100 YEARS TRB
MOVING IDEAS: ADVANCING SOCIETY

CENTENNIAL PAPERS

Standing Committee on Structures Maintenance (AHD30)
George Hearn, Chair

Maintenance of Highway Structures

GEORGE HEARN, *University of Colorado*

AHD 30 STRUCTURES MAINTENANCE

TRB committee ADH30, the standing committee on structures maintenance, is concerned with the maintenance of bridges, culverts, sign supports, tunnels, retaining walls, and other structures necessary to highway transportation. Maintenance programs for structures use information on deterioration, on the actions needed in response to deterioration, on the performance of methods and materials used in maintenance actions, and on execution and management to complete needed work efficiently. The information needs of maintenance programs are the topics for the structures maintenance committee:

- Finding defects and deterioration
- Quantifying and characterizing conditions and defects
- Identifying methods and materials to apply
- Managing structures and maintenance actions efficiently

Each of these topics, deterioration, materials, methods, and management is addressed directly by a standing TRB committee. Each topic includes a number of related areas of study such as inspection methods, robotics for inspection, nondestructive evaluation, structural health monitoring, coating and sealing products, patch and repair products, agency policies on maintenance and repair, measures of performance of structures, and measures of performance of maintenance programs. The structures maintenance committee works on the coordinated implementation of current knowledge and new findings on these topics, and identifies how knowledge and findings can improve maintenance of transportation structures.

Research and its implementation are advanced by the structures maintenance committee through cooperative work with subcommittees, with TRB standing committees, with AASHTO committees for bridges and structures and for maintenance, with State transportation agencies, and with the Federal Highway Administration (FHWA).

Subcommittees to AHD30

AHD30 Structures Maintenance has three subcommittees. AHD30(1) Subcommittee on Underwater Inspection and Maintenance, AHD30(2) Subcommittee on Structural Coatings and Linings, and AHD30(3) Joint Subcommittee on Structural Health Monitoring.

HISTORY

The history of the structures maintenance committee is presented here (adapted from (*1*) and (*2*)).

The National Research Council (NRC) formed a highway research committee in year 1919. The highway research committee recommended the formation of a committee on maintenance to learn, through research, what maintenance methods give the best results under different conditions and in various sections of the United States.

The following year, 1920, an Advisory Board on Highway Research was formed under the division of engineering of the NRC. The Advisory Board included seven committees. One was a committee on maintenance. This first maintenance committee was a highway committee. The committee addressed pavements and structures, and also maintenance equipment, winter operations, maintenance personnel, and all aspects of operating and repairing highways.

By 1930, the Advisory Board became the Highway Research Board (HRB). HRB established six departments; one was a maintenance department. The maintenance department had five committees; one was a committee on maintenance of way and structures.

By 1950, HRB had a committee on bridge and culvert maintenance. By 1960, this became Committee M-10 Maintenance of Structures with a Subcommittee M-10(1) Bibliography on Structures Maintenance.

The HRB maintenance department continued until year 1970 when HRB was re-organized into divisions. Division A Technical Activities, Group 3 Operation and Maintenance of Transportation Facilities, Section D Maintenance of Facilities included committee A3D02 Structures Maintenance. Committees were re-organized again in year 1984. Committee A3C06 Structures Maintenance became part of Section C Maintenance in TRB Division A, Group 3.

In the 1980s, the structures maintenance committee became active in bridge management systems. There was a name change to A3C06 Committee on Structures Maintenance and Management, and a subcommittee A3C06(3) on Bridge Management was formed.

After year 2000, A3C06 reverted to its previous name, Structures Maintenance, when its subcommittee on bridge management became a standing committee. A further re-organization after year 2003 created committee AHD30 Structures Maintenance in the Maintenance and Preservation Section of the Operations and Preservation Group.

In TRB today there are twenty-two standing committees that are concerned with maintenance. Four committees are concerned with some aspect of maintenance of structures (AHD30, AHD35, AHD37, ARO60), and three committees are concerned with materials used in maintenance (AHD25, AHD40 and AHD45). Also, each of the eight committees in the Structures Section of the Design Group (AFF committees) has some activity in performance of structures in service; basically maintenance.

History - Subcommittees

There is limited information on subcommittees to the committee on structures maintenance. In the 1960s, there was a subcommittee for bibliography on structures maintenance. In the 1980s and 1990s there were three subcommittees: Underwater inspection and maintenance, bridge deck inspection and maintenance, and bridge management. By year 2005, there was a subcommittee on bridge steel coatings. By year 2010 there was a joint subcommittee on bridge preservation.

Two current TRB standing committees began as subcommittees to the structures maintenance committee. These are AHD35 Bridge Management Committee, and AHD37 Bridge Preservation Committee.

TODAY

The structures maintenance committee collects and shares information on maintenance materials and methods for transportation structures. The information may introduce new materials and methods, or may quantify the performance of materials and methods currently in use. Information on materials and methods necessarily entails bases for their selection, and management for their efficient application. As a result, the structures maintenance committee is active in inspection

methods, decision rules and decision support, performance and economics of materials and methods, inspection coding especially the use of digital data to support maintenance programs, and inspection methods especially emerging practices for inspection using unmanned aerial vehicles and robotics.

The structures maintenance committee learns of new challenges of DOTs, tracks new approaches to solutions, identifies research needs growing from new challenges and new approaches, and promotes the use of new methods and materials as these become available.

The structures maintenance committee, like all of TRB, engages in applied research. Research need statements are developed by the structures maintenance committee. Study panels for projects are populated by committee members. Implementation of research is a TRB priority now and was a priority in the early days. The report of the HRB Director in 1928 (*1*) said " … the object of this institution is … in making practical use of the results of research."

TRB Annual Meeting

The structures maintenance committee organizes sessions and workshops at TRB annual meetings. In recent years, the topics presented include inspections for maintenance, long-term monitoring of bridges, truck weights, bridge repair, nondestructive evaluation, scour rating, inspections using unmanned aerial vehicles, maintenance of sign structures, and risk assessment in maintenance programs.

Coordination

Anson Marston, the first chair of the NRC highway research committee, stated in 1919 that two classes of research committees were needed: Committees that take up a group of closely allied studies, and committees devoted to a single, definite research project (*1*).

The structures maintenance committee fits Marston's idea of a committee for closely allied studies. Subcommittees handle detailed consideration of specific areas. The structures maintenance committee has routinely shifted the consideration of more specialized areas into subcommittees while the parent committee retains a general scope.

Subcommittees

The Structures Maintenance Committee has three subcommittees.

AHD30(1) Underwater Inspection and Maintenance Subcommittee addresses advanced methods for underwater inspections including robotics, unmanned vehicles, acoustic imaging and surveying, and remote sensing. The subcommittee connects the structures maintenance committee to National Highway Institute courses on underwater inspection and repair. In year 2018, the subcommittee presented a workshop at the TRB Annual Meeting on acoustic imaging for underwater bridge inspection,

AHD30(2) Structure Coatings and Linings Subcommittee addresses cost-effective protection of highway structures against degradation while maintaining a structure's function and appearance. The subcommittee connects the structures maintenance committee to groups at AASHTO, NTPEP, NACE, and SSPC. The subcommittee developed a research need statement on use of duplex coatings that was funded in year 2018 as NCHRP project 12-117.

AHD30(3) Structural Health Monitoring (SHM) Joint Subcommittee focuses on monitoring technologies that support decisions in structures maintenance. This is a joint committee. SHM at the research level demands expertise in sensors, data collection, data interpretation, and use of data in support of decisions. For these reasons, the structures maintenance

committee partners with TRB committees AFF40 and AHD35 for this joint subcommittee. In year 2018, the joint subcommittee developed an advice document on structural monitoring that will be published as a TRB circular.

TRB Standing Committees

The structures maintenance committee shares a joint subcommittee AHD30(3) with standing committees AFF40 and AHD35. The structures maintenance committee develops research need statements with other TRB committees including AHD35, AHD37, AFF20, AFF30, and AFF40.

AASHTO Committees

The structures maintenance committee interacts with technical committees of the AASHTO Committee for Bridges and Structures (COBS) to develop research need statements and to move research needs toward funding. The structures maintenance committee also interacts with the Bridge Technical Working Group of the AASHTO Committee on Maintenance (COM).

FHWA Expert Task Group on Bridge Preservation

The FHWA expert task group on bridge preservation has, by charter, representation from three TRB standing committees: AHD30 Structures Maintenance, AHD35 Bridge Management, and AHD37 Bridge Preservation. These are the structures maintenance committee plus two of its former subcommittees.

Research Program

The structures maintenance committee develops research need statements, and helps to move research need statements toward funding through coordination with committees at AASHTO. The structures maintenance committee together with its subcommittees has in recent years developed research needs statements for concrete sealers, steel coatings, deck overlays, UAVs for bridge inspection, improved inspection of fracture-critical structures, underwater inspection with acoustic imaging, performance of bridge joints, and guidance to local government agencies on efficient maintenance of transportation structures. Several research need statements developed by the structures maintenance committee have reached the ballot for NCHRP funding. One research need statement has been funded.

FUTURE

At its start, the HRB saw needs for research in maintenance materials and methods, in efficient management of maintenance programs, and in the selection of maintenance materials and methods for specific regions and environments. These same concerns remain today. Research needs, at least in name, appear to persist. This appearance of persistent need is not new. In the annual report for year 1929, the HRB Director noted (*1*) "Many of the topics suggested for research are old, … Doubtless the explanation is that some words continue to describe briefly the needs under changing conditions for more and better and more precise determinations."

The categories of research to reduce deterioration, to improve performance of materials, and to optimize the tradeoffs among time, cost and quality of maintenance all remain. These are features of a natural world and a temporal existence. The work of TRB has been successful and useful. The ability of engineers to respond to corrosion, to deploy materials, and to manage programs is better at TRB's centennial than it was at HRB's founding.

The categories of research are persistent. The technologies, products of human invention, are transient. Research work continues because newer methods and materials are possible, and can be beneficial.

Does the structures maintenance committee remain relevant today? Do we expect that the committee will make contributions in the future? You decide. Do your bridges need maintenance? Would you like to improve your maintenance program?

REFERENCES

1. National Research Council (1970). Ideas and Actions - A History of the Highway Research Board 1920-1970. National Academy of Sciences.
2. Viest, I.M. (1999). Fifty Years of TRB Bridge Committees. TRB Circ E-C007.