

Project No. NCHRP 23-15

Guidance on Risks Related to Emerging and Disruptive Transportation Technologies: Support for Transportation Agency Risk Management

Implementation of Research Findings and Products

This implementation plan is supplemental to *NCHRP Research Report 1090: Risks Related to Emerging and Disruptive Transportation Technologies: A Guide* (NCHRP Project 23-15). The full report can be found by searching for the report title on the National Academies Press website (nap.nationalacademies.org).

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TRANSPORTATION OPERATIONS MANUAL

Introduction

NCHRP Project 23-15, “Guidance on Risks Related to Emerging and Disruptive Transportation Technologies: Support for Transportation Agency Risk Management,” developed a risk register of emerging and disruptive transportation technologies for transportation professionals. The register and report were the principal results of the research. Owing to the rapidity of change being brought into being by the implementation of new technologies, the purpose of the register is to provide a framework to account for, describe the consequences of, track, and implement policy actions to mitigate the risk posed by emerging and disruptive transportation technologies. Rather than a static register, the report should be read as a template for agency staffers charged with managing agency risk in the prospect of profound change of unknown dimensions. The report is organized into four major sections across eight chapters:

- How to read the risk registers and risk priority rankings
- Risk register and risk priorities for each of the four emerging and disruptive transportation technologies (electric vehicles, connected autonomous vehicles, mobility on demand/mobility as a service, advanced aerial mobility).
- Policies and strategies for agency resilience to risks
- Moving forward inside state Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs)

The target audience for the register includes a range of individuals in the public and private sector. The primary focus is in public sector agencies including state DOTs, regional planning organizations, and local municipalities. In these governmental bodies is found a range of leadership, planning, and technical roles. Each is a key contributor to planning and therefore is a key audience for the risk register tool. Beyond the public sector, the register will be useful for transportation planners and consultants, technology developers, cybersecurity professionals, and data providers. Additional parties who would find utility in this report include:

- Those interested in risk associated with specific technologies: Chapter 1 provides useful background, but the reader might begin with Chapter 2 describing the risk register format and then select among Chapters 3-6 for the specific technology of interest.
- Those interested in risk to specific agency goals: Chapter 1 provides useful background, but the reader might begin with Chapter 2 describing the risk register format. Turn to Appendix B for the full risk register arranged by agency goal and risk priority. Appendix A consists of a statistical breakdown of risk priority among agency goals. Further information on specific sources of risk may then be gained by using the unique identifier associated with any row in the Appendix B risk register to identify additional information found in Chapters 3-6 in Tables 3.1b through 6.1b as well as the literature survey associated with each chapter.
- Those interested in agency risk management: Chapter 1 provides the background of this report. Chapter 2 describes the risk register format. The method used to develop the risk

register, as well as guidelines for how agencies may both modify its entries as well as tailor the tools used to develop it to local circumstances and priorities is presented in Appendix C. Chapter 7 provides brief primers on high-level policy and strategy to enhance the resilience of transportation agencies as organizations while Appendix D provides fuller versions of these briefs. Appendix A contains a statistical breakdown of risk priority among agency goals and technology groups.

- Those interested in methodological innovation: Chapter 1 provides useful background and Chapter 2 describes the risk register format and approach. The method used to develop the risk register, as well as guidelines for how agencies may both modify its entries and also tailor the tools used to develop it to local circumstances and priorities is presented in Appendix C.

The research project included significant outreach to the risk register target audience:

- Three separate peer exchanges based on perceived questions arising from the literature
 - Equity; Safety; Mobility/Sustainability
- ‘Red teaming’ and live testing of the report methodology
 - Two peer exchanges including those who had been invited to the initial three peer exchanges
 - A workshop exercise with Southern California Association of Governments (SCAG) and Caltrans staff
- Informal outreach to other individuals and organizations
 - E.g., Sacramento Area Council of Governments (SACOG)

The purpose of this implementation plan is to:

- Provide recommendations on how to best put the research findings/products into practice.
- Identify possible institutions that might take leadership in applying the research findings/products.
- Identify issues affecting potential implementation of the findings/products and recommend possible actions to address these issues.
- Recommend methods of identifying and measuring the impacts associated with implementation of the findings/products.

Recommendations on How Best to Put Research Findings into Practice

The principal method of putting the research findings into practice is through the dissemination of the research product and the education of professionals on the use of the risk assessment methodology embodied in the risk register tool. The report was written in such a way as to allow planners to implement the tool independently. The associated literature review, exemplar risk registers, policies guides, and practical appendices included in the report will facilitate the tool’s use.

Institutions That Will Lead the Application of Research Findings

The institutions that could lead the application of the research findings are at the MPO and state DOT levels. As discussed below, AASHTO can play a useful facilitating role. The project team

was aware from the project onset about the need to bridge the gap between the research and report writing on the one hand and the critical initial application on the other. This is characteristic of NCHRP projects once the study panel has completed their effort. Therefore, in the outreach portion of the research, principally in forming invitation lists to and conducting several peer exchange sessions and red-teaming workshops, there was conscious thought that individual participants might serve as potential change agents within their respective organizations. Effort should be made to contact these individuals to make them aware of the report's publication.

Issues Affecting the Implementation of Research Findings and Recommended Actions to Address the Issues

- Implementation should take cognizant and advantage of the fact that not all DOTs and MPOs are equal in peer stature nor in strategies for process innovation. There are DOTs and MPOs that are looked to for indications of where the leading-edge of best practice may be found. A second group of agencies then seek to follow in the wake of those who are in the vanguard. A third group will be observers of where the bulk of their peer organizations have positioned themselves and how they conduct the relevant processes. To the extent that outreach is possible, it would be profitable to engage the DOTs and MPOs that fall with the first of these three tiers. AASHTO may be the appropriate forum to engage them in a process of examining and testing the approach outlined in the report.
- A primary concern limiting the implementation of the research findings is the exposure of the risk register to agency management and planning professionals. Though the report will be made publicly available, the dissemination of the utility of the methodology and its adoption as a planning tool are constrained by a planner's or a planning team's limited capacity to seek out and learn to implement new tools.

Two approaches may be tapped that may aid in the dissemination of the tool's utility: a "Top Down" approach and a "Bottom Up" approach. In a "Top Down" approach, hosting a seminar or scheduling an informational session would pay dividends toward adoption and implementation of the risk register. A seminar or session could be integrated into the schedule of conferences or similar meetings. In a "Bottom Up" approach, planners who do adopt the risk register tool could be encouraged to spread word of the tool's utility, perhaps with an incentive from State DOTs. Steps could be taken to create a grass roots-level community of practice among staffs seeking to apply the report's methods. This will not only advance dissemination and implementation among practitioners but will surely also produce advances in method beyond those developed by the researchers.

- A further concern may be the role certain elements from the characteristics-based level of concern (CB-LOC) measure (e.g., size affected, speed, information, etc.) play in the calculation of the risk. The way planners at the state, regional, and local municipality level assess the elements could differ from organization to organization. That is by intent; the method is grounded in a particular agency's own operating environment and set of agency goals. But this means that in tailoring the elements to their own needs, organizations could

end up with inconsistently assessed levels of risk across organizations, thus creating a barrier to building consensus on risk among organizations.

To address this concern, promoting communication of basic assumptions influencing an organization's assessment of the elements to other organizations should be considered a best practice. Only by making such assumptions clear, can consensus begin to emerge.

- As noted in the report, the risk register format itself makes an implicit presumption of independence among the hazards and risks assessed in each of its rows. This means that it under-assesses the effect of possible interactions not only among hazards but among mitigating actions. Such actions might be well-judged for any given row, but the cumulative and possibly indirect effects of those actions on other hazards and their associated risk may not be accounted for. More detailed research on interactions among mitigating actions, sources of risk, and hazard correlation would be warranted.
- Project resource limitations and the impacts COVID-19 curtailed the ability to seek wider engagement with agency professionals during the research phase. These limitations also prevented being able to observe the report's methods in actual application. It would be useful to consider benchmarking trials applying the report method in agency settings to fine tune criteria, examine range of response, and test the proposition that regional circumstances can be reflected in a manner more appropriate than those currently being used in agency risk management.
- Only the four groups of technologies included in the original statement of work were examined and assessed. The template risk register might be widened to include other technologies beyond the four specified (e.g., AI.)
- The constraints of the risk register framing, along with detailed research and examination of the hazards included in the risk register along with their associated mitigating actions, disclosed that existing regulatory frameworks may not be adequate to meet coming challenges nor allow the interaction among DOTs, MPOs, and regulatory bodies that might be deemed necessary. This suggests the value of turning the research discussed in the report on its head: What new concepts for regulation of emerging, disruptive technology might be required? That is, rather than seeking to fit mitigating actions into current regulations, instead examine and determine the regulatory framework that might be the most favorable from the standpoint of better managing emerging and dynamically changing risk.

Recommended Methods to Identify and Measure the Impacts of Implementation

The primary measure of the risk register's impact of implementation is the number of users of the register, the number of hazards as well as emerging transportation technologies added to the register, and the subsequent identification and mitigation of additional risks related to these emerging technologies. Beyond the adoption of the register by planning professionals, the impacts will be able to be determined by such measures as:

- The number of professionals who attend training courses that include use of the risk register.

- The number of agency documents that reference the risk register.
- The number of research projects that reference the risk register.
- The number of articles in professional journals that reference the risk register.
- The number of educational institutions that incorporate the risk register in their curricula.

All are, of course, indirect proxies. Their validity would stem from the presumption that for each additional instance of use, there would be value perceived and received by the agency in order for the implementation to occur in the face of all the organizational and process changes that would be required to do so.