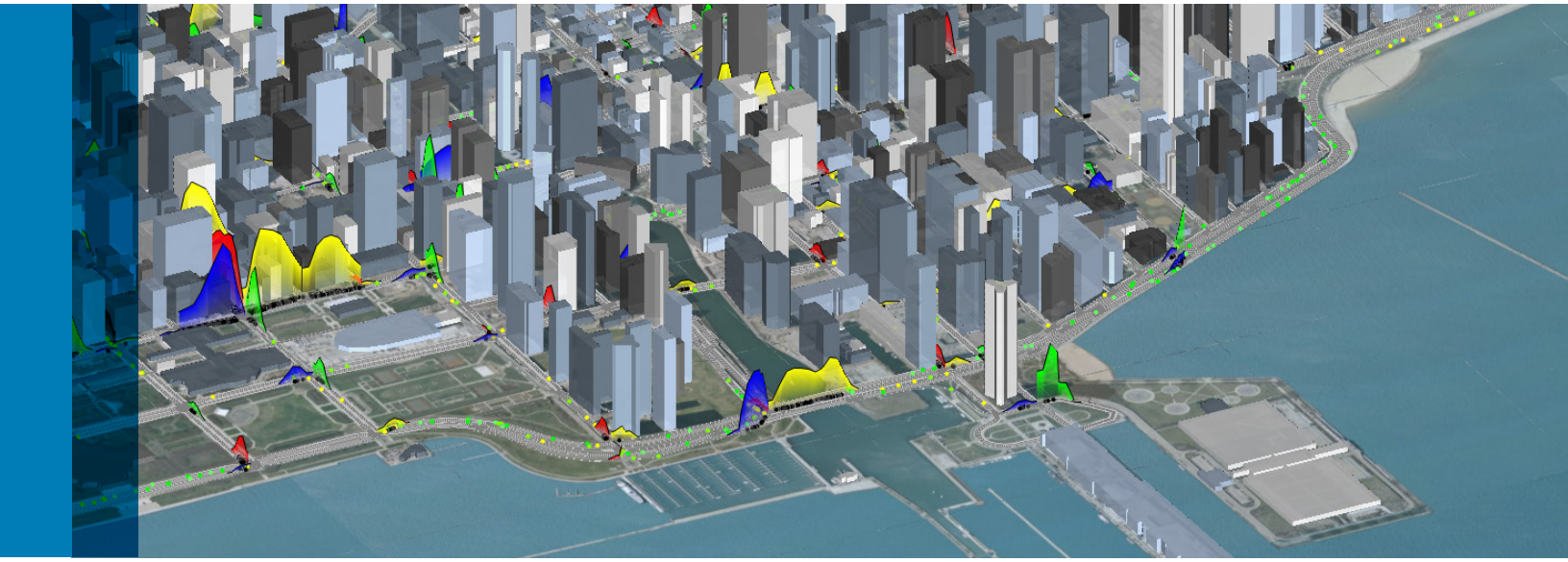
Argonne NATIONAL LABORATORY

TRANSPORTATION RESEARCH AND ANALYSIS COMPUTING CENTER



Visualization of high stress areas at a pier in a flood helps engineers determine where riverbed erosion measures may be needed.

The Transportation Research and Analysis Computing Center (TRACC) is the intersection of state-of-the-art computing and critical science and engineering research that is improving how the nation plans, builds, and secures a transportation system for the twenty-first century.

Vital to the economy and national security, U.S. highways, railways, and ports have evolved over generations and, in some cases, are outliving their limits. At the same time, a greater number of people are traveling with rapidly changing expectations for their vehicles and transit systems. Smart, sustainable solutions are needed to bridge aging infrastructures with new revolutions in the transportation sector, and high-performance computing (HPC) is lighting the way.

Supercomputers can recreate the flow of traffic on busy city streets, predict the toil of flooding on bridges, analyze a crash from all angles, and take the heat in engine combustion simulations. Located at Argonne National Laboratory, TRACC, a U.S. Department of Energy (DOE) User Facility, operates the U.S. Department of Transportation's (DOT's) largest HPC systems as the TRACC HPC Cluster. Experts in supercomputing, advanced modeling and simulation, and scientific visualization work with users to design and implement computational tools that address structural, environmental, safety, and systemic challenges in transportation.

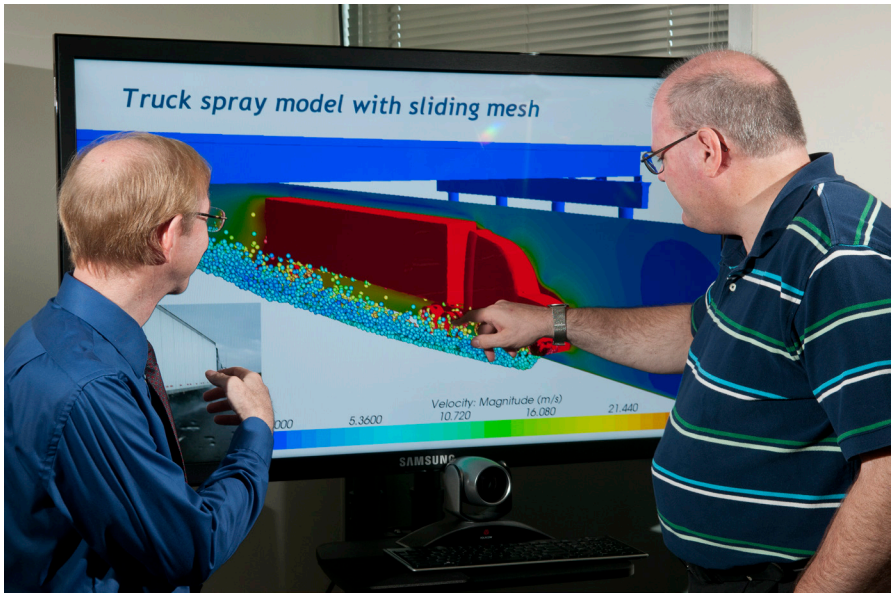
RESEARCH AREAS OF EXPERTISE

Transportation Systems

To understand core causes of costly and polluting traffic congestion, users can simulate the second-by-second movement of vehicles and travelers in a region with the center's POLARIS software—the latest generation of codes developed by DOE and DOT—and TRANSIMS software—developed by DOE, DOT, and the U.S. Environmental Protection Agency. Working with TRACC model developers, users can evaluate strategies for preventing traffic snares and planning evacuation responses by simulating different transportation network conditions, like a normal day or an evacuation. POLARIS and TRANSIMS also feature interactive visualization software, which promotes efficient decision-making and is crucial for evacuation scenarios.

Computational Fluid Dynamics

Infrastructure—like bridges and roads—takes a beating in severe weather, putting passengers at greater risk. With advanced computational fluid dynamics (CFD) modeling, users can follow the flow of wind and water across millions of points in space. The high-fidelity of physics-based CFD models on the TRACC HPC Cluster allows users to assess and reduce failure risks for bridges and other structures and decrease construction and maintenance costs. For industry, CFD is essential for virtual prototype testing that significantly reduces cost and production time so that safer, more efficient products make it to market faster.



Truck tire salt spray analysis helps identify causes of rapid rusting in bridges using weathering steel.

Computational Structural Mechanics

Structural failures and car crashes involve many components—structures such as bridges and road barriers, weather, vehicle damage, and passenger injuries. Using a mix of structural analysis, atomic and molecular dynamics, and general-purpose multi-physics codes across hundreds of cores, TRACC applications quickly compute how a range of transportation system components respond to crashes, extreme loading, volatile weather, and other dynamic and complex conditions.

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