State of Good Repair

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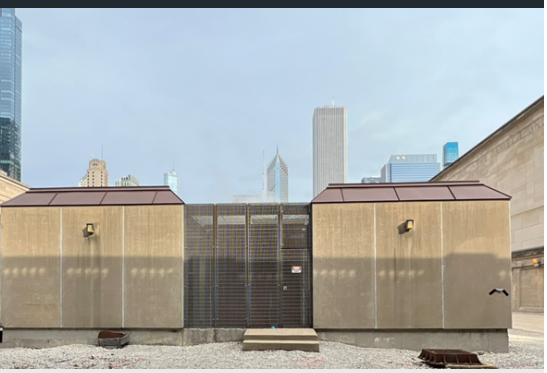

TRACTION POWER SYSTEM ELECTRICAL ENGINEERING DESIGN SERVICES

NORTHEAST ILLINOIS REGIONAL COMMUTER RAILROAD CORPORATION (METRA)

LOCATION
Chicago, IL

NAME OF CLIENT
Northeast Illinois Regional Commuter Railroad Corporation (Metra)

PROJECT TIMELINE
2020 - 2025

PROJECT COST
US $10 million

PROJECT OVERVIEW

Northeast Illinois Regional Commuter Railroad Corporation (Metra) operates the Metra Electric District (MED), an electrified commuter line that provides regular service between Millennium Station in Downtown Chicago and the southern suburbs. The MED uses 1500 Vdc distributed by traction power substations and an overhead contact system. Metra is in the process to expand their traction power capacity on the Metra Electric District by converting tie stations into traction power substations (TPS), overhauling and upgrading their substations with new and modern electrical equipment and improving the performance of their overhead contact system. Additionally, Metra substations distributes 3-phase 4.16 kVac power to the MED rail signal system and passenger stations.

Hatch has a long history with providing vehicle and systems engineering services to Metra. In 2020, Metra selected Hatch again for the Traction Power System Electrical Engineering Design Services contract. Under this contract, Hatch has performed engineering studies, equipment assessments, conceptual engineering design services and final design services for their substations and overhead contact system. Future tasks will include a condition assessment for their OCS, design for upgrading the OCS to a fixed tensioned system, and additional substation modernization services.

SCOPE OF WORK

Specific tasks under this contract included the development of a system-wide load flow study and conceptual engineering design services for the modernization of four traction power substations (Harvey TPSS, Vollmer TPSS, Brookdale TPSS, and University Park TPSS). The load flow model evaluated the power system load capacity for normal operations and for various contingency operational scenarios. The purpose was to understand the allowable construction phasing of the substation upgrades as each substation requires de-energization during construction. As for the design engineering, Hatch developed an assessment of all existing traction power equipment and the building facilities for four traction power substations. After this, a conceptual design was developed for the modernization of each substation. Final deliverables included drawings, technical specifications, construction staging, cost estimates, civil, structural, and architectural assessment of the facilities and recommendations for improvements.

Hatch delivered another task for Jackson Boulevard TPS, for a final design that included the replacement of existing equipment within the existing TPS building, and installation of new substation building adjacent to the existing TPS building. The design included the demolition and replacement of 12 kVac switchgear, rectifiers, transformers, dc switchgear, RTU, cables, and ancillary equipment. The new building contained new 12 kVac switchgear, auxiliary transformers, 4.16 kVac light and power transformers, 4.16 kVac switchgear, RTU, cabling, and ancillary equipment. Project deliverables included drawings, technical specifications, calculations, cost estimates and a construction schedule. This upgrade will provide additional longevity and capacity to Metra's 4.16 kVac distribution system as well as replacing end-of-life TPS equipment at Jackson TPSS.

PROJECT HIGHLIGHTS

+ System-wide traction power load flow study evaluating normal and contingency operating scenarios
+ Power system capacity analysis to support construction phasing during substation de-energization
+ Conceptual engineering and modernization design for four traction power substations
+ Assessment of existing traction power equipment and building facilities
+ Civil, structural, and architectural evaluations with recommendations for facility improvements
+ Construction staging plans, drawings, technical specifications, and cost estimates
+ Final design for Jackson Boulevard traction power substation modernization, including a new adjacent substation building

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TRACTION POWER SUBSTATION AND TIE STATION MODERNIZATION

NORTHEAST ILLINOIS REGIONAL COMMUTER RAILROAD CORPORATION (METRA)

LOCATION
Chicago, IL

NAME OF CLIENT
Northeast Illinois Regional Commuter Railroad Corporation (Metra)

PROJECT TIMELINE
2016 - 2026

PROJECT COST
US $12.5 Million

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PROJECT OVERVIEW

The Northeast Illinois Regional Commuter Railroad Corporation (Metra) operates the Metra Electric District (MED) Line, a 64 mile electrified commuter rail line that provides regular service between downtown Chicago and the southern suburbs. Metra operates eleven 1,500 VDC traction power substations and four tie stations to distribute traction power, signal power, and passenger station power along the MED Line and to related station facilities.

In 2016, Metra selected Hatch to provide general engineering design services for the modernization and overhaul of its existing substations. In 2020, Metra again selected Hatch for a follow on contract to continue supporting Metra by providing design services for the modernization of its traction power system.

SCOPE OF WORK

Since 2016, Hatch has provided the following engineering services to Metra:

95th Street and Riverdale Tie Station Conversion Metra's 95th Street and Riverdale Tie Stations were converted to traction power substations to increase capacity on the MED Line. Hatch prepared issued for construction (IFC) drawings, specifications, and cost estimates for the procurement and installation of prepackaged traction power substation (TPSS) buildings adjacent to the existing tie station buildings. The prepackaged buildings include 12 kVAC switchgear, two 3 MW rectifier transformers, and cathode breakers. DC feeders were installed between the new prepackaged TPSS buildings and the existing tie station facilities at each location.

Matteson Substation Matteson Substation is an existing facility with aging equipment. Hatch's scope of work included preparing drawings, specifications, and cost estimates for a new prepackaged TPSS building adjacent to the existing substation. The project required demolition of the existing 12 kVAC switchgear, rectifiers, and transformers, while retaining the existing DC switchgear. The new prepackaged TPSS includes 12 kVAC switchgear, rectifier transformer units, auxiliary transformers, a 4.16 kVAC light and power transformer, a source changeover device, and 4.16 kVAC switchgear. This upgrade increased capacity within Metra's 4.16 kVAC distribution system and replaced equipment that had reached the end of its service life.

Homewood Substation Similar to the 95th Street and Riverdale locations, Homewood includes an existing and aging tie station near the Homewood Passenger Station. This area has experienced voltage stability issues due to the large spacing between traction power substations. Hatch is currently developing designs for a new substation building at Homewood to increase capacity and improve power stability along the MED Line. Hatch's engineering scope includes preparing drawings, specifications, and cost estimates for a new substation building, a new ComEd utility yard, 12 kV AC switchgear, DC switchgear, rectifier transformers, and DC disconnect switches.

Harvey, Brookdale, Volmer, and University Park Substations – Concept Design Hatch prepared a systemwide load flow study, conceptual engineering designs, and cost estimates for the overhaul of existing equipment at the Harvey, Brookdale, Volmer, and University Park substations. This effort evaluated spatial constraints and future equipment requirements to support Metra's eventual replacement of equipment at these facilities.

Jackson Substation Improvements Project Jackson Substation is Metra's largest substation and provides traction power to the MED Line at Millennium Station. Originally constructed in the 1980s, the substation equipment had reached the end of its service life. Metra is currently undertaking construction to replace all equipment within the substation. Hatch's scope included the development of drawings, specifications, and cost estimates for the replacement of 12 kVAC switchgear, DC switchgear, rectifiers, transformers, communications systems, and other aging building appurtenances. An additional rectifier transformer was added to increase both capacity and redundancy, enabling future expansion of MED service.

In addition to replacing existing equipment, Hatch designed a new Light and Power Substation building located north of the Jackson Substation. This facility houses two new 3 MW distribution transformers, 12 kVAC switchgear, and a 2.4 kVAC distribution system. The light and power substation was designed to serve existing and future passenger station and wayside electrical loads in the area.

Other Engineering Services In addition to design services, Hatch has performed stray current remediation and conceptual design studies for portions of the MED Line. Hatch has also developed design concepts for overhead contact system (OCS) structures to assist Metra in evaluating modifications from fixed terminated OCS to fixed tension OCS. Additional electrical engineering services performed include short circuit analysis, AC and DC relay coordination studies, DC traction power load flow studies, and arc flash studies.

PROJECT HIGHLIGHTS

- 64-mile electrified commuter rail corridor with system-wide traction power, signal power, and station power distribution
- Modernization and overhaul program for eleven 1,500 VDC traction power substations and four tie stations
- Conversion of existing tie stations to full traction power substations to increase system capacity
- Replacement and upgrade of end-of-life traction power equipment to improve reliability and redundancy
- New prepackaged and site-built substation facilities integrated with existing railroad infrastructure
- Added rectifier transformers and distribution equipment to support future service expansion
- Capacity and voltage stability improvements in areas with wide substation spacing
- Systemwide traction power studies, conceptual designs, and electrical analyses supporting long-term modernization planning
- Issued-for-construction drawings, technical specifications, and cost estimates supporting phased substation replacements

TRACTION POWER SUBSTATION SYSTEM MODERNIZATION

NORTHERN INDIANA COMMUTER TRANSPORTATION DISTRICT (NICTD)

LOCATION
Michigan City, IN

NAME OF CLIENT
Northern Indiana Commuter Transportation District (NICTD)

PROJECT TIMELINE
2018 - 2029

PROJECT COST
US $138 million

PROJECT OVERVIEW

The Northern Indiana Commuter Transportation District (NICTD) operates the South Shore Line, providing passenger rail service from Millennium Station in Chicago to South Bend International Airport in South Bend, Indiana. The South Shore Line is approximately 75 miles long, with the majority of the railroad consisting of single track with frequent passing sidings. Passenger service is provided by electric multiple unit (EMU) vehicles powered by ten 1,500 VDC traction power substations that were commissioned approximately 40 years ago. Hatch was selected by NICTD to evaluate existing conditions and develop designs for new traction power substations and upgrade existing substations that have reached their end of life.

SCOPE OF WORK

Hatch was tasked with evaluating the addition of approximately 25 miles of second track between mileposts (MP) 37 and 58 using a proposed train operating schedule. This evaluation included performing a load flow study to identify traction power improvements required to support NICTD's future operations.

Hatch utilized its in house load flow simulator, TrainOps®, a comprehensive software tool used for the design and analysis of traction electrification systems. TrainOps® combines fast and accurate circuit analysis methods with an advanced train performance model. Hatch developed a TrainOps® model of the South Shore Line trackage and electrification infrastructure and calibrated the model using field measurements.

Hatch successfully modeled this unique system and developed recommendations for system upgrades. The load flow analysis identified new substation locations and requirements for modernizing existing substations. The modernization scope included upgrading controls and communications systems to support automation and increasing substation capacity. New substations were designed as prefabricated enclosures housing medium voltage AC switchgear, transformers, rectifiers, and DC switchgear. These substations were designed for off site fabrication and pretesting, with modular, low maintenance configurations.

PROJECT HIGHLIGHTS

+ Approximately 75-mile electrified commuter rail corridor operating between Chicago and South Bend Passenger service operated with EMU vehicles powered by ten 1,500 VDC traction power substations
+ Evaluation and replacement planning for traction power substations approaching end of service life
+ Load flow study supporting the addition of approximately 25 miles of second track
+ Traction power capacity analysis based on proposed future operating schedules
+ System modeling and performance analysis using an advanced in-house traction power simulator
+ Identification of new substation locations and modernization requirements for existing facilities
+ Prefabricated, modular traction power substation designs supporting increased capacity, automation, and low-maintenance operation
+ Upgrade of traction power controls and communications systems to enable greater automation, reliability, and operational flexibility

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