National Cooperative Highway Research Program

May 2024

Announcement of NCHRP Synthesis Topics

The National Cooperative Highway Research Program (NCHRP) is supported on a continuing basis by funds from participating member states of the American Association of State Highway and Transportation Officials (AASHTO), with the full cooperation and support of the Federal Highway Administration, U.S. Department of Transportation. The NCHRP is administered by the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine. The NCHRP is an applied contract research program that provides practical and timely solutions to problems facing highway and transportation practitioners and administrators.

NCHRP syntheses are state-of-the-practice reports prepared under contract by outside individuals or firms. These reports seek to document current practice within state departments of transportation (DOTs) to (1) identify ongoing and recently completed research, (2) learn what problems remain largely unsolved, and (3) organize and document the useful information acquired. These synthesis projects do not undertake new research, nor do the synthesis reports contain policy recommendations. Syntheses document and describe current practice in a given area and highlight practices that are viewed as successful by many of the state DOTs surveyed in developing the synthesis or that are characterized as such in the literature reviewed by the synthesis author(s).

Nominations of others and self-nominations for panel members should be submitted by June 30, 2024, through the MyTRB portal.

You will be asked to log in to MyTRB. If you do not already have an account, you will be asked to quickly create one using your email and a password. **Scroll down to synthesis projects beginning with 20-05/Topic 56-01 through 20-05/Topic 56-22.** To ensure proper consideration of nominations, please provide all of the information requested. A current resume or CV is necessary to determine relevant knowledge and experience.

Before nominating yourself to serve as a panel member, please review our Conflict of Interest Resource page and policy.

Communication to determine an individual's interest and availability in serving will be made from this office only after we have matched available expertise (e.g., knowledge and experience as presented in the resume) with that required by the nature of the project.

NCHRP is also seeking principal investigators for the new synthesis topics. To formally express interest in being a principal investigator for a topic, a two-page Letter of Interest and professional resume or CV are required. The fixed-price fee is $55,000. Please submit Letters of Interest to the Letters of Interest Submission Portal.

The Letter of Interest and professional resume or CV should convey a concise idea of the principal investigator's knowledge of the topic and related work and experience in the subject area. **The deadline for Letters of Interest is August 27, 2024.** During panel meetings held in Fall 2024, scopes of work will be finalized and principal investigators chosen.

Information about panel nominations and Letters of Interest for the new synthesis topics can also be found at the synthesis website:
https://www.trb.org/SynthesisPrograms/SynthesesNCHRP.aspx

National Cooperative Highway Research Program Synthesis Topics

(Titles are HYPERLINKS)

Synthesis Topic 56-01
Specialized Training and Knowledge Transfer Practices for Employee Safety

Preliminary Scope

Safety training is an important tool for (1) informing employees about workplace hazards and (2) increasing their awareness of safety controls to remove and/or minimize associated risks. The Occupational Safety and Health Administration (OSHA) recommends specialized training for workers and supervisors when the workplace presents unique hazards. Workplace hazards exist for many employees within state DOT highway construction and maintenance operations, both inside and outside of active work zones. Specialized training programs and knowledge transfer strategies can help increase safety awareness and improve safety performance.

The objective of this synthesis is to document state DOT practice regarding specialized safety training programs and knowledge transfer.

Information to be gathered includes (but is not limited to):

- Written training requirements;
- Types of specialized safety training programs used;
- Position-specific training requirements;
- Frequency of training required;
- Method of training delivery;
- In-house-developed or consultant-led safety training programs;
- Practices for keeping safety training programs current and relevant;
- Practices for getting employee feedback on safety training programs;
- Whether safety training programs are agency-wide or district-specific;
- How safety training programs match up with agency-wide risk management and other priorities;
- Collection of safety data (e.g., agency level, district level); and
- Tracking training around near misses.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- Ammar, A., and Dadi, G.B. (2023). “Specialized Safety Training and Tracking for Highway Construction and Maintenance Personnel.” *International Conference on Transportation & Development*, American Society of Civil Engineers, Austin, TX. June 14-17, 2023.
- Dadi, G.B., Ammar, A., Atkins, S., and Horseman, M. (2022). “Specialized Safety Training and Tracking for KYTC Construction and Maintenance Personnel.” *Research Report KTC-22-18/SPR21-608-1F.* Kentucky Transportation Center, Lexington, KY.
- Jazayeri, E., Liu, H., and Dadi, G.B. (2018). “Modeling a Safety Training and Competence Model for Construction Craft Professionals.” *2018 Construction Research Congress* (CRC). New Orleans, LA. April 2-5, 2018.

- Mullen, J. (2004). “Investigating factors that influence individual safety behavior at work.” *Journal of Safety Research*, *35*(3), 275-285.

- Namian, M., Albert, A., Zuluaga, C. M., and Jaselskis, E. J. (2016). “Improving Hazard-Recognition Performance and Safety Training Outcomes: Integrating Strategies for Training Transfer.” *Journal of Construction Engineering and Management* *142*(10):04016048. DOI:10.1061/(ASCE)CO.1943-7862.0001160

- Wang, Y., Goodrum, P. M., Haas, C. T., and Glover, R. W. (2008). “Craft Training Issues in American Industrial and Commercial Construction.” *Journal of Construction Engineering and Management*, *134*(10), 795-803.

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Meeting Dates
First Panel Meeting: September 19, 2024 (Virtual meeting)
Teleconference with Consultant: TBD
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Synthesis Topic 56-02
Design, Production, and Construction of High RAP Asphalt Mixtures

Preliminary Scope

Reclaimed asphalt pavement (RAP) has been used in pavement rehabilitation and construction for decades. Due to the potential engineering, economic, and environmental benefits, FHWA has highlighted the importance of using RAP in the highway construction industry. In recent years, several state DOTs have introduced special provisions and specifications to allow the use of high RAP contents in asphalt mixtures. NCHRP Project 09-58 defines high RAP mixtures as those characterized by high recycled binder ratios (RBRs), typically greater than 0.3. Nevertheless, the definition of “high RAP mixtures” remains state specific. Some state DOTs have had challenges specifying, designing, and controlling the quality of asphalt mixtures containing RAP, especially those with high contents. The primary concern with such mixtures is that using high RAP contents may stiffen asphalt mixtures, making them brittle and prone to premature cracking. In addition, improper design of high RAP mixtures can lead to numerous construction challenges and performance issues such as poor compactability and workability and increased risk for cracking (e.g., thermal cracking, reflection cracking) and raveling.

Not all state DOTs have experience with mixtures containing higher RAP contents than allowable according to their current specifications. The main roadblocks to greater use of RAP in asphalt mixtures have included limitations related to specifications; lack of performance engineered based design methods; limited access to quality RAP material; lack of expertise in RAP processing; and the absence of a comprehensive resource detailing current advancements and practices to educate agencies about the benefits, challenges, and responsible implementation of high RAP mixtures.

This objective of this synthesis is to document current DOT practices regarding the design, production, and construction of high RAP content mixtures.

Information to be gathered includes (but is not limited to):

- DOT policies, specifications, definitions (e.g., RAP usage by mix type), and guidelines related to designing, producing, and placing high RAP mixtures (existing and/or under development);
- DOT policies, specifications, and guidelines related to RAP stockpile management and testing;
- Mix design strategies adopted by DOTs to design high RAP mixtures, including balanced mix design (BMD);
- Challenges faced during design and/or production;
- State DOT field experience with high RAP mixtures;
- Documented case examples of long-term field performance;
- DOT incentives to contractors for using high RAP mixtures; and
- Factors limiting the use of high RAP contents in asphalt mixtures.

Information will be gathered through a comprehensive literature review, a survey of state DOTs, and follow-up interviews with selected DOTs with relevant experience to develop case examples. Information gaps and suggestions for research to address those gaps will be identified and presented.

Information Sources (Partial)

- Diefenderfer, S. D., Habbouche, J., and Boz, I. (2023). "Balanced Mix Design for Surface Asphalt Mixtures: 2020 Field Trials." *VTRC 23-R13*. Virginia Transportation Research Council, Charlottesville, VA.
- Sias, J. E., Dave, E. V., and Zhang, R. (2022). *NCHRP Synthesis 586: Use of Recycling Agents in Asphalt Concrete Mixtures.* Transportation Research Board, Washington, DC.
- Hand, A. J. T., and Aschenbrener, T. B. (2021). "Successful Use of Reclaimed Asphalt Pavement in Asphalt Mixtures." *WRSC-TR-21-10*. University of Nevada, Reno.
- FHWA (2021). "Resource Responsible Use of Reclaimed Asphalt Pavement in Asphalt Mixtures." *FHWA-HIF-22-003*. Washington, DC.
- Diefenderfer, S. D., Boz, I., and Habbouche, J. (2021). "Balanced Mix Design for Surface Asphalt Mixtures: 2019 Field Trials." *VTRC 21-R21*. Virginia Transportation Research Council, Charlottesville, VA.
- Habbouche, J., Boz, I., Underwood, B. S., Castorena, C., Gulzar, S., Fried, A., and Preciado, J. (2021). "Review From Multiple Perspectives for the State of the Practice on the Use of Recycled Asphalt Materials and Recycling Agents in Asphalt Concrete Surface Mixtures." *Transportation Research Record 2676*, pp. 407-420. Transportation Research Board, Washington, DC.
- Epps-Martin, A., Kaseer, F., Arámbula-Mercado, E., Bajaj, A., Cucalon, L.G., Yin, F., Chowdhury, A., Epps, J., Glover, C., Hajj, E.Y., Morian, N., Daniel, J.S., Oshone, M., Rahbar-Rastegar, R., Ogbo, C., and King G. (2020). *NCHRP Research Report 927: Evaluating the Effects of Recycling Agents on Asphalt Mixtures With High RAS and RAP Binder Ratios.* Transportation Research Board, Washington, DC.
- Federal Highway Administration (2018). State of the Knowledge for the Use of Asphalt Mixtures with Reclaimed Binder Content. FHWA-HIF-18-059. Washington, DC.
- Stroup-Gardiner, M. (2016). *NCHRP Synthesis 495: Use of Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Mixtures.* Transportation Research Board, Washington, DC.

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Synthesis Topic 56-03
Current Practices in Pedestrian Safety Enhancements by State DOTs

Preliminary Scope

Pedestrian safety has become a pressing issue due to a significant rise in pedestrian fatalities and injuries across the country. State DOTs have responded by implementing various safety measures, including infrastructure upgrades, technology integration, and public awareness campaigns. These efforts are customized to address the diverse challenges posed by different environments and facilities, such as urban intersections and rural roadways. The goal is not only to address current concerns but also to promote long-term resilience and prioritize pedestrian-friendly transportation networks.

The objective of this synthesis is to document state DOT practices for enhancing pedestrian safety on state roads.

Information to be gathered includes (but is not limited to):

- Infrastructure improvements for pedestrian safety;
- Technologies deployed for pedestrian crossings and safety monitoring (e.g., design innovations, signaling improvements);
- Public awareness campaigns focused on pedestrian safety;
- Policies and regulations implemented to protect pedestrians;
- Community engagement strategies and their roles in enhancing pedestrian safety;
- Evaluation methods used by DOTs to assess pedestrian safety measures;
- Collaborative efforts between state DOTs and local municipalities or organizations;
- Challenges faced in implementing pedestrian safety initiatives; and

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- Connecticut DOT. (2021). "Comprehensive Pedestrian Safety Strategy." https://portal.ct.gov/-/media/DOT/documents/dcommunications/Press_Release/Comprehensive-Pedestrian-Safety-Strategy-JanFeb-2021.pdf
- Maryland DOT. (2023). "Pedestrian Safety Action Plan." https://experience.arcgis.com/experience/a4c07b80731b4a109a79bf6c86aad4c9

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Teleconference with Consultant: TBD
Second Panel Meeting: TBD

Synthesis Topic 56-04

Practices on Mental Health, Suicide Prevention, and Addiction Mitigation in Construction and Maintenance

Preliminary Scope

The construction industry confronts alarming statistics regarding mental health, suicide, and addiction. Approximately 16.5% of construction workers report heavy drinking, 11.6% engage in illicit drug use, and 14.3% battle substance misuse addictions. Opioid overdoses, responsible for 47,600 deaths in 2017, disproportionately affected the construction and extraction industry, contributing to 26% of these fatalities. The onset of COVID-19 exacerbated this situation. Disturbingly, the construction sector faces elevated suicide rates, surpassing fatalities from physical hazards by a ratio of 3 to 1. Males in the construction field exhibit notably higher suicide rates than any other industry. This trend is further exacerbated in transportation projects, where extended and irregular working hours, coupled with prolonged work-related travel, make the industry even more vulnerable.

National and industry-level initiatives, spearheaded by organizations such as the Construction Industry Alliance for Suicide Prevention (CIASP), Substance Abuse and Mental Health Services Administration (SAMHSA), and the Construction Suicide Prevention Partnership (CSPP), aim to address suicide prevention, opioid use, and mental health. However, in the transportation sector, these initiatives need broader acceptance, not only by contractors but also by state DOTs, to establish a culture prioritizing mental health and wellbeing for suicide and opioid use prevention. Although some initiatives exist (e.g., the ongoing transit-oriented effort "TCRP F-29 Mental Health, Wellness, and Resilience for Transit System Workers," and policies from the office of Drug and Alcohol Policy & Compliance by USDOT, and FTA resources for mental health and suicide prevention), further progress is essential. As the construction industry grapples with endemic mental health challenges, there is significant variability in organizational awareness and implementation strategies across different state DOTs.

The objective of this synthesis is to document state DOT practices on mental health, suicide prevention, and addiction mitigation in construction and maintenance.

Information to be gathered includes (but is not limited to):

- Policies, procedures, contract specifications, and/or guidelines state DOTs have in place to address mental health, suicide prevention, and substance addiction;
- Processes that state DOTs employ to spread awareness regarding these issues;
- How state DOTs incentivize stakeholders (e.g., contractors) to establish mental health, suicide prevention, and opioid use mitigation as part of their safety programs;

- Communication practices to key external stakeholders, such as federal, state, and local officials, planning agencies, legislators, and members of the general public; and
- Examples from the implementation of any awareness programs, policies, or incentives implemented by state DOTs.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- FTA. (2022). *SA-22-4 Safety Advisory: Suicide Prevention Signage on Public Transit*
- FTA. "Mental Health Resources for Transit Workers" https://www.transit.dot.gov/regulations-and-programs/safety/mental-health-resources
- Peterson C., Sussell A., Li J., Schumacher P.K., Yeoman K., Stone D.M. Suicide Rates by Industry and Occupation — National Violent Death Reporting System, 32 States, 2016. MMWR Morb Mortal Wkly Rep 2020;69:57–62. DOI: http://dx.doi.org/10.15585/mmwr.mm6903a1
- USDOT - Office of Drug and Alcohol Policy & Compliance - https://www.transportation.gov/odapc/employee
- Construction Coalition for a Drug- and Alcohol-Free Workplace
- Orlando Recovery Center. Construction Workers and Addiction. https://www.orlandorecovery.com/resources/construction-workers-and-addiction/#:~:text=Among%20full%2Dtime%20construction%20workers,to%20alcohol%20or%20other%20drugs

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Second Panel Meeting: June 4, 2025, Washington, DC

Synthesis Topic 56-05

Traffic Analysis Practices for Non-Motorized Modes (Vulnerable Road Users)

Preliminary Scope

Traffic analysis, whether for operational, design, or planning purposes, plays a crucial role in informed decision-making regarding transportation investments. While historically focused on motorized modes and roadway facilities, recent decades have seen advancements in incorporating non-motorized modes (also known as Vulnerable Road Users) such as pedestrians and cyclists into traffic analysis practices. Despite the development of methodologies like the *Highway Capacity Manual* (HCM) for non-motorized modes, there is limited information on how state DOTs are integrating these modes into their traffic analysis processes.

The objective of this synthesis is to document the current state of the traffic analysis practice (not limited to the deterministic methods such as HCM) for non-motorized modes (or multimodal analysis).

Information to be gathered includes (but is not limited to):
- Administrative procedures or protocols affecting the consideration of non-motorized modes in traffic analysis projects;
- Integration of non-motorized modes in current traffic analysis practices;
- Recent projects where analysis results for non-motorized modes were obtained;
- Primary reasons for not considering non-motorized modes;
- Methods and guidelines for traffic analysis involving non-motorized modes;
- Tools, data sources, and methods used to incorporate and analyze non-motorized modes in traffic analysis; and
- Outputs obtained from traffic analysis related to non-motorized modes and desired outputs that were abandoned due to limitations.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

<u>Information Sources (Partial)</u>

- HCM (Latest Edition), Transportation Research Board, Washington, DC.
- Multimodal Quality/Level of Service Handbook, Florida DOT
- Dowling, R., et al. (2008). *NCHRP Report 616: Multimodal Level of Service Analysis for Urban Streets*, National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/14175.

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First Panel Meeting: September 26, 2024, in-person meeting in Washington, DC
Teleconference with Consultant: TBD
Second Panel Meeting: TBD

Synthesis Topic 56-06
Practices for Transitioning to Digital Project Delivery

Preliminary Scope

With rapid technological advancements in construction, state DOTs are prioritizing digital project delivery to bridge data capture gaps. The FHWA recognizes the potential for enhanced data collection in asset management through digital technologies. FHWA's Every Day Counts (EDC) program, initiated in collaboration with AASHTO, promotes innovation. EDC Rounds 2 and 3 (2013-2016) emphasized 3D models in construction, while Round 4 (2017-2018) focused on e-construction and partnering. In Round 6 (2021-2022), the emphasis shifted to e-ticketing and digital as-builts (DAB). Additionally, buildingSMART is working with AASHTO to advance digital project delivery through various initiatives and joint committees.

FHWA’s commitment to digital project delivery is underscored by the Accelerated Implementation and Deployment of Advanced Digital Construction Management Systems (ADCMS) program. This initiative aims to promote, implement, deploy, demonstrate, showcase, support, and document the application of ADCMS, practices, performance, and benefits. State DOTs are in various stages of transitioning to digital project delivery.

The objective of this synthesis is to document state DOT practices related to adopting and implementing digital project delivery.

Information to be gathered includes (but is not limited to):

- Status of digital project delivery transition within different operational areas (e.g., design, planning, construction, and maintenance);
- Policy changes made to support transition to digital project delivery;
- Organizational structure supporting digital project delivery (e.g., staff involvement and roles, executive champion, engineer of record, and contracted support):
- How implementation effort was scoped;
- Practices for coordinating and managing the internal transition;
- IT solutions supporting digital project delivery;
- Hardware used to support the transition;
- Training supporting the transition;
- Strategies developed and used to support, track, and communicate the transition;
- Data-related practices; and
- Outcomes.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- USDOT, FHWA. (2022). *Innovator Newsletter*, September/October 2022, Volume 16 (92). Washington, DC https://doi.org/10.21949/1521850

- Dadi, G.B. et al. (2022) *NCHRP Synthesis Report 594: Technological Capabilities of Departments of Transportation for Digital Project Management and Delivery*. National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/26738.
- Ongoing NCHRP 10-113: Quality Management for 3D Model-Based Project Development and Delivery
- Nassereddine, H., et al. (2022). *NCHRP Synthesis Report 593: 3D Digital Models as Highway Construction Contract Documents*. National Cooperative Highway Research Program; Transportation Research Board; National Academies of Sciences, Engineering, and Medicine
- Dadi, G.B. et al. (2021). *NCHRP Synthesis Report 560: Practices for Construction-Ready Digital Terrain Models*. National Cooperative Highway Research Program; Transportation Research Board; National Academies of Sciences, Engineering, and Medicine. 2021. Washington, DC: The National Academies Press. https://doi.org/10.17226/26085.

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First Panel Meeting: September 25, 2024 (Virtual meeting)
Teleconference with Consultant: TBD
Second Panel Meeting: TBD

Synthesis Topic 56-07

Practices for Incorporating Risk into Bridge Management Plans

Preliminary Scope

Section 11105 of the Bipartisan Infrastructure Law (BIL) changes to Title 23, United States Code (U.S.C.), Section 119(e)(4) requires that all states are required to consider extreme weather and resilience as a part of the life-cycle planning and risk management within a state asset management plan.

The objective of this synthesis is to document current state DOT practice for incorporating risk into bridge management plans.

Information to be gathered includes (but is not limited to):

- Extent to which state DOTs incorporate risk into bridge management plans;
- Items considered in risk analysis for bridges;
- Prioritization of risk items considered in the bridge management plan;
- Decision-making structure for incorporating risk into the bridge management plan (e.g., decision makers, staff involvement, and roles);
- Practices for reviewing output and recalibrating if needed;
- Impact on funding of incorporating risk in the bridge management plan; and
- Practices for incorporating risk-based priorities into the transportation asset management plan (TAMP).

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- State DOT TAMP Documents
- *NCHRP Web-Only Document 107: Risk-Based Management Guidelines for Scour at Bridges with Unknown Foundations.* (2007). National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/23243.

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Second Panel Meeting: TBD

Synthesis Topic 56-08

Using Cathodic Protection to Mitigate Corrosion of Reinforced Concrete and Structural Steel Components of Highway Structures

Preliminary Scope

In 2003, the National Association of Corrosion Engineers (NACE) estimated that the cost of corrosion to bridge infrastructure was $8.3 billion annually. In a follow-up study in 2013, the global cost of corrosion was estimated to be US$2.5 trillion, which was equivalent to 3.4% of the global GDP. Ten years on, those costs are likely to have substantially increased. Corrosion deterioration of highway bridges significantly impacts the overall service life of the structures, which can lead to costly repairs for the bridge owners and high indirect costs and disruption for the users. The application of cathodic protection (CP) can control corrosion and extend the service life of highway structures. Many state DOTs use CP in various applications, depending on their regional environments and experience with the technology, to preserve and extend the service life of structures.

Several different CP products, solutions, and applications are available for mitigation of reinforced concrete or structural steel corrosion, and new technologies are being developed each year. Highway structures throughout the United States are exposed to a wide variety of environments (e.g., a marine structure in coastal Florida, a bridge in Minnesota exposed to deicing chemicals) for which corrosion challenges vary. Therefore, DOTs use an array of CP solutions to maintain structures across a range of environments. The methods by which DOTs monitor these systems also varies.

The objective of the synthesis is to document (1) the different types of CP methods and their applications to mitigate corrosion in reinforced concrete and structural steel components of highway structures and (2) how DOTs currently implement and manage various CP systems.

Information to be gathered includes (but is not limited to):

- Existing CP products used by the DOTs;
- How DOTs are implementing CP technologies and using them for bridge preservation;
- Alternative CP systems (e.g., passive galvanic systems versus active impressed current systems) for common highway structure applications;
- CP systems management practices, including monitoring, data collection, analysis, interpretation, and adjustment or modification;
- Challenges to successful installation and long-term operation of different CP technologies; and
- Case examples from states that implement CP.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs with significant experience in deploying CP. Information gaps and suggestions for research to address those gaps will be identified.

<u>Information Sources (Partial)</u>

A detailed literature search has not been undertaken, but relevant information is expected to be available through

- Association for Materials Protection and Performance (AMPP) (formerly NACE) committees and publications
- AASHTO TSP-2 Bridge Preservation Partnerships website
- Individual State DOT websites (design and operation policies, research, and development reports, etc.)

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Second Panel Meeting: TBD (Virtual via Microsoft Teams)

Synthesis Topic 56-09

Staffing Models for Transportation Systems Management and Operations (TSMO)

Preliminary Scope

State DOTs have historically approached information technology functions as separate and distinct from activities associated with technology elements used to manage the transportation system (i.e., operations technology (OT)). The OT, in this context, encompasses infrastructure and services such as telecommunications, intelligent transportation systems, real-time data and data sharing, incident and emergency management technology and services, and real-time decision-support systems, along with traffic management centers, systems, and software. These OT examples can all be considered part of the state DOT Transportation Systems Management and Operations (TSMO).

Increasingly, IT and OT spheres are converging due to several trends and developments including

- Expanded cybersecurity needs requirements;
- Greater system management applications requiring real-time data;
- Increased utilization of shared digital networks;
- Increased need for remote access and control of TSMO software and field devices;
- Greater inter-agency operations-related data sharing;
- Use of more cloud-based software and services; and
- Requirements for connected and automated vehicles and digital infrastructure.

As discovered through a small sampling of agencies participating in an FHWA project examining the intersection of IT and TSMO, state DOTs have addressed the need for IT staff support for TSMO in various ways. For example, some agencies dedicate IT staff for TSMO and may embed them within traffic operations or TSMO units. At the other end of the spectrum, TSMO programs may be required to work through a separate IT agency which may have responsibility over multiple state business areas, with transportation being only one of many.

The objective of this synthesis is to document state DOT staffing models for TSMOs.

Information to be gathered includes (but is not limited to):

- Processes for determining staffing levels for the TSMO;
- Staff requirements and backgrounds;
- Policy considerations for the staffing model;
- Practices related to committing and funding IT staff support;
- State DOT use of consultants or vendors in an IT staffing capacity; and
- Staffing implications on TSMO project life-cycle phases (e.g., technology procurement, implementation, management, maintenance, and sunsetting).

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- FHWA IT-TSMO resources
  https://ops.fhwa.dot.gov/plan4ops/focus_areas/integrating/it.htm
- National Operations Center of Excellence Peer Exchange Summary (December 2023)
- 2024 TRB Annual Meeting IT-OT Workshop co-sponsored by several TRB Committees

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Meeting Dates
First Panel Meeting: October 1, 2024 (Virtual meeting)
Teleconference with Consultant: TBD
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Synthesis Topic 56-10
Practices to Reduce Serious Injuries and Fatalities

Preliminary Scope

The Occupational Safety and Health Administration (OSHA) began tracking and publishing industry-wide safety metrics like the total recordable incident rate (TRIR) in the 1970s. The TRIR is a rate of recordable incidents (requiring medical treatment beyond first aid) that communicates this rate per 100 full-time employees annually. Due to various factors and initiatives, industries have seen significant improvements in the TRIR over the years. For instance, the construction industry's TRIR in 1994 was 11.8. The most recent published data for the construction industry was in 2022, and the TRIR was 2.4. This improvement represents significant effort from many individuals at industry, company, and project levels; however, non-zero numbers represent individuals who experience harm in the workplace. Further, many safety professionals have focused on the rate of serious injuries and fatalities (SIFs). OSHA defines SIFs as an amputation, in-patient hospitalization, loss of an eye, or fatality. Unfortunately, SIFs rates have not seen consistent and significant decreases. State DOTs have a range of efforts to manage occupational safety and health which seeks to reduce all incidents.

The objective of this synthesis is to document state DOT practice regarding efforts to reduce SIFs for DOT employees.

Information to be gathered includes (but is not limited to):

- Data collection efforts on SIFs;
- Practices and procedures specifically focused on SIFs reduction;
- Practices for assessing, managing, and mitigating fatigue and distraction of highway construction and maintenance workers;
- Use of technology to monitor and manage fatigue and distraction of highway construction and maintenance workers;
- Training programs aimed at reducing SIFs;
- Employee engagement and awareness of training programs to reduce SIFs;
- Results and analysis performed by state DOTs on implemented strategies, training, or use of supporting technologies; and
- Written policies and procedures regarding SIFs.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- Dadi, G.B., Sturgill, R.E., and Ramadan, B. (2023). *NCHRP Synthesis 608: Practices to Motivate Safe Behaviors with Highway Construction and Maintenance Crews*. National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/27176

- OSHA (2022). "Severe Injury Report: A Seven Year Lookback." OSHA, US Department of Labor. https://www.osha.gov/sites/default/files/severe-injury-report-2015to2021.pdf. Accessed January 26th, 2024.
- ISN (2023). "Serious Injury and Fatality Insights: A Cross-Industry Analysis of Data and Best Practices." ISN Software Corporation. https://www.isnetworld.com/en/newsroom/publications/1868. Accessed January 26th, 2024.
- Spencer, C. (2023). "Issues & Policy: The Power to Prevent Serious Injuries and Fatalities." Edison Electric Institute, https://www.eei.org/en/issues-and-policy/power-to-prevent-sif, Accessed January 26th, 2024.

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Teleconference with Consultant: TBD
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Synthesis Topic 56-11
Practices for Transportation Planning in Non-Metropolitan Areas

Preliminary Scope

Rural communities traditionally have been underrepresented in transportation planning efforts by state DOTs) During the early to mid-2000s, there were significant efforts to document rural consultation efforts by state DOTs, with the goal of building relationships and communication between state DOTs and rural community leaders. The ultimate goal of these efforts was to create a more widely inclusive transportation planning and project development process, consistent with statutory language in ISTEA and TEA-21, as well as the FHWA and FTA joint planning regulations in 2003. Early research on state outreach to rural places identified the use of regional, rural planning entities as one effective practice for conducting local official consultation.

Ultimately, these efforts culminated in the establishment of statutory language in the surface transportation bill MAP-21 that enabled the establishment and designation of regional transportation planning organizations (RTPOs). In addition, statewide and non-metropolitan planning language changed the relationship between states and rural local officials from “consultation” to “cooperation,” necessitating a higher level of communication. Between the date of this authorizing language and the current day, very few designated RTPOs have been established, even though over 30 states are using some form of RTPO-like entities, regardless of designation status, sometimes referred to as rural planning entities (RPEs).

The objective of this synthesis is to document state DOT practices for transportation planning in non-metropolitan areas.

Information to be gathered includes (but is not limited to):

- Type of rural planning organizations state DOTs cooperate with in transportation planning and project development and delivery;
- Outreach methods used for conducting local official consultation and cooperation, regardless of RTPO designation status;
- Degree of technical assistance offered by state DOTs to RPEs (e.g., hours, staffing, and funding);
- Planning activities currently undertaken by RPEs in support of, or in place of state DOTs conducting their own transportation planning in non-metropolitan areas;
- Practices of state DOT interaction with RPEs;
- Practices and relationships of state DOTs with FHWA, FTA, and other federal transportation entities related to RPEs;
- If applicable, state DOT activities coordinated with FHWA, FTA, or other federal transportation entities for the advancement of rural transportation planning; and
- Processes used for consultation with localities.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- National Association of Development Organizations (NADO) Research Foundation. (2016). "Regional Rural Transportation Planning: Models for Local Consultation, Regional Coordination, and Regional Transportation Planning Organizations." https://www.nado.org/wp-content/uploads/2016/11/Reg_transportation_planning_report_FINAL2.pdf
- NADO Research Foundation. (2017). "Regional Transportation Planning Organizations. Peer Exchange Summary." (2017). http://ruraltransportation.org/wp-content/uploads/2017/11/RTPOpeer2017.pdf
- Washington State DOT. (2019). WSDOT/MPO/RTPO Reference Materials: Selected Federal & State Planning Requirements. https://wsdot.wa.gov/sites/default/files/2021-10/WSDOT-MPO-RTPO-ReferenceMaterials2019.pdf.pdf
- Ohio DOT. (2020). RTPO Administration Manual. https://www.transportation.ohio.gov/working/publications/rtpo-administration-manual
- Federal Register Final Rule. Volume 81, Number 103 (Friday, May 27, 2016). https://www.govinfo.gov/content/pkg/FR-2016-05-27/html/2016-11964.htm
- ICF Consulting, requested by the AASHTO Standing Committee on Planning. Evaluating State DOT Rural Planning Practices. December 2003. https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=1251

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Synthesis Topic 56-12

Practices on Management, Operation, and Maintenance of Automated Traffic Signal Performances Measures

Preliminary Scope

State DOTs traditionally manage traffic signals through routine, scheduled processes that lack active performance monitoring, leading to inefficient resource allocation and potential safety and operational issues going unaddressed. Recently, there has been a shift toward Automated Traffic Signal Performance Measures (ATSPM) to actively manage signal operations, including timing optimization. ATSPM offers insights and performance metrics, facilitating dynamic signal timing optimization without extensive manual data collection. By directing resources strategically, ATSPM aims to enhance safety and reliability across all transportation modes. However, DOTs face barriers hindering ATSPM's full potential.

The objective of this synthesis is to document state DOT practices for enhancing traffic signal management, operations, and maintenance along networks and corridors. The synthesis will focus primarily on practices related to the application of ATSPM to streamline these tasks.

Information to be gathered includes (but is not limited to):

- State DOTs use of ATSPM for active traffic signal monitoring, evaluation, and optimization;
- ATSPM’s role in supporting maintenance and ensuring a state of good repair;
- Development of skills within DOTs concerning policy, procedure, and mandatory software for ATSPM implementation, including staff training initiatives;
- Common applications of traffic signal optimization processes, encompassing in-house programs, corridor studies, and post-construction projects;
- Factors influencing traffic signal optimization, including procedural policies, funding and scheduling constraints, extent of data collection, geographic considerations, and safety performance factors;
- Adoption of big data practices and procedures, encompassing data sources, data age, frequency of updates, and data flow techniques in operational models;
- Review practices for traffic signal optimization and safety performance analysis;
- Examination of qualitative and quantitative return on investment metrics; and
- Barriers and constraints hindering the transition from traditional reactive traffic signal timing to active approaches using tools like ATSPMs.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Gaps and suggestions for research to address those gaps will be identified.

<u>Information Sources (Partial)</u>

- Nevers, B. et al. (2020). *NCHRP Research Report 954: Performance-Based Management of Traffic Signals*. National Academies of Sciences, Engineering, and Medicine; Washington, DC.

- Day, C. M., Bullock, D. M., Li, H., Lavrenz, S., Smith, W. B., and Sturdevant, J. R. (2015). *Integrating Traffic Signal Performance Measures into Agency Business Processes.* Purdue University, West Lafayette, Indiana. https://doi.org/10.5703/1288284316063

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Synthesis Topic 56-13

Budgetary Practices for Stormwater Permit Compliance Programs

Preliminary Scope

Since 2003 and, in some cases, earlier, state DOTs have been required to develop and implement stormwater management programs to meet Section 402 - National Pollutant Discharge Elimination System (NPDES) requirements of the Clean Water Act, known as the Municipal Separate Storm Sewer System (MS4) permit. State DOTs are regulated as Non-Traditional MS4 owner/operators of storm sewer systems. The MS4 permit places requirements on the management of stormwater quality and quantity and allows state DOTs to discharge stormwater runoff from their storm sewer systems. Additionally, a standard permit provision is that state DOTs must maintain adequate funding and staffing to meet the requirements of the permit.

Like other state DOT programs, the MS4 stormwater programs are subject to risks such as budget shortfalls, project overruns, diversion of funds to address emergencies or non-compliance situations, and staff turnover and the associated loss of institutional knowledge. MS4 permits are renewed every 5 years with requirements typically escalating with each permit reissuance.

To address these risks and uncertainties, state DOTs currently implement a wide variety of budget development and program cost determination practices and procedures. These practices vary from highly centralized models for determining permit program budgets to decentralized models where budgets are allowed to vary significantly across DOT districts. Some practices involve no budgeting at all, with DOTs taking the position that certain permit compliance programs are ancillary activities undertaken in pursuit of achieving a larger primary objective.

The objective of this synthesis is to document current state DOT MS4 budget development and program cost determination practices.

Information to be gathered includes (but is not limited to):

- Programs compliant with MS4 stormwater permits;
- Existence of written guidelines or procedures for developing MS4 stormwater program budgets (e.g., responsible staff, frequency);
- Process for developing the MS4 stormwater program budget;
- MS4 stormwater program budget funding source;
- MS4 stormwater program budget management practices;
- Methods to forecast MS4 stormwater program administrative, management, and implementation needs;
- Programs funded by the MS4 stormwater program budget; and

- Management practices for MS4 stormwater program budgets (e.g., frequency, performance metrics, and revisions).

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- National Municipal Stormwater Alliance (NMSA) – Web page link - https://ms4resource.nationalstormwateralliance.org/index.php/determining-program-costs/#Topic%203
- AASHTO. (2010). *Cost and Benefit of Transportation-Specific MS4 and Construction Permitting*.
- Taylor, S., et al. (2014). *NCHRP Report 792: Long-Term Performance and Life-Cycle Costs of Stormwater Best Management Practices*. National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/22275.
- Whitman, J.B., and Perez, M.A. (2024). *NCHRP Synthesis Report 614: Outsourcing Post-Construction Stormwater Best Management Practice Inspection and Maintenance Activities.* National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/27502.
- Dong, R., Nelson, J., Cummins, S., and Goodall, J. (2023). "Tracking the Cost of Maintaining Stormwater Best-Management Practice Facilities: The Role of Database Design and Data Entry Best Practices." *Journal of Sustainable Water in the Built Environment*.

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Synthesis Topic 56-14

State DOT Training Programs to Comply with NPDES Stormwater Permit Requirements

Preliminary Scope

The federal Clean Water Act (CWA) mandates that state DOTs adhere to National Pollutant Discharge Elimination System (NPDES) stormwater permits, regulating stormwater management during transportation facility construction and post-construction. These permits extend to facilities supporting the transportation network. Training requirements within these permits aim to equip DOT staff and contractors with the necessary knowledge to fulfill permit mandates and educate the public on stormwater runoff impacts.

Despite challenges such as staff dispersion—both geographically and across various job responsibilities—and limited equipment access, especially for field maintenance staff, state DOTs have developed various training delivery methods. These range from posters, fliers, classroom and virtual training to certification programs, as well as radio and television public service announcements. Developing and delivering these programs is resource-intensive, prompting the need for improved efficiency and effectiveness, which this synthesis aims to address for the benefit of state DOTs, AASHTO, and researchers.

The objective of this synthesis is to document current state DOT practices for development and delivery of training programs required by NPDES stormwater permits.

Information to be gathered includes (but is not limited to):

- Identification of stormwater permit compliance programs with associated training requirements;
- Practices for identifying target audiences;
- Methods used to administer trainings, e.g., in person/instructor led, on-demand virtual, mass media, or physical materials such as posters;
- Methods for documenting training audiences and events;
- Methods for assessing the effectiveness of trainings;
- Outreach methods for communicating training requirements to non-DOT staff such as construction contractors and private engineering firms;
- Outreach practices applicable to the public; and
- Case examples of training programs, including a training program associated with the issuance and maintenance of a certification program.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- EPA Construction Inspector Training Course: https://www.epa.gov/npdes/construction-inspection-training-course (EPA training resources are sometimes used by state DOTs)
- ACRP 02-61 Airport Stormwater Management Electronic Resource Library (https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3834)

- AASHTO Committee on Knowledge Management: https://transportation.org/km/

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Synthesis Topic 56-15

Practices for Designing, Installing, Maintaining, Replacing, and Successively Using Complementary Bridge Deck Protection Systems

Preliminary Scope

A complementary bridge deck protection system consists of deck treatments (AASHTO Element 510 Wearing Surface and Element 521 Concrete Protective Coating) constructed together as a system to extend the service life of a deck beyond what either treatment would achieve if used separately.

Once a bridge is constructed and put into service, it begins to deteriorate. One of the most vulnerable bridge components to deterioration is the bridge deck. Decks are often exposed to contaminants and adverse weather conditions (e.g., deicing chemicals, road salts, etc.), water, freeze-thaw conditions, and saltwater environments. Water and contaminants can penetrate concrete and cause accelerated deterioration.

State DOTs undertake various strategies in design, construction, and maintenance to minimize, reduce, and slow the deterioration of their bridges. Many bridge decks have overlays, such as asphalt only, asphalt with a liquid applied waterproof membrane, asphalt with a sheet applied waterproof membrane, rigid cementitious concrete, latex-modified concrete, premixed polymer concrete with primer, multi-layer polymer concrete with primer, etc. These overlays function as protective wearing surfaces that reduce the amount of water and contaminants permeating the underlying deck concrete, thereby increasing the service life of the deck. However, these overlays may obscure the condition and hide deterioration of the underlying deck.

Some state DOTs use overlays in conjunction with deck treatments, such as concrete-penetrating sealers, crack sealers, or healer sealers, or a combination of sealer types. These complementary bridge deck protection systems further extend the service life of decks because the top layer of protection (the overlay) has to fail before the second layer of protection (the sealer) begins to work. Using a complementary bridge deck protection system may give state DOT bridge owners latitude about when to replace the overlay without experiencing significant deck deterioration. The cost of applying a concrete-penetrating sealer, crack sealer, or healer sealer is estimated to be 2% of the cost of replacing a deck, 4% of the cost of a partial-depth deck replacement, and 1% of the cost of new bridge construction. However, even at this relatively low cost, it is unknown how extensively complementary bridge deck protection measures are used.

The objective of this synthesis is to document state DOT practices for the use and design of complementary bridge deck protection systems. The synthesis encompasses current practices for designing (e.g., selecting a deck treatment combination), installing, maintaining, replacing, and successively using complementary bridge deck protection systems to extend the service life of bridge decks.

Information to be gathered includes (but is not limited to):

- Deck protection treatments (overlay or sealer) used as a single (stand-alone) deck protection strategy;

- Complementary bridge deck protection systems used, including the treatments that comprise the systems and the duration of use;
- Factors and constraints considered when selecting and designing appropriate deck protection systems;
- Written policies, guidelines, or specifications for decision-making on individual or complementary deck protection systems;
- Strategies and practices for installing, maintaining, and replacing complementary deck protection systems or individual treatments within the system;
- Criteria used to evaluate performance, and
- Performance of complementary bridge deck protection systems.

Information will be gathered through a literature review, a survey of bridge owners, and follow-up interviews with selected bridge owners for the development of case studies. Knowledge gaps and suggestions for future research to address those gaps will be identified.

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First Panel Meeting: October 8, 2024 (Virtual meeting)
Teleconference with Consultant: TBD
Second Panel Meeting: TBD

Synthesis Topic 56-16
Data Collection and Management to Expedite Pothole Repairs

Preliminary Scope

In the last few years, the pothole detection and information transfer techniques have come a long way. State DOTs have begun using some of these new techniques, and there is considerable benefit to making this information available to other DOTs looking to upgrade their pothole detection and repair processes. Potholes present a significant challenge for roadway maintenance by affecting road safety, causing traffic congestion and vehicle damage, and affecting driver comfort. DOTs are tasked with the identification, prioritization, and timely repair of these road defects. However, practices for managing this task vary among DOTs due to differences in climate, traffic volume, and available resources.

Although they share a goal of a rapid response to pothole repairs, state DOTs exhibit a variety of approaches in the collection and management of data relevant to identifying, prioritizing, and addressing these road defects. These differences in methods range from the use of advanced technologies, such as vision-based mapping and mobile sensor data, to more traditional methods like public reporting and manual inspections. In addition, DOTs frequently encounter high volumes of pothole repair requests, particularly in seasons prone to significant freeze/thaw cycles. Such seasonal challenges underscore the need for effective maintenance strategies, but these challenges also raise questions regarding the practices adopted by different DOTs for the early detection of potholes and the monitoring of areas susceptible to their formation. This divergence in data collection and management practices highlights the need for a synthesis to document the range of practices employed by state DOTs, with the goal of identifying those that promote efficient, effective, and rapid pothole repairs. This synthesis seeks to explore these practices.

The objective of this synthesis is to document current state DOT practice for the collection, management, and utilization of data in the process of pothole repair, focusing on the technological and methodological approaches to data collection, prioritization algorithms, and management systems that facilitate pothole repairs.

Information to be gathered includes (but is not limited to):

- Data collection technologies used for identifying potholes (e.g., crowdsourcing, mobile sensors, drones, public reporting systems, and internal reporting systems);
- Criteria and algorithms for prioritizing pothole repairs (e.g., size, location, traffic volume, and number of duplicate requests from unique requestors);
- How and when detection information is conveyed to responsible maintenance resources for action;
- Data management systems used to track and coordinate maintenance requests and repair activities;
- Integration of data collection and management practices with maintenance management systems;
- Case examples of state DOTs with pothole repair strategies;

- Challenges faced by DOTs in the early detection of potholes and identification of pothole-prone areas; and
- Challenges and limitations faced by DOTs in pothole repair efforts.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- Chougule, S., and Barhatte, A. (2023). "Smart Pothole Detection System using Deep Learning Algorithms." *International Journal of Intelligent Transportation Systems Research*, Volume 21, Issue 3, pp 483-492, https://trid.trb.org/view/2292501
- Ranyal, E., Sadhu, A., and Jain, K. (2023). "Automated pothole condition assessment in pavement using photogrammetry-assisted convolutional neural network." *International Journal of Pavement Engineering*, Volume 24, Issue 1, 2183401, https://trid.trb.org/view/2310698
- FHWA. Start date: 21 Dec. 2023. "Exploring the Use of Ground-Based Robotic Assistance in Uncrewed Operations of State DOTs." https://trid.trb.org/view/2307269
- Office of the Assistant Secretary for Research and Technology. Start date: 18 Feb. 2020. "Visible and Thermal Imaging in a Deep-Learning Approach to Robust Automated Pothole Detection and Highway Maintenance Prioritization." https://trid.trb.org/view/1691153
- Sharma, N., and Garg, R. D. (2023). "Real-Time IoT-Based Connected Vehicle Infrastructure for Intelligent Transportation Safety." *IEEE Transactions on Intelligent Transportation Systems*, Volume 24, Issue 8, pp 8339-8347, https://trid.trb.org/view/2224193
- Talha, S. A., Karasneh, M. A., Manasreh, D., Al Oide, A., and Nazzal, M. D. (2023). "A LiDAR-camera fusion approach for automated detection and assessment of potholes using an autonomous vehicle platform." *Innovative Infrastructure Solutions*, 8(10), 274.
- Anastasopoulos, P. Ch., McCullouch, Bob G., Gkritza, K., Mannering, F., and Sinha, K. C. (2010). "Cost Savings Analysis of Performance-Based Contracts for Highway Maintenance Operations." *Journal of Infrastructure Systems*, Volume 16, Issue 4, pp 251-263, https://trid.trb.org/view/1084328
- Romero-Chambi E., Villarroel-Quezada S., Atencio E., Muñoz-La Rivera F. (2020). "Analysis of Optimal Flight Parameters of Unmanned Aerial Vehicles (UAVs) for Detecting Potholes in Pavements." *Applied Sciences*. 10(12):4157. https://doi.org/10.3390/app10124157
- Aarabi, F., and Batta, R. (2020). "Scheduling spatially distributed jobs with degradation: Application to pothole repair." *Socio-Economic Planning Sciences*, *72*, 100904.

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Synthesis Topic 56-17

Testing and Modeling Practices for the Implementation of a Pavement Friction Management Program

Preliminary Scope

FHWA Technical Advisory T5040 provides information and guidelines for implementing a pavement friction management program (PFMP), which helps state DOTs refine their friction testing practices and places a greater emphasis on the relationship between crashes and pavement friction to minimize friction-related crashes. In the case of macrotexture, *NCHRP Report 964* describes the protocols for network-level macrotexture measurements. However, one of the key components of any PFMP is the network safety analysis. For such an analysis, a functional relationship between crashes (or crash risks) and skid resistance is needed, i.e., a safety performance function (SPF) that uses friction and/or texture as one of the safety predictors. To develop SPFs, agencies may use different crash and safety performance metrics (e.g., a wet/dry crash ratio, wet crash frequencies, the type and severity of the crash, etc.) as well as specifying different time windows over which to analyze the crashes. Moreover, depending on the crash reports and the structure of the database, the crash metric used may correspond to one or two traffic directions. Finally, the model structure defined for the SPF can differ among DOTs: some utilize the negative binomial model framework described in the *Highway Safety Manual* (HSM), while others include model coefficients to represent a panel data structure, random effects, spatial correlations, clustering analysis, machine learning, etc.

Because of this great variation in defining these components for safety analysis, there is a need to document the different methods and practices used by state DOTs to model safety performance as a function of skid resistance and to integrate this analysis into a comprehensive PFMP.

The objective of this synthesis is to document current and anticipated state DOT practices and methods to (1) measure pavement friction and texture; (2) account for friction and texture during associated design processes (e.g., mixture, geometrical, etc.); (3) model the relationship between these parameters and highway safety; and (4) integrate this information into pavement management processes.

Information to be gathered includes (but is not limited to):

- Testing technologies, measurement protocols, and analysis techniques used to characterize skid resistance (friction and texture). These include (1) performance models; (2) possible correction factors (e.g., testing speeds, temperature, seasonality, etc.); (3) measurement frequency; (4) testing location; (5) delineation of homogeneous sections; and (6) representative index value to correlate with safety and to represent pavement performance.

- Identify whether friction and/or texture demand are accounted for during the roadway and materials design processes.
- Identify analysis tools used by each state DOT to model safety performance, including identifying the variables frequently used as safety descriptors, whether skid resistance is considered as a safety descriptor, and if that is the case, what is the safety metric used.
- Identify the factors used to define friction demand categories.
- Identify the extent to which DOTs are integrating their PFMP into the broader pavement management system, including prioritization and optimization.
- What data collection plans do the DOTs use? How frequently is data collected?
- How often is the model updated?

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

Information Sources (Partial)

- Flintsch, G.W., et al. (2021). *NCHRP Report 964: Protocols for Network-Level Macrotexture Measurement*. National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/26225.
- *Guide for Pavement Friction*, 2nd Edition, 2022.
- *Highway Safety Manual*, 1st Edition, 2010.
- *FHWA Technical Advisory T 5040.38: Pavement Friction Management Program*.
- *FHWA-RC-20-0009 PFM Program Utilizing Continuous Friction Measurement Equipment and State-of-the-Practice Safety Analysis Demonstration*.
- NCHRP Synthesis 20-05/Topic 54-10: State Customization of Highway Safety Manual Methods.

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Meeting Dates
First Panel Meeting: September 25, 2024 (Virtual via Microsoft Teams)
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Second Panel Meeting: TBD (Virtual via Microsoft Teams)

Synthesis Topic 56-18
Practices for Personal Protective Equipment

Preliminary Scope

The Occupational Safety and Health Administration (OSHA) defines personal protective equipment (PPE) as equipment worn to minimize exposure to hazards that may cause injuries and illnesses. PPE can include items such as safety glasses and various types of gloves, boots, hearing protection, respirators, hard hats, and more. OSHA also notes that the selection, use and training, care, replacement, disposal, and monitoring are important factors in the effective adoption and use of PPE. In the context of state DOTs, DOT employees face a wide range of unique hazards from their laboratory and office settings to their highway construction and maintenance operations near live traffic. PPE practices and programs at state DOTs would likely need to be adaptable, offering PPE from high-visibility clothing to items for chemical protection.

There have also been many recent advances and research in the improvement of PPE. One such advancement has been in the move from traditional hard hats to Class II helmets. At least one state DOT has moved entirely to the Class II helmets for personnel needing head protection. Other DOTs have piloted these helmets and will issue them to specific work groups or by request. Adoption of Class II helmets by state DOTs will likely increase.

The objective of this synthesis is to document state DOT practices for the distribution and assignment of PPE, including the adoption and implementation of newly developed PPE.

Information to be gathered includes (but is not limited to):

- Written policies and procedures regarding PPE;
- Types of PPE used and when they are used;
- Tracking and management of PPE;
- Adoption of newly developed PPE and piloting (e.g., Class II helmets, high-visibility clothing, PPE for chemical protection);
- Provision or requirements for employee purchases of PPE;
- Colors allowed for PPE;
- Nightwork PPE;
- PPE training programs;
- Employee input and feedback on the use of PPE; and
- PPE care, replacement, and disposal practices.

Information will be gathered through a literature review, a survey of state DOTs, and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

<u>Information Sources (Partial)</u>

- Dadi, G.B., Sturgill, R.E., Jr., Al-Shabbani, Z., and Ammar, A. (2022). *NCHRP Synthesis 591: Use of Safety Management Systems in Managing Highway Maintenance Worker Safety*. National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/26672

- Dadi, G.B., Sturgill, R.E., and Ramadan, B. (2023). *NCHRP Synthesis 608: Practices to Motivate Safe Behaviors with Highway Construction and Maintenance Crews*. National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press. https://doi.org/10.17226/27176
- OSHA. "Head Protection: Safety Helmets in the Workplace." Safety and Health Information Bulletin SHIB. 11-22-2023.
- NCDOT Communications. (2023). "NCDOT New Safety Helmets." Online Video. April 10, 2023. https://www.youtube.com/watch?v=1meu0QID4bk
- ISN (2023). "Serious Injury and Fatality Insights: A Cross-Industry Analysis of Data and Best Practices." ISN Software Corporation. https://www.isnetworld.com/en/newsroom/publications/1868. Accessed January 26th, 2024.

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Synthesis Topic 56-19

Practices on Coordination of DOT Safety Activities and Governors Highway Safety Offices

Preliminary Scope

The Highway Safety Improvement Program (HSIP) is a key federal-aid initiative aimed at reducing fatalities and severe injuries on public roads. States choose and implement projects aligned with their Strategic Highway Safety Plan (SHSP) goals to reduce fatalities and serious injuries. While all states adhere to the required regulations, practices and evaluation methods vary. Recent federal highway authorizations have modified the HSIP. Typically, HSIP practitioners analyze state databases for fatal and injury crash data, identifying high crash locations for further analysis and implementation of appropriate safety improvements. These improvements can include various treatments such as capital projects, enforcement, education, planning, and research. Collaboration with stakeholders like Highway Safety Offices and Metropolitan Planning Organizations may be involved. Understanding other DOTs' project prioritization processes and funding sources allows states to optimize their HSIP allocations. A synthesis of program practices would demonstrate the effectiveness of DOTs in addressing safety priorities through HSIP, strategic planning, and program management aligned with SHSP and Highway Safety Office programs.

The objective of this synthesis is to document how state DOTs incorporate Highway Safety Office practices and associated funding into their processes, including program structure, planning, implementation, evaluation, and reporting. The selection of countermeasures and projects is influenced by various factors such as the DOT's operational methods (e.g., district capital project development, organizational structure, capacity, contracting, planning, etc.).

Information to be gathered includes (but is not limited to):

- Organizational structures of HSIPs and HSOs;
- HSIP and HSO evaluation metrics, tools, and influence on other project delivery methods;
- Incorporation of the Infrastructure Investment and Jobs Act (IIJA)/Bipartisan Infrastructure Law (BIL) special rules (Vulnerable Road User Assessment);
- HSIP planning and capital project selection process;
- Data sources used by HSIPs and Highway Safety Offices;
- HSIP management at HQ or District level;
- Safety management processes, particularly candidate project identification through network screening;
- Sub-program project selection processes: Safe Routes to School, Railroad at-grade crossings, High Risk Rural Road, and the new Vulnerable Road User plan;
- Management of HSOs (NHTSA funding);
- Public involvement and transparency in HSIP and HSO programs regarding the planning and project selection process;
- Dashboards and publicly shared data; and
- Data collection practices, including innovative data sources such as crowd-sourced and Artificial Intelligence analyses.

Information will be gathered through a literature review, a survey of state DOTs and follow-up interviews with selected DOTs for the development of case examples. Information gaps and suggestions for research to address those gaps will be addressed.

Information Sources (Partial)

- Two active NCHRP syntheses: NCHRP 20-05/54-08: "Practices for Integrating Performance-Based Plans with Long-Range Transportation Plans and Statewide Transportation Investment Programs" and NCHRP 20-05/54-03: "DOT Practices on Road Safety Audits."
- Idaho DOT. (2019). *Idaho Highway Safety Improvement Program Report*. Available online here and here.
- South Dakota DOT. (2017). *South Dakota Highway Safety Improvement Program Report*. Available online here.
- NJDOT. (2022). New Jersey DOT's HSIP implementation plan. Available online here.
- Highway Safety Improvement Program National Scan Tour - 2016.
- FHWA HSIP Guidance, Legislation & Policy; Governors Highway Safety Association Resources.

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Meeting Dates
First Panel Meeting: October 10, 2024, in-person meeting in Washington, DC
Teleconference with Consultant: TBD
Second Panel Meeting: TBD

Synthesis Topic 56-20

Pavement Design and Evaluation of Low-Volume Roads with Heavy Loads

Preliminary Scope

Low-volume road (LVR) networks function as the primary link to highway transportation systems as well as the connection of communities. The structural capacity of LVRs plays a vital role in providing competent, stable, and durable roads. While state DOTs and FHWA have invested significant resources in improving the structural design of high-volume pavements, the structural design of LVRs, particularly local access roads in rural areas, often goes overlooked. LVRs built following a template design or minimum local standards may be sufficient for passenger vehicles, but once LVRs are subjected to heavy traffic from agriculture, renewable and non-renewable energy development, or logging operations, the structural capacity of LVRs is compromised and severe damage occurs. The damage from heavy loads can be further exacerbated by seasonal impacts such as spring thaw.

When designing pavements for LVRs, many LVR owners and managers follow the AASHTO design guide, which converts axle loads into equivalent single-axle loads (ESALs) by using load equivalency factors (LEFs). However, these design practices may not adequately account for heavy loads (i.e., overweight standard trucks and non-standard axle-configurations) nor were they developed to provide designs for all types of LVRs (i.e., paved, unpaved, and unimproved types). LVRs that experience a high percentage of heavy standard trucks and overweight non-standard traffic and commensurately high loads suffer rapid and premature road deterioration. Such failures are often attributed to overweight loads applied to a substandard road design. To address such failures, it is crucial to improve the structural design of LVRs carrying overweight loads (i.e., apply factors to ensure a more robust pavement structure).

The objective of this synthesis is to document current state DOT practice for the structural design of LVRs (i.e., paved, unpaved, and unimproved types), particularly those exposed to heavy loads. The synthesis will also identify opportunities for future research to modify current evaluation methods and design standards to provide LVR networks that can effectively accommodate heavy loads and prevent premature structural failure.

Information to be gathered includes (but is not limited to):

- Typical structural design of LVRs;
- Definition of heavy loads for LVRs;
- Common types of overweight trucks and non-standard heavy traffic;
- Overload permitting process;
- Design modifications for LVRs supporting heavy loads, including what and where heavy loads are used in the United States;
- The impacts of heavy loads on the structural capacity of LVRs;

- Common effects of heavy loads on LVRs and the primary causes of structural failure of overloaded pavement sections;
- Modifications to structural design of LVRs to accommodate heavy loads; and
- The role and impact of spring-time load restrictions on LVRs.

An extensive literature review and a survey of state DOT's will be conducted to gather information on the synthesis topic. Follow-up interviews will be carried out with selected state DOTs.

Information gathered will be used to identify examples of LVRs supporting heavy loads and document associated modifications to structural designs, if applicable. Information gaps and suggestions for research to address gaps in structural design and evaluation of LVRs supporting heavy loads will be identified and reported.

Information Sources (Partial)

- Coghlan, G. T. (2000). *Opportunities for Low-Volume Roads*. Transportation Research Board CD.
- Sebaaly, P. E., Siddharthan, R., and Huft, D. (2003). "Impact of Heavy Vehicles On Low-Volume Roads." *Transportation Research Record 1819*(1), 228-235.
- Wilde, W.J. (2014) "Assessing the effects of heavy vehicles on local roadways." MnDOT, 2014-32.

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First Panel Meeting: September 4, 2024 (Virtual via Microsoft Teams)
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Second Panel Meeting: TBD (Virtual via Microsoft Teams)

Synthesis Topic 56-21
Practices Related to Design and Construction Contingency

Preliminary Scope

Contingency is defined as a predetermined amount of money set aside in a project budget to cover unexpected costs, changes, or risks that may arise during the design and/or construction process. Contingency funds serve as a financial buffer to ensure the project can address unforeseen challenges without requiring additional funding approvals. Contingency plays a crucial role in project planning and budgeting.

The integration and management of contingency funds by state DOTs are typically influenced by project delivery methods, risk tolerances, and specific project conditions, whether managed by the owner, shared, or designated to contractors. The interplay between risk assessment/mitigation and contingency allocation also plays a role in the choice of project delivery method.

The objective of this synthesis is to document state DOT practices related to project contingency analysis, development, structure, and use across various project delivery methods, including Design-Bid-Build (DBB), Design-Build (DB), Construction Manager/General Contractor (CM/GC), and Progressive Design-Build (PDB).

Information to be gathered includes (but is not limited to):

- Written guidelines for contingency development and draw-down procedures;
- Methods, tools, and processes used for contingency analysis and risk-based cost estimation for various project delivery methods (e.g., DBB, DB, CM/GC, and PDB);
- Distinction between contingency and allowance in usage;
- Contingency structure and allocation approaches (e.g., owner versus shared pool versus contractor);
- Contingency tracking and management practices; and
- Past performance of project contingency use.

Information will be gathered through a literature review, a survey of bridge owners, and follow-up interviews with selected bridge owners for the development of case examples. Knowledge gaps and suggestions for future research to address those gaps will be identified.

Information Sources (Partial)

- FHWA Manuals and resources on project risk assessment, contingency development, and alternative project delivery
- Relevant TRB papers and reports
- State DOT contingency (estimating) and risk management guidelines or procedures
- Industry research and resources (e.g., AASHTO, AACE, DBIA, etc.)

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First Panel Meeting: October 16, 2024 (Virtual meeting)
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Second Panel Meeting: TBD

Synthesis Topic 56-22
State DOT Practices for Recruiting and Retaining Engineering, Planning, and Management Employees

Preliminary Scope

State DOTs are facing a significant challenge in recruiting and retaining sufficient numbers of engineers, planners, managers, and staff for other key positions. Retirements, fewer civil engineering graduates, and a hyper-competitive employment environment make it difficult for state DOTs to attract and maintain the level of skilled employees they need. Other factors such as greater complexity of construction methods have also added challenges for agencies' efforts to develop and retain critical positions such as construction project managers.

The objective of this synthesis is to document state DOT practices for recruiting and retaining engineers, planners, managers, and other key positions.

Information to be gathered includes (but is not limited to):
- State DOT policies, programs, and practices for recruiting needed employees;
- Programs, practices, and incentives to help retain employees;
- Approaches for making state DOTs attractive to younger professionals;
- Strategies for expanding the existing pool of eligible staff to fill needed positions;
- Implementation and performance measurement, including determining competency;
- Measures of success.

Information will be collected through a literature review, a survey of state DOTs, and follow-up interviews with selected agencies for the development of case examples. Information gaps and suggestions for research to address those gaps will be identified.

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