with national organizations to ensure that national standards, specifications, and computer programs will be converted well before September 30, 1996. This list includes such standards as the AASHTO Green Book, the TRB *Highway Capacity Manual,* other design manuals, and their associated computer programs. Drafts or summaries of these manuals will most likely be circulated before their publishing dates as an aid to the design community.

State and local government agencies will be responsible for updating their specification books, standard drawings, and other manuals such as their adaptations of the *Manual on Uniform Traffic Control Devices.*

AASHTO Actions

In response to federal initiatives toward metrication, the AASHTO Standing Committee on Highways appointed a Metrication Task Force in 1991. The purpose of the task force was to work with FHWA and to address the impacts of conversion for transportation agencies at the state, county, and city levels.

The task force held its first meeting in 1991. Three areas of emphasis were identified during this meeting:

- Timing. Much must be done in a short time to meet the conversion schedule adopted by FHWA.
- Costs. There is a pressing need to find the most cost-effective approaches to conversion so that highway agencies can absorb costs within their existing budgets.
- Public relations. It is desired to generate a public awareness and information program to prepare the way for conversion activities.

The first actions of the task force were arranged to help it determine the state of the art. With further study, the group developed a plan that included the following decisive actions:

1. A resolution was prepared and sent to the AASHTO Policy Committee asking that the U.S. Department of Commerce develop and implement a public awareness program.
2. Under the National Cooperative Highway Research Program (NCHRP), a consultant was engaged to review Canadian conversion experiences in Ontario and to document them in a summary report. The consultant was also to arrange a meeting between task force members and key Canadian transportation officials to review conversion experiences.
3. Requests were sent to all AASHTO subcommittees asking that they review hard and soft metric conversions and develop conversion factors in their areas of expertise.
4. A second consultant under the NCHRP project was engaged to prepare a comprehensive conversion guide report (the *AASHTO Guide to Metric Conversion*).

Throughout 1992 the task force met periodically to review the work of its consultants and to coordinate the metrication efforts. This was an arduous process requiring many difficult decisions.

AASHTO Guide

The fourth element of the plan of action took shape when NCHRP issued a contract to the Civil Engineering Department of the University of Alabama to develop the *AASHTO Guide to Metric Conversion.* The objective of the project was the rapid development of a conversion document that could be adopted by AASHTO.

The guide includes chapters entitled "Conversion Experiences of Other Nations," "Forming a Metric Conversion Plan," "Hints and Suggestions," and "Checklists for Conversion." The appendixes include a list of state highway agency metric coordinators; a review of metric units, terms, symbols, and conversion factors; interim AASHTO metric criteria for geometric design; and two case studies of conversion plans for branches of state highway agencies.

The document was delivered to AASHTO in January 1993. The guide was approved through the balloting process and was published in late spring 1993. Copies are available through the AASHTO offices in Washington, D.C.

The guide contains recommendations from two of the AASHTO subcommittees: Geometric Design and Traffic Engineering.

Only the Geometric Design recommendations have received AASHTO balloting approval thus far. Examples of the Geometric Design data include replacing 10-, 11-, and 12-feet lane widths with 3.0-, 3.3-, and 3.6-meter widths, respectively. Eye height and object height used to calculate stopping sight distance will be 1070 millimeters instead of 3.5 feet and 150 millimeters instead of 6 inches.

Traffic Signs

Perhaps the most expensive element of metrication will be converting signs to metric units. Comprehensive estimates of the nationwide sign conversion costs have not been made. For a point of reference, a detailed study of approximately 10,900 miles of state-maintained roads in Alabama developed "absolute minimum" sign conversion costs at $2.7 million, including a 15 percent contingency factor. Roughly half of the total cost was for replacing milepost markers with kilometer markers.

FHWA published "Options for Coordinating the Metric Conversion of Traffic Control Signs" in the *Federal Register* on August 31, 1993 (58 F.R. 46036). The notice requested public comments on three options for sign conversion:

- Conversion through routine maintenance over the next four to seven years;
- Quick conversion of all signs over a six-month to one-year period; and
- Two-phase transition with dual metric and U.S. customary signs posted by October 1996. U.S. customary signs would be removed over a period to be determined later.

Comments were due November 1, 1993, and are being evaluated.

Canada's Conversion

The Canadian experience appears to have been almost uniformly positive and can serve as a model for U.S. conversion. Canada's conversion process began in 1970 with a government white paper explaining and justifying the nationwide conversion to metric. The Roads and Transportation Association of Canada (RTAC, now TAC) National Conversion Plan was approved in 1974. It called for highway sign conversions in 1977 and metric highway construction beginning in 1979.

Listed in Figure 2 are the milestones of the Canadian metric conversion process. The program began with several years of close cooperation and careful planning among government agencies. The first public test arrived in August 1977, when sign conversion began. The public had been carefully prepared for the event through displays of the new signs, full-page newspaper ads, radio and television spots, and information pamphlets. Municipalities had been given packages containing the new sign standards, conversion factors, conversion schedules, and instructions on how to perform sign overlays, metric painting standards, and so forth to help in their planning.

Authorities later called the sign changeover the biggest "non-event" in recent history. Careful planning and the public information campaign are largely credited for the smooth transition.

Canadian highway construction became metric in 1979, successfully completing the initial step of the conversion process. The experience in Canada provides an overriding theme: there is never too much lead time. U.S. highway agencies should begin metrication planning processes immediately to reach the 1996 deadline.

Acknowledgments

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FIGURE 2 Milestones of Canadian Conversion

DATE	MILESTONE
1970	Federal white paper published to explain and justify need for metric conversion.
1971	Federal Metric Commission established to plan conversion of all industries.
6/72	RTAC Metric Conversion Committee established to develop highway conversion standards.
1/74	RTAC committee standards adopted concerning speed, distances, weights, signals, markings, and so on.
12/76	Most plans for sign conversion completed.
7/6/77	Highway Traffic Act 1977 enacted to convert speed limits and distance measurements.
8/1/77	Distance sign changes began.
9/77	Speed limit sign changes began.
9/30/77	All sign conversion completed.
4/1/78	Legislation enacted governing vehicle dimensions, tire pressures, and the like.
1979	Metric highway construction began.