RIC 2020

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

#NRCRIC2020

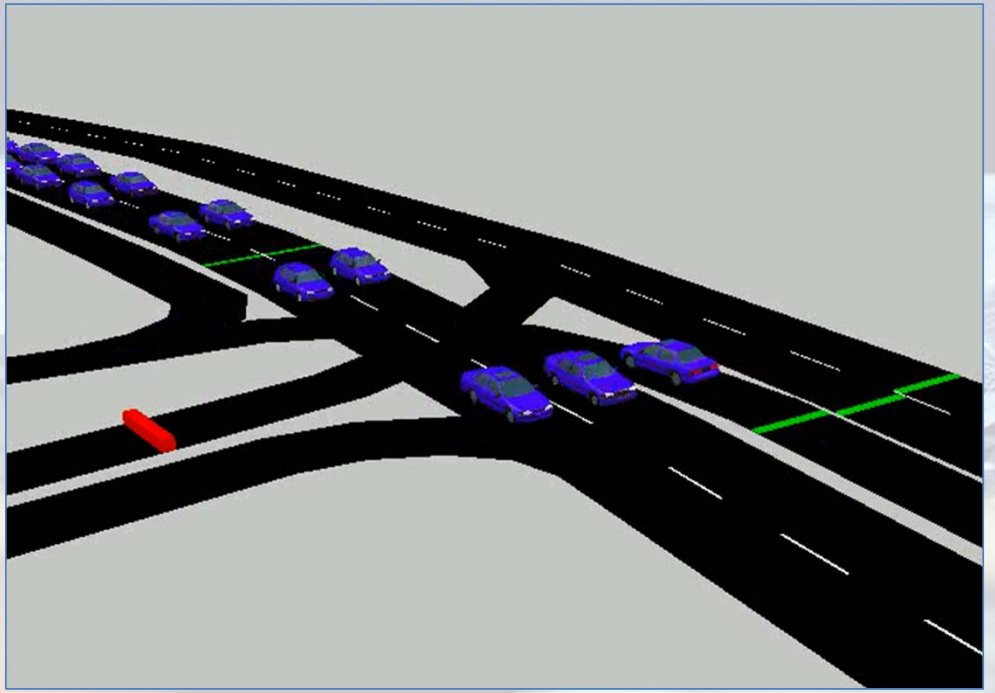
Advanced Simulations for Evacuations

Office of Nuclear Security and Incident Response
Office of Nuclear Regulatory Research

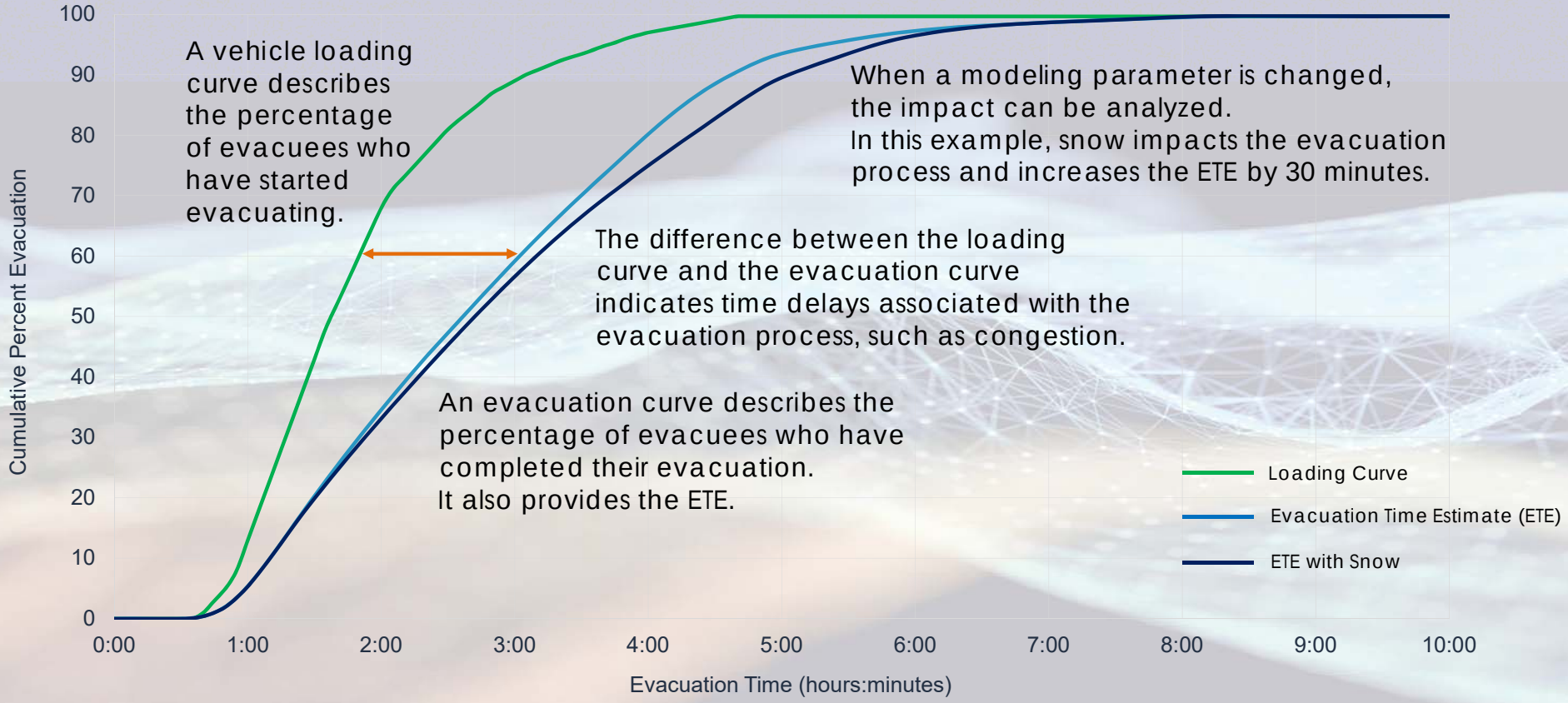
What Are We Learning?

Study of Evacuation Time Estimates (ETEs)
The NRC completed a three-year study on evacuations using state-of-the-art traffic modeling and simulation. The ETE study provides valuable insights into evacuation dynamics.

Enhanced ETE Guidance
The NRC will use ETE study insights to update the guidance in NUREG/CR-7002, "Criteria for Development of Evacuation Time Estimate Studies." The agency plans to release a revision to NUREG/CR-7002 before the next required decennial ETE updates.



What Do Evacuation Simulations Tell Us?



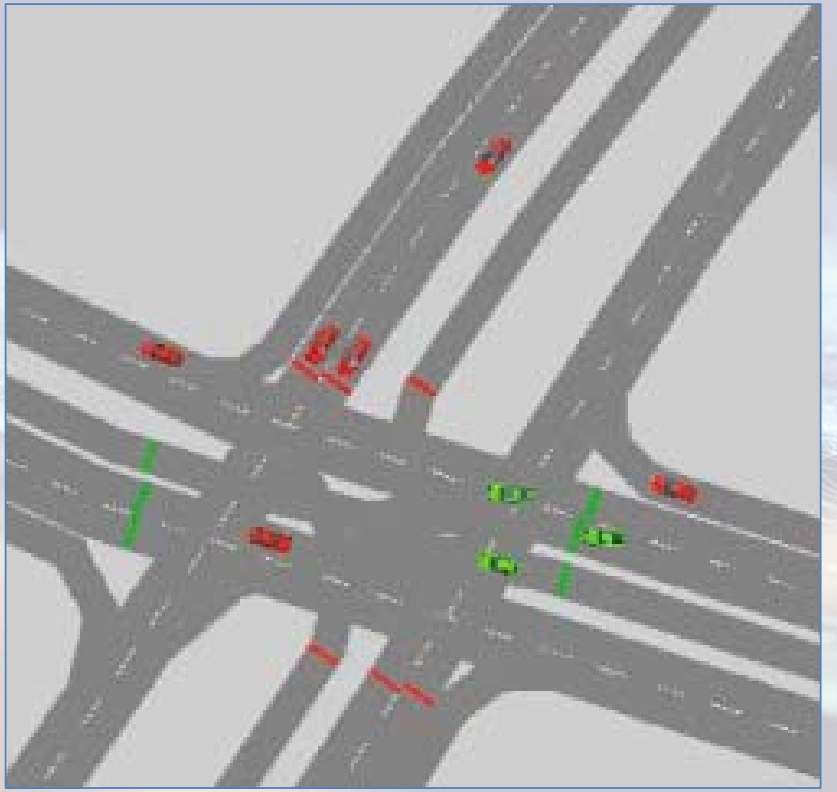
How Can Evacuation Simulations Inform Guidance?

As an example, consider the impact of a ***Shadow Evacuation***.

A shadow evacuation occurs when people outside of an evacuation zone also evacuate.

This creates the potential for impeding the flow of evacuees away from the hazard.

In this simulation, a large shadow evacuation is occurring in the 10 to 15-mile region beyond the emergency planning zone (EPZ).



Despite the presence of the shadow evacuees (**green vehicles**), EPZ evacuees (**red vehicles**) are free to continue their evacuation, unimpeded.

The ETE study shows that shadow evacuations are not likely to significantly impede an ordered evacuation, particularly in rural locations.

With this understanding, the NRC can enhance guidance to provide information on when to consider the effects of a shadow evacuation.

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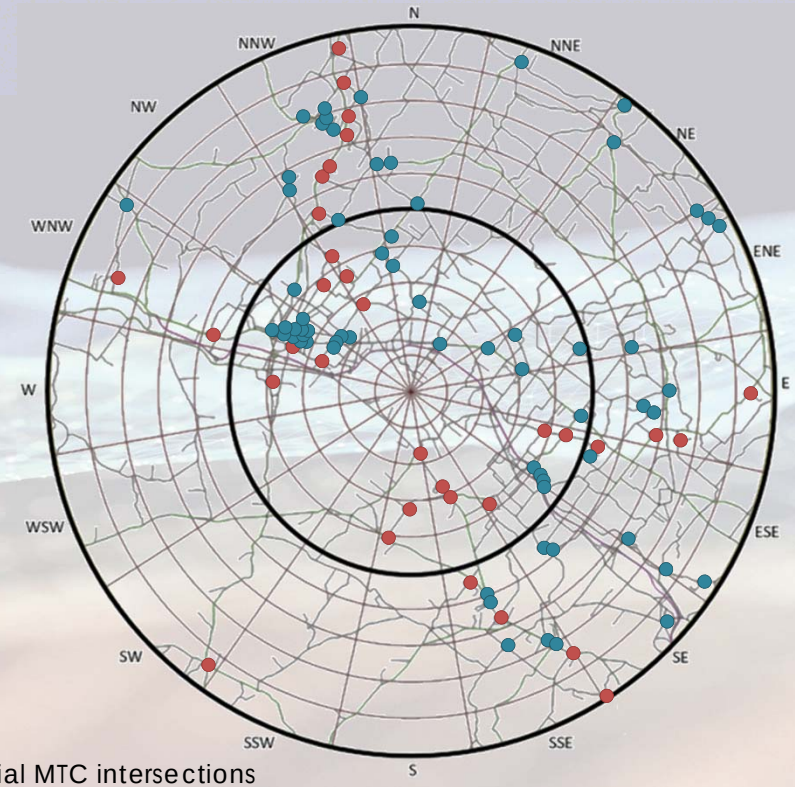

NRC models simulated police officers directing traffic at key intersections and compared evacuation times to those achieved using automated traffic control signals.

The ETE study revealed that manual traffic control (MTC) is useful for loading traffic onto the network, such as clearing large parking lots, but traffic control signals are better for moving traffic out of the evacuation zone.

This effect is largely independent of the number of staffed traffic control points.

These new insights can improve ETE guidance in the area of staffed traffic control.

Additionally, this research suggests that fewer staffed traffic control points are needed during an evacuation. This would reduce an officer's risk of radiological exposure and would free up valuable police resources to be used where needed.

How Will This Research Enhance ETE Studies?

Measures of Effectiveness
Updated evacuation model measures of effectiveness will provide essential planning information and will help licensees and the NRC assess the quality of ETE studies.

Risk-Informed Guidance
Identifying parameters of importance will enable licensees and the NRC to risk-inform ETE studies. This will better inform emergency planning and save time and resources in ETE development.

Manual Traffic Control
Informing guidance for when and how to model manual traffic control can save on valuable police resources during an evacuation and reduce the burden on ETE development.

Simulation Modeling
New or revised guidance for scenario development, microscopic traffic simulation, mobilization time, adverse weather impacts, and model boundaries will aid ETE model development.

Regulatory Uses
Updated guidance will clarify requirements for ETE updates, simplify ETE studies for early site permit applications, and include provisions for scalable EPZ sizes.

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