MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-551 (project 642) | August 2024

Resilience-based Recovery Planning of Transportation Network Following Earthquakes

the **ISSUE**

Disrupted transportation due to infrastructure damage or failure after an earthquake poses increased safety risks. Improved recovery and prioritization planning is needed to minimize risks and enhance resiliency of transportation infrastructure.

the **RESEARCH**

This research focused on developing a resilience-based recovery planning framework for transportation networks affected by earthquakes. The methodology integrates both traffic efficiency and safety into resilience assessment, utilizing a microscopic traffic flow simulation model to estimate travel times on partially closed roads and a probabilistic sampling method for uncertainty analysis. The study introduces a resilience indicator to evaluate traffic performance and safety and proposes a bridge restoration prioritization measure based on system resilience. The framework is demonstrated on a hypothetical network in an earthquake-prone area, providing critical insights for post-disaster recovery planning and bridge restoration prioritization. The study employs Monte Carlo simulation, Latin hypercube sampling, and the user-equilibrium method for traffic assignment.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

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South Dakota State University
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Project Title

Resilience-based Recovery Planning of Transportation Network Following Earthquakes

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the FINDINGS

The researchers found that incorporating both traffic efficiency and safety into a resilience-based framework significantly improves recovery planning for transportation networks after earthquakes. The proposed resilience indicator and bridge restoration prioritization measure enable better decision-making for post-disaster recovery. Simulations demonstrated that prioritizing bridge repairs based on the framework enhances overall network resilience, reducing both travel times and the risk of accidents during recovery. The study highlights the importance of considering uncertainties in earthquake impact and restoration processes, emphasizing that a comprehensive approach to resilience planning can lead to more effective and safer recovery strategies for affected transportation networks.

the IMPACT

The researchers demonstrated the framework using a hypothetical network in an earthquake-prone area to validate the framework's effectiveness. This simulation approach allowed the researchers to test various scenarios and analyze the potential impact of different recovery strategies without actual real-world deployment. The study's findings provide insights that could guide future real-world applications for resilience planning and post-disaster recovery in transportation networks.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1196

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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