RAIL NETWORK ANALYSIS SYSTEM
TRANSPORTATION MODEL

MODEL OVERVIEW
The rail system is a critical component of the U.S. transportation system. The National Infrastructure Simulation and Analysis Center’s (NISAC’s) Rail Network Analysis System (R-NAS) model determines the impact to the flow of commodities over the national rail network when one or more components of the rail system are unavailable. R-NAS combines a network flow model, a representation of the rail network created by Oak Ridge National Laboratory, and commodity data from the Surface Transportation Board’s Confidential Waybill to achieve a best-in-class capability.

MODEL CHARACTERISTICS
- National-level perspective.
- Optimization model for commodity flow prediction.
  - Goal: minimize total flow cost (impedance)
  - Impedance values can be based on multiple arc characteristics (e.g., time, distance)

OUTPUT
- Quantity of disrupted shipments by origin, destination, and commodity group.
- Changes in traffic flow patterns on the rail network.
- Changes in transportation cost, which can be used as input to regional economic models.

MODEL APPLICATIONS
- Hurricane impact analysis.
- Impact analysis of specific bridge, yard, and rail line disruptions.
- Movement of toxic inhalation hazards.
- Analysis of cyber-induced physical effects.
- Multi-modal transportation systems.
- Hurricane and earthquake planning exercises.

QUESTIONS ADDRESSED
Given an event that will impact a component of the rail system, or affect the commodities that move on the rail system, NISAC can use R-NAS to answer the following types of questions:
- How would the loss of one or more major assets in the rail network affect its ability to maintain service?
- Which commodities (and in what quantity) could not be shipped or received?
- How would transportation costs increase if rerouting rail traffic were required?
- If R-NAS is used in conjunction with an economic model, what are the economic impacts of the disruption?
- Could the rail system support additional demand if another transportation mode were disrupted (e.g., water shipping)?

ABOUT OCIA
The Department of Homeland Security, National Protection and Programs Directorate’s (NPPD) Office of Cyber and Infrastructure Analysis (OCIA) manages NISAC, which is a Congressionally mandated center of excellence in modeling, simulation, and analysis of critical infrastructure.

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