



Bridge and Tunnel

Engineering Qualifications

CONTACT:

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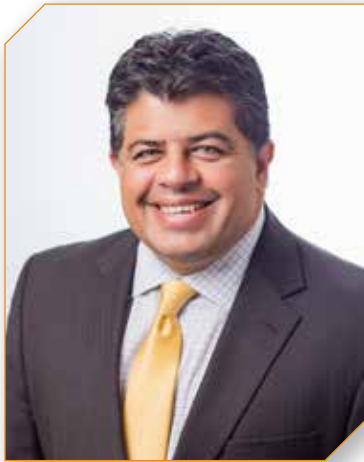
Rethinking Infrastructure®





Arora Engineers, Inc.
aroraengineers.com

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Dear Prospective Client,

Over our 32-year history, Arora Engineers, Inc. has worked with Transportation agencies across the country on a range of services covering the complete project life cycle. Arora's technical expertise lies in transportation stations as well as systems for bridges and tunnels. We have worked on bridges including George Washington, Bayonne, Goethals, Walt Witman and Ben Franklin, and tunnels including Lincoln, Brooklyn Battery, Canarsie, East Side Access, PATCO and more.

Bridge and Tunnel systems design has grown into one of Arora's areas technical expertise. Ranging from lighting, fire protection(Alarms and Standpipes) to security, communications, fiber/data, and smoke ventilation we have performed a broad array . We have dedicated disciplines in Mechanical, Electrical, Plumbing, Fire/Life Safety, and Special Systems (Security, Telecom, IT). We design systems with the future in mind and live our tagline of Rethinking Infrastructure as we approach each unique project.

Our Construction and Program Management group (PM/CM) experience ranges from serving as agency extension of staff and owners rep running capital projects and programs, to field inspections, to working with general contractors as master systems integrators, performing constructability reviews, and managing and overseeing the design and construction process.

No project is too big or too small, and we look forward to working with you and exceeding your expectations for quality and service.

Sincerely,

A handwritten signature in blue ink, appearing to read "Manik Arora".

Manik Arora
President and CEO

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+ Company
Overview

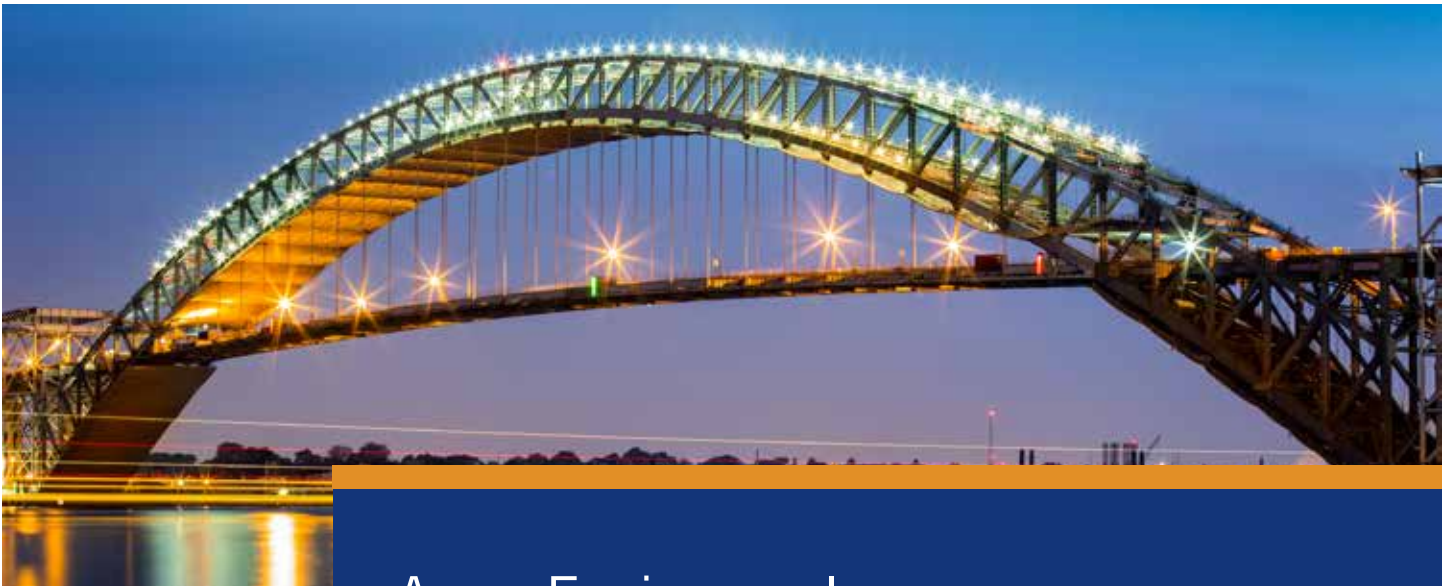


+ Bridge
Experience



+ Tunnel
Experience





Arora Engineers, Inc.

At Arora Engineers, we believe infrastructure needs to do far more than provide a seamless, safe, sustainable and comfortable environment. Our goal is to maximize its role, impact and value through highly intelligent solutions that not only meet operational needs, but forward business objectives.

We meet the evolving needs of the world's most critical industries – aviation, transportation and education – through more intelligent, sustainable and connected infrastructure solutions that maximize value for our clients and partners.

Expertise

Throughout our history of more than 30 years, we have held ourselves to rethinking the role of the traditional MEP firm. As a result, we've evolved our practice to emphasize the technology and processes that connect systems infrastructure, improve operations and longevity and make life safer and easier for those who use it.

Arora specializes in providing engineering services tailored for clients in aviation, transportation, education, government and commercial sectors and has developed a unique understanding of the challenges and opportunities facing these critical industries.

Services

SPECIAL SYSTEMS / TECHNOLOGY

- + Mass Notification & Public Address
- + WiFi systems
- + Voice/data systems
- + Network architecture
- + Data centers
- + MDF/IDF room layouts
- + Network design via fiber or copper backbone
- + Plant cabling systems
- + Fiber optic and copper structured cabling systems
- + Communications system design
- + CCTV/MATV/CATV systems
- + Access control
- + Duress systems
- + Perimeter intrusion detection
- + Risk and needs assessments
- + Video walls
- + Security operations and procedures evaluation
- + Passenger/customer information display systems
- + Signage/Electronic video information display systems (EVIDS)
- + Software and equipment evaluation and recommendations
- + FIDS/BIDS/GIDS/CUPPS/SUPPS
- + Multi-lingual/International traveler



ELECTRICAL

- + Low and medium voltage power distribution
- + Emergency and standby power systems
- + Lighting design and photometrics
- + Substation/switchgear
- + Grounding and lightning protection
- + Single-line diagrams
- + Short circuit & coordination studies
- + Power and lighting equipment selection and specifications
- + Motor control centers
- + Electrical equipment sizing
- + Energy efficient systems
- + Electrical code analysis
- + Electrical plan review and master plan development

AERONAUTICAL ELECTRICAL

- + Airfield Lighting and Signage
- + Approach Lighting Systems
- + Instrument Landing Systems
- + Navigational Aids
- + Airfield Lighting and Control Systems
- + Runway Incursion Mitigation
- + Pavement Surface Sensor Systems

HVAC / PLUMBING

- + Sustainable/Green Building design
- + HVAC
- + Central plant design
- + Underfloor Air Systems design
- + Constant and variable air volume systems
- + Radiant heating systems
- + Geothermal system design
- + Building automation and digital controls
- + Domestic water systems
- + Storm and sanitary system design
- + Fuel system design
- + Lifecycle Costing, Energy Analyses

FIRE PROTECTION AND LIFE SAFETY

- + Fire alarm and detection system design
- + Standpipes and water-based sprinkler system design
- + Foam systems and special hazard suppression design
- + Fire pumps and fire protection water supply system design
- + Smoke management
- + Code analysis and consulting
- + Plan review
- + Due diligence reports
- + Performance based analysis
- + Risk/hazard assessment
- + Site conditions survey

GEOGRAPHIC INFORMATION SYSTEMS (GIS)

- + Database setup and implementation plans
- + CAD to GIS conversion plans
- + FAA Airport GIS program compliance
- + Legacy data access integration
- + Web-based GIS portal development
- + Asset and utility data management
- + Field inspection and inventory
- + GPS data capture and attribution

PROGRAM MANAGEMENT

- + Project management
- + Procurement coordination
- + Information management
- + All-inclusive project control
- + Runway Incursion Mitigation
- + Pavement Surface Sensor Systems
- + Airfield Lighting Vaults and Power Distribution
- + Sustainable Solutions
- + Construction Safety and Phasing

CONSTRUCTION MANAGEMENT & INSPECTION

- + Project administration
- + Master systems integrator
- + Daily inspection
- + Project documentation
- + Submittal review/tenant permit reviews
- + Design support
- + Constructability reviews
- + Value engineering
- + Critical path review
- + Materials testing
- + Cost estimating
- + Claims analysis
- + Runway Incursion Mitigation
- + Airfield Lighting Vaults and Power Distribution
- + Pavement Surface Sensor Systems
- + Construction Safety and Phasing

ATLANTA

BALTIMORE

BOSTON

CHARLOTTE

CHICAGO

DALLAS

FT. LAUDERDALE

NASHVILLE

NEW YORK

PHILADELPHIA

SAN JOSE



PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Bayonne Bridge Raising

Bayonne, NJ, and Staten Island, NY

PROJECT DETAILS

CLIENT

HDR Engineering, Inc.
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Vice President
One Riverfront Plaza
1037 Raymond Blvd., Suite 1400
Newark, NJ 07102-5418
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973-474-5010

CONSTRUCTION

\$7,000,000

PROJECT START

2012

PROJECT COMPLETION

2019

HIGHLIGHTS

- + Project will raise the Bayonne Bridge deck 64 feet above its existing position
- + Arora tasked with electrical and fire protection engineering
- + Finished project will feature wider travel lanes, shoulders, and median divider for improved safety

In order to accommodate the larger Panamax ships due to pass under the Bayonne Bridge, efforts are underway to raise the bridge by approximately 64 feet above the current height of the waterway.

SCOPE OF WORK INCLUDED:

- + The development of contract drawings for one line diagrams
- + Final short circuit analysis and voltage drop calculations
- + Electrical equipment replacement staging and phasing drawings
- + Emergency generator system layout plans
- + Site plans with all electrical room locations
- + Electrical room equipment layouts

Arora also provided: power requirements, conduit routing and design of the fire alarm system; routing for major conduit and cable runs at the site and in electrical rooms; bridge, roadway, security, navigation, and aviation lighting layout complete with lighting fixture schedules, control schemes, conduit, and cable routings; power and lighting for the new toll system; grounding plans; coordinated power supply and conduit routing for SCADA equipment layout and interconnection diagrams prepared by others; and lightning protection system design and drawings.



PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Goethals Bridge Replacement Project

Elizabeth, NJ to Staten Island, NY

PROJECT DETAILS

CLIENT

Parsons Corporation
Seth Condell, PE
Project Manager
100 Broadway
New York, NY 10005
seth.condell@parsons.com
212-266-8398

CONSTRUCTION

\$1,500,000,000

PROJECT START

2014

PROJECT COMPLETION

2018

HIGHLIGHTS

- + Designed fire protection for new dual-span bridge and bridge utility and support structures
- + Bridge standpipe design features a redundant dual fire pump system
- + Clean agent suppression for areas housing sensitive equipment



Arora provided fire protection design services as a subconsultant to Parsons Corporation in connection with the Kiewit/Weeks/Massman (KWM) design/build team for the replacement of the historic Goethals bridge. The project will replace the existing structure which spans the Arthur Kill River on I-278 connecting Elizabeth, NJ with Staten Island, NY. The existing bridge has been in service since the 1920s and will be replaced by new dual spans. The original bridge will be demolished once construction is complete.

SCOPE OF WORK INCLUDED:

Arora's scope of work featured fire protection design services for the new Goethals Bridge communications systems, primary and secondary electrical systems, and fire pump rooms housed within the bridge utility structures and generator enclosures. These systems include the fire pumps that feed the bridge standpipe system and fire protection systems required to protect the utility and generator structures. Due to the critical nature of the equipment within these structures the use of clean agent as well as pre-action sprinkler protection was utilized for areas with water-sensitive equipment.

The scope of work also included the design of a dual fire pump system to provide redundant service to the bridge standpipe system. The project design met the requirements of NFPA 13, NFPA 14, NFPA 20 as well as those of the emergency response agencies located in both New York and New Jersey. The fire pumps and supply piping were sized to meet the 10 fill time requirement per NFPA 502.

The utility structure fire protection systems included both wet and pre-action sprinkler systems for the mechanical and electrical spaces as well as clean agent suppression systems for the sensitive communications rooms. Upon completion of the project design documents, Arora will provide services during the construction phase in the form of submittal reviews and site surveys.

DELAWARE PORT AUTHORITY

Walt Whitman Bridge – Suspension Span Deck Replacement

Philadelphia, PA and Gloucester City, NJ

PROJECT DETAILS

CLIENT

Delaware River Port Authority
Vijay Pandya, PE, Senior Engineer
One Port Center
2 Riverside Drive
PO Box 1949
Camden, NJ 08101
vrpandya@drpa.org
856-968-2077

CONSTRUCTION

\$128,000,000

PROJECT START

2007

PROJECT COMPLETION

2014

HIGHLIGHTS

- + Preliminary engineering report analyzed impacts to electric, traffic, lighting, security, and communication systems
- + Performed utility system verification, impact analysis, and relocation/redesign
- + The Arora team ensured continued operation of bridge systems during deck reconstruction

Arora evaluated the impact to existing electrical power, traffic control, lighting, security, and communication utilities based on different deck replacement alternatives for the Walt Whitman Bridge. Arora prepared a preliminary design report based on the impact findings, and subsequently prepared design drawings for the utility relocations to insure continuous operation for those systems at the Walt Whitman Bridge during and after construction. Project responsibilities included utility system verification and utility system impact and redesign to assist the construction of the new deck on the bridge.

SCOPE OF WORK INCLUDED:

The electrical design included relocating the 5kV medium voltage power service to the anchorages and tower sections of the bridge to provide continuous power to traffic control, security, and communication systems. Design for new street lighting was also included to insure proper lighting levels were maintained in the driving lanes with bridge vibration taken into account for reliable lighting systems and improved lamp life. Navigation lighting power for under-bridge ship traffic was also maintained.

Special system design involved security camera surveillance and communication relocation for continuity, fiber optics to DRPA traffic lane signal gantry control, and interstate fiber optic communications including AboveNet systems to insure utility services are in continuous operation during the entire construction process.



THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY (PANYNJ)

George Washington Bridge PIP Helix Ramp Replacement

Fort Lee, NJ

PROJECT DETAILS

CLIENT

STV
William (Bill) Brooks
820 Bear Tavern Rd.
Suite 200
William.Brooks@stvinc.com
(609) 530-0300

CONSTRUCTION

\$30,000,000

PROJECT START

2013

PROJECT COMPLETION

2015

HIGHLIGHTS

- + Provided design and construction phase services.
- + Performed bridge standpipe design and fire/life safety engineering services.
- + Provided electrical and lighting design engineering services.

Constructed in 1952, the Palisades Interstate Parkway (PIP) Helix bridges are critical to transportation in the New York/New Jersey region because of their location relative to the George Washington Bridge (GWB). Structural and seismic analyses of the bridges indicated that they were near the end of their useful life and not performing as designed.

Arora Engineers, Inc. (Arora) provided design and construction phase services for temporary and new Helix ramps to replace the existing Helix ramp connecting the PIP to the Eastbound I-95 roadway and the GWB. The design included electrical and fire protection engineering services for both temporary and permanent new ramps, fire/life safety code review, coordination with Authorities Having Jurisdiction (AHJ), fire suppression dry stand-pipe system, and construction administration.

Arora's fire/life safety designers utilized state of the art hydraulic calculation software to analyze pressure drop and fluid delivery time. The electrical team also used advanced software to analyze voltage drops, load calculations, and lighting photometrics for the project.





AMTRAK

New York City Penn Station Tunnels and Platforms Video Surveillance System (VSS) and Access Control Security Designs Task Order

New York, NY

PROJECT DETAILS

CLIENT

WSP

Charles "Chuck" Reed - PSP, CAS
Supervising Security &
Communications Engineer
One Penn Plaza
New York, NY 10119
212-465-5188
Chuck.reed@wsp.com

PROJECT START

2017

PROJECT COMPLETION

2017

HIGHLIGHTS

- + Perform survey and electrical design
 - + Detailed VSS assessment report
 - + Design documents including value engineering propositions
- Arora Engineers, Inc. (Arora) was retained to perform survey and electrical design services for AMTRAK at Penn Station in New York, NY. Arora, in conjunction with WSP and AMTRAK, will incorporate industry standards and best practices to provide AMTRAK with a detailed assessment of Video Surveillance System (VSS) and Access Control requirements for the identified tunnels and platforms. Arora will leverage data from the Risk Assessment, conduct site visits, identify VSS and Access Control placement, type and operational challenges, document requirements, and create a design for VSS and Access Control solutions for the tunnels.
- #### SCOPE OF WORK INCLUDED:
- Arora's work activities include, but are not limited to:
- + Becoming familiar with the operational functionalities of the site for AMTRAK and its rail partners.
 - + Reviewing and analyzing AMTRAK's most recent Risk Assessment, as well as other site specific data.
 - + Utilizing AMTRAK's Tunnel Vulnerability Methodology to evaluate additional data and inputs for documenting VSS requirements.
- + Preparing preliminary cost estimates for security improvements. The cost estimates include all project costs, including but not limited to project design, construction, administration, in-house labor (AMTRAK Forces), projected life cycle costs in terms of continued maintenance and head count, and sustainment.
 - + Attending regular task progress meetings with AMTRAK's EMCS Team and other agencies as identified by AMTRAK.
 - + Developing a detailed schedule document and submitting the same for AMTRAK EMCS approval within three (3) weeks of the issuance of Notice to Proceed (NTP) date. The schedule shall clearly document all intermediate milestones. The schedule shall be prepared using AMTRAK's standard scheduling software and shall be presented in the style and format as approved by AMTRAK's EMCS, with necessary charts and reports as requested.
 - + Presenting on all deliverables at the time of submission to AMTRAK's EMCS designated Project Manager.
 - + Performing all associated and incidental work as may be necessary for the completion of this assignment.



PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Access Control Systems (ACS)

Lincoln Tunnel, Weehawken, NJ and New York, NY

PROJECT DETAILS

CLIENT

Port Authority of New York and New Jersey
Sergio Martinez, PE, PMP
Program Manager – Security
Project Management
221 Erie Street, Room 220
Jersey City, NJ 07310
smartinez@panynj.gov
201-595-4738

CONSTRUCTION

\$24,000,000

PROJECT START

2009

PROJECT COMPLETION

2012

HIGHLIGHTS

- + Security engineering for the Lincoln Tunnel
- + Design tasks included access control, intrusion detection, and CCTV systems

Arora Engineers provided special systems engineering design services to the Port Authority of New York and New Jersey for the expansion of the access control system and CCTV expansions and upgrades for the Lincoln Tunnel. The access control package included power, special systems, and architectural design work to secure doors at the Lincoln Tunnel vent, administration, and river buildings.

SCOPE OF WORK INCLUDED:

Access control design included new door control panels and panel details, sonnet node expansions, power, door elevations, and programming requirements. The CCTV system upgrade and expansion included sonet ring connections and CCTV camera design including camera views, lens sizing, copper and fiber optic communications, encoding, and storage. CCTV design also included the conversion of existing head end analog equipment to IP based storage and video management equipment. In general, the package included:

- + Station plans
- + Riser diagrams
- + Mounting details
- + Connections details
- + System integration plans

This package is deemed confidential and privileged under the PANYNJ Security Handbook. No further information can be disclosed about this project.



DELAWARE RIVER PORT AUTHORITY

PATCO Subway Tunnels Forced Air Ventilation Study

Philadelphia, PA

PROJECT DETAILS

CLIENT

Hatch Mott MacDonald
David G. Newman, PE, CEng.
Principal Project Manager
400 Blue Hill Drive
Suite 100
Westwood, MA 02090
781-636-4124
David.Newman@hatchmott.com

PROJECT START

2013

PROJECT COMPLETION

2014

HIGHLIGHTS

- + Assisted HMM in survey work
- + Assisted HMM in preparing sketches for schematic level report
- + Supported the electrical design effort in the field verification of existing conditions
- + Assessed fire alarm/management panels for the inclusion of a ventilation system

Arora Engineers, Inc. (Arora) was retained to assist Hatch Mott MacDonald with survey work, cost estimates, and preparation of sketches for a schematic level report for the Subway Tunnels Forced Air Ventilation Study. Arora was tasked with handling the fire alarm and communications services, and supporting the electrical design effort, primarily in the form of field verification of existing conditions.

SCOPE OF WORK INCLUDED:

Arora's scope of work included the following phases:

- + Reviewing existing documents, including previous studies, existing drawings, PATCO fleet details
- + Reviewing fire alarm/management panels and verifying the possibilities of inclusion of ventilation system
- + Verifying existing conditions, including field surveys to collect SES/CFD information, measurement of illuminance levels, and field activity coordination/scheduling
- + Reviewing regulations and other requirements
- + Preparing design-build & design-bid-build recommendations
- + Preparing a preliminary report
- + Formulating design criteria
- + Preparing the final report submission
- + Project management/meetings



METROPOLITAN TRANSPORTATION AUTHORITY

BB28 Brooklyn Battery Tunnel Rehabilitation – Design and Construction Support Services Phase II, Contract PSC-12-2913

Brooklyn, NY

PROJECT DETAILS

CLIENT

Hatch Mott MacDonald
Anthony McGinn
Electrical Department Manger
111 Wood Avenue South
Iselin, NJ 08830-4112
973-379-3400

PROJECT START

2015

PROJECT COMPLETION

2016

HIGHLIGHTS

- + Provided construction administration for the Brooklyn Battery Tunnel rehabilitation
- + Reviewed electrical and special systems drawings and specifications
- + Assisted with the review of contractor submittals
- + Performed construction field inspections

Arora Engineers, Inc. (Arora) provided construction administration services for the electrical and communications design in the Brooklyn Battery Tunnel rehabilitation. The overall design project encompassed the rehabilitation of the tunnel and included structural elements, roadway drainage, firelines, and associated elements of the tunnel.

SCOPE OF WORK INCLUDED:

Arora's scope of work focused on construction phase services, including:

- + A review of electrical and special systems shop drawings:
 - + Arora reviewed and provided comments on the electrical drawings and specifications of the BB-28 Phase II project, including notes, plans, elevations, sections, schedules, phasing/staging, and details.
- + Construction submittal and Request for Information (RFI) review:
 - + Arora assisted with the review of contractor submittals and RFI's by reviewing and assessing with relation to the contract drawings and specifications, and providing comments to the submittals and RFI's as required.
- + Attending meetings on site
- + Site inspections if needed:
 - + The team performed construction field inspections services as required and recorded findings.



MTA BRIDGES & TUNNELS

Control Room Renovations, Queens Midtown Tunnel

New York, NY

PROJECT DETAILS

CLIENT

Mott MacDonald
Norris Harvey, PE
Tunnel Fire/Life Safety Division
1400 Broadway
New York, NY 10018
Norris.Harvey@hatchmott.com
212-589-1127

CONSTRUCTION

\$23,000,000

PROJECT START

2014

PROJECT COMPLETION

2016

HIGHLIGHTS

- + MEP for control, server and electronics rooms
- + Evaluate fiber optic cable capacity



Arora assisted in the development of the design for the mechanical, electrical, and plumbing related systems for the control room renovations at the Queens Midtown Tunnel (QMT). This effort also included MEP support for back-up control rooms at the QMT and the Hugh L Carey Tunnel (formerly the Brooklyn Battery Tunnel). The project required the upgrade of existing electronic control systems to improve situational awareness, improve customer and employee safety, and increase operational efficiencies, reliability and maintenance planning.

SCOPE OF WORK INCLUDED:

- + Support of the Mechanical, Electrical, Plumbing, and Fire Protection/Alarm systems on the renovations in the Queens Service Building for the conditioned

spaces in the control, server, and electronics rooms. In addition, support was provided for the temporary control room while the upgrades are occurring.

- + HVAC systems were designed to handle all anticipated loads and conditions. Calculations were determined future loading conditions based on the upgraded systems and equipment as part of the project..
- + Electrical systems included reconfigurations of power supplies and cabling, the design of a new UPS system, cabling management system, access control devices, and relocation of CCTV cameras.
- + Plumbing system design included the relocation of pipes located above the control room.
- + Fire Protection and Alarm Systems were designed for each of the rooms and their associated hazards in accordance with all applicable codes and NFPA standards.

In addition, Arora developed options for increasing fiber optic cable capacity through the QMT including connecting the service building to the tunnel. Arora identified and evaluated installed fiber cable in the tunnel for current and future needs.

METROPOLITAN TRANSPORTATION AUTHORITY

New York City Transit Authority Canarsie Tunnel Stations

Brooklyn, NY

PROJECT DETAILS

CLIENT

Parsons Brinckerhoff
C. Jeremy Hung, PA
Geotechnical and Tunneling Group
One Penn Plaza
New York, NY 10119
212-465-5206
Hung@PBWorld.com

PROJECT START

2016

PROJECT COMPLETION

2016

HIGHLIGHTS

- + Provided CAD support for MEP assessment
 - + Developed conceptual schematics for flood mitigation/resiliency systems
 - + Provided electrical, fire/life safety, and special systems design services for tunnel stations
- + Conduit and cabling were provided for the integration with the existing PA system controller (within the Communications Room) to allow remote activation of the evacuation signals via the PA system.
- + Arora added three monitor modules and two control modules to the Communications Room in both stations, within three feet of the PA controller.
- + Arora evaluated if it was feasible to provide a fire suppression system for the back of the house rooms at both First Avenue and Bedford Avenue stations.



Arora Engineers, Inc. (Arora) was chosen to provide minor mechanical, electrical, plumbing, and fire/life safety design services for the New York City Transit (NYCT) Authority Canarsie Tunnel Stations.

SCOPE OF WORK INCLUDED:

Arora's scope of work included the following task orders:

Task Order #10: CAD Support for MEP Assessment Report

- + Arora provided CAD support, as needed, for an MEP Assessment Report. The CAD support was provided for the 50% design submittal and the 100% design submittal.

Task Order #11: Flood Mitigation/Resiliency Project

- + Arora provided CADD Operator/Drafting services to develop graphics and/or simple conceptual-level schematics presenting typical applications of flood mitigation/resiliency systems selected by the PB/PTG Joint Venture team.
- + The examples were developed through the research and investigations of possible worldwide flood mitigation/resiliency systems, and were set to be applied to the NYCT transportation assets.

Task Order #12: IDIQ Architectural/Engineering Design Services for Federally Funded Miscellaneous Construction and Capital Security Project

- + Arora provided strobe lights in all public and control areas, as well as fire detection in all new and existing back of house areas, and alarm panels at the agent booths on First Avenue and Bedford Avenue mezzanines.

PENNSYLVANIA TURNPIKE COMMISSION

Lehigh Tunnel Roadway Tunnel Lighting & Raceway Milepost Replacements

Lehigh and Carbon Counties, PA

PROJECT DETAILS

CLIENT

Mott MacDonald, LLC
Michael T. Kelly, PE
1400 Broadway
30th Floor
New York, NY 10018
212-589-1153
Michael.kelly@mottmac.com

PROJECT START

2016

PROJECT COMPLETION

2017

HIGHLIGHTS

- + Provided electrical engineering and design support for new roadway lighting
- + Assisted in tunnel inspections and site surveys
- + Assisted in cost and quantity estimation
- + Supported the preparation of detailed design specifications to replace the roadway lighting

Arora Engineers, Inc. (Arora) provided electrical engineering and design support for the Lehigh Tunnel's new roadway tunnel lighting and related systems.

The Lehigh Tunnel, located on Interstate 476 between Lehigh and Carbon County, consists of two separate tubes, Northbound (NB) and Southbound (SB), and is approximately 4,380' in length. The NB tube was constructed in 1957; the SB tube was completed in 1991.

Water ingress in the Lehigh Tunnel, combined with regular freeze-thaw cycles and heavy traffic flow, led to a gradual deterioration in the appearance and condition of the tunnel wall tiles. As a result, the existing SB and NB luminaire housings and SB raceways were corroded and needed to be replaced.

The replacement project consisted of engineering design services, including field surveys, MEP design and specialized lighting design for long tunnels, electrical power distribution design, emergency power design, cost estimating for the replacement of the existing roadway and emergency lighting systems, and southbound raceway replacement. The tunnel lighting was designed in accordance with ANSI/IES RP-22-11 and NFPA502, understanding that some NFPA502 requirements are 'grandfathered' by PTC.

SCOPE OF WORK INCLUDED:

Arora's scope of work drew on the firm's expertise in the design of electrical systems and the provision of drafting and estimating services. These tasks included:

- + Tunnel inspection and site surveys
- + Contribution to project reports
- + Cost estimation
- + Quantity estimation
- + Preliminary design
- + Preparation of detailed engineering design specifications



SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY

Substation Rehabilitation Project

Philadelphia, PA

PROJECT DETAILS

CLIENT

Southeastern Pennsylvania
Transportation Authority
Dan Ferrante
Project Manager, Power
SEPTA EM&C Power Department
1234 Market Street
Philadelphia, PA 19107
DFerrante@septa.org
215-580-7625

CONSTRUCTION

\$130.4 million

PROJECT START

2016

PROJECT COMPLETION

Ongoing

HIGHLIGHTS

- + Includes 16 substations to be rehabilitated
- + 1 new construction substation facility
- + Locations include catenary, under street, and stand-alone units
- + Complete systems assessment and upgrade recommendations
- + TPSS's will be completely overhauled and upgraded by the team
- + 21 month design schedule

Arora, as a subconsultant to HDR and HNTB, is providing mechanical/plumbing, fire/life safety, special systems, and electrical services for 16 substations and facilities. The overall objective of the project is to provide SEPTA with upgraded substations throughout the Regional Rail (RRD) and Center City Transit (CCT) divisions of SEPTA. There is a total of 16 existing substations that will get rehabilitated and one new substation will be built.

SCOPE OF WORK INCLUDED:

- + **Phase 1** of this project is site assessments of all systems and preparation of a conceptual report for each station detailing the condition of and recommendations for each individual system by site.
- + **Phase 2** consists of preparation of 30% and 50% design packages for recommended upgrades to be taken over by the awarded design builder at 50%. Woodbourne station is the exception, and this is a new greenfield site and design will be taken to 100%.
- + **Phase 3** is construction related services to review submittals and shop drawings, respond to RFIs, as-built/record documentation, and as needed technical assistance.

The mechanical services include design for the HVAC, ventilation, and exhaust systems in the buildings. The plumbing services include design for the bathrooms, as necessary, the eyewash stations and the rainwater conductor systems for each of the buildings. Design is in accordance with all applicable codes and standards.

The fire/life safety design includes fire alarm and detection systems for each building. Heat and smoke detection systems are required throughout and will communicate to SEPTA's operations center. Design is in accordance with all applicable codes and standards, including NFPA 70, 72 and 130.

The special systems design includes security, CCTV, and communications for each of the buildings. An intrusion detection and alarm system is provided for each building.

The electrical design is related to the non-TPSS systems and includes general convenience power and receptacles and lighting.



PORT AUTHORITY OF NEW YORK AND NEW JERSEY

PATH Fire Alarm Replacement Stage III and IV

Various Port Authority Trans Hudson (PATH) Facilities, NY and NJ

PROJECT DETAILS

CLIENT

Port Authority of New York and New Jersey
Atul Ragoowansi
Project Manager
aragoowa@panynj.gov
201-595-4039

PROJECT START

2015

PROJECT COMPLETION

2017

HIGHLIGHTS

- + Design services for the upgrade of the entire PATH fire alarm network.
- + Campus type network composed of various fire alarm manufacturers interconnected via fiber optic cable.
- + Intelligible voice evacuation systems for public spaces
- + Preparation of a detailed construction cost estimate
- + Code consulting utilizing NFPA, NY, NYC, NJ and UL codes and standards

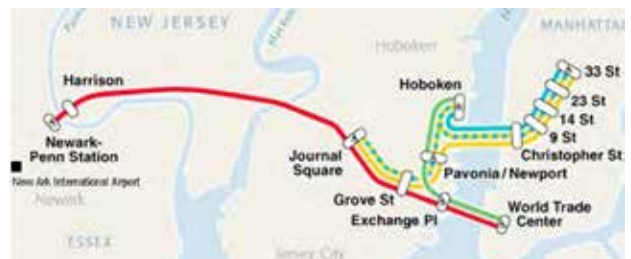
Arora has recently been awarded, as a sub-consultant, the Stage III and Stage IV design services for the upgrade of the Port Authority Trans Hudson (PATH) fire alarm systems. The scope includes the complete fire alarm upgrade and associated IP based communication between 50 plus light rail facilities. associated with the PATH system located in both New York and New Jersey. The project shall include the survey of existing systems, the development of design documents and construction support services.

SCOPE OF WORK INCLUDED:

The project objective is to upgrade and unify all of the fire alarm systems protecting the various PATH facilities. The scope includes the design of a code compliant dedicated fire alarm system for the entire PATH system and Fire Alarm network over the PATH SONET to enable IP digital alarm communicator transmitter (DACT) communications between the Fire Alarm Panels at each Facility and the Proprietary Supervising Stations. The system includes monitoring by designated external Central Monitoring Station (CMS) located outside the PATH premises and other monitoring stations located within the PATH facilities.

The design is based on the Stage I design criteria, survey of existing conditions of each facility, and includes the overall PATH fire alarm network and the fire alarm systems located at each of the facilities. The systems include fire alarm panels, power supplies, voice evacuation equipment, initiation devices (manual pull stations, smoke/heat detectors, duct, etc.), notification appliances (speakers, horns, strobes, etc.), network communication equipment and all other equipment required for a code compliant fire alarm system. The system design includes all interface to other systems required to be supervised or operated by the fire alarm system to provide ancillary fire/life safety functions.

The scope includes the development of detailed design drawings, specifications and cost estimates to be used for bidding purposes. The documents shall be developed through a progressive design process with multiple submittals. Upon completion of the design documents Arora shall provide support services throughout the duration of construction including review and response to RFI's, review of submittals, punchlist surveys and review of close out documentation.



Rethinking Infrastructure®



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