ABSTRACT: Ground transportation systems are essential for the mobility of people, goods and services. Thus, making sure these systems are resilient to the impact of natural and man-made disasters has become a top priority for engineers and policy makers. One of the major obstacles for increasing the resilience of ground transportation systems is the lack of a measuring framework. Such measuring framework is critical for identifying needs, monitoring changes, assessing improvements, and performing cost-benefit analysis. This research addresses this problem by developing a traffic-based framework for measuring the resilience of ground transportation systems under normal and extreme conditions. The research methodology consisted of: (1) creating a microscopic traffic model of the road under study, (2) simulating different intrusions and interventions, and (3) measuring the resilience of the system under the different scenarios using the framework developed. This research expanded the current definition of infrastructure resilience, which includes the assessment of system performance versus time, to add a third dimension of resilience for ground transportation system’s applications, namely: location. This third dimension considers how the system changes along the different locations in the network, which reflects more accurately the continuous behavior of a ground transportation network. The framework was tested in a 24 km segment of Interstate 95 in Virginia, near Washington, D.C. Four hazard conditions were simulated: inadequate base capacity, traffic incidents, work zones, and weather events. Intervention strategies tested include ramp meters and the use of the shoulder lane during extreme events. Public policy was also considered as a powerful intervention strategy. The findings of this research shed light over the current and future resilience of ground transportation systems when subject to multiple hazards, and the effects of implementing potential interventions.

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