

Road Weather Management And Connected Vehicles

Improving Road Safety - A Benefit-Cost Analysis



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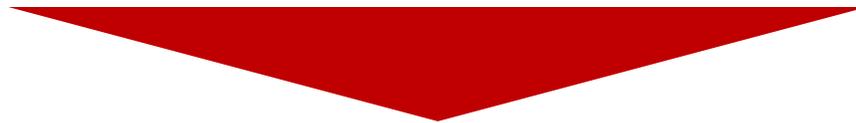
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NEXT STEPS



Introduction

- More than 7,000 fatalities occur under adverse road conditions annually
- Weather forecasts don't provide enough information
- Connected vehicle technology provides an opportunity

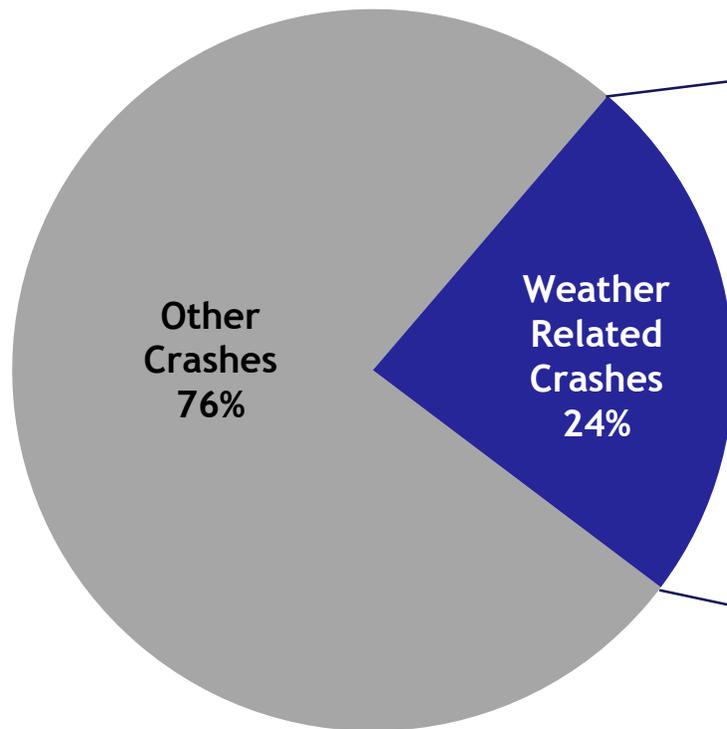


- DOT Road Weather Management Program is evaluating road-weather specific applications
- Benefit-Cost Analysis of applications estimated the *safety* benefits and the *incremental* costs of deploying road-weather applications

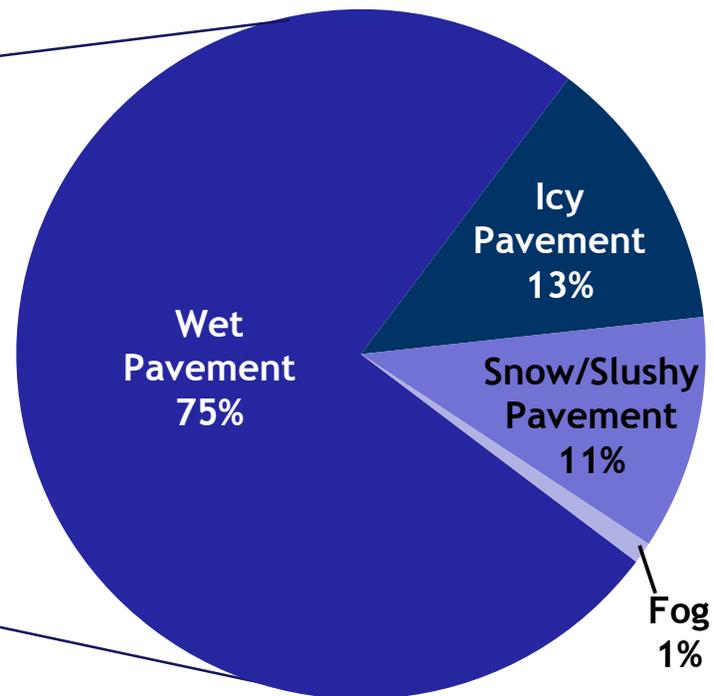


Current Road Weather Safety Impacts

Total Annual Crashes
Average = 6,301,000



Weather Related Crashes
*By Road Weather Condition**

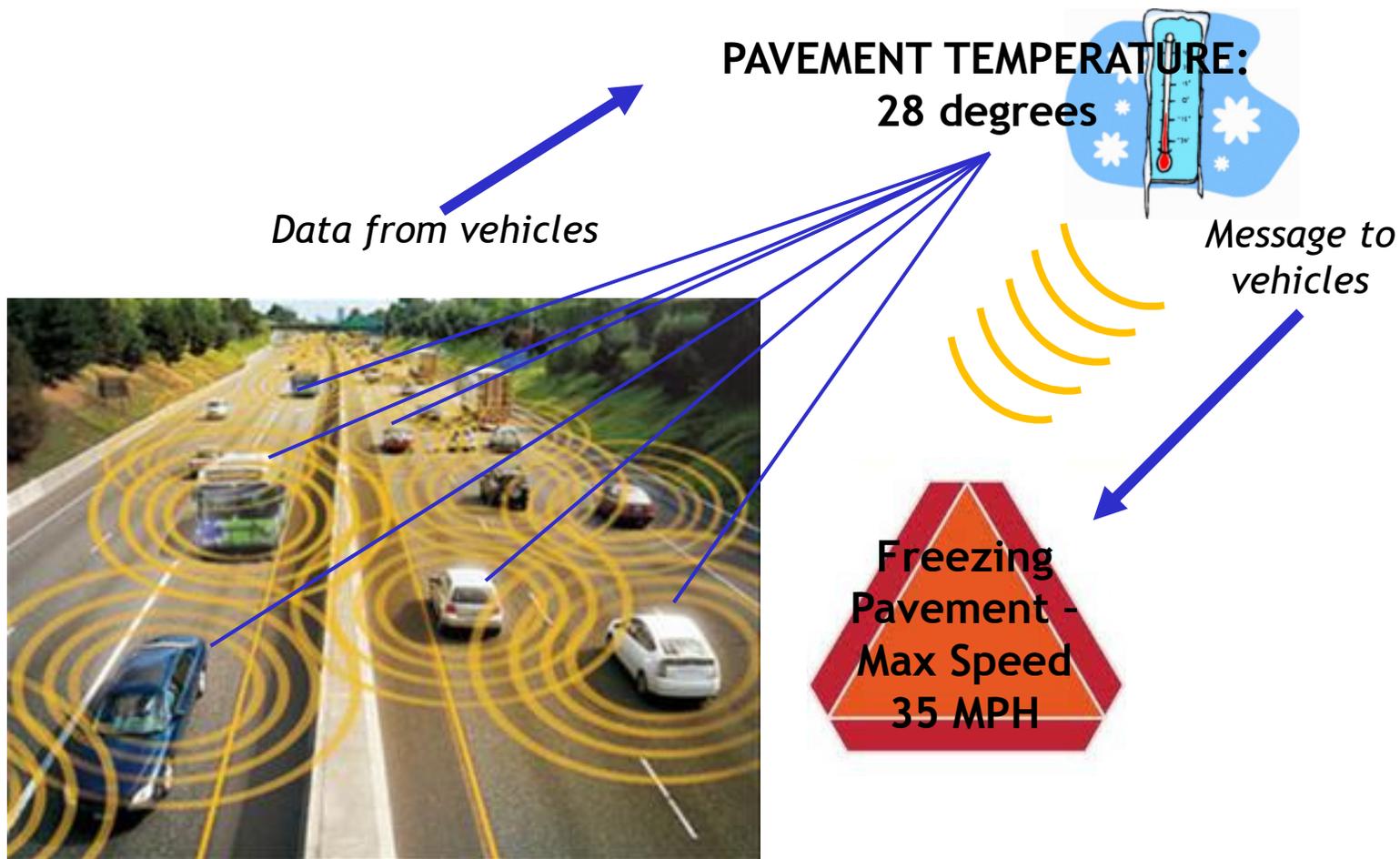


*Crashes that occurred under adverse conditions; additional factors such as rain, snow, and fog are not disaggregated from pavement conditions in this graphic. The percentage due to fog is for those crashes that occur under foggy conditions, but not wet, icy, or snowy pavement conditions.

Source: Road Weather Management Program, Table: Weather-Related Crash Statistics (Annual Averages), Available at: http://www.ops.fhwa.dot.gov/weather/q1_roadimpact.htm



Connected Vehicle Technology can Enable Road-Weather Applications



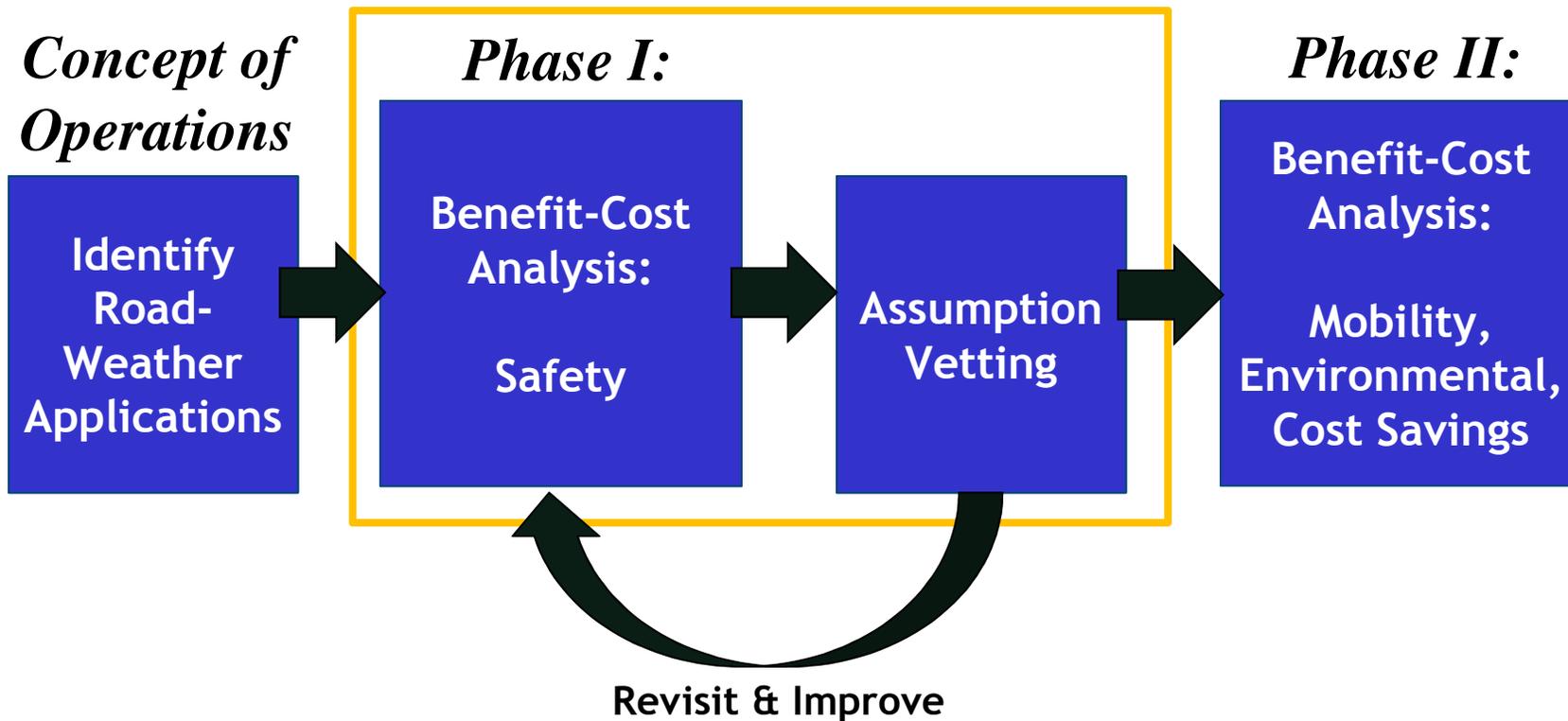
Road-Weather Connected Vehicle Applications

Application	Description
Enhanced Maintenance Decision Support System	Road-weather connected vehicle data from snow plows, other agency fleet vehicles, and other vehicles operated by the general public provide input data to Enhanced-MDSS, resulting in improved maintenance operations and increased safety.
Information for Maintenance and Fleet Management Systems	Road-weather connected vehicle data are key inputs to Maintenance and Fleet Management Systems and can, in turn, be passed to an Enhanced-MDSS to refine the recommended winter weather response plans and treatment strategies.
Variable Speed Limits for Weather-Responsive Traffic Management	Road-weather connected vehicle data can be used to inform Variable Speed Limits systems to provide real-time information on appropriate speeds for current conditions and warn drivers of coming road conditions; this application is envisioned in particular in work zones during adverse driving conditions.
Motorist Advisories and Warnings	Road-weather connected vehicle data will provide advanced warning on deteriorating road and weather conditions on specific roadway segments to travelers pre-trip and en-route.
Information for Freight Carriers	Road-weather connected vehicle data will provide information on deteriorating road and weather conditions on specific roadway segments to both truck drivers and their dispatchers. This information can be used to improve scheduling decisions and parking availability and delivery schedules.
Information and Routing Support for Emergency Responders	Road-weather connected vehicle data will provide emergency responders, including ambulance operators, paramedics, and fire and rescue companies road-weather alerts and warnings. Road-weather conditions, especially road or lane closures due to snow, flooding, and wind-blown debris, for specific roadway segments will be used to determine response routes, calculate response times, and inform decisions to hand-off emergency calls from one responder to another in a different location.

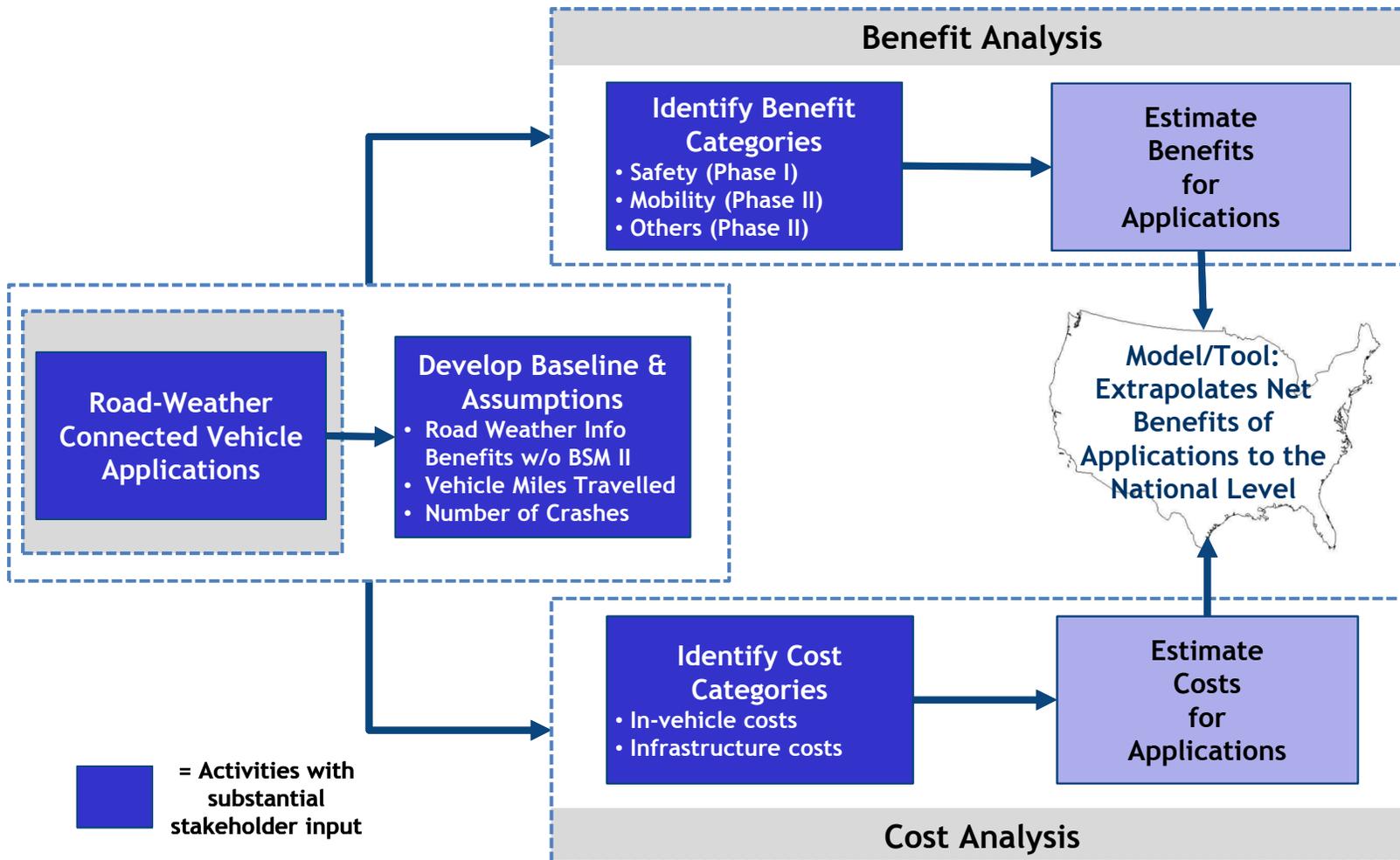


Benefit-Cost Analysis

The Benefit-Cost Analysis is being conducted in multiple phases



Overall Approach



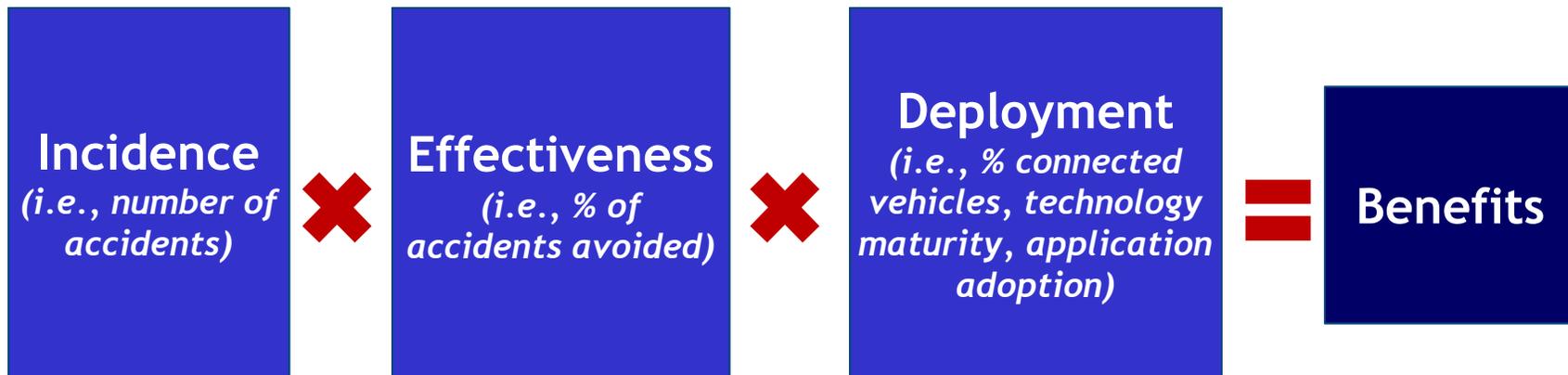
Key Assumptions of the Analysis

- Only **safety benefits** and **incremental costs** considered
- Safety benefits include:
 - Fatalities avoided
 - Injuries avoided
 - Property damage avoided
- Core connected vehicle components assumed to be in-place
- Incremental costs include:
 - Development, integration, and management of the applications
 - Additional equipment and communications required to enable applications
- Benefits realization is dependent on deployment of:
 - Connected vehicles
 - Road-weather applications



Estimating Safety Benefits

Approach



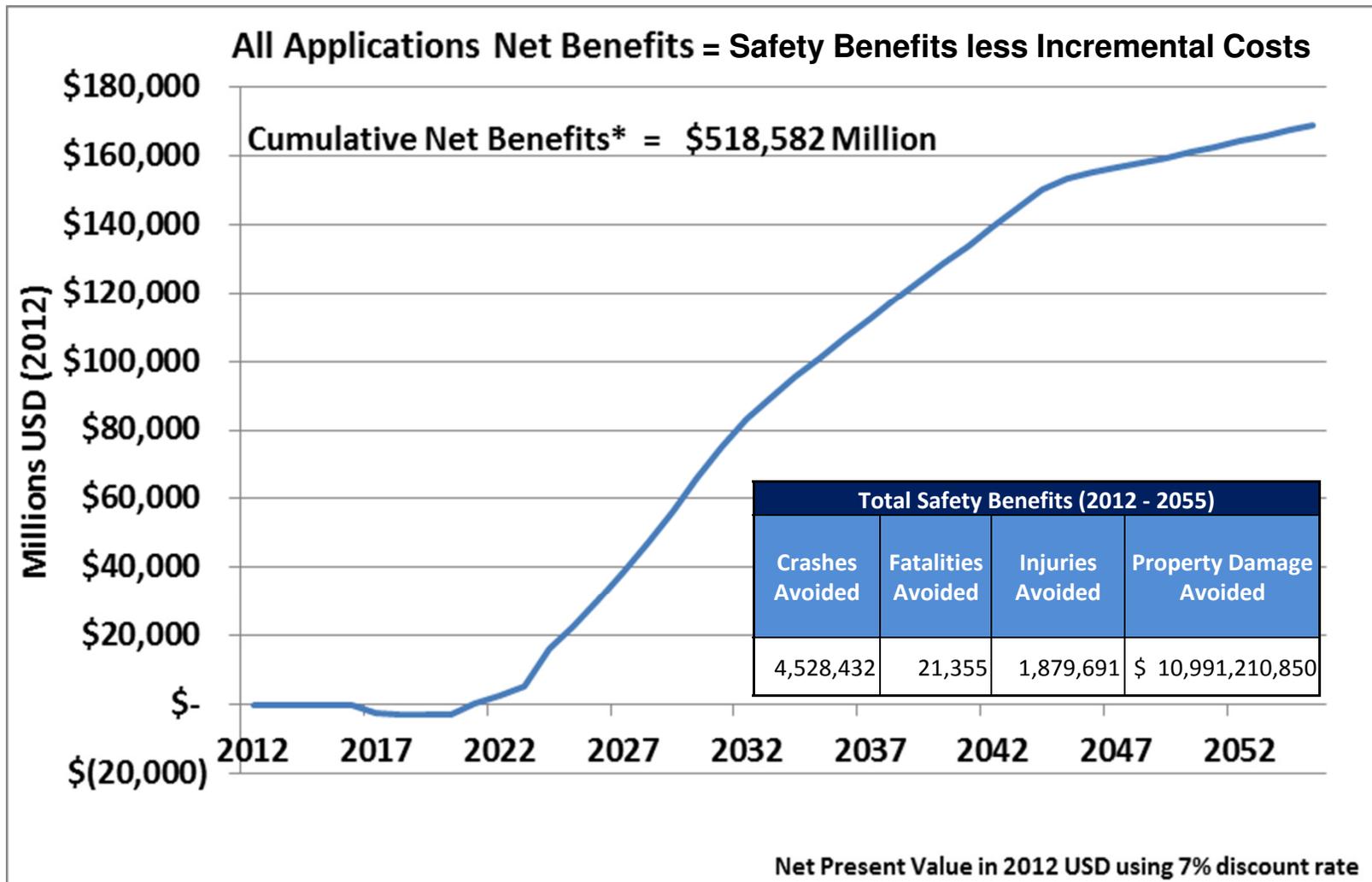
Example



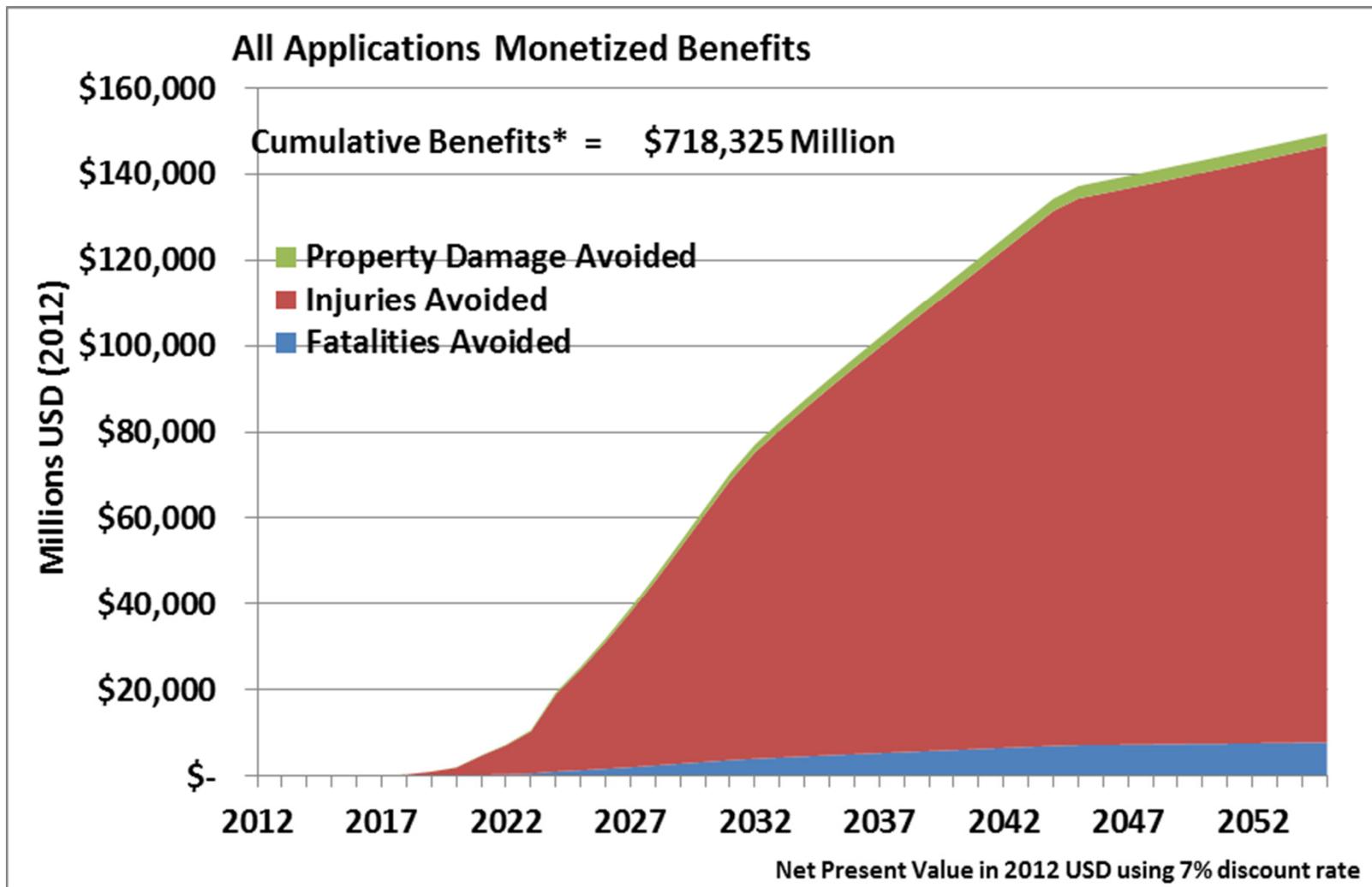
Benefit-Cost Analysis - Preliminary Results



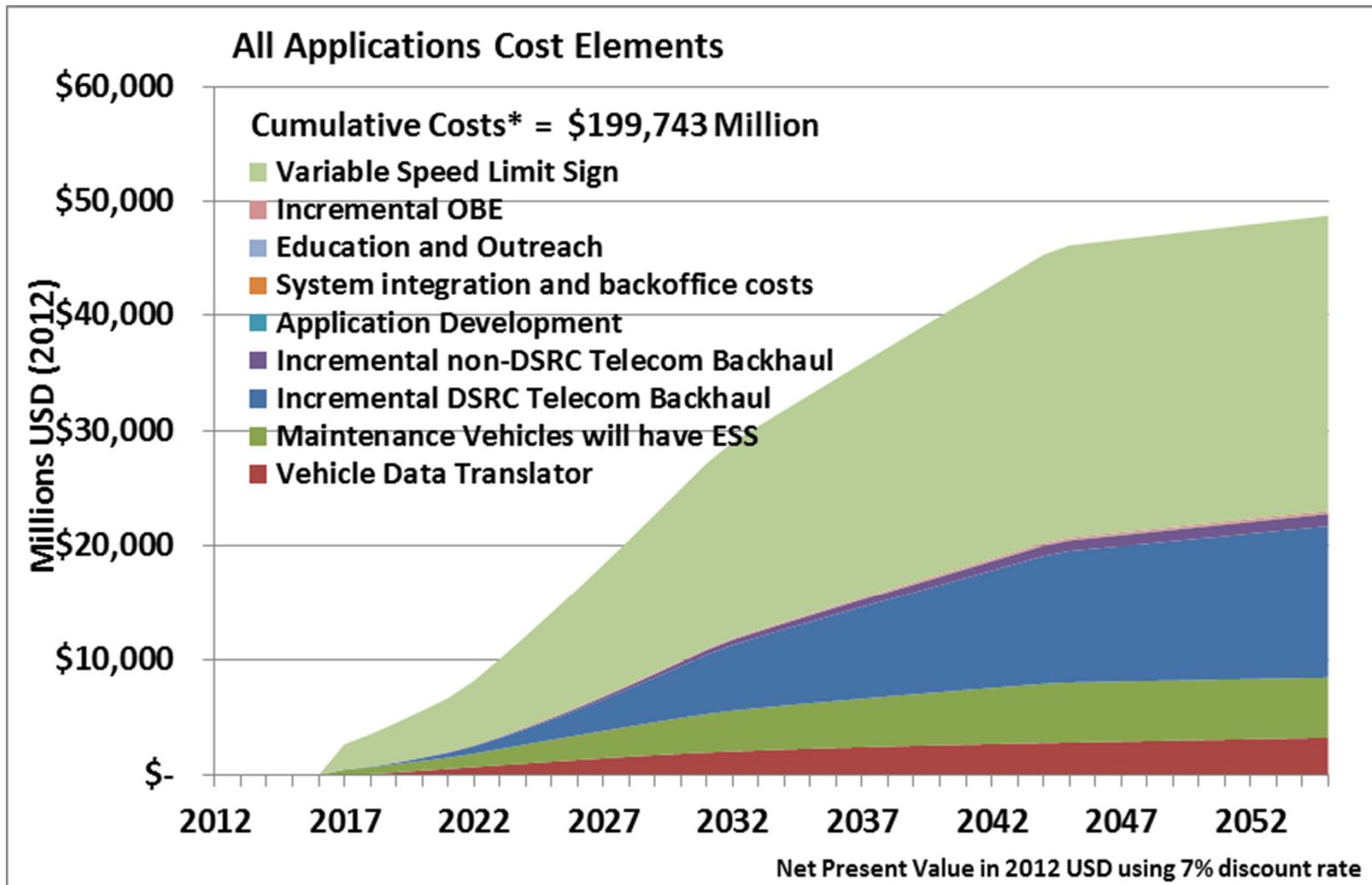
Monetized Net Benefits of All Road-Weather Applications



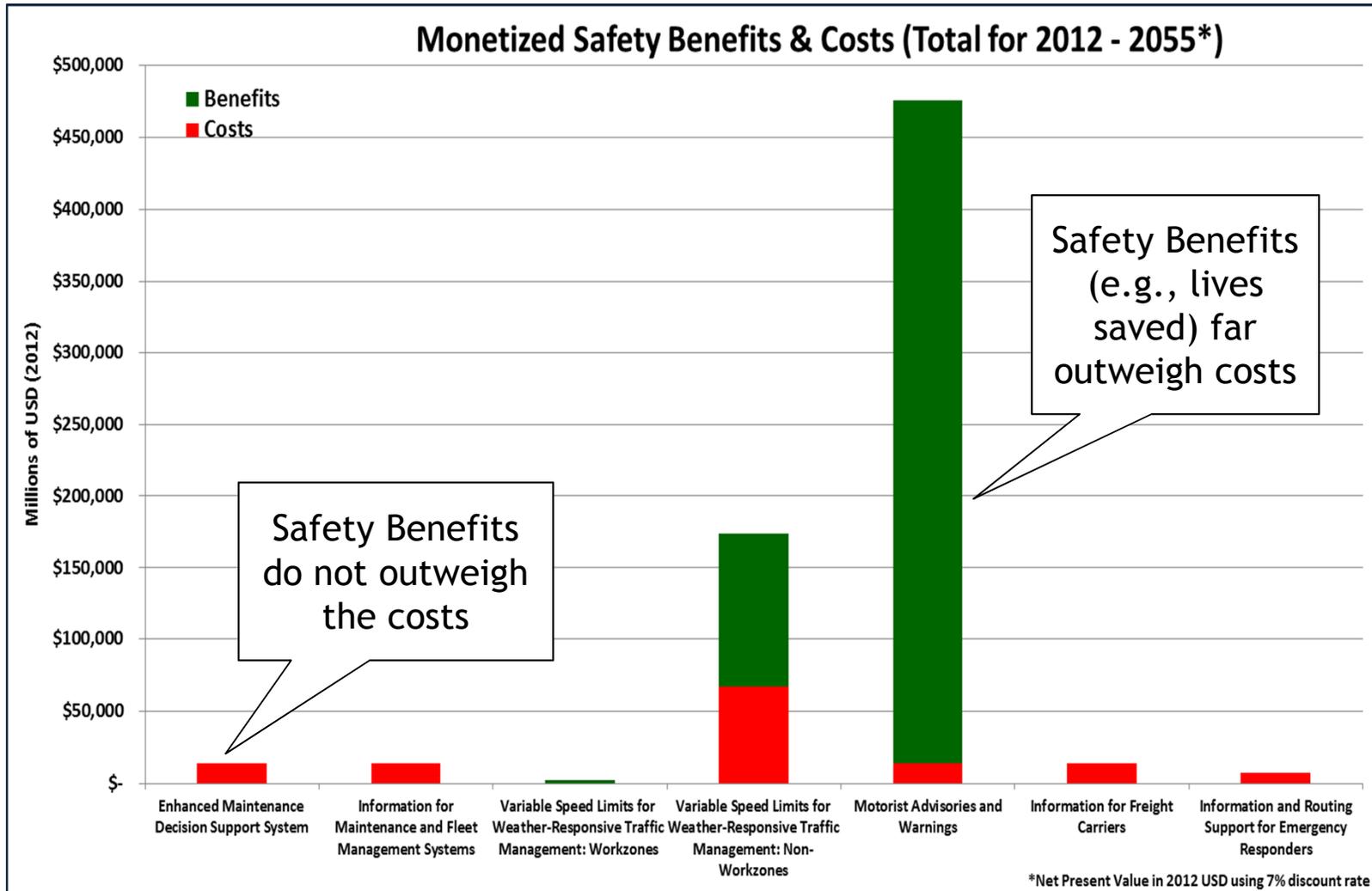
Monetized Benefit Components of All Road-Weather Applications



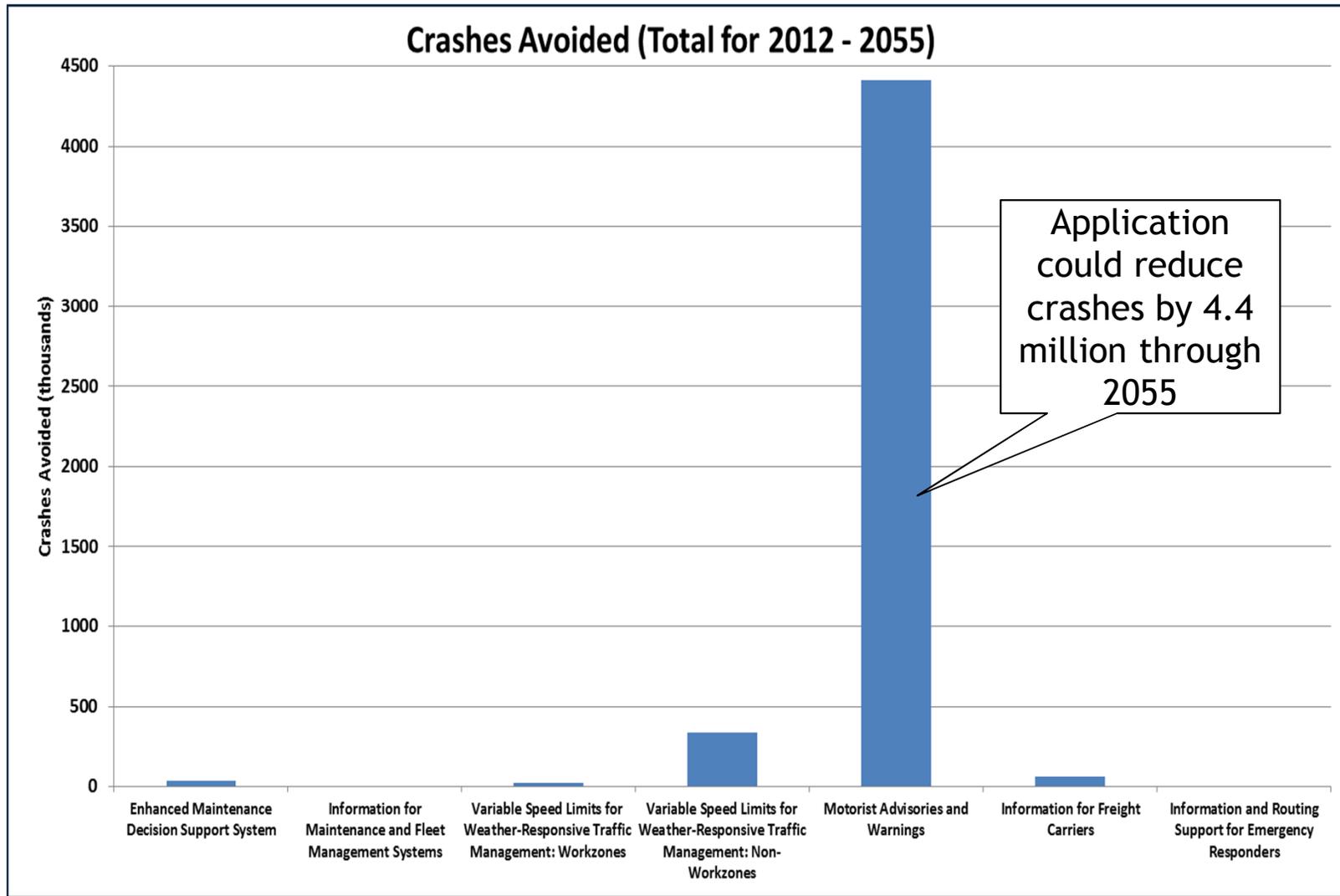
Cost Elements of All Road-Weather Applications



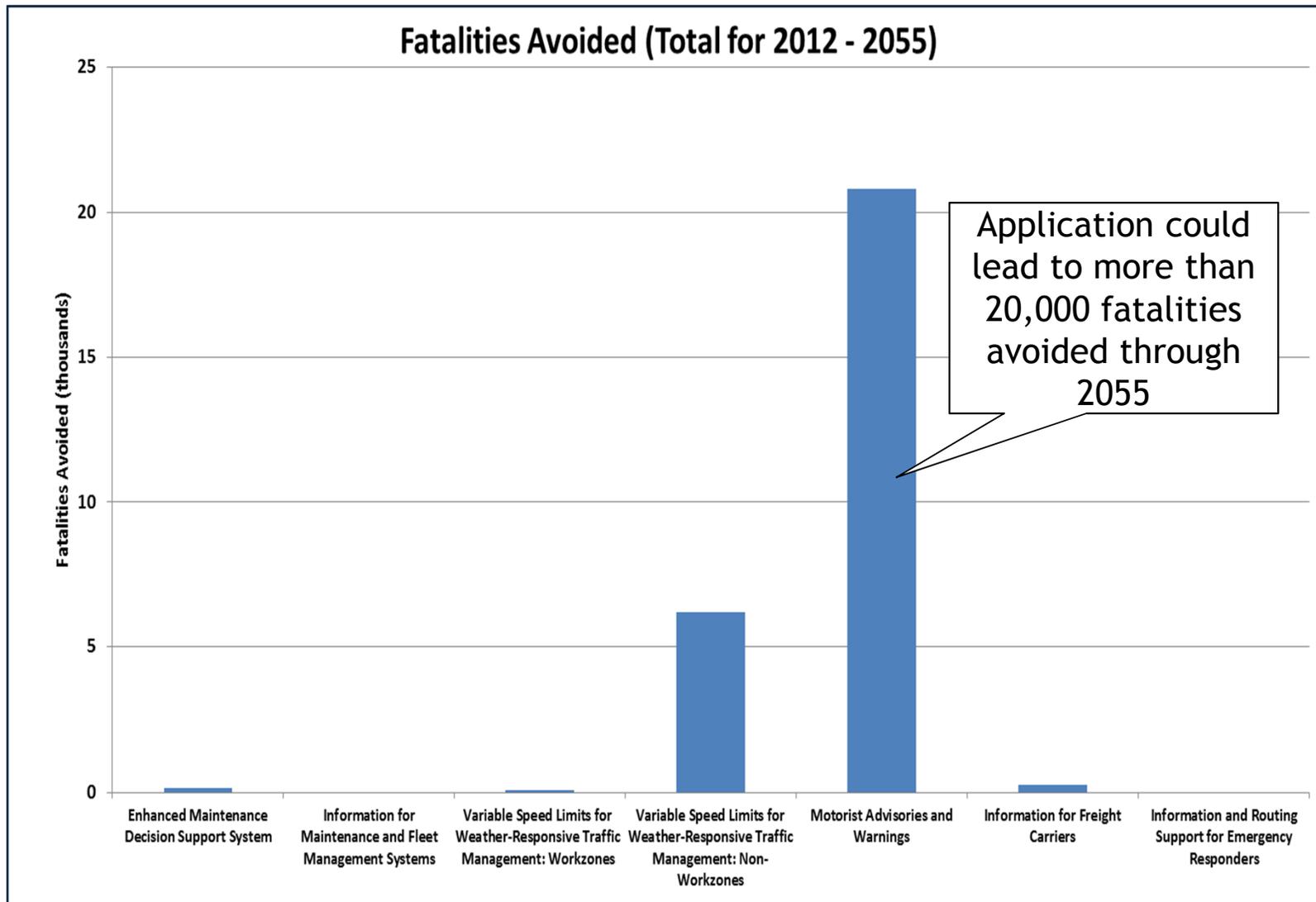
Application Comparison - Benefits & Costs



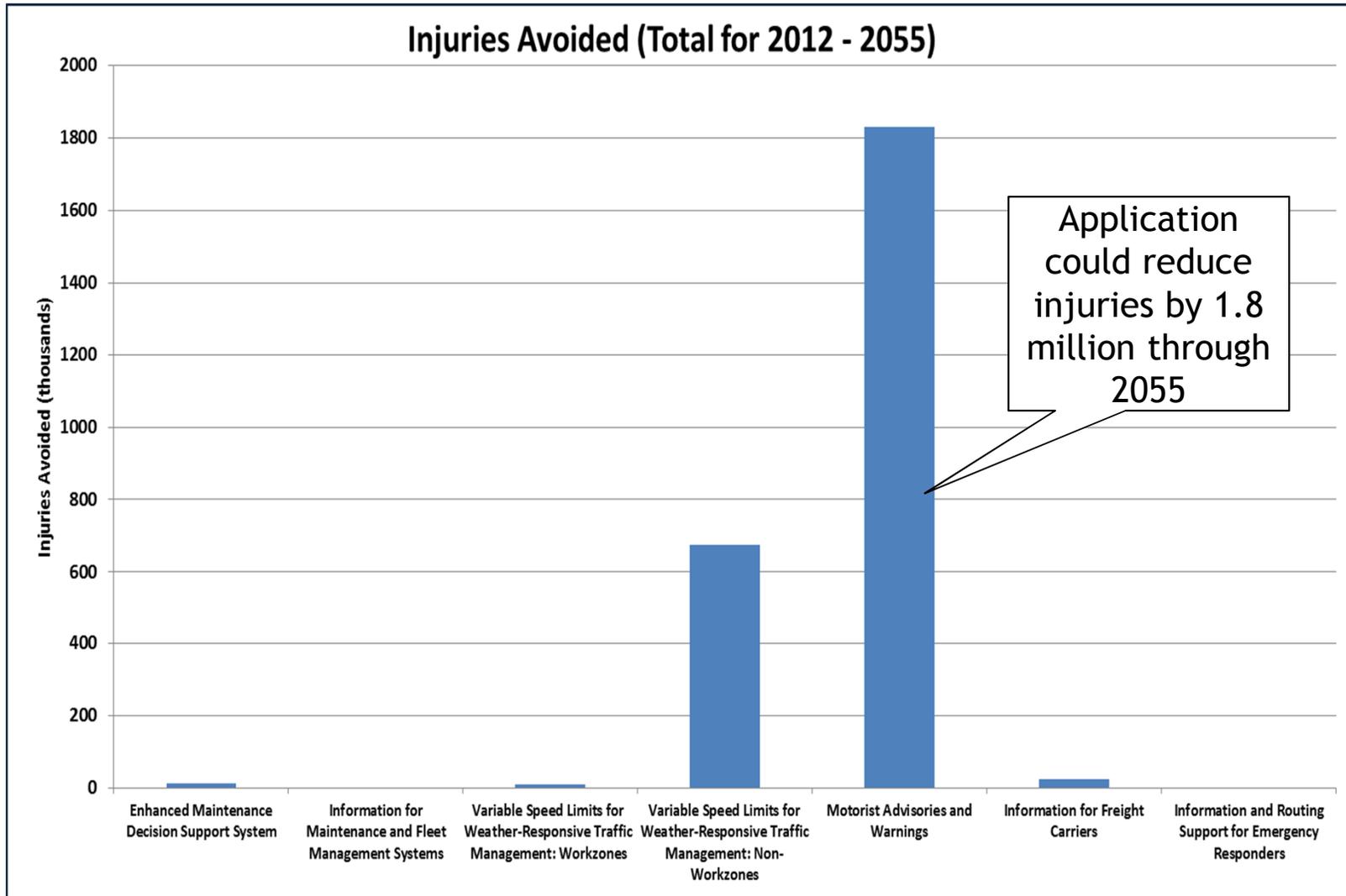
Application Comparison - Crashes Avoided



Comparison of Applications -Fatalities Avoided



Comparison of Applications - Injuries Avoided



Next Steps

- Phase II will evaluate additional benefits
 - Mobility - passenger and freight time savings
 - Environmental - reduced use of deicing chemicals/salts with same level of service
 - Cost Savings - reduced use of materials and labor
 - Other - additional benefits may be estimated as research continues

