100 YEARS TRB
MOVING IDEAS: ADVANCING SOCIETY

CENTENNIAL PAPERS

Standing Committee on Pavement Maintenance (AHD20)
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Pavement Maintenance: Past, Present and Future

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THE EVOLUTION OF PAVEMENT MAINTENANCE

Pavement engineering has developed and evolved over time into a complex field. Pavement structures were first built to get out of the mud, providing an improved structure over which people and goods could travel in a safer and quicker manner. Pavement design progressed from empirical methods based on observations of what worked in the past (before the AASHO Road Test, 1958 to 1960) to more mechanistic methods based on understanding how different materials respond to the loads to which they're subjected (today's AASHTO ME). Pavement rehabilitation techniques were also developed and improved upon in recognition of the fact that roads don't last forever, and reconstruction is both costly and disruptive. The timely application of well-designed structural improvements could help to extend the life of an existing pavement to the benefit of both its managers and roadway users.

In the 1970s the principles of pavement management began to take shape in highway agencies. The concepts embodied in pavement management were a further acknowledgment that improvements in pavement design and construction would benefit from the application of improved management practices. If the stewards of roadway networks were responsible for doing the right thing at the right time while responsibly spending public monies, pavement management tools helped them to identify what was right.

More recently, pavement preservation has emerged as a tool that could be used to cost-effectively extend the lives of pavements. Colloquially referred to as "keeping good roads in good condition," pavement preservation includes the application of a range of thin surfacing applications and other treatments to a pavement to slow its deterioration or restore desirable characteristics such as ride or friction.

While pavement engineering is an ever-expanding field and one that it is becoming increasingly complex, it might well be argued that when it comes to pavements, maintenance is the oldest specialization and one that, at least on the surface, does not look too different today than it did 100 years ago. Pavement maintenance certainly predates pavement design, pavement rehabilitation, pavement management, and a host of other pavement-associated technical disciplines, such as geotechnical engineering or drainage. Our roadway networks were built first and then, as they deteriorated, those responsible for the roadway network figured out how to maintain them. Then, as now, pavement maintenance focuses on keeping or restoring roads to serviceable conditions through patching and sealing activities. Pavement maintenance includes both planned and reactive activities performed both by an agency's maintenance crews and by contract.

STANDING COMMITTEE ON PAVEMENT MAINTENANCE

In 2003, the Pavement Maintenance Committee A3C05 was designated to become AHD20. The first annual meeting of the new AHD20 was in January 2004. Beginning in 2003 the Pavement Maintenance Committee saw the need to separate preservation from operational maintenance activities and proposed a TRB Task Force on Pavement Preservation. The purpose of the task force was to develop and address the technical, operational and economic issues vital to preserving pavement assets. In April of 2004, the Task Force on Roadway Pavement Preservation (AF020T) was approved by TRB. In the summer of 2008, the TRB granted full Committee status and established the Standing Committee on Pavement Preservation AHD18.

In 2018, the Scope of the Pavement Maintenance Committee AHD20 was redefined and clarified to better reflect the difference between maintenance and preservation. The Pavement Maintenance Committee has been in the forefront advocating new maintenance actions to keep pace with the current demands on the Nation's pavement network. The current scope of the pavement maintenance committee is stated as follows:

> *This committee is concerned with all aspects of reactive maintenance of both asphalt and concrete pavements, including their deterioration and the subsequent means and methods used to treat the resulting deficiencies.*

Throughout the years, this committee has reviewed numerous papers, developed sessions and workshops in preparation for the annual meetings. Many research needs statements and synthesis topics have been developed and submitted. Recently completed projects include:

- Maintenance Quality Assurance Field Inspection Practices (NCHRP Synthesis 45-13)
- Training and Certification of Highway Maintenance Workers (NCHRP Synthesis 46-17)
- Very Short Duration Work Zone Safety for Maintenance and other Activities (NCHRP Synthesis 49-04)

Members come from several disciplines of engineering and science with diverse affiliations. The membership structure includes federal/national (2), state/provincial (3), private sector (10), nonprofit/other (4), and academicians (9); in addition, the committee has 4 international member and 3 young members. The committee acknowledges and greatly appreciates the contributions of our three emeritus members: Jim Moulthrop, Roger Smith and Roger Olson.

Individual members maintain affiliations in a variety of professional and technical organizations including: Association of Asphalt Paving Technologists (AAPT); American Association of State Highway and Transportation Officials (AASHTO); American Concrete Paving Association (ACPA); American Society of Civil Engineers (ASCE); American Society for Testing and Materials (ASTM); FHWA Pavement Preservation Expert Task Group (PPETG); Foundation for Pavement Preservation (FP2); National Asphalt Pavement Association (NAPA); Transportation Association of Canada (TAC); International Slurry Seal Association (ISSA); and the International Society of Asphalt Pavements (ISAP), Transportation and Development Institute; and others. There are 90 friends of the committee who are included in all Committee communications and most volunteer to review papers.

The Committee will continue to focus on the topics of interest to maintenance workers in public agencies, and collaborate with other TRB committees and other groups with overlapping and mutual interests to advance the field of pavement maintenance.

PAVEMENT MAINTENANCE FOCUS ON THE FUTURE

Today this Committee is interested in many of the same topics that have interested those responsible for taking care of pavements since they were first built, along with topics that take us to the 21st Century. Critical issues that have been identified for the near future:

Post Extreme Event Maintenance Decisions

During and immediately following extreme events such as hurricanes, flooding, forest fires, earthquakes etc., maintenance managers and pavement maintenance crews are faced with challenges associated with emergency repairs to open roadways to emergency responders and other critical utilities. At present, there is wide discrepancy in post-extreme event emergency pavement maintenance practices and decision processes. Development and dissemination of decision processes regarding maintenance type selection and best field practices are of interest to this Committee. Specifically, assessment methodologies to support maintenance type selection, decision tools for on-site use, and preparedness at agency maintenance facilities are of interest.

Resilience to Climate Variability:

With continually evolving variabilities in climatic patterns, the current approaches of pavement maintenance, which are typically based on historic climatic trends, are threatened with lower reliability and can lead to non-sustainable practices. Research in climate variability resilient maintenance activities (type selection, material specification, actual construction processes and post-maintenance inspection) is necessary to ensure economic feasibilities and improved performance. This Committee is interested in adopting pavement maintenance framework that incorporate future climate projections as well as climate projection uncertainties.

Emerging Methods of Identifying Needs of Maintenance and Tracking Performance

There are many new technologies being used to identify, monitor, and report on the conditions of pavements, including the need for and performance of pavement maintenance. These include high-speed data collection vans, unmanned aerial systems (e.g., drones), mobile phones, connected and automated vehicles, and so on. The ability to capture pertinent data needed to identify the need and ensure the effectiveness of pavement maintenance activities and provide input to maintenance management systems (MMS) is of great interest to this Committee, especially to the extent that this can be accomplished accurately, more rapidly through automation, and more safely than commonly used methods. Of particular interest to the use of MMS is the ability to track activities such as: work accomplished (labor, materials, and equipment at specific locations used for pavement repairs and data needed for pavement optimizing performance).

Capturing and reporting details of pavement repairs and costs on specific roadways sections are also important for pavement management purposes. Automating processes for incorporating this data into pavement management system (PMS) construction history enhances life cycle planning and refinement of models and decision trees.

Improving Efficiency and Safety of Pavement Maintenance
Traditional pavement maintenance activities are identified by the number and type of personnel required, materials, hand tools, motorized equipment, vehicles, and so on. The deployment of technologies that automate or semi-automate pavement maintenance are an opportunity to improve worker safety, increase production rates, and perhaps improve maintenance performance. Automated pothole repair and crack sealing equipment are two examples of such technologies, but this Committee is interested in all the technologies that might provide safety and performance advantages over the more common and traditional methods. We will build on research done under SHRP regarding automated crack repair and automated pothole repair.

Innovate and Improved Materials for Pavement Repairs
Pavement maintenance activities are often performed using short-term lane closures or utilizing traffic control measures for moving operations. Accordingly, high performance materials that can be quickly placed with minimal equipment requirements, e.g. compaction equipment, while minimizing worker exposure are highly desirable. The safety of maintenance workers and the public is of utmost importance with respect to the conduct of pavement repairs and associated work zones. To that end, the committee is interested in advancing the use of new or innovative pavement patching and repair materials that minimize worker exposure while also offering a high level of short and long-term performance to minimize repeated repairs at the same location. The result will be rapid repairs made using high performance materials to improve roadway serviceability and reduced user costs.

Stopgap or End-of-Life Maintenance Treatments
Surface treatments generally used for pavement preservation, in combination with spot repairs and traditional pavement maintenance treatments, are applied by state agencies to hold together badly distressed pavements. These applications of surface treatments are often mixed with preservation and misrepresent preservation practices. There is a need to investigate the untapped topic of stopgap or end-of-life maintenance to properly recognize the value of these treatment and separate them from the preventive applications (preservation). Issues that need to be addressed: definition of stopgap maintenance, triggers used to apply stopgap treatments, distinguishing stopgap maintenance from other pavement activities, performance monitoring and evaluation, life cycle costs, and stopgap pavement maintenance best practices (combination of various treatments).

Transportation Asset Management
Transportation Asset Management is a strategic approach to managing transportation infrastructure assets. It focuses on the business processes for resource allocation and utilization with the objective of better decision-making that is based upon quality information about assets and well-defined objectives expressed as Performance Measures/ Levels of Service. Project decisions are driven by strategic decisions, which directly affect the network level performance. Most state agencies do not have adequate funding to be always proactive and use the most cost effective, preventive/ preservation pavement strategies. Reactive pavement maintenance and stopgap or end-of-life treatments performed are crucial as they increase the time before reconstruction is unavoidable and make a safer and more reliable pavement. Therefore, business processes for resource allocation for these practices should be included in Transportation Asset Management Plans.