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Benefit Cost Analysis of Railroad Track Monitoring Using Sensors Onboard Revenue Service Trains

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the ISSUE

Railroads are critical to the resilience and sustainability of our nation's supply chain, but accidents consistently plague their operations and result in huge financial losses. Technologies to help reduce the risk of several types of railroad accidents exist but uncertainties about their effectiveness and their return on investment hinder adoption.

the RESEARCH

This research applied three different analytical techniques to gain insights about railroad accident characteristics and to assess tradeoffs in the scope of safety technology deployments and their potential ROI. We used the applied methods, exploratory data analysis (EDA), machine learning (ML), and benefit-cost analysis (BCA) to inform decision making amid uncertainty.

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Project Title

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the FINDINGS

Derailment type accidents consistently approached 1,500 each year and accounted for more than 60% of the annual accidents. Human factors, track and roadbed problems, and mechanical failures were the top three accident causes, which accounted for 81% of all accidents. Derailment type accidents were statistically associated with lower track classes, non-signalized territories, and areas with restricted limits of movement authorization. Derailments were typically the result of track and roadbed problems and their association with human error was not statistically significant. By federal mandate, the railroad industry deployed a positive train control (PTC) system to help prevent accidents caused by human error. However, based on the actual deployment costs, railroads must seek benefits beyond the prevention of human-caused accidents to realize a positive ROI. For example, railroads can add sensors onboard locomotives to monitor for track and roadbed problems.

the IMPACT

Adding onboard condition monitoring sensors that can use the PTC network for real-time communications can help railroads avoid billions of dollars in both derailments and human-caused accidents. Railroads can use the BCA models developed in this research to help assess tradeoffs between affordability, performance, and payback period.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1055