Enhancing Traffic Operations through Real-Time, Data-Driven Strategies at NJDOT's Arterial Management Center (AMC)

By New Jersey Department of Transportation

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Benefits Statement

New Jersey's Arterial Management Center (AMC) modernized traffic operations through AI-powered adaptive signal control, real-time data fusion, and predictive analytics. This proactive system reduced congestion-related crashes, saved time with travel delay reductions of 10–30%, minimized unplanned maintenance, and optimized infrastructure investments. AMC's centralized, intelligent approach set a scalable foundation for smarter, safer, and more cost-effective mobility statewide.

In this case study you will learn:

1. How New Jersey DOT's adaptive signal control and AI-driven analytics reduced traffic delays by up to 30%.
2. How predictive maintenance can cut costs and prevent system failures before they occur.
3. How New Jersey DOT's centralized, data-integrated model improves safety, efficiency, and scalability for future intelligent transportation systems.

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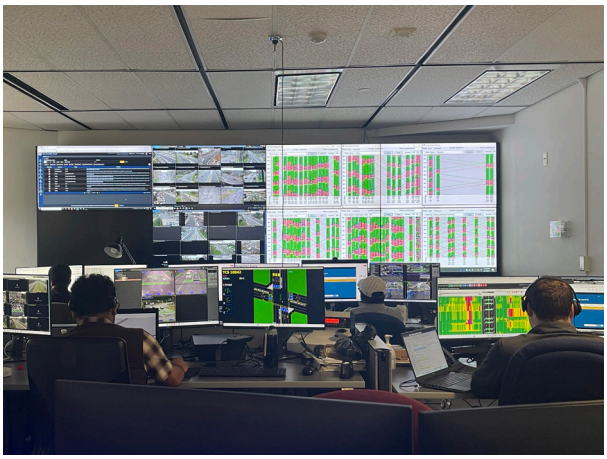
BACKGROUND

In response to the intensifying complexity of New Jersey's arterial transportation networks, the New Jersey Department of Transportation (NJDOT) initiated a transformative venture through its Arterial Management Center (AMC). Faced with persistent congestion, fluctuating traffic patterns, and disjointed signal coordination, NJDOT recognized the imperative for an agile, real-time, and integrative solution. Operated by AtkinsRéalis and its sub-consultants, AMC embodies a centralized operational paradigm leveraging adaptive technologies and sophisticated data analysis and decision support ecosystems. Information from platforms such as RITIS, 511NJ, and SPATEL are cohesively synchronized with SCATS adaptive traffic signal control to form a unified infrastructure for advanced traffic applications and solutions. This initiative marked a pivotal shift from reactive traffic management to proactive, predictive mobility strategies, establishing AMC as a nerve center of statewide traffic coordination, safety and innovation.

TSMO PLANNING, STRATEGIES AND DEPLOYMENT

The strategic architecture of AMC's TSMO deployment is predicated on a high-fidelity, end-to-end operational lifecycle, encompassing system diagnostics, adaptive controls, decision support systems, predictive traffic modeling and asset management. SCATS adaptive signal systems were calibrated to modulate traffic flow dynamically, based on live detector inputs and incident-based triggers. The deployment was further augmented through a data fusion platform that integrates multimodal datasets from SPATEL, RITIS, SCATS, and historic information augmented with decision support systems empowering AMC analysts with a panoramic operational view. AI- and ML-driven algorithms were incorporated to forecast congestion hotspots and infrastructure degradation patterns, enabling anticipatory actions such as signal adjustments and targeted maintenance scheduling. These predictive engines are underpinned by continuous machine learning pipelines, calibrated to improve accuracy using feedback loops from field data.

To validate and refine operational strategies, AMC leveraged Vissim microsimulation modeling and Synchro-based signal optimization. Vissim provided a granular, vehicle-level simulation environment to test adaptive signal timing scenarios, evaluate multimodal interactions, and quantify delay, queue lengths, and level-of-service metrics under varying demand conditions. Synchro was used to optimize signal phasing and coordination plans, ensuring that timing strategies aligned with corridor-level performance goals and regional mobility objectives. These simulation tools were instrumental in scenario testing, before-and-after studies, and stakeholder engagement, offering visual and quantitative evidence to support decisions and policy alignment.



The AMC team also explored knowledge transfer and cross-domain learning as foundational steps toward future convergence with Artificial General Intelligence (AGI) frameworks. Performance audits, rigorous QA/QC protocols, and econometric models for cost-benefit evaluation ensured that strategies remained evidence-based, resilient, economically viable and benefiting society at large.

COMMUNICATIONS PLANNING AND EXECUTION

A cornerstone of AMC's operational success lies in its multidimensional communications strategy. Internal communication protocols promote seamless coordination between traffic engineers, system operators, and field responders through structured daily briefings and real-time escalation mechanisms. Weekly data-driven performance reviews foster a culture of transparency and agile refinement. Externally, the AMC coordinates with NJDOT's Statewide Traffic Management Center and Mobility Operations Center South where operators utilize the 511NJ platform and DMS boards to disseminate real-time information to motorists. The AMC's communications strategy also capitalizes on cloud-based collaboration tools and decision-support dashboards that visually convey congestion narratives and operational KPIs. These platforms have enhanced situational awareness and fostered consensus across institutional boundaries, facilitating coordinated deployments of TSMO interventions.

OUTCOME, BENEFITS AND LEARNINGS

The AMC initiative has yielded transformative operational outcomes. Post-implementation analyses revealed travel delay reductions of 10%–30% across targeted corridors, validated through rigorous before-and-after studies.

Predictive analytics significantly curtailed unplanned maintenance by anticipating sensor degradation and system anomalies, enabling just-in-time interventions. Econometric modeling facilitated strategic investment decisions by quantifying user delay cost and travel time savings justifying the ROI.

The Integration of AI/ML tools not only enhanced the operational reliability but also laid the groundwork for scalable, intelligent traffic ecosystems where both heavily instrumented and lightly instrumented signal systems can be optimized. Lessons learned underscore the indispensable value of real-time data fusion, the necessity of AI-enabled adaptability, and the potential trajectory toward AGI-inspired systems that unify decision-making across complex, interdependent mobility networks. AMC's success story exemplifies the potency of blending advanced computation with human-centric traffic governance to positively influence transportation for society at large.