

# TRB Standing Committee on Construction Management (AHF10): Research Needs Statements

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# AFH-10 Roster

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- **University of Colorado, Boulder**
- **Iowa State University**
- **Arkansas State Highway & Transportation Department**
- **Virginia Department of Transportation**
- **University of New Mexico**
- **Hennepin County**
- **Delcan Corporation**
- **Texas A&M University**
- **Louisiana State University**
- **Rhode Island Department of Transportation**
- **North Carolina State University**
- **Ohio Department of Transportation**
- **Parsons Transportation Group, Inc.**
- **Golder Associates Inc.**
- **SoundTransit**
- **Syracuse University**
- **University of Canterbury**
- **Oregon State University**
- **S&ME, Inc.**
- **Florida Department of Transportation**
- **University of Kansas**
- **Utah Department of Transportation**
- **Rutgers, The State University of New Jersey**
- **Port of Seattle**
- **University of Kentucky**
- **University of Washington**
- **Kentucky Transportation Center**
- **KCI Technologies, Inc.**
- **Orrin Riley, PE, PC**

# Safety, Environmental, and Workforce Development Section – Research Ideas

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1. Recruiting, Retaining, and Promoting Qualified Personnel in Transportation Construction
2. Alternative Technologies for Mitigating the Risk of Accidents in the Work Zone
3. Guidebook on Staffing Skill Sets and Knowledge for Alternative Contracting Methods

# Recruiting, Retaining, and Promoting Qualified Personnel in Transportation Construction

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**Background** – Attracting and retaining ambitious and motivated employees is a difficult task for transportation agencies due to lower pay scales, fewer benefits, and the inability to maintain technical career paths that reward and support staff with valuable skills when compared to the private sector of construction

**Objective** – Identify best practices and recommend practical methods and strategies for recruiting and retaining qualified personnel in highway construction

**Potential Benefit** – Practical methods and strategies for recruiting, promoting, and retaining qualified personnel in the transportation construction industry

**Deliverable** – Final report that includes best practices and recommendations to successfully recruit and retain DOT employees, barriers that exist and could be revised to enhance recruiting and retaining for agencies, and methods to quantify personnel needs for human resources

# Alternative Technologies for Mitigating the Risk of Accidents in the Work Zone

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**Background** – Working near an active roadway drastically increases the probability of being struck by passing vehicles. Thus, improving work-zone safety is one of the leading concerns for transportation agencies.

**Objective** – To provide a proof-of-concept for alternative technologies that can be used to detect vehicles intruding into work zones, reduce the risk of being struck by heavy equipment, and provide early warning for both drivers and workers by testing the viability of alternative technologies and effective practices to reduce risk of injuries in work-zone areas.

**Potential Benefits** – The development of innovative means and methods to reduce the number of crashes and vehicles intruding into work-zone areas. The payoff of this research will be significant in reducing accidents in work zones.

**Deliverable** – A guidebook to help DOTs select and implement alternative technologies for mitigating the risk of traffic intrusion into the work zone, which will include guidance that allows DOTs to justify the selection of a solution based on offsetting accident costs.

# Guidebook on Staffing Skill Sets and Knowledge for Alternative Contracting Methods

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**Background** – The staffing needs for ACMs vary widely among DOTs and are affected by project and program size and type, staffing availability, organizational structure preferences, and ACM selection processes among other factors. There is a need for developing a formal process and procedure to help state DOTs effectively and efficiently select the “right” people for the ACM project team.

**Objective** – To develop a process and guidelines to assist state DOTs to effectively and efficiently plan and develop a sustainable core workforce for successfully implementing ACMs

**Potential Benefits** – The intent of this project is to furnish a uniform set of guidelines for planning efficient and effective staffing on ACMs

**Deliverable** – A guidebook to help state DOTs establish an effective and efficient staffing level for their ACM projects.

# Integrated Construction & Technologies

## Section – Research Ideas

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1. Standard Practices for Use of Mobile IT Devices in Construction
2. Alignment and Cost Benefit Analysis of the Standardization of Data Interoperability
3. Decision Support System to Prioritize Investments for Effective CIM Implementation

# Standard Practices for Use of Mobile IT Devices in Construction

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**Background** – There is concern of a gap between low implementers of mobile IT devices and those considered medium and high implementers, a narrowing range of mobile IT devices used in the field for design, construction and asset management, and a lack of applications designed specifically to improve project performance in the transportation industry

**Objective** – Identify best practices, recommend strategies, and develop a return on investment methodology for standardization of mobile IT devices on highway construction projects

**Potential Benefits** – This research is beneficial in addressing the ever-increasing staffing demand by many STAs and other construction players by providing practical methods and strategies for acquiring, deploying, training, and using mobile IT devices in the transportation construction industry

**Deliverable** – Final report that documents standard practices for acquiring, deploying, training, and using mobile IT devices in the transportation construction industry

# A Guide to Automate Project Progress Control by Leveraging LiDAR and 3D/4D Information Models

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**Background** – 3D LiDAR coupled with 4D information models have shown potential for saving time and cost by recording project status of construction projects to support some project progress tracking. Although both LiDAR and 3D/4D information models are being investigated and used in multiple applications by DOTs, their potential for monitoring construction of transportation projects have not yet been explored.

**Objective** – To automate progress tracking of transportation bridge construction projects using LiDAR and 3D/4D information models

**Potential Benefits** – A progress tracking system that is efficient, accurate, and objective will help DOTs better monitor projects, and take timely actions when necessary. Such automated progress tracking system could help improve construction productivity, along with schedule and cost performance

**Deliverable** – Guidebook for DOTs to automate progress tracking of transportation bridge construction projects by leveraging 3D LiDAR point clouds and 4D information models

# Decision Support System to Prioritize Investments for Effective CIM Implementation

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**Background** – Currently the transportation sector is adopting CIM in a manner that is similar to which the building sector adopted BIM. To enhance interoperability, it is necessary to identify methods that will assist DOT agencies in developing and following data sharing protocols.

**Objective** – To provide a decision support system for state DOT agencies that would encourage CIM implementation by helping to develop feasible agency specific plans for CIM implementation

**Potential Benefits** – Provides a central repository of data, information and knowledge that will provide better decisions through the lifecycle of transportation assets and increases efficiency of transportation agencies by making data, information and knowledge easily available and retrievable

**Deliverable** – Guidebook that describes a decision support system that will guide agencies thru the CIM implementation process. Issues of interoperability, education and training, and legal and contractual issues will also be addressed. In addition a research report will be developed including (as chapters) literature review results, survey results, recommendations, and case study results.

# Alignment and Cost Benefit Analysis of the Standardization of Data Interoperability

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**Background** – The lack of interoperability among infrastructure information models has been a major issue, causing an increase in manual data entry errors and omissions. In order to help increase interoperability, there have been attempts and research efforts to identify solutions. However, many of these efforts are overlapping and repetitive.

**Objective** – To investigate the current methods and efforts to achieve interoperability, which promotes alignment and consensus, and to quantify the cost of interoperability in today's dollars and a summary of best practices of the current research methods.

**Potential Benefits** – Promoting alignment and consensus, thus eliminating redundant work and time to ultimately reduce costs. The cost benefit analysis will provide the monetary value of the alignment efforts and most efficient practices of achieving data interoperability.

**Deliverable** – A report summarizing current efforts to provide a roadmap of objectives and future needs in terms of interoperability

# Contract Administration Section – Research Ideas

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1. Alternate Scheduling Methods for Transportation Projects
2. Guidebook for Risk-Based Construction Inspection
3. Guidebook on the Impact of Accelerated Construction Methods and Technologies for Transportation Infrastructure
4. Guidebook for Strategic Programmatic Delivery for State DOTs and Local Public Agencies

# Alternate Schedule Methods for Transportation Projects

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**Background** – Common scheduling methods for transportation projects are the bar chart and the critical path method. However, there has been some criticism about these conventional methods in terms of its effectiveness as a project management tool for avoiding delays and better planning and managing resources.

**Objective** – To develop guidance for applying alternate scheduling methods to transportation projects by identifying and documenting current project schedule development and management practices, identifying benefits of alternate scheduling methods, and piloting the guidance on several DOT projects.

**Potential Benefits** – Alternative scheduling techniques can be production-based scheduling tools that graphically depicts the construction program in terms of the location and time in which activities are performed, which allows for the duration, physical length, and production-rate of any activity in the project to be quickly identified and assessed.

**Deliverable** – A guidebook for applying alternative scheduling methods for transportation projects, which includes linear scheduling, last planner, pull planning scheduling, and other scheduling methods.

# Guidebook for Risk-Based Construction Inspection

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**Background** – State DOTs are facing the critical challenge of supporting an increased demand for highway system rehabilitation and construction work with reduced funding and staff. Also, Construction Inspection (CI) prioritizations are based on inspectors' experience and judgment, making these less efficient when used by inexperienced inspectors.

**Objective** – To develop RBCI implementation guidance. The guidance should compile effective practices identified through a comprehensive review of the existing relevant research and a critical analysis of the state-of-the-practice in using RBCI systems in transportation construction/maintenance projects as well as in other industries

**Potential Benefits** – RBCI practices facilitate the CI process and minimize the risk of reduced inspections, helping DOTs to deal with the fact that it is not possible to fully inspect all project activities with their current staffing levels. An effective RBCI system also captures critical knowledge from experienced inspectors to incorporate it into the risk assessment process.

**Deliverable** – Guidebook of effective RBCI practices, which includes a methodology to factor the perceived risk of CI activities into the decision-making process associated with the outsourcing of CI services

# Guidebook on the Impact of Accelerated Construction Methods and Technologies for Transportation Infrastructure

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**Background** – State DOTs use alternative contracting methods to shorten a project schedule, enhance innovation, and optimize resources. However, there is a concern about sustainability, public health, congestion, social, and economic impacts from construction of transportation infrastructure.

**Objective** – Develop guidance to evaluate various accelerated construction methods and technologies for roads, bridges, tunnels, and culverts associated with sustainability, public health, congestion, society, and the economy

**Potential Benefits** – DOT agencies guidance to effectively and efficiently use accelerated construction methods and technologies to maximize benefits and reduce risk associated with sustainability, public health, congestion, society and the economy

**Deliverable** – A Guidebook for accelerated construction that will address the findings of the study and provide recommendations for the implementation of accelerated construction methods as well as tools to assess the life cycle benefits/costs and performance measures related to the triple-bottom-line

# Guidebook for Strategic Programmatic Delivery for State DOTs and Local Public Agencies

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**Background** – There is a need for developing a formal process and procedure to help state DOTs and LPAs effectively and efficiently deliver and manage their programs. The benefits of using ACMs at the program level are well perceived, but not evaluated.

**Objective** – To develop a process and guidelines to assist state DOTs and LPAs to effectively and efficiently plan, develop, and deliver a program of projects

**Potential Benefits** – provide guidance for programmatic delivery and how to incorporate ACMs into programs to strategically deliver a program of projects.

**Deliverable** – a guidebook to help state DOTs plan, develop, and strategically deliver a program of projects. This valuable tool will provide another way for state DOTs to implement ACMs into transportation highway projects.