MTA RFP No. 16098
Energy Consulting Services
Tenco Engineering Corporation

The Turner Engineering Corporation (Tenco) Team proposes to provide the Metropolitan Transportation Authority (MTA) with the selected Energy Consulting Services on an as-needed basis on the Energy Consulting Panel, per RFP No. 16098.

In lieu of an Oral Presentation Teams Meeting, the Selection Committee Members compiled a list of specific questions for a few proposers to address. MTA questions and Tenco responses follow.

Q1: What energy savings have you achieved via regenerative braking projects with other clients?

Tenco is a transit industry engineering leader in modeling, measurement, and maximization of regenerative braking energy reuse for major transit authorities across the US. Tenco is expert in quantification of braking energy available for savings, in the critical analysis and testing required to determine system changes to deliver significant, measurable savings, and in designing and implementing the necessary equipment and changes to achieve the savings.

Key examples are:

New York City Transit (NYCT): Tenco led the Regeneration Energy Improvement Project (REIP) under New York Power Authority (NYPA) contract, to quantify and increase NYCT AC train regenerative energy savings. Tenco determined and demonstrated modifications to the R142 train propulsion parameters which recovered up to 44% of the total propulsion energy in a start to stop station run, an increase of more than 3x in captured energy compared to the parameters then in service. The work showed the path forward for significantly increasing the energy savings for all NYCT AC trains.

Los Angeles Metro: Tenco performed the design, control system implementation, integration, system assurance, and commissioning of a 2 MW flywheel Wayside Energy Storage System (WESS) on the LA Metro Red Line. In service, the LA WESS reduced peak power demand by 18-20% and provided average energy savings of 11.5% of total traction power system energy.

Caltrain (Peninsula Corridor Electrification Project): The recently completed Caltrain Peninsula Corridor Electrification Project (PCEP) now provides electric train service from San Francisco to San Jose. The line uses a 2x25 kV 60 Hz AC system with Electric Multiple Unit (EMU) trains. Tenco was the engineer responsible for EMC, and for quantifying the impacts of the combined trains, rails and OCS, and traction power system on the local utility 230 kV, 115 kV, and 60 kV networks over the whole San Francisco peninsula. The impact analysis, covering imbalance, harmonics, and faults, was a crucial milestone getting utility approval to regenerate power back into the utility grid.

Tenco analysis of onboard data from a June 2024 Caltrain test provide quantitative results. In a nine-minute run, a 7-car EMU consumed approximately **325 kWh** of energy. During braking, the train regenerated approximately **150 kWh** of that energy back to the grid. This is a recovery of nearly **46%** of the consumed energy, which yields a significant cost savings for Caltrain.

Tenco's expertise covers both DC and AC traction power systems. We deliver practical, data-driven solutions that provide cost-effective paths to maximize energy savings.

Q2: Could you expand on your expertise in Electromagnetic Interference Testing, and provide details on how you conduct the tests?

Tenco is a recognized industry leader in transit Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI) engineering, analysis, test, and qualification.

Tenco develops the quantitative and qualification standards and limits that govern railcar procurements and EMI qualification for major transit authorities. Under contract to NYCT, Tenco developed the NYCT AC Train EMC Standard and associated Conducted EMI Test Procedure, which govern the procurement of all railcars and third-rail connected wayside electronic equipment including energy storage systems. Tenco provided similar service for LA Metro for both its heavy rail subway lines and light rail lines, and for MBTA, Sacramento RT, Edmonton, etc.

Tenco performs EMI qualification programs and tests for railcars and wayside systems for transit operators around the world, including for MTA LIRR, MNR, and NYCT, and for Boston MBTA, Calgary CT, Chicago CTA, Chicago Metra, Edmonton ETS, Houston METRO, Indiana NICTD, Jakarta MRTJ, LA Metro, Montreal RTM, Philadelphia SEPTA, Phoenix Valley Metro, Pittsburgh PRT, Portland Tri-Met, Sacramento RT, Salt Lake UTA, SF BART, Sonoma SMART, Taiwan TRA, Toronto Metrolinx, and Washington DC WMATA. Tenco works for transit agencies, for carbuilders, and for equipment suppliers, so fully understands the challenges of each participant entity, and develops practical solutions to achieve all stakeholder requirements. Tenco's work covers:

- New light rail, heavy rail, commuter, and high-speed EMU trainsets as well as DMUs and streetcars
- Railcar equipment including propulsion, APS, train control, auxiliary inverters e.g., for HVAC, etc.
- Railcar and railcar equipment overhauls and upgrades, including mid-life overhauls (e.g., LIRR M7)
- Adapting AC train programs to provide EMC track circuit protection for workcars operating at NYCT
- Adapting AC train programs to provide EMC track circuit protection for new third rail connected wayside electronic systems. The work started in 2000 with the first flywheel energy storage system demonstration at NYCT, and continues now with ABB's ongoing NYCT Smart Battery System project.

Tenco EMI Qualification Test Methodology

Tenco established and applied its EMI qualification testing methodology at agencies across the US and Canada. The Tenco methodology is frequently incorporated into railcar procurement specifications, Four basic steps yield clear and full understanding of risks and objectives, full evaluation of potential emissions and sensitive equipment to be protected, and designs, tests, analyses, and reports which meet regulatory and operator requirements, and ensure safe and dependable operation of the target rail equipment and systems.

1. **Establish the Framework - The Electromagnetic Compatibility Plan:** When working to design, build, and deliver equipment, the first step is to make a project-specific Electromagnetic Compatibility Plan (EMCP). The EMCP lays out the program, including client and regulatory requirements, applicable standards, planned program activities, hazards to be resolved and considerations to be recognized, and the definition of deliverables to be developed and ultimate accepted. Importantly, the EMCP defines analyses and tests that will qualify the equipment to be delivered.

2. **Develop Detailed Test Procedures:** For tests planned in the EMCP, test procedures state the key information, including requirements, pass/fail criteria, test arrangements including for equipment under test and test facility or track, specifics of test equipment and connection, planned operating modes and test runs, data collection requirements, data analysis requirements, and test report format. The test procedures provide all needed information and step-by-step guidance so that any experienced test team can perform the tests.

3. **Plan, Coordinate, Mobilize, and Perform Tests and Acquire Data:** EMC tests on a transit property require the cooperation of many departments, including track allocation, car equipment, signals, traction power, maintenance, operations, engineering, and management. Because of the role of these departments, good planning, coordination, and mobilization is needed to get everyone and everything to the right place on time. Once the people and equipment are in place, the Tenco test team uses its expertise in transit equipment operation, transit equipment and EMC design, state-of-the-art instrumentation to orchestrate all needed activities. Typical tests include conducted emissions, inductive emissions, cab signal interference, train-to-wayside communications, radio susceptibility, and radiated emissions, each with its own specific setups, equipment, technical focus, operating scenarios, and frequency spectra. Tenco plans and performs tests under relevant operational modes - acceleration, braking, spin-slide, cut-out, extremes of power, partial equipment failures, etc. - to ensure the equipment is compliant under worst-case scenarios.

4. **Analyze and Report:** Tenco analyzes the EMI data to highlight the limit conditions, and analyzes it and compares it against the test-specific pass/fail limits. Tenco prepares Test Report which provides an executive summary, test summaries, and specific examples to clearly show the data, the analysis, and the results regarding compliance. If any non-conformances are identified, Tenco's engineering expertise is applied to assist in diagnosing the issue and developing effective mitigation strategies.