For state departments of transportation (DOTs), increasingly frequent severe weather events present a connected set of issues with potentially serious, costly effects on infrastructure. Moreover, much of the United States’ transportation infrastructure is reaching the end of its useful life, and—in some cases—competing priorities and limited budgets have resulted in underfunded preventive maintenance programs. In addition to extreme weather events, aging infrastructure is also being stressed by increases in population and development.

What processes and criteria can transportation decision makers use to prioritize projects for funding in the face of changing weather and climate conditions? The Federal Highway Administration (FHWA) has developed a framework for practitioners to evaluate the potential effects of climate change and extreme weather on transportation assets and systems to help determine if and where adaptation would be effective to increase resilience to these changing conditions (1). The framework suggested selection criteria based on technical feasibility, political appetite, flexibility, environmental impacts, societal impacts, effectiveness, and costs and benefits. This last criterion—costs and benefits—is a tool that, historically, transportation practitioners have seldom used but warrants additional consideration for agencies trying to demonstrate fiscal responsibility to taxpayers while also trying to meet agency goals and objectives.

National Cooperative Highway Research Program (NCHRP) Research Report 938: Incorporating the Costs and Benefits of Adaptation Measures in Preparation for Extreme Weather Events and Climate Change—Guidebook and accompanying resources provide state DOTs with a relatively simple, screening-level, cost–benefit analysis (CBA) method that incorporates adaptation to improve resilience to climate change and extreme weather into the decision-making process (2). Although state DOTs report that the expectation of damage from adverse weather events is becoming a key driver in resilience investment decisions, state DOTs typically do...
The basic premise of the approaches that were developed is that the relationship between the magnitude of the event and the damages that event causes remains constant (Figure 1) even while the relationship between the event frequency and magnitude may change over time because of evolving climate conditions (Figure 2). The goal of the sketch-level analysis is to determine the net present value of an adaptation project that will maintain the current frequency–damage relationship under future conditions. Adaptation projects—or adaptation components of capital projects—with costs less than or equal to the net present value calculated are likely to be cost-effective and may warrant further evaluation. A climate resilience analysis builds on a sketch-level analysis and improves the accuracy of the projected frequency–damage relationship. In this level of analysis, the future damages considering climate change are calculated with and without adaptation measures in place. Both levels of analysis are intended to be completed using the agency’s data and publicly available tools such as SWMM-CAT, FHWA's climate vulnerability tools, and National Oceanic and Atmospheric Administration (NOAA) Atlas 14.

To evaluate the approach that was developed, the research team applied...
Much of the United States' transportation infrastructure is reaching the end of its useful life and is also being stressed by increases in population and development.

State DOTs report that they increasingly are considering climate and extreme weather adaptation in planning and designing their projects, but CBAs are not commonly used in the project planning and development process. NCHRP Research Report 938 provides state DOTs with a practical CBA method for application to projects that address transportation system resilience. The method establishes a rigorous foundation for decision making that can improve stewardship of limited public monies and overall transportation system resilience. CBAs can help strengthen the case for resilience investments. CBA does have limitations that must also be considered when evaluating transportation projects for funding. These limitations include project benefits and costs that cannot be easily quantified, uncertainties associated with climate projections, and the challenge of selecting an appropriate discount rate to use in the face of uncertainty. Despite these limitations, CBA is a useful tool in a state DOT's toolbox. As state DOTs acknowledge and plan for the increased stress a changing climate and extreme weather are likely to bring, CBA can help them identify when and which adaptation measures should be considered for incorporation into a project. Using a simplified CBA approach to screen projects for cost-effectiveness can provide additional data for decision makers to consider when evaluating and prioritizing projects.

REFERENCES


