



# NJ Transit-Resource Program

*The mission of the NJ Transit Resource Program (NJT-RP) hosted at the Center of Advanced Infrastructure and Transportation (CAIT) of the School of Engineering (SOE) at Rutgers University is to provide long-term research, technical support and workforce development assistance to NJ Transit Corporation for continually improving its rail and bus operational safety, efficiency, sustainability and resiliency, as well as developing a sustainable pipeline of talents for its future workforce.*

Located along the Northeast Corridor, Rutgers CAIT has the opportunity to conduct real-world research that can benefit commuters, businesses, and the rail and transit industry every day. The NJT-RP at CAIT is a one-stop-shop for all technology and workforce development needs in a unique and busy location. It integrates a portfolio of intellectual resources at Rutgers University to address NJ Transit's current and emerging needs in a variety of areas, including but not limited to, track infrastructure, rolling stock, train operation, bus operation, system safety, risk and resiliency, asset management, logistics and capital planning, and assessment of emerging rail technologies.

Expert researchers and experienced engineers allow CAIT to take on the pressing challenges that the industry faces from turning big data into useful information to support data-driven asset management, to studying Positive Train Control (PTC) for safety improvements, CAIT faculty and staff have expertise in a range of disciplines. Their work turns into real results too. CAIT has collaborated on projects with the Federal Railroad Administration (FRA), Pipeline and Hazardous Materials Safety Administration (PHMSA), Class 1 railroads, transit agencies, consulting firms, and many others.

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## PROGRAM HIGHLIGHTS

- Asset Management, Risk and Resiliency, and System Safety
- Intelligent Connected Transit and Rail Technologies
- Logistics and Capital Planning
- Collaboration with FTA, FRA, Transit Agencies, Class 1 Railroads, Consultants and Technology Providers

## ABOUT CAIT

CAIT is the USDOT Region 2 University Transportation Center focused on improving the durability and extending the life of transportation infrastructure.

CAIT has more than 100 full-time and affiliated researchers, 500 students in research, and 47 full-time professional staff.

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# Program Highlights

## >> State of Good Repair and Asset Management

Transit asset owners and managers face complex challenges in maintaining state of good repair of their assets while facing steady decrease in financial resources set aside for maintenance and preservation. This creates an infrastructure funding gap that cannot be closed with new resources alone. NJT-RP focuses on: 1) Development and deployment of advanced tools and technologies for better assessment of asset conditions, i.e., robotics and automation. And 2) Development new life cycle cost analysis and infrastructure data mining and optimization capabilities that support transit engineers in developing strategies to reduce the life cycle cost of transit infrastructure and optimize the investment of limited resources into projects that create the best value.

## >> Logistics and Capital Planning

Capital and logistical planning are essential for transit agencies in light of the funding gaps in improving level of service, maintaining infrastructure state of good repair, and addressing the key choke-points limiting reliability and ridership growth in the long run. Capital planning provides NJ TRANSIT with a major opportunity to be a leader in significant improvement through optimization of the delivery and life cycle performance of infrastructure investments, increasing the return on the limited funding available. Forecasting ridership, predicting the demand and inventory for mechanical parts, dispatching trains and buses, optimizing work schedules and prioritizing capital spending on alternative projects are among the critical decisions that transit owners need to make, at both strategic and operational levels. The NJT-RP assembles expertise in economic analysis, logistics planning, operations research, simulation and optimization techniques, to assist NJ Transit to address challenging capital and logistical planning issues. In the past, CAIT has analyzed the economic impacts for multiple projects for NJT including the first 5-Year Capital Plan, Portal North Bridge, etc.

## >> Intelligent Connected Rail Technology

Self-driving cars tend to be in the spotlight these days, but the U.S. rail industry is heading toward increased connectivity, intelligence, and automation too. At CAIT, researchers have developed advanced sensory networks, wireless communication technologies, and automation technology to help improve transportation safety and efficiency. As an academic institution, Rutgers has the unique capability to thoroughly evaluate new technology, using its extensive research network to ensure a new product works and is worth the cost. CAIT research on wireless communication, sensor network optimizations, and cyber assurance are just a few examples of this. Rutgers CAIT also has research on evaluating PTC technology. Industry collaborations in this area currently include the FRA, Amtrak, and more.

## >> Risk Management and Resilience

Safety is a top priority for rail owners, especially ones transporting hazardous materials. Researchers at CAIT are helping them make informed safety choices through developing an Integrated Risk Management Model to predict transportation risks associated with tank car design, population density, and other factors. On the resiliency side, CAIT is developing a simulation model to estimate service disruption and recovery. Projects like this help to inform the future of safety and resiliency policy in the industry. Rutgers CAIT is working with FRA, PHMSA, and other stakeholders in this area.

## >> Innovative Transit Technologies

Innovation is the cornerstone for development of next generation public transit systems, leveraging Artificial Intelligence (AI), Internet of Things (IoT), and automation technologies to continuously improve operational safety, efficiency, sustainability, resiliency and customer satisfaction. Serving as an innovation resource hub for NJ Transit, NJT-RP focuses on 1) testing, evaluation and implementation of automated transit technologies (e.g. automated shuttles) for “feeder/circulator” service within local neighborhoods and transit hubs to help extend the reach of the transit system and build a better end-to-end mobility experience for more riders; 2) machine learning and predictive analytics technologies for predicting transit asset degradation before failures occur, to avoid accidents and minimize system service disruption; and 3) AI and simulation technologies to better understand passenger movement characteristics in transit stations, so as to support human-centered transit infrastructure design, repair, improvement and the corresponding capital planning.

## >> Teaching Tomorrow's Workforce Today

Rutgers CAIT has the capability to train the next generation of rail engineers. The CAIT rail program is currently the only academic rail initiative in the New York and New Jersey region, at a time when reports show that the industry is undergoing a “brain drain” as experienced workers are retiring at high rate. CAIT, with access to numerous faculty and educational resources, has the capability to address workforce development issues and prepare students to become future leaders in the transportation industry. Over the last five years, the program has already introduced more than 200 students to rail education. As the CAIT rail program continues to grow, more opportunities will arise for new research, but also to keep the pipeline of rail workforce development going.