

Project title: Intelligent Transportation Systems Resource Center (ITSRC)

Posting No.: 2020-03

Date of RFP Announcement: 06/15/2020

Closing Date: 07/29/2020

Proposals must be prepared in accordance with NJDOT's *Supplemental and Proposals guidelines*. Please visit https://www.state.nj.us/transportation/business/research/guidelines.shtm for the most current version.

All proposals must also have a corresponding online PreAward Risk Assessment form completed and submitted by the PIs prior to the RFP closing date and time. This online form can be found at: https://www.state.nj.us/transportation/business/research/risk assessment forms.shtm

1 - RESEARCH PROBLEM STATEMENT AND OBJECTIVES

1.1. Problem Statement

The New Jersey Department of Transportation (NJDOT) is seeking a qualified University to run the established Intelligent Transportation Systems Resource Center (ITSRC) Program, and assist with its continuation and support in improving, applying and implementing comprehensive ITS and Transportation Systems Management and Operations (TSM&O) strategies that maximizes technology advancement, deployment and research performance effectiveness, human and capital resources utilization to improve safety, mobility, and traveler information for the motoring public.

ITSRC will address core elements and undertake new research planning, outreach, training, technology transfer and other activities.

1.2. Research Objectives

The ITS Resource Center was established by the New Jersey Department of Transportation in 2008 to utilize extensive technological resources and expertise of academia and their research partners in assisting NJDOT towards developing and implementing a comprehensive Intelligent Transportation Systems (ITS) management strategy. New Jersey recognizes it cannot solve most congestion issues by expanding roadways. ITS is a means of optimizing utilization of existing capacity for harmonized throughput and overall efficiency of the transportation network without the challenges of extensive right of way (ROW) needs for roadway widening; most improvements are made within the existing ROW. With limited resources and a challenging atmosphere for road widening, the focus has shifted to getting more utilization of existing capacity through deployment of 'smart technology,' better known as ITS, accompanied by enhanced incident management operations and intensive special event operations. Moreover, these new transportation technologies and tools create opportunity for emission reductions, if they are researched, planned and implemented strategically.

The Resource Center consists of a collaborative and comprehensive program (Program) that has developed into a premier statewide resource for NJDOT's planners and engineers regarding the



improvement of ITS and Transportation Systems Management and Operations (TSM&O). The program includes researching state-of-the-art ITS practices and provide expertise in developing, implementing, and evaluating innovative ITS applications, Incident Management response, coordination and training, innovative business processes, planning and management strategies, agency collaboration and information exchange. It also is a comprehensive resource for data and models necessary for generating reliable measures of system performance, which is used in decision making processes and provides the needed technical, research, education, and knowledge transfer necessary to support the Department in improving safety, mobility, and efficiency of New Jersey's surface transportation systems. The Program also provides ITS technology, research, planning and pilot deployment support as appropriate in the Department where it may assist in advancing the Department's overall mission of improving lives by improving transportation.

The overall goal is to enhance NJDOT's Transportation Systems Management & Operations goals through the research of available cutting-edge ITS resources through technology assessment, evaluation of ITS implementation strategies and scenarios, applications of advanced modeling and simulation tools for corridor planning and management, evaluation of emerging concepts, applications and technologies, and technology transfer. Moreover, this Program is a resource available through the NJDOT to facilitate partnerships between federal and state transportation agencies, metropolitan planning organizations, transit operations, academia, private industry, and other entities that promote and advance implementation of ITS technologies in New Jersey's transportation system. This partnership is reflected in the involvement of these entities on a regular basis.

The objective of the ITS Resource Center Program is to identify enhance, guide and strengthen the State's direction and decision making in the activities of NJDOT Transportation Mobility. Since its inception, the Program has conducted these types of core activities:

- 1. Applied studies and program evaluation/analyses;
- 2. Concept of Operations documentation;
- 3. Training and education;
- 4. Operations Center evaluations and improvements;
- 5. Safety Service Patrol and Incident Management Response Team assessments, improvements, research and deployments;
- 6. Technical and Executive Management assistance; and
- 7. Outreach and information dissemination.

The activities above were achieved by maximizing the use of resources, identifying often- changing needs and technologies, managing performance, and supporting integration of activities with other Departmental programming and decision-making efforts. These activities specifically focused on technology assessments, operational tests, planning and research studies, development of new technology applications, testing deployments of new technologies, scenario development, pilot studies, evaluation of ITS implementation strategies, application of advanced transportation and traffic modeling tools,



maintaining and upgrading the ITS information database, outreach, education, and technology transfer. These efforts ensured that the Department made and continues to make appropriate decisions in investing in the most effective ITS applications and deployments, which maximizes benefits to the traveling public.

This robust program has begun to move the Department forward in a strategic, well-documented and effective manner in technology advancements to improve surface transportation and benefit all road users. However these technologies are rapidly developing and new processes, management tools, and applications continue to emerge. Many TSM&O technologies and processes recently identified require additional refinement, design and systems engineering, performance assessment and/or evaluation to assist the Department in developing appropriate strategies. It is envisioned that some of the tasks listed below will aid in the implementation of others in a carefully executed program.

The ITSRC proposed work program will address the core items above and undertake additional items, for an overall combined TSM&O program which will:

- 1. Conduct Annual Best Practices Reviews;
- 2. Support implementation of the NJDOT ITS Strategic Deployment Plan and Emerging Technology Policies;
- 3. Provide ITS and TSM&O Training and Technology Transfer and Outreach for NJDOT and Other Agencies;
- 4. Provide support to NJDOT for data analysis, tools, research and solutions for TSM&O and transportation planning and operations application;
- 5. Support Planning and Capacity Building For Effective Traffic Operations and Integration of Arterial and Freeway Management;
- 6. Conduct and Implement Work Zone and Related Mobility Monitoring Research and Evaluation;
- 7. Provide Technical and on-call support for Technology Evaluation and Deployment;
- 8. Conduct ITS Feasibility, ConOps and Concept Development and System Requirement Studies for ITS and TSM&O Pilot Applications; and
- 9. Provide Program Management/Communication Protocol and Methodology for Technical Leads.

Tasks

[Provide a listing of appropriate general tasks divided into phases based on types of work (e.g., laboratory, field) or by year (e.g., year 1, year 2) or other appropriate milestones]

The NJDOT is seeking the insight of proposal responders on how best to achieve the research objectives. Proposers are expected to describe a research effort that can realistically be accomplished as expeditiously as possible. Proposals must present the proposers' current thinking in sufficient detail to demonstrate their understanding of the problem and the soundness of their approach for conducting the required research.



PHASE I – Literature Search

Conduct a literature search of the current state of the practice. After the award of the project, a more comprehensive literature search should be conducted. At the completion of this literature search, the PI will make a presentation to the Technical Advisory Panel (TAP) to discuss their findings and to discuss the appropriate research approach.

PHASE II - Research Approach and Anticipated Results

Clear description of how you will solve the problem and implement anticipated findings. Work may be divided into phases (e.g., Laboratory, Field or Year 1, Year 2) as necessary to clarify tasks. *Exit Criteria* must be developed during this phase.

For all tasks identify accepted standards or practices anticipated to be utilized in the proposed work program.

Task 1: Best Practices Research and Strategic Planning/Policy Development

TSM and ITS techniques, technologies, policies, regulatory environments and practices continue to rapidly change. To assist NJDOT in adopting practices and technologies to respond to these changing landscapes and to address relevant emphasis areas identified in federal transportation legislation, conduct high level Best Practice national/international scans annually for:

- A. All Departmental-related traffic operational and deployment aspects including Traffic Incident Management, Safety Service Patrol, Central Dispatch, Incident Management Response Team and Traffic Operations Centers, and related software and technologies; Comprehensive TSM&O Management Systems incorporating elements of ITS engineering and systems, management systems, freight management, smart cities technologies, financial and capital management and mobility systems engineering and related deployment aspects including arterial management, traffic management plans (TMP), other work zone (WZ) practices and technologies in a national/international scan. Review and recommend improvements, focusing on the use of ITS and TSM&O technologies and strategies; best practices relating to a traffic operations center (TOC) evaluation and improvement program that reviews and incorporates best practices from around the country.
- B. Develop a recommendation for a comprehensive and formal *TSM&O Management System* that incorporates appropriate measures and elements of Transportation Mobility, Mobility Engineering, and Traffic Operations to provide input to other Departmental functions. Utilize lessons learned in Best Practices scan. Propose an implementation methodology to include a feedback-loop with a given time frame, and updates. Propose means to connect this new Management Strategy with the NJDOT ITS Strategic Deployment Plan (SDP) as well as Departmental capital programming.
- C. Support Implementation of NJDOT ITS Strategic Deployment Plan (SDP), and related policy research to ensure updates and communication with multiple Department units occur and the SDP moves forward



towards identified goals. Propose process for improving integration with Capital Investment, Statewide Planning, Traffic, and Capital Program units, and incorporated freight planning ITS component to the SDP for traditional and emerging applications such as Weigh-in-Motion Systems (WIMS) and other ITS-related freight technologies. Research, quantify and support the tools, techniques and outreach as appropriate for ITS and Transportation Systems Management and Operations (TSM&O) strategies and technologies as identified in the current SDP for consideration in the transportation planning, capital programming and project delivery processes to improve integration of planning and operations and document recommendations.

- D. In concert with TSM&O statewide partners, as well as within the Department, contribute to the development, planning, evaluation, adoption, training and implementation of the Connected Corridor, ITS Architecture and the Capability Maturity Model (CMM) frameworks and plans for New Jersey.
- E. Promote TSM&O successes within and external to the Department by creation of website concept and execution, to be eventually incorporated and regularly updated as part of the Department's Internet site. Identify methodology for making a business case for the benefits of TSM&O in NJ.
- F. Assist in integration of performance-based planning and programming concepts in deployment plans for ITS and TSM&O strategies, and as part of the Smart Growth Investigative Team and related statewide planning efforts such as the Long-Range Plan update, congestion management support, and tool selection. Create draft 'report card' type approach of TSM benchmarks of potential interest to NJ roadway users and set up transferable database to automatically extract information into said Report Card utilizing already-identified performance measures and ones anticipated to be incorporated in the TSM&O Management System. Include available and emerging technologies and road users that are interacting with and on the roads as well as those behind the scene that can result in improvements. TSM&O seeks to improve transportation, special event related traffic, and minimize impacts of major roadway construction projects. Support, document and participate in TSM&O programs and outreach initiatives such as the ITS SDP update process, Complete Team, Connected Corridor, and Statewide ITS Architecture in collaboration with NJDOT, FHWA, MPO, and other stakeholders.

Task 1: Deliverables

Provide appropriate deliverables, such as memos, reports, within agreed upon time frame.

Task 2: Develop and Conduct TSM&O and ITS Training, Technology Transfer and Outreach

A. Develop and execute an overall ITS/TSM&O annual plan for training in specific areas of traffic management and operations that builds upon training to date to enhance the effectiveness of NJDOT and local agency incident management-related personnel. Provide ITS and TSM&O training and technology transfer and outreach for NJDOT and other agencies, a critical measure in the rapidly changing and emerging technology of traffic operations and management. Provide these opportunities to all areas of the Department performing activities related to ITS. Ensure adequate training so all existing and new personnel have appropriate levels of utilization of technologies, software and other tools they utilize. A full range of Peer-to-Peer, in-person instruction, workshops, webinars etc. and technology transfer training opportunities should be included. Arrange for invitations, attendance



tracking and certificate distributions. As appropriate arrange for in-field workshops to apply classroom learning on-site. Provide all attendees with detailed training documentation.

Task 2: Deliverables

Provide appropriate deliverables, such as memos, reports, within agreed upon time frame.

Task 3: Data Analysis Tools, Solutions and Research to Support TSM&O and Transportation Planning for Operations

- A. Conduct research, and develop a framework for collecting and assessing best methodologies for extraction, analysis and utilization of data for performance measure criteria. Provide assistance, research and technical support for data acquisition, integration, analysis, innovative solutions, performance measure evaluation, reporting, and visualization for transportation planning and operations, including smart city data needs, for data synthesis/engines for real-time optimization, situational awareness and predictive analytics as needed. Support collaboration internal and external through various committees.
- B. Conduct research and develop a framework for utilization of mobile data collection from Departmental, partner agency and external sources. Consider use of DOT fleet for pilot application: traffic, weather, infrastructure condition data, cameras, AVL, etc.

Task 3: Deliverables

Provide appropriate deliverables, such as memos, reports, within agreed upon time frame.

Task 4: Traffic Operations Capacity Building and Integration of Arterial and Freeway Management

- A. Collect information and practices from other existing TOCs and Central Dispatch Centers (CDU) and conduct traffic operations and CDU research studies to evaluate technical, logistical and human capital requirements and scheduling for optimal 24-hour functionality, taking into account NJ's unique traffic operation parameters. Develop Concept of Operations design and propose process for testing and implementation. Develop a methodology for deployment of improvements.
- B. Research and develop a formal Safety Service Patrol (SSP) Program that considers national best practices and encompasses multiple parameters and culminates in an easily updatable Operational Manual, utilizing accepted national guidelines. Provide manual and training. Conduct and create concept of operations for utilization of permanently installed cameras on SSP trucks and IMRT vehicles.
- C. Develop a program that conveys the Safe Passage regulations in a pictorial or multi-lingual sign format for placement along roadsides; evaluate placement locations and design options that maintain any regulatory compliance requirements.
- D. Evaluate the feasibility of combining arterial management center operations with freeway operations at the TOCs, and recommend best practices for integration/communication protocols. Develop pilot to test and evaluate impacts to overall operations. Include technology, human capital, communications, technology transfer and locational components. Develop protocols for signal timing,



- ramp metering (if in effect), hard shoulder running, ATM, and other tools for modification during emergencies, weather and special events, and major incidents.
- E. Evaluate the performance of NJDOT Traffic Incident Management (TIM) programs and provide recommendations for program improvements. Building on the existing adopted statewide TIM plan and related working group input, recommend and update the existing adopted plan through plan updates, Statewide Committee review and comment, and adoption. Expand and foster interagency coordination and enhance collaboration and communication among the agencies participating in traffic incident management.
- F. Assess capabilities of current practices of traffic operations (weekly calls, TMP reviews, etc.) with other Departmental functions (construction for ex.,); test and recommend optimized practices.

Task 4: Deliverables

Provide appropriate deliverables, such as memos, reports, within agreed upon time frame.

Task 5: Work Zone and Related Mobility Monitoring and Improvement Research

- A. Conduct interactive review of best practices with iterative feedback loop to test and improve work zone monitoring utilizing NoCOE and other nationally accepted measures.
- B. Develop work zone monitoring programs for utilization in evaluating WZ ITS strategies. Test usefulness in pilot applications as an online application with a backend database. Program to include instrumentation of select work zones in order to collect background data in support of development, testing and evaluation of mid- and long-term work zone management plans. Reference FHWA WZ ITS Implementation Guide for defining project needs assessment, deployment of appropriate WZ ITS data collection, performance measures and effective WZ management.

Task 5: Deliverables

Provide appropriate deliverables, such as memos, reports, within agreed upon time frame.

Task 6: Technical Support for Technology Evaluation and Deployment

- A. Provide Technical Support for Technology Evaluation and Deployment: Conduct innovative ITS technologies and TSM&O strategies pilot research and deployment studies and assess feasibility of implementing, costs and effectiveness for traffic operations, incident management, traffic and related surveillance, data collection, and related areas. Propose researched and structured guidelines and specify methodologies to be utilized for technology evaluations in a systematic manner, including costs and life-cycle maintenance, implementation considerations and recommendations (as appropriate). Such research will include but not be limited to available and emerging technologies as follows:
 - Connected vehicle technologies and vehicle/highway automation pilot studies; incorporate CV/AV evaluations for freight/trucks, paratransit as applicable, in addition to passenger vehicles. Utilize FHWA V2I guidance and products to ensure interoperability, efficient and effective planning, procurement and operations. Also utilize/reference FHWA CV Reference Implementation Architecture to ensure appropriate use of CV Standards regarding software



- programming (codes, definitions, formats) to create interoperable, consistent and seamless communication data exchange;
- Evaluate, explore, investigate and develop the application of Artificial Intelligence (AI) solutions for technical challenges for traditional and non-traditional engineering processes.
 Some example include but not limited to Video Analytics, Video detections in adverse and non-adverse weather and light conditions, recurring and non-recurring congestion determination and Signal optimization algorithms.
- Assist and support the agency in existing and ongoing technical tasks of testing and evaluating connected technologies and AI solutions applications with technical teams comprising of diverse subject matter experts.
- 4. Connected and automated vehicle policy research and deployment/utilization of for NJ, relating to requirements for in-state test bed locations, on-road testing, and develop recommendations for regulations/legislation necessary to safely implement operating same for pilot tests within the state of NJ;
- 5. Unmanned aerial vehicles (UAV) (drones) for remote traffic video surveillance, incident management surveillance, bridge inspection and evaluation, Light Detection and Ranging (LiDAR)-Assisted accident site reconstruction, WZ and special event reconnaissance, and UAV to Vehicle or other communication center, and incorporating appropriate federal regulatory compliance;
- 6. On-call support to NJDOT related to ITS technology research, evaluation and potential deployment of pilot applications including pilots for arterial and corridor management.
- B. Traffic simulation and analysis models as needed to evaluate and test modifications to existing traffic engineering practices/solutions utilizing existing and emerging technologies.
- C. Video analytics pilot studies and test proposed technologies, applying earlier lessons learned

Task 6: Deliverables

Provide appropriate deliverables, such as memos, reports, within agreed upon time frame.

Task 7: Conduct ITS Feasibility Studies, Concepts of Operations, and System Requirement Studies for ITS and TSM&O Pilot Applications

Follow the Federal and Regional systems engineering process ('V diagram') and the ITS Architecture for all of the following tasks, and provide recommendations and lessons learned based upon outcomes for:

- **A.** Conduct high-level concept of operations (ConOps) studies, including for the following potential applications utilizing the FHWA Regional ITS Architecture by following the systems engineering process ('V diagram') and the ITS Architecture:
 - 1. Conduct Active Traffic Demand Management (ATDM) studies
 - a) Following up on earlier ATM research as well as applicability for utilizing additional ATDM strategies and concepts or in additional locations.
 - b) Additional ATDM research in truck parking, parking demand management and other potential pilot deployments



- Conduct advanced signal control and advanced traffic management systems (ATMS) ConOps and research. Propose and test algorithms and strategies to improve operations on priority signalized (arterial) corridors.
- 3. Conduct advanced ICM development and design studies to enhance the current systems. Build on ongoing studies to maintain communication and mutually-agreed system protocols. Propose and test pilot applications and measure mobility, reliability, efficiency and safety across multiple travel modes to assess traveler benefits and options in real-time.
- B. In this task, for each activity where a high-level ConOps effort was completed, develop more detailed and refined System Requirements Specification studies for completed ConOps studies, including the high-level ConOps for the Integrated Corridor Management (ICM) effort along the I-495 corridor begun in the 2015-2016 Program. Ensure the needs identified in the ConOps are satisfied and that all applicable ITS Regional Architecture standards are met. These pilot efforts are intended to test and improve on results utilizing the V-diagram process as well as integrate multi-agency communication/outreach to support successful long term utilization. Develop high-level system design documentation to define the overall system framework, detailed design specifications for system components and integration, verification and validation plans. Use the FHWA recommended Regional ITS Architecture and Systems Engineering processes for ITS project development and planning to ensure project/user needs, institutional agreement, technical integration and requirements are met.
- C. As part of the V-diagram systems engineering process, develop and test traffic demand and other traffic models, and conduct simulations for testing select ITS and TSM&O applications. This step involves data collection, simulation development, research and selection of appropriate modeling options, model evaluation of impacts, and analysis of operational strategies, identifying those strategies best suited to meeting stated goals established earlier in the V-diagram process. Ensure all recommended Regional Architecture and Systems Engineering processes are utilized and requirements met.

Task 7: Deliverables

Provide appropriate deliverables, such as memos, reports, within agreed upon time frame.

Task 8: Program Management

A. To ensure satisfactory progress this task is integral to overall program success and covers all contract/technical management responsibilities to ensure all activities are undertaken as well as possible and within the parameters of the Basic Agreement and awarded Task Order. Select and identify a single individual to be sole source of contact with technical Department management and contract management. Describe communication protocol that will ensure all communication is conducted with the involvement of this individual and their technical TSM&O counterpart. Also provide management/communication protocol and methodology for technical leads in completing



activities. Provide copies of any/all subcontracts/scopes and describe quality assurance measures that will be utilized to ensure timely deliverables receipt.

- B. Meet with TSM&O technical staff management as appropriate, at a minimum once a month for management meetings. Attend conference call and technical activity meetings to review current progress, discuss and resolve obstacles as needed. This monthly progress meeting is separate from technical activity meetings. Propose options for resolving management, contractual or deliverable obstacles to ensure agreed upon deadlines can be maintained. Take and prepare brief meeting summaries to identify action items, outcomes, next steps and deliverables for all meetings and provide same to TSM&O with maximum a one-week turnaround after the meeting. Oversee preparation of technical reports and provide quality control. Schedule and plan deliverable schedules with ample time for Departmental review, revision and approval. Ensure that the Department staff are aware of all communications at appropriate decision points, including communications with sub-consultants. Explain methodology to ensure schedules provided are adhered to and detail staff support needed to ensure timely completion of all work program tasks. Assist in preparations for meetings with Department/FHWA staff in reporting progress.
- C. A draft final report will be prepared, following NJDOT Bureau of Research publication guidelines, to document project activities, findings and recommendations. This report will be reviewed by the TAP, updated by the Principal Investigator (PI) to incorporate technical comments, and then approved by the Research Project Manager (RPM) before this task is considered complete. If possible, a TAP meeting will be scheduled to facilitate the discussion of the draft report.

Task 8: Deliverables

Provide appropriate deliverables, such as memos, reports and invoices, within agreed upon time frame.

1.3. Type of Contract

It is proposed that if the Issuing Office enters into a contract because of this Request for Proposal (RFP), it will be a **Cost Reimbursement**, **Deliverable-Based** contract containing the Standard Contract Terms and Conditions.

2 - BUDGET and CONTRACT TIME

The **TOTAL** project budget shall not exceed \$12,000,000 US Dollars (\$3,000,000 per year). Budgets will be evaluated separately, and only after a selection has been made as to which proposal is the most qualified based on technical merit. Please place three (3) copies of the budget for this project in a separate sealed envelope.

The PI must provide the anticipated research study duration based on the proposed tasks. Consideration should be given to potential impediments so that adjustments are incorporated into the schedule minimizing the need for time extensions. Contract time shall include sufficient time for the procurement



of subcontractors, as well as no less than three months for Final Report review and acceptance. Please be advised that going forward, new task orders having permissible justification will be allowed no more than a one-time extension with the advent of 2 CFR 200.

A 48-month total project duration is preferred.

Please provide a Gantt Chart schedule, by month number (e.g. 1-48), showing tasks start/end, and deliverables. List corresponding deliverables below the chart.

3 - Oral Presentations

Oral presentations may be requested as part of this RFP. If required, you will be notified by the Bureau of Research to schedule your oral presentation. They will be held at NJDOT headquarters in Trenton, NJ, attended by the Technical Advisory Panel (TAP), and be limited to no more than an hour, including time for questions and answers.

4 - DEADLINE

Proposals (10 single-bound copies) are due at the NJDOT Bureau of Research no later than **4:00 p.m. on July 29, 2020.**

Start Date: The official start date is the date that the Transportation Mobility unit obtains a signature from their Assistant Commissioner.

5 - CONTACTS

Interested parties shall send all questions related to this RFP to the Bureau Manager by sending an e-mail to Research.Bureau@dot.nj.gov or by phone (609-963-2224). Questions on this topic **shall not** be directed to any Research Project Manager, Research Customer, or any other NJDOT person. All questions must be received **on or before June 29, 2020 in order to be answered.**

A pre-proposal meeting may be scheduled with interested parties upon the request of *more than one* Institution of Higher Education. **This must be requested on or before June 25, 2020**.

PROPOSAL DELIVERY INSTRUCTIONS:

For private, paid messenger services such as Federal Express, DHL, UPS, etc., or for hand-carried deliveries*: *During the COVID-19 pandemic, hand-carried deliveries will not be accepted.

RFP No. **2020-03** PROPOSAL-NJDOT New Jersey Department of Transportation Bureau of Research 1035 Parkway Avenue Trenton, New Jersey 08625-0600



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