Massachusetts Bay Transportation Authority
Green Line Traction Power Upgrade Study

BOSTON, MA

Burns Engineering, Inc., (Burns), studied and offered recommendations to upgrade the MBTA's Green Line traction power system. The goals of the project were to build an engineering model of the existing Green Line Electric power distribution system and evaluate its performance within the current operational mode; determine the impact of planned operation mode changes on the traction power system; and identify improvements that may be needed to accommodate future operational mode changes. These goals were accomplished through the following phases:

Phases 1 & 2: Data Identification and Collection: the team identified all data to be collected through meetings with all appropriate staff of both the MBTA Power Division and Green Line Operations, developing a detailed project schedule as a result. This included all information required to develop the initial traction power system model, verify the baseline model, and perform the primary simulations in preparation to build a computer model of the Green Line system.

Phase 3: Development of the Traction Power System Model: the team loaded all data sourced/organized as part of Phase 2 into its RAIL-Power simulation program to create a model of the Green Line's electric power distribution system. Once loaded, the team ran an initial program to establish baseline power flow and voltage, and established current curves across the entire length of the Green Line system. The simulation calculated system voltage at the train consist collector as it traveled the line; the rectifier output at each station; the current loading for each positive supply feeder and negative return circuit; and temperature rise for each positive supply and negative return cable.

Phase 4: Verification of the Baseline Model and Primary Simulation Performance: the team first focused on verifying the baseline simulation result by observing and metering data at key points along the Green Line to confirm the model's accuracy. Upon confirming the baseline model to be accurate, the team then re-iterated simulation of the basic operating scenario for three contingency situations defined by Green Line Operations and the Power Division. The team then performed a new simulation for the enhanced operating scenario, which included a larger number of three-car train consists on all runs during rush hour with all available power in service. The team then repeated the simulation for this

scenario for the same three contingency cases that were used for the basic operating scenario.

Phase 5: Preliminary Report Preparation: the team developed a report that interpreted all information derived from the initial eight simulations. The report included a methodology summary, a power system data model-building summary, a summary of all assumptions used in developing the model, and a graphic presentation of the calculated data. This was accompanied by a strengths/weaknesses analysis of the existing system and suggested actions for improving/optimizing performance for present and future operating conditions.

Phase 6: Additional Simulations Performance: the team performed 8 additional simulations under differing/varying operating conditions as agreed upon by Green Line Operations and the Power Division.

Phase 7: Final Report Preparation: the team developed and organized a thorough report detailing all aspects of the study effort. In addition to methodology and data collection summary, the report included a presentation of all simulation results with accompanying interpretation, an analysis of system strengths and weaknesses, and recommendations for improving overall systems performance.