PORT AUTHORITY OF ALLEGHENY COUNTY

TRANSMITTAL MEMORANDUM

TO: All Holders of Bid Documents for the Subject Contract

SUBJECT: North Shore Connector
NSC Train Systems (System Wide)
Contract No. NSC-009

DATE: September 12, 2008

Please find enclosed the following:

- Addendum No. #7 dated September 12, 2008
- Question and Answers 46, 136, 148, 149, 152, 153, 156-166
- Form B (Unit Price Schedule), Sheets B-2 through B-10 Excel file (A7-NSC-009 Form B.xls).

All document holder, the Excel file listed above, is provided on the CD as a separate file that is in addition to the (.pdf) files for the Addendum.

To use the Excel file, copy the file to your computer, right click on the file and go to "Properties". Under the pop-up locate "Attributes" and uncheck the "Read-only" toggle. The bidder remains responsible for the proper submission of its Bid in accordance with the Bid Documents. Any additional updates to the Unit Price Schedule will be issued in Excel format as a part of related Addenda.

The following signature acknowledges the receipt of this Transmittal.

_____
Signature

_____
Name of Company

_____
Date

Please sign and return one (1) copy to:

Port Authority of Allegheny County
Purchasing and Materials Management Department
Heinz 57 Center
345 Sixth Avenue, Third Floor
Pittsburgh, PA 15222-2527
Attention: Ms. Toni Matessa

PORT AUTHORITY OF ALLEGHENY COUNTY

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Port Authority of Allegheny County

North Shore Connector

NSC Train Systems (System Wide)

Contract No. NSC-009

ADDENDUM NO. 7

September 12, 2008

This Addendum modifies Bid Documents for the subject Contract as set forth below. The Bidder shall acknowledge receipt of this Addendum in the appropriate space on the Form of Proposal, Form B.

To identify revisions on the attached Contract Drawings, an irregular line joined by a diamond symbol with a number inside it appears at the revision location; and the diamond symbol with a number inside it, date and a description appear in the Revision Block.

To identify revisions on the attached pages, a vertical bar appears in the right margin at the revision location.

CHANGES TO TERMS AND CONDITIONS (VOLUME 1)

1. Section 00400, Bid/Award Forms, Form B, Page B-2. Delete and replace with page B-2.
2. Section 00400, Bid/Award Forms, Form B, Page B-4. Delete and replace with page B-4.
3. Section 00400, Bid/Award Forms, Form B, Page B-8. Delete and replace with page B-8.

CHANGES TO TECHNICAL PROVISIONS (VOLUME 2)

1. Section 02451, Replacement of Existing Direct Fixation Track, Page 02451-1. Delete and replace with page 02451-1.
2. Section 02451, Replacement of Existing Direct Fixation Track, Pages 02451-6 through 02451-7. Delete and replace with pages 02451-6 through 02451-7.
3. Section 02451, Replacement of Existing Direct Fixation Track, Page 02451-10. Delete and replace with page 02451-10.
4. Section 05520, Miscellaneous Metalwork, Page 05520-1. Delete and replace with page 05520-1.

5. Section 05520, Miscellaneous Metalwork, Pages 05520-10 through 05520-11. Delete and replace with pages 05520-10 through 05520-11.

CHANGES TO TECHNICAL PROVISIONS (VOLUME 3)

1. Section 15400, Tunnel Services Scope of Work, Page 15400-2. Delete and replace with page 15400-2.

2. Section 15886, Tunnel Ventilation Jet Fan Active Control, Page 15886-5. Delete and replace with page 15886-5.

3. Section 15886, Tunnel Ventilation Jet Fan Active Control, Pages 15886-7 through 15886-9. Delete and replace with pages 15886-7 through 15886-9.

4. Section 15890, Tunnel Ventilation Jet Fans, Pages 15890-1 through 15890-2. Delete and replace with pages 15890-1 through 15890-2.

5. Section 15891, Tunnel Services Mechanical Testing And Commissioning, Page 15891-2. Delete and replace with page 15891-2.

6. Section 16060, Grounding and Bonding, Page 16060-9. Delete and replace with page 16060-9.

7. Section 16120, Low Voltage Power Cables, Pages 16120-1 through 16120-2. Delete and replace with pages 16120-1 through 16120-2.

8. Section 16602, General Requirements Overhead Contact System, Pages 16602-6 through 16602-7. Delete and replace with pages 16602-6 through 16602-7.

9. Section 16889, Tunnel Services Electrical Testing And Commissioning, Page 16889-1. Delete and replace with page 16889-1.

10. Section 16890, Tunnel Services Electrical Requirements of Mechanical Equipment, Pages 16890-1 through 16890-2. Delete and replace with pages 16890-1 through 16890-2.

11. Section 16891, Tunnel Services Low Voltage Switchboard And Motor Control Center, Pages 16891-1 through 16891-2. Delete and replace with pages 16891-1 through 16891-2.

12. Section 16895, Tunnel Services Low Voltage AC Variable Speed Drive, Pages 16895-1 through 16895-2. Delete and replace with pages 16895-1 through 16895-2.

CHANGES TO NSC-009 CONTRACT DRAWINGS (VOLUME 1)

(Modified or Added Drawings are attached here to)

1. Drawing No. TN130, Sheet No 54. Drawing Modified.
2. Drawing No. TP013, Sheet No 278. Drawing Modified.

3. Drawing No. TP016, Sheet No 281. Drawing Modified.
4. Drawing No. TP018, Sheet No 283. Drawing Modified.

CHANGES TO NSC-009 ALSO PLANS (REF DWGS) (VOLUME 2)
(Modified or Added Drawings are attached here to)

1. Drawing No. GN006A. Drawing Modified.
2. CY-111, Drawing No. TS-15 – Double Line Track & Signal Plan. Drawing Added.

PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
CONTRACT NO. NSC-009

UNIT PRICE SCHEDULE

BID ITEM	DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
00771.001	INSURANCE DEDUCTIBLE FUND ALLOWANCE	PDA	1	$50,000.00	$50,000.00
01100.001	PARTNERING	PDA	1	$50,000.00	$50,000.00
01755.001	MOBILIZATION	LS	1		
01777.001	SYSTEMS INTEGRATION TESTING	LS	1		
01780.001	PARKING LOT NO. 1 ACCESS FOR PNC PARK EVENTS (OVER 30,000 ATTENDANCE)	EA	48		
01780.002	PARKING LOT NO. 1 ACCESS FOR HEINZ FIELD EVENTS	EA	48		
01784.001	TEMPORARY PEDESTRIAN ACCOMMODATIONS	LS	1		
01791.008	RE-INSTALL PARKING LOT SPECIAL SIGNAGE	EA	1		
01791.013	PERMANENT RELOCATION OF EXISTING PARKING LOT BOOTHS	LS	1		
01800.001	EROSION AND SEDIMENTATION CONTROL	LS	1		
01810.001	CITY OF PITTSBURGH OFF-DUTY UNIFORMED POLICE OFFICER	PDA	1	$50,000.00	$50,000.00
01900.001	TRAIN CLEARANCE TESTING PROGRAM	LS	1		
02020.001	CONTAMINATED MATERIALS HANDLING	PDA	1	$50,000.00	$50,000.00
02220.001	DEMOLITION OF EXISTING GATEWAY STATION LOOP FACILITES	LS	1		
02220.002	UNFORESEEN FACILITY DEMOLITION	PDA	1	$50,000.00	$50,000.00
02220.003	DEMOLITION OF TEMPORARY TUNNEL CLOSURE WALL	LS	1		
02316.001	CLASS 1 EXCAVATION	CY	945		
02320.002	AASHTO NO. 57 COURSE AGGREGATE	CY	50		
02451.001	REPLACEMENT OF EXISTING DIRECT FIXATION TRACK	LF	960		
02451.002	AS DIRECTED REPLACEMENT OF EXISTING DIRECT FIXATION TRACK	PDA	1	$200,000.00	$200,000.00
02452.001	DIRECT FIXATION TRACK, TYPE I	LF	7,324		
02452.002	DIRECT FIXATION TRACK, TYPE II	LF	191		
02452.003	DIRECT FIXATION TRACK, TYPE III	LF	995		
02452.004	DIRECT FIXATION TRACK, TYPE IV	LF	3,423		
02453.001	NO.4 SPECIAL CONSTRUCTION CROSSOVER AT ALLEGHENY	LS	1		

PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
CONTRACT NO. NSC-009

UNIT PRICE SCHEDULE

BID ITEM	DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
02840.005	REMOVE EXISTING GUIDE RAIL (CONTRACTOR'S PROPERTY)	LF	1,100		
02843.001	BOLLARDS	EA	5		
02891.002	POST MOUNTED SIGNS, TYPE B MODIFIED	SF	50		
02891.020	OVERHEAD CLEARANCE BAR	EA	6		
03305.001	TRACTION POWER SUBSTATION PAD AND TRANSFORMER PADS	LS	1		
03630.001	PLINTH ANCHORAGE	TF	12,750		
04200.001	TEMPORARY TUNNEL CLOSURE WALL	LS	1		
04200.002	CONCRETE GROUND FACE BLOCK WALL, 10" CMU	SF	435		
04200.003	CONCRETE BLOCK WALL, 10" CMU	SF	340		
05520.002	GRATING	SF	182		
05520.007	EMERGENCY WALKWAYS	LF	6,510		
05520.008	EMERGENCY WALKWAY CROSSOVERS	LF	685		
05520.009	LADDERS	EA	68		
05520.010	STAIRS	EA	18		
05520.011	12 FOOT CROSSOVER PLATFORM	SF	420		
05520.012	EMERGENCY STAND ALONE WALKWAYS	LF	114		
05520.013	ANCILARY ROOM STAIRS	EA	1		
05520.014	WALL MOUNTED HANDRAIL	LF	7,746		
09900.003	PENETRATING SEALER	SY	4,000		
13570.001	ALLEGHENY AVENUE STATION INTERLOCKING AND THE ASSOCIATED AUTOMATIC BLOCK SIGNAL SYSTEM	LS	1		
13570.002	NORTH SIDE STATION AUTOMATIC BLOCK SIGNAL SYSTEM	LS	1		
13570.003	MODIFIED GATEWAY INTERLOCKING AND THE ASSOCIATED AUTOMATIC BLOCK SIGNAL SYSTEM	LS	1		
13570.004	MODIFIED WOOD STREET INTERLOCKING	LS	1		

PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
CONTRACT NO. NSC-009

UNIT PRICE SCHEDULE

BID ITEM	DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
16602.007	DOWN GUY ANCHOR	EA	6		
16602.008	SECTION INSULATOR	EA	15		
16602.009	DISCONNECT SWITCH	EA	13		
16602.010	SURGE ARRESTER	EA	2		
16602.011	TUNNEL SUPPORT	EA	150		
16602.012	HEADSPAN	EA	1		
16602.013	DEAD END BRACKET	EA	10		
16602.014	SIGNAGE	LS	1		
16602.016	OCS ELECTRICAL TESTING, ACCEPTANCE AND REVENUE SUPPORT	LS	1		
16602.017	CONTACT WIRE HEATER SYSTEM	LS	1		
16701.001	FIBER OPTIC OUTSIDE PLANT	LS	1		
16702.001	COPPER OUTSIDE PLANT	LS	1		
16703.001	CARRIER TRANSMISSION SYSTEM	LS	1		
16705.001	COMMUNICATIONS SYSTEM POWER SUPPLY	LS	1		
16721.001	TELEPHONE SYSTEM	LS	1		
16722.002	RADIO SYSTEM AND RADIATING/COAXIAL CABLE ALLEGHENY	LS	1		
16722.003	RADIO SYSTEM AND RADIATING/COAXIAL CABLE NORTH SIDE	LS	1		
16722.004	RADIO SYSTEM AND RADIATING/COAXIAL CABLE GATEWAY	LS	1		
16741.001	VARIABLE MESSAGE SIGN/PA SYSTEM	LS	1		
16742.001	SCADA SYSTEM	LS	1		

SECTION 02451

REPLACEMENT OF EXISTING DIRECT FIXATION TRACK

ARTICLE 1 GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for Replacement of Existing Direct Fixation Track, in accordance with the Contract Documents.

B. The work of this Section includes, but is not limited to, the demolition of the existing deteriorated concrete plinths; reconstruction with new cast-in-place concrete plinths; new direct fixation fasteners; and utilizing the existing rail, as shown on the Contract Documents and as follows:
   1. Furnish materials including:
      a. Plinth concrete and stirrup and plinth reinforcing steel.
      b. Direct fixation rail fasteners with anchorage assemblies and rail clips.
      c. Track appurtenances and other track material as required to complete the construction.
   2. Construct Direct Fixation Track including:
      a. Identify areas to be removed in the field, including areas identified in this Section and as directed by the Engineer in the field, review these limits with the Engineer and receive Engineer's acceptance of areas of removal.
      b. Perform survey of areas to be removed to determine the horizontal and vertical alignment of the track in these areas and establish reference marks for re-installation.
      c. Removing existing rail fasteners and demolishing existing deteriorated concrete plinths. Note that the existing rail is to remain in place and is to be temporarily supported as necessary to complete this work.
      d. Protect and clean existing reinforcement bars that connect the plinth to the track bed concrete for re-use.
      e. Locating existing reinforcing steel in track bed if the bar connecting the track bed to the plinth needs to be replaced due to deterioration.
      f. Drilling of track bed for reinforcement bar replacement, installing, orienting, and epoxy in place required replacement reinforcement.
      g. Layout and Forming of plinth concrete, placing reinforcement, embedded inserts and direct fixation fastener anchorage inserts, and placing plinth concrete for direct fixation track.
      h. Installing direct fixation rail fasteners.
      i. Track appurtenances and other track material as required to complete the construction.
   3. Constructing demonstration section.
   4. Performing electrical testing.
   5. Performing final adjustments and clean up of site area.

2.09 CONCRETE BONDING COMPOUND

A. In accordance with PENNDOT 408, Section 706.

ARTICLE 3 EXECUTION

3.01 GENERAL

A. Staged replacement of the deteriorated plinths identified in the Contract Documents shall be performed during numerous, full shutdown, weekend outages, with revenue service being returned after each outage. This work shall be completed concurrent with the existing Wood Street double crossover replacement schedule in accordance with Section 00500, Article 2.1.L.

B. Contractor shall plan this work so that only the length of plinth that can be completed within these weekend shutdowns is demolished, replaced, tested, and ready for Revenue Service. If the Contractor has demolished more plinth than can be replaced, before the "Return to Service", the Contractor shall support and anchor the track in a method acceptable to Authority. Method of support and anchorage shall be designed by Contractor and submitted for approval.

C. Contractor shall protect all existing components to remain including station platform areas from demolition and construction debris, and clean these componets after each outage before returning track to service.

3.02 LOCATING DETERIORATED PLINTHS

A. Contractor shall mark the deteriorated existing plinths to be removed based on the locations described in Article 3.03 of this Section, or as directed by the Engineer. The Contractor shall have these areas approved by the Engineer prior to performing any work.

B. Contractor shall survey the existing track horizontal and vertical geometry in the areas where the existing plinths are to be removed and shall survey 50 feet outside these removal limits on either side of the replacement area. Contractor shall provide the Engineer with a copy of the survey data.

3.03 DETERIORATED PLINTH LOCATIONS

A. The existing plinths vary in length with a maximum length of approx. 60 feet. Note the left and right rail identified below are based on looking in the direction of travel.

B. INBOUND TRACK

Approx. Station 1019+90 to 1020+60 through the horizontal curve after Wood Street Station. 6 plinths total 3 on left rail and 3 on the right rail.

C. OUTBOUND TRACK
   1. Approx. Station 1020+56. 2 plinths total 1 on left rail and 1 on the right rail.
   2. Approx. Station 1025+00. 2 plinths total 1 on left rail and 1 on the right rail.
   3. Approx. Station 1028+50. 1 plinth on the right rail.
   4. Approx. Station 1031+50. 1 plinth on the right rail.
   5. Approx. Station 1667+30 to 1669+50 at Steel Plaza Station. 4 plinths on the right rail.

D. The existing track geometry through the areas where plinth replacement is to be performed is included with the Contract Documents.

E. The Engineer will identify additional limits of as directed deteriorated plinth removal in the field.

3.04 DEMOLITION OF DETERIORATED PLINTHS

A. Contractor shall remove and dispose of all existing rail fasteners in the area to be demolished.

B. Contractor shall leave the existing rail in place and remove the existing concrete plinth by way of 90 pound maximum weight hand held pneumatic hammers. Contractor shall temporarily support the rail as necessary to complete this work.

C. Contractor shall take care not to damage the existing reinforcing steel dowels that connect the concrete plinth to the existing track bed. All removed existing concrete, reinforcing steel, and existing anchorages shall be removed and disposed.

D. Contractor shall inspect the existing track bed concrete that remains, to verify that the remaining concrete surface is sound and does not require repair prior to beginning plinth replacement. If repair is necessary, use the grout material identified in Article 2.03.

3.05 PREPARATION

A. Alignment and elevation points shall be established in accordance with Section 02450, "General Track Construction" utilizing the survey information obtained.

B. Replacement plinths shall be laid out per typical sections and requirements shown in Contract Drawings, including, but not limited to, overall plinth length and quantity of direct fixation fasteners per plinth.

C. Existing dowel bars that are to be re-used, for the cast-in-place plinth, shall be sand blast cleaned and painted with a zinc-rich primer.

D. The existing concrete track bed surface shall be etched with muriatic acid and washed with water.

E. Locate existing track bed rebar and mark replacement dowel bar locations per Section 03630,"Plinth Anchoring System

C. Perform concrete testing in accordance with Section 03305, "Cast-in-Place Concrete and Cement Concrete Structures."

3.08 ADJUSTMENT AND CLEANING

A. In accordance with Section 02450, "General Track Construction."

ARTICLE 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Item 02451.001 – Replacement of Existing Direct Fixation Track shall be measured per linear foot of plinth constructed, complete in place.

B. Item 02451.002 – As Directed Replacement of Existing Direct Fixation Track shall be measured as directed by the Engineer.

4.02 PAYMENT

A. Item 02451.001 – Replacement of Existing Direct Fixation Track will be paid at the unit price and shall include the cost of all related work specified in this Section.

B. Item 02451.002 - As Directed Replacement of Existing Direct Fixation Track will be paid for as part of a Predetermined Amount (PDA), as such work is directed to be performed by the Engineer. The value to be paid for the directed work of this Contract Item will be established, at the discretion of Authority, by one or more of the following methods
   1. By use of unit prices for items of work that have an established unit price for other Contract Items under the Contract,
   2. By a negotiated amount, subsequent to receipt of the Contractor's submission of a proposal, following the procedures for establishing a price for a negotiated Change Order in Section 00900, Article 1.7,
   3. By force account, following the procedures for establishing the value of force account work as set forth in Section 01200, Article 4, and/or
   4. By Authority on the basis of the Engineer's estimate of an equitable value for the work to be performed. This would be a unilateral value as determined by Authority.

END OF SECTION

SECTION 05520

MISCELLANEOUS METALWORK

ARTICLE 1 GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for miscellaneous metalwork in accordance with the Contract Documents.

B. The work of this Section includes, but is not limited to, the following activities:
   1. Supplying, fabricating, finishing, and installing miscellaneous steel items including embedded plates, assemblies, and angles.
   2. [NOT USED]
   3. Grating
   4. Frames
   5. Safety nosings.
   6. Tunnel Emergency Walkways and Crossovers including, but not limited to: design, fabricate, construct, and coordinate the tunnel emergency walkways, crossovers, ladders, end barriers, stair assemblies, ancillary room stairs, hand rails, and railings.

C. The Contract Documents provide the performance parameters and design criteria to complete the Tunnel Emergency Walkways and Crossovers portion of the Work. The Contractor shall be responsible to provide a complete design for this portion of the Work.

1.02 RELATED SECTIONS

A. Section 03305, "Cast-in-Place Concrete and Cement Concrete Structures"

B. Section 16060, "Grounding and Bonding."

1.03 REFERENCE STANDARDS

A. PENNDOT Publication 408

B. PENNDOT Publication 19, PTM

C. PENNDOT Publication 35 (Bulletin 15)

D. AASHTO

E. ASTM

ARTICLE 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. [NOT USED]

B. Item 05520.002 - Grating shall be measured per square foot, complete in place.

C. [NOT USED]

D. [NOT USED]

E. [NOT USED]

F. [NOT USED]

G. Item 05520.007 – Emergency Walkways shall be measured per linear foot, complete in place.

H. Item 05520.008 – Emergency Walkway Crossovers shall be measured per linear foot, complete in place.

I. Item 05520.009 – Ladders shall be measured per each, complete in place.

J. Item 05520.010 – Stairs shall be measured per each, complete in place.

K. Item 05520.011 – 12 Foot Crossover Platform shall be measured per square foot, complete in place.

L. Item 05520.012 - Emergency Stand Alone Walkways shall be measured per linear foot, complete in place.

M. Item 05520.013 – Ancillary Room Stairs shall be measured per each, complete in place.

N. Item 05520.014 – Wall Mounted Handrail shall be measured per linear foot, complete in place.

PAYMENT

A. [NOT USED]

B. Item 05520.002 - Grating will be paid at the unit price and shall include the cost of all related work specified in this Section.

C. [NOT USED]

D. [NOT USED]

E. [NOT USED]

F. [NOT USED]

G. Item 05520.007 – Emergency Walkways will be paid at the unit price, and shall include the cost of all related work specified in this Section.

H. Item 05520.008 – Emergency Walkway Crossovers will be paid at the unit price, and shall include the cost of all related work specified in this Section.

I. Item 05520.009 – Ladders will be paid at the unit price, and shall include the cost of all related work specified in this Section.

J. Item 05520.010 – Stairs will be paid at the unit price, and shall include the cost of all related work specified in this Section.

K. Item 05520.011 – 12 Foot Crossover Platform will be paid at the unit price, and shall include the cost of all related work specified in this Section.

L. Item 05520.012 – Emergency Stand Alone Walkways will be paid at the unit price, and shall include the cost of all related work specified in this Section.

M. Item 05520.013 –Ancillary Room Stairs will be paid at the unit price, and shall include the cost of all related work specified in this Section.

N. Item 05520.014 –Wall Mounted Handrail will be paid at the unit price, and shall include the cost of all related work specified in this Section.

END OF SECTION

I. Section 15445, "Tunnel Mechanical Drainage Systems"

J. Section 15884, "Tunnel Fire Extinguishers and Cabinets"

K. Section 15885, "Tunnel Dry Standpipe Systems"

L. Section 15886, "Tunnel Ventilation Jet Fan Active Control"

M. Section 15887, "Tunnel Ventilation and Balancing Dampers"

N. Section 15888, "Tunnel Ventilation Noise Attenuators"

O. Section 15889, "Tunnel Ventilation Fans"

P. Section 15890, "Tunnel Ventilation Jet Fans"

Q. Section 15891, "Tunnel Services Mechanical Testing and Commissioning"

R. Section 16060, "Grounding and Bonding"

S. Section 16111, "Conduit"

T. Section 16120, "Low Voltage Power Cables"

U. Section 16130, "Raceways and Boxes"

V. Section 16702, "Copper Outside Plant"

W. Section 16742, "SCADA System"

X. Section 16889, "Tunnel Services Electrical Testing and Commissioning"

Y. Section 16890, "Tunnel Services Electrical Requirements of Mechanical Equipment"

Z. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"

AA. Section 16892, "Tunnel Services Uninterruptible Power Supply"

BB. Section 16893, "Tunnel Services Power Factor Correction"

CC. Section 16894, "Tunnel Emergency Rail Lighting and Lighting Receptacles"

DD. Section 16985, "Tunnel Services Low Voltage AC Variable Speed Drive"

1.03 REFERENCE STANDARDS

A. AMCA

B. ANSI

D. Equipment Identification
   1. Equipment and control devices shall be permanently labeled after installation. All labels shall be of a uniform format. This format shall identify individual equipment items and provide information regarding equipment type, equipment function, flow direction and other such data as appropriate. Identification shall include the equipment designator given in the Contract Drawings.
   2. The manufacturer's branding and model number shall be clearly recorded on the anemometer casing.

2.02 SCOPE OF WORK

A. The Contractor is responsible for the complete implementation of the jet fan active control system in accordance to the Contract Documents, including all require coordination efforts with other Authority Contracts.

B. Equipment and services to be provided by the Contractor shall include, but not be limited to, the following;
   1. Anemometers complete with mounting brackets and associated hardware.
   2. Low voltage AC variable speed drives (VSDs) suitable for jet fans as indicated in the Contract Documents.
   3. Power and communication cabling between the anemometers, PLC(s) and VSDs at North Side station, including power supply units suitable for anemometer operation.
   4. Spare parts.
   5. Special tools and test apparatus.
   6. Installation of all system components, inclusive of all electrical and communication cabling terminations.
   7. Design, modeling/simulation, development and documentation of the program logic and PID controls.
   8. Programming of PLC(s) to process the information from the anemometers.
   9. Programming of PLC(s) to implement Proportional-Integral-Derivative (PID) control of tunnel airflow.
   10. Programming of PLC(s) to communicate with and control jet fan VSD(s).
   11. Tuning of PID parameters in the PLC(s) to enable stable and effective control of jet fan speed to achieve a pre-determined tunnel air velocity during different emergency scenarios to the satisfaction of the Engineer.
   12. Interfacing with the SCADA system.
   13. Design, supply and install all equipment mountings. It is the Contractor's responsibility to provide frames and other supports required to mount the equipment to the fixed locations.
   14. Testing and commissioning as required by the Contract Documents.

2.03 JET FAN ACTIVE CONTROL SYSTEM DESCRIPTION

A. The following presents a high level description of the intent and functionality of the jet fan active control system. It aims to assist the Contractor in the detailed design of the

B. Anemometers shall be capable of measuring air velocity from 0 – 50 feet per second (fps) with an accuracy of ± 2% or less and a minimum resolution of 0.033 feet per second or less through the entire range.

C. Anemometers shall have a start up time of less than 1 second.

D. Anemometers shall be factory calibrated within the specified measurement range. Individual factory calibration certificates shall accompany each anemometer.

E. Anemometers shall be capable of satisfactory and reliable operation in all expected environments within the tunnels at the Project location. Mean Time Before Failure (MTBF) shall be no less than 15 years.

F. Anemometers shall use a suitable communication protocol, taking into account the distance between the most remote anemometer and the North Side Station PLC(s).

G. Anemometers shall have the capability of transmitting a status code, when polled, to provide the PLC with an indication of its operation status.

H. Anemometers shall be capable of being remotely configurable via software, to enable operator selection of output rates, units of measurements and measurement range.

I. Other
   1. Site measurement
      i. Anemometer mountings are designated in the Contract Drawings. The Contractor shall site measure all locations to be fitted with anemometer mountings and shall be responsible for correct manufacture and installation.
      ii. The Contractor shall ensure that the anemometers are not mounted in close proximity to any high power radio transmitters or devices. A site survey for external electrical interference may be required.
   2. Fixtures
      i. Mounting frames shall be supplied complete with all fixtures (nuts, bolts, spacers, washers, seals, packers etc) such that mounting frames and components supplied with the anemometers can be completely assembled.
   3. Equipment surface corrosion protection
      i. Unless specified, appropriate anti-corrosion provisions shall be made by the Contractor for all components based on SSPC standards suitable for installation conditions. The Contractor shall provide information regarding material selections and corrosion protection schemes.

2.05 CABLING

A. Communication cabling to anemometers shall be suitably shielded based on the anemometer communication protocol.

B. Power cabling to anemometers shall be suitably sized, based on anemometer power rating.

C. Anemometer communication cabling shall be UL Listed individually shielded twisted pairs, low smoke, zero halogen, X-Link TC as manufactured by Rockbestos-Surprenant or approved equal as required by NFPA 130.

D. Anemometer power cabling shall be Type RHW, 2-hour fire-rated, low smoke, zero halogen, as manufactured by Raychem or approved equal as required by NFPA 130.

E. Depending on anemometer configuration, both communication cabling and power cabling may be incorporated into a single cable as specified in Article 2.05.C of this Section.

F. Additional electrical requirements are given in Section 16120, "Low Voltage Power Cables" and Section 16890, "Tunnel Services Electrical Requirements for Mechanical Equipment".

2.06 OPERATIONAL REQUIREMENTS OF THE ACTIVE CONTROL SYSTEM

A. The system shall be capable of continually monitoring the tunnel air velocity during normal operation, and provide air velocity information to the operator via the SCADA interface. Continual logging of air velocity data shall be via the SCADA.

B. The system shall continually monitor the operational status of each installed anemometer in the tunnel, and provide status reporting and logging via the SCADA interface.

C. The system shall also be capable of displaying tunnel airflow rates in cubic feet per minute (cfm) if required by the operator, via the SCADA.

D. Faulty anemometers shall be reported to the operator via the SCADA interface, and the system shall be capable of automatically isolating and removing the faulty anemometer feedback during data processing for jet fan active control.

E. During jet fan active control, the system shall have sufficient tolerance for error and delays in achieving the desired airflow velocity, to prevent unstable and oscillatory system responses.

F. The system shall be fully configurable and tunable for changing operating conditions. All PID parameters shall be fully adjustable.

G. Adjustment of individual gain (calibration) and confidence weighting of each anemometer shall be possible within the control software.

H. The system shall incorporate a Maintenance Testing mode. When initiated, the system will automatically achieve and maintain a pre-determined air velocity in each tunnel in turn for 10 minutes each and automatically return to normal operation mode upon completion of the test. Air velocity readings from all anemometers shall be logged individually and at a sampling period of not more than 10 seconds, for the duration of the test and a comprehensive test report shall be generated upon completion.

I. In the event of complete failure of all anemometers, communications or other items that disrupts the feedback on air speed, the system shall be capable of reverting to a fixed response mode where a default jet fan speed shall be achieved and maintained.

J. In the event of complete failure of the jet fan active control system, the PLC(s) shall revert to a fixed response where a default jet fan speed shall be achieved and maintained.

2.07 DATA PROCESSING REQUIREMENTS OF THE ACTIVE CONTROL SYSTEM

A. When active control of jet fans command is initiated, the system shall firstly perform a poll on all active anemometers in the tunnel of interest. Active anemometers are defined as anemometers which have previously returned a "healthy" operation status.

B. Upon completion of the poll, the system shall decide the available number of "healthy" anemometers in the tunnel. If the number of "healthy" anemometers in the tunnel of interest is less than 3, then the system shall revert to a fix response with a default jet fan speed.

C. If the number of "healthy" anemometers is equal to or greater than 3, the system shall perform a continual averaging of the velocity readings from only the "healthy" anemometers, while simultaneously excluding the highest and lowest anemometer velocity readings from the averaging algorithm. Time averaging periods shall be fully adjustable by the operator.

D. The averaged air velocity readings shall be submitted to the PID control module as the actual velocity in the tunnel, V_{actual}. The desired velocity, $V_{desired}$ shall be determined during system testing and commissioning ($V_{desired}$ should be between to the critical velocity and the velocity which would be caused by smoke overshoot into Gateway Station, as agreed by the Engineer).

E. The PID control module shall output the appropriate speed control signals to the VSD(s) controlling the jet fans, and continually adjust jet fan speeds to achieve and maintain $V_{actual} \approx V_{desired}$ in the tunnel for as long as the active control command is maintained.

F. In the event of one or more anemometers becoming "faulty" during active control of the jet fans, the system shall automatically isolate and exclude the "faulty" anemometers from the averaging algorithm.

G. In the event that the number of "healthy" anemometers drops below 3 during active control of the jet fans, the system shall automatically revert to a fixed response with a default jet fan speed.

H. When jet fan active control is no longer required, the system shall return to normal operation mode.

SECTION 15890

TUNNEL VENTILATION JET FANS

ARTICLE 1 GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment and incidentals necessary for tunnel ventilation jet fans, in accordance with the Contract Documents.

B. The work of this Section includes, but is not limited to, the following activities:
   1. Design detailing, manufacture detailing, supply, delivery, off-loading, storage, furnish, install, testing and commissioning of the new jet fans and other equipment associated with the system.

C. The Contract Documents provide the performance parameters and Design Criteria to complete the jet fans portion of the Work. The Contractor shall be responsible to provide a completed design for this portion of the Work.

1.02 RELATED SECTIONS

A. Section 01785, "Construction Surveying"

B. Section 01910, "Operations, Maintenance and Repair Data"

C. Section 05120, "Structural Steel"

D. Section 05520, "Miscellaneous Metal Work"

E. Section 01911, "Operations, Maintenance and Repair Database"

F. Section 15400, "Tunnel Services Scope of Work"

G. Section 15886, "Tunnel Ventilation Jet Fan Active Control"

H. Section 15887, "Tunnel Ventilation and Balancing Dampers"

I. Section 15888, "Tunnel Ventilation Noise Attenuators"

J. Section 15889, "Tunnel Ventilation Fans"

K. Section 15891, "Tunnel Services Mechanical Testing and Commissioning"

L. Section 16889, "Tunnel Services Electrical Testing and Commissioning"

M. Section 16890, "Tunnel Services Electrical Requirements for Mechanical Equipment"

N. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"

1.03 REFERENCE STANDARDS

A. Anti-friction Bearing Manufacturer's Association (AFBMA)

B. AMCA

C. ANSI

D. ASHRAE

E. ASTM

F. AWS

G. British Standards (BS)

H. IEEE

I. ISO

J. NEMA

K. NFPA

L. SSPC

M. UL

1.04 SUBMITTALS

A. All drawing, calculation and design submittals shall be sealed by a Professional Engineer.

B. Jet fan clearance waiver
   1. The jet fans in the Liberty Avenue tunnel between Wood St Station and Gateway Station are the subject of a waiver for interference with the clearance (LRV and pantograph) envelope. The status of this shall be confirmed by the Contractor prior to shipment of the jet fans or components to the Worksite.
   2. A construction survey shall be completed by the Contractor in accordance with Section 01785, "Construction Surveying". This shall be used by the Contractor as a basis to develop a CAD drawing of the cross sections where the Liberty Avenue jet fans are to be installed. The cross section shall include the clearance envelope (LRV and pantograph) and the proposed jet fans including attenuators, fully detailed mountings and all other auxiliary equipment required for a fully functional jet fan assembly in accordance with the Contract Documents. The cross

E. This Section outlines the minimal requirements for commissioning. Commissioning of other equipment and systems not listed above or described in this Section is described in Related Sections.

1.02 RELATED SECTIONS

A. Section 15400, "Tunnel Services Scope of Work"

B. Section 15445, "Tunnel Mechanical Drainage Systems"

C. Section 15884, "Tunnel Fire Extinguishers and Cabinets"

D. Section 15885, "Tunnel Dry Standpipe Systems"

E. Section 15886, "Tunnel Ventilation Jet Fan Active Control"

F. Section 15887, "Tunnel Ventilation and Balancing Dampers"

G. Section 15888, "Tunnel Ventilation Noise Attenuators"

H. Section 15889, "Tunnel Ventilation Fans"

I. Section 15890, "Tunnel Ventilation Jet Fans"

J. Section 16889, "Tunnel Services Electrical Testing and Commissioning"

K. Section 16890, "Tunnel Services Electrical Requirements of Mechanical Equipment"

L. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"

M. Section 16892, "Tunnel Services Uninterruptible Power Supply"

N. Section 16893, "Tunnel Services Power Factor Correction"

O. Section 16894, "Tunnel Emergency Rail Lighting and Lighting Receptacles"

P. Section 16895, "Tunnel Services Low Voltage AC Variable Speed Drive"

1.03 REFERENCE STANDARDS

A. AMCA

B. ANSI

C. Anti-Friction Bearing Manufacturer's Association (AFBMA)

D. ASHRAE

E. ASME

A. Field testing shall be thorough, complete and performed throughout the installation. Fully document the following as a minimum:
   1. Electrical resistance tests shall be made for each ground system installation to verify continuity and compliance with specified resistances.
   2. Measure, record and report the resistance to earth of each portion of the grounding system as soon as possible after installation so that corrective measures, if required, may be made with minimum disruption of construction. All required ground resistances shall be equal to or less than the following values:
      a. OCS poles and portal cross-beam mounted on aerial structures: 10 ohms or less.
      b. Surge Arrestors: 5 ohms or less or as recommended by the arrestor manufacturer.
      c. Overhead bridge girders and metal barriers crossing over OCS wires and ROW: 25 ohms or less.
      d. Tunnel Supports: 10 ohms or less.
   3. Measure, record, and report the ground resistance at each location where a grounding system is installed and any special conditions.

B. Resistance-to-earth tests shall be witnessed by the Engineer and the written results of these tests shall be submitted to the Engineer for evaluation and instructions regarding any corrective action which may be deemed necessary.
   1. Ground resistance tests shall be made using the three-probe method described in IEEE Standard 81

ARTICLE 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Item 16060.001 – Grounding and Bonding shall be measured as a lump sum unit, complete in place.

B. [NOT USED]

4.02 PAYMENT

A. Item 16060.001 – Grounding and Bonding will be paid at the lump sum price and shall include the cost of all work specified in the Section.

B. [NOT USED]

END OF SECTION

SECTION 16120

LOW VOLTAGE POWER CABLES

ARTICLE 1 GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for low voltage power cables, in accordance with the Contract Documents.

B. The work of this Section includes, but is not limited to the design, coordination and implementation of the following activities:
   1. Contractor's design shall provide wire and cables as shown on the Contract Drawings, and as specified in this Section.
   2. The Work includes the installation of all necessary conduits to complete the cable installation as shown in the Contract Drawings.
   3. The Work also includes the installation of all pull boxes, splice enclosures, slack enclosures cable ladder and other miscellaneous hardware required to provide a functional, reliable and maintainable system.
   4. Furnishing and installing cable and wires in tunnels and, conduit, pull boxes, splice enclosures, terminations, connectors and other miscellaneous hardware necessary to provide a reliable, maintainable system that meets the requirements of the Contract Documents.
   5. Cable sizing and conduit routing provided in the Contract Drawings are indicative only, and Contractor shall design, check, and verify cable sizing and lengths required.
   6. Testing of the cabling installation.
   7. Wire and cables rated 600V and less.

C. The Contract Documents provide the performance parameters and Design Criteria to complete the low voltage power cabling systems portion of the Work. The Contractor shall be responsible to provide a completed design for this portion of the Work.

1.02 RELATED SECTIONS

A. Section 15400, "Tunnel Services Scope of Work".

B. Section 15886, "Tunnel Ventilation Jet Fan Active Control"

C. Section 16050, "Basic Electrical Requirements."

D. Section 16060, "Grounding and Bonding."

E. Section 16075, "Electrical Identification."

F. Section 16081, "Electrical Testing AC Systems."

G. Section 16111, "Conduit"

H. Section 16130, "Raceways and Boxes"

I. Section 16702, "Copper Outside Plant"

J. Section 16890, "Tunnel Services Electrical Requirements of Mechanical Equipment"

1.03 REFERENCE STANDARDS

A. NFPA 70 - NEC

B. UL

C. ICEA

D. City of Pittsburgh Building Code

E. NEMA

F. International Electrical Testing Association (NETA) – Acceptance Testing Specifications (ATS) for Electrical Power Distribution Equipment and Systems

G. ASTM

H. IEEE

I. NESC

J. NFPA 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems

K. BOCA

1.04 SUBMITTALS

A. Product data for each product specified.

B. Submit the procedure for pulling all wires and cables through ducts and conduits to the Engineer for approval.

C. Product Certification: Signed by manufacturer of equipment certifying that products comply with the Contract Document requirements.

D. Report of Field Tests: Certified copies of field tests.

E. Manufacturers' Test reports: Indicate procedures and values obtained.

F. Manufacturers' Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.

G. Manufacturers' qualifications.

G. Item 16602.007 - Down Guy Anchor shall be measured per each, complete in place.

H. Item 16602.008 - Section Insulator shall be measured per each, complete in place.

I. Item 16602.009 - Disconnect Switch shall be measured per each, complete in place.

J. Item 16602.010 - Surge Arrester shall be measured per each, complete in place.

K. Item 16602.011 - Tunnel Support shall be measured per each, complete in place.

L. Item 16602.012 - Headspan shall be measured per each, complete in place.

M. Item 16602.013 - Dead End Bracket shall be measured per each, complete in place.

N. Item 16602.014 - Signage shall be measured per Lump Sum, complete in place.

O. [NOT USED]

P. Item 16602.016 - OCS Electrical Testing, Acceptance and Revenue Support shall be measured per Lump Sum, complete in place.

Q. Item 16602.017 - Contact Wire Heater System shall be measured per Lump Sum, complete in place.

4.02 PAYMENT

A. Item 16602.001 - OCS Pole will be paid at the unit price and shall include the cost of all related work specified in this Section.

B. Item 16602.002 - OCS Portal will be paid at the unit price and shall include the cost of all related work specified in this Section.

C. Item 16602.003 - OCS Cantilever will be paid at the unit price and shall include the cost of all related work specified in this Section.

D. Item 16602.004 - OCS Wiring will be paid at the unit price and shall include the cost of all related work specified in this Section.

E. Item 16602.005 - Balance Weight Anchor Assembly will be paid at the unit price and shall include the cost of all related work specified in this Section.

F. Item 16602.006 - Fixed Termination Assembly will be paid at the unit price and shall include the cost of all related work specified in this Section.

G. Item 16602.007 - Down Guy Anchor will be paid at the unit price and shall include the cost of all work specified in this Section.

H. Item 16602.008 - Section Insulator will be paid at the unit price and shall include the cost of all related work specified in this Section.

I. Item 16602.009 - Disconnect Switch will be paid at the unit price and shall include the cost of all related work specified in this Section.

J. Item 16602.010 - Surge Arrester will be paid at the unit price and shall include the cost of all related work specified in this Section.

K. Item 16602.011 - Tunnel Support will be paid at the unit price and shall include the cost of all related work specified in this Section.

L. Item 16602.012 - Headspan will be paid at the unit price and shall include the cost of all related work specified in this Section.

M. Item 16602.013 - Dead End Bracket will be paid at the unit price and shall include the cost of all related work specified in this Section.

N. Item 16602.014 - Signage will be paid at the lump sum price and shall include the cost of all work specified in this Section.

O. [NOT USED]

P. Item 16602.016 - OCS Electrical Testing, Acceptance and Revenue Support will be paid at the lump sum price and shall include the cost of all work specified in this Section.

Q. Item 16602.017 - Contact Wire Heater System will be paid at the lump sum price and shall include the cost of all work specified in this Section.

END OF SECTION

SECTION 16889

TUNNEL SERVICES ELECTRICAL TESTING AND COMMISSIONING

ARTICLE 1 GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment and incidentals necessary for tunnel services electrical testing and commissioning, in accordance with the Contract Documents.

B. The work of this Section includes, but is not limited to, the following activities:
   1. Electrical testing and commissioning for new tunnel services systems.

C. The Contract Documents provide the performance parameters and Design Criteria to complete the tunnel services electrical testing and commissioning portion of the Work. The Contractor shall be responsible to provide a completed design for this portion of the Work.

1.02 RELATED SECTIONS

A. Section 15400, "Tunnel Services Scope of Work"

B. Section 15445, "Tunnel Mechanical Drainage Systems"

C. Section 15886, "Tunnel Ventilation Jet Fan Active Control"

D. Section 15887, "Tunnel Ventilation and Balancing Dampers"

E. Section 15889, "Tunnel Ventilation Fans"

F. Section 15890, "Tunnel Ventilation Jet Fans"

G. Section 15891, "Tunnel Services Mechanical Testing and Commissioning"

H. Section 16890, "Tunnel Services Electrical Requirements of Mechanical Equipment"

I. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"

J. Section 16892, "Tunnel Services Uninterruptible Power Supply"

K. Section 16893, "Tunnel Services Power Factor Correction"

L. Section 16894, "Tunnel Emergency Rail Lighting and Lighting Receptacles"

M. Section 16895 "Tunnel Services Low Voltage AC Variable Speed Drive"

1.03 REFERENCE STANDARDS

SECTION 16890

TUNNEL SERVICES ELECTRICAL REQUIREMENTS OF MECHANICAL EQUIPMENT

ARTICLE 1 GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment and incidentals necessary for electrical requirements of mechanical equipment for tunnel services, in accordance with the Contract Documents.

B. The work of this Section includes, but is not limited to, the following activities:
   1. Design, manufacture, furnish, install and testing of all electrical requirements of mechanical equipment for tunnel services.

C. The Contract Documents provide the performance parameters and Design Criteria to complete the tunnel services electrical requirements of mechanical equipment portion of the Work. The Contractor shall be responsible to provide a completed design for this portion of the Work.

1.02 RELATED SECTIONS

A. Section 01910, "Operations, Maintenance and Repair Data"

B. Section 13590, "Housings And Housing Equipment"

C. Section 15400, "Tunnel Services Scope of Work"

D. Section 15445, "Tunnel Mechanical Drainage Systems"

E. Section 15886, "Tunnel Ventilation Jet Fan Active Control"

F. Section 15887, "Tunnel Ventilation and Balancing Dampers"

G. Section 15889, "Tunnel Ventilation Fans"

H. Section 15890, "Tunnel Ventilation Jet Fans"

I. Section 15891, "Tunnel Services Mechanical Testing and Commissioning"

J. Section 16111, "Conduit"

K. Section 16120, "Low Voltage Power Cables"

L. Section 16130, "Raceways and Boxes"

M. Section 16702, "Copper Outside Plant"

N. Section 16742, "SCADA System"

O. Section 16889, "Tunnel Services Electrical Testing and Commissioning"

P. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"

Q. Section 16892, "Tunnel Services Uninterruptible Power Supply"

R. Section 16893, "Tunnel Services Power Factor Correction"

S. Section 16894, "Tunnel Emergency Rail Lighting and Lighting Receptacles"

T. Section 16895, "Tunnel Services Low Voltage AC Variable Speed Drive"

1.03 REFERENCE STANDARDS

A. ANSI

B. British Standards (BS)

C. Deutsches Institut fur Normung (DIN)

D. IEC

E. IEEE

F. NEC

G. NEMA

H. NFPA

I. UL

1.04 SUBMITTALS

A. All submittals shall be sealed by a Professional Engineer.

B. Shop Drawings shall include circuit, connection and instrument loop diagrams which clearly identify all cables, terminations and connections and indicate accurately the numbers of cables, wires, terminals and cable cores marked on the installed plant. Indicate front and side views of enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; electrical characteristics including voltage, frame size and trip ratings; all termination numbers and identification of purpose; and time-current curves of all equipment and components.

C. Test certificate shall include equipment type test certificates (UL Listed) where applicable.

SECTION 16891

TUNNEL SERVICES LOW VOLTAGE SWITCHBOARD AND MOTOR CONTROL CENTER

ARTICLE 1 GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment and incidentals necessary for tunnel services low voltage switchboard and motor control center, in accordance with the Contract Documents.

B. The work of this Section includes, but is not limited to, the following activities:
   1. Design, manufacture, furnish, install, and testing of the new low voltage switchboard and motor control center for tunnel services and other equipment associated with the system.

C. The Contract Documents provide the performance parameters and Design Criteria to complete the tunnel services low voltage switchboard and motor control center portion of the Work. The Contractor shall be responsible to provide a completed design for this portion of the Work.

1.02 RELATED SECTIONS

A. Section 15400, "Tunnel Services Scope of Work"

B. Section 15445, "Tunnel Mechanical Drainage Systems"

C. Section 15886, "Tunnel Ventilation Jet Fan Active Control"

D. Section 15887, "Tunnel Ventilation and Balancing Dampers"

E. Section 15889, "Tunnel Ventilation Fans"

F. Section 15890, "Tunnel Ventilation Jet Fans"

G. Section 15891, "Tunnel Services Mechanical Testing and Commissioning"

H. Section 16111, "Conduit"

I. Section 16120, "Low Voltage Power Cables"

J. Section 16702, "Copper Outside Plant"

K. Section 16742, "SCADA System"

L. Section 16889, "Tunnel Services Electrical Testing and Commissioning"

M. Section 16890, "Tunnel Services Electrical Requirements of Mechanical Equipment"

N. Section 16892, "Tunnel Services Uninterruptible Power Supply"

O. Section 16893, "Tunnel Services Power Factor Correction"

P. Section 16894, "Tunnel Emergency Rail Lighting and Lighting Receptacles"

Q. Section 16895 "Tunnel Services Low Voltage AC Variable Speed Drive"

1.03 REFERENCE STANDARDS

A. ANSI

B. IEC

C. IEEE

D. NEC

E. NEMA

F. NFPA

G. UL

1.04 SUBMITTALS

A. All submittals shall be sealed by a Professional Engineer.

B. Type test certificates (UL Listed) from a recognized testing agency.

C. Product Data sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

D. Final short circuit coordination study and arc fault study.

E. Provide final settings required for all adjustable/electronic type circuit breakers with long time, short time, ground fault and instantaneous settings.

F. Furnish Time–Current curves of fuses, relays, circuit breaker trip units.

G. Shop Drawings indicating general arrangements, front, side and plan section views of MCC with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; electrical characteristics including voltage, frame size and trip ratings; all termination numbers and identification of purpose; and time-current curves of all equipment and components.

H. Shop Drawings of RTU/PLC Cabinet showing equipment layout and equipment description and list.

SECTION 16895

TUNNEL SERVICES LOW VOLTAGE AC VARIABLE SPEED DRIVE

ARTICLE 1 GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment and incidentals necessary for low voltage AC variable speed drive controllers for tunnel services systems, in accordance with the Contract Documents.

B. The work of this Section includes, but is not limited to, the following activities:
   1. Design, manufacture, furnish, install, and testing of the low voltage AC variable speed drive for tunnel services systems and other equipment associated with the system.

C. The Contract Documents provide the performance parameters and Design Criteria to complete the tunnel services low voltage AC variable speed drive portion of the work. The Contractor shall be responsible to provide a completed design for this portion of the work.

1.02 RELATED SECTIONS

A. Section 15400, "Tunnel Services Scope of Work"

B. Section 15886, "Tunnel Ventilation Jet Fan Active Control"

C. Section 15889, "Tunnel Ventilation Fans"

D. Section 15890, "Tunnel Ventilation Jet Fans"

E. Section 15891, "Tunnel Services Mechanical Testing and Commissioning"

F. Section 16111, "Conduit"

G. Section 16120, "Low Voltage Power Cables"

H. Section 16702, "Copper Outside Plant"

I. Section 16742, "SCADA System"

J. Section 16889, "Tunnel Services Electrical Testing and Commissioning"

K. Section 16890, "Tunnel Services Electrical Requirements of Mechanical Equipment"

L. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"

M. Section 16893, "Tunnel Services Power Factor Correction"

1.03 REFERENCE STANDARDS

A. ANSI

B. IEC

C. IEEE

D. NEC

E. NEMA

F. NFPA

G. UL

1.04 SUBMITTALS

A. All submittals shall be sealed by a Professional Engineer.

B. Shop Drawings shall include circuit, connection and instrument loop diagrams which clearly identify all cables, terminations and connections and indicate accurately the numbers of cables, wires, terminals and cable cores marked on the installed plant. Shop Drawings indicating front and side views of enclosures with overall dimensions, including conduit entrance locations and requirements; nameplate legends; electrical characteristics.

C. Test certificate shall include equipment type test certificates (UL Listed) where applicable.

D. Characteristic graphs of drive motor speed/torque/starting current and driven load torque on starting when run-up exceeds 8 seconds.

E. Technical specification and datasheets.

F. Documentation of offered design showing proven service.

G. Manufacturer recommendations for handling and long term storage of any spare equipment.

ARTICLE 2 PRODUCTS

2.01 APPLICATION SPECIFIC REQUIREMENTS

Table 16895-1

ITEM	DESCRIPTION	UNIT	DATA
1	Supply Voltage Three Phase	VAC	480
2	Supply Voltage Motors Three Phase (Ventilation Fans, Jet Fans)	VAC	480

PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SHORE CONNECTOR PROJECT

CONTRACT NO. NSC-009

The following Questions and Answers Summary shall not be construed to modify or change the Bid Documents. The Bidder shall submit its Bid based upon the Bid Documents. The Bid Documents may only be changed through the use of explicitly identified changes to the Bid Document, and any necessary change to the Bid Documents will be explicitly identified as such in an Addendum that would be issued by Port Authority.

Question 46: Section 13574, Item 2.03.A - the Contractor shall provide and install ATS equipment at all signal locations. In reviewing contract drawing 432, it appears that a trip stop was added at Wood signal 12S, but not at signal 8N. Should a trip stop be added at signal 8N as well? Also, contract drawing 345, should we add trip stops at Gateway signals 10N and 12S?

Response 46: A Trip Stop is required at 12S at Wood St., but trip stops are not required at 8N (Wood Street), 10N and 12S (Gateway), as shown in the Contract Drawings.

Question 136: Addendum #3, Response 46 states the trip for 12S signal at Wood Street (which was being added for this job) shall not be added, but the cable plan for Wood Street in Addendum #3 still shows the trip and new cable being required. Please clarify.

Response 136: See response to Question 46. Cable Plan is correct as shown.

Question 148: Specification Sections 16060 "Grounding and Bonding" references requirements for OCS bonding and states that no separate measurement or payment shall be made for the OCS work of this section. However, Specification Section 16602 "General Requirements Overhead Contact System" references measurement and payment for Bid Item 16602.015 "OCS Grounding". Please confirm that ALL grounding and bonding shall be measured and paid under Bid Item 16060.001 "Ground and Bonding" and that no cost should be allocated to Bid Item 16602.015 "OCS Grounding" and will be deleted.

Response 148: All grounding and bonding will be measured and paid under Bid Item 16060.001. See Addendum 7.

Question 149: Contract Drawing TP013 shows manholes ACMH 1 and ACMH 2. No dimensions manhole details are given. Please confirm that the furnish and install of these manholes is included in the NSC-009 contract and provided details on each of the manholes.

Response 149: Manhole drawings are shown on drawing TP-018. See Addendum 7 for clarifications.

Question 152: Contract Specification 02220 "Demolition", Section 2.08 "Signal System" requires the Contractor to remove tunnel signals 16N, 18S, 20S and Electric Switch Machine #3. Please provide information as to the location of this equipment.

Response 152: Switch #3 and the 3 signals are located on Gateway Loop. Gateway layout added to Also Drawings. See Addendum 7.

Question 153: Reference Bid Item #05520.001 - Misc. Fabricated Steel Items. Please provide information as to what materials this bid item is referencing.

Response 153: This Item has been deleted and an Item for hand rail has been added. See Addendum 7.

Question 156: On September 3, 2008, we previously requested a three-week bid date extension to the current bid date of September 24, 2008. However, today after receiving addendum nos. four and five along with the many changes, for that reason, along with our previously stated reasons for that three-week bid date extension request, we reconsider and now request a four-week bid date extension to the current bid date of September 24, 2008.

Response 156: See Addendum 6

Question 157: Fire extinguishers: Provide UL- 10A: 120B C, 20# - This should be listed as 20A: 120B:C and this extinguisher's shipping weight is 38 pounds and very heavy for 1 person to pick up and put out a fire with it.

Additionally, if 10# extinguishers would suffice, then the cabinet could be one size smaller and then less expensive,

Response 157: Extinguishers to be provided shall be 20 pound nominal, U/L rated 20A:120B:C, multi-purpose dry chemical type manufactured by Potter Roemer or equivalent as approved by the Engineer. Smaller extinguisher sizes are not acceptable.

Question 158: Per Article 2 under 2.01 A - Design Life: cabinets shall be designed for an operating life of 20 years unless noted otherwise. The manufacturer has built cabinets that were used in a tunnel system in California and New York and they were 14 gauge. If you want these cabinets to have an operating life of 20 years, then they should be 14 gauge. Surface mount cabinets are not fire rated and if the recessed are going into the walls of the tunnel, one must have at least an 8 inch wall but fire rated is not needed in concrete, this is one of their larger cabinets.

Response 158: Cabinets are required to be designed and built for an operating life of 20 years. Steel thickness should be as per manufacturer's recommendations for the intended operating life, taking into account material of construction, which shall be stainless steel in this case as per 2.04-E and 2.04-G.1.a.

Question 159: Specs under 2.04 — F: Trimless hidden flange does not work with cabinet # 1706 or 1756. And under 2.04 — G: Do you want the lever handle with cam action latch or cylinder key locks. Additionally, the cast iron door handle is an additional cost as is a "fire-rated cabinet."

Response 159: 2.04-F describes a recessed cabinet (Model #1706) with a flange which overlaps the surrounding wall finish, and flange joints hidden by an overlapping door. Concealed hinges are preferred. Provide lever handle with cam action, and cylinder locks keyed alike for all cabinets as per 2.04-G.1.c and 2.05-C. Cabinets shall remain unlocked as per 3.04-D.

Question 160: Per the drawing it appears that you will need a quantity of (37) with 2 spares but not sure of how many of each cabinet you would require and this affects the pricing.

Response 160: There are 36 cabinet locations as shown in drawing FP-100. One spare cabinet of each type shall be supplied. 24 units of surface mounted cabinets (#1756) shall be installed in the bored tunnel section, and 12 units of recessed cabinets (#1706) shall be installed in the remaining locations.

Question 161: Specification 16220 Section 2.06 (a-g) describes a 3 phase multifunction relay, and 2.06 (h) indicates a single phase relay as does the one line drawing TP008 sheet 274, which is correct?

Response 161: Contractor should follow specification. Section 2.06.H indicates single-phase relay.

Question 162: Specification 16220 Section 2.06 (s) Please identify quantity and locations?

Response 162: 3-phase digital power meter, one (1) per each metering compartment (TP010) - PAAC Metering Compartment #1 and PAAC Metering Compartment #2.

Question 163: Specification 16220 Section 2.11 (H) Please clarify if you are requiring ground cables or a ground and test device?

Response 163: Providing ground cables will be adequate.

Question 164: Specification 16200 Section 1.07(a) states switchgear supplied by DLC, what switchgear are they supplying?

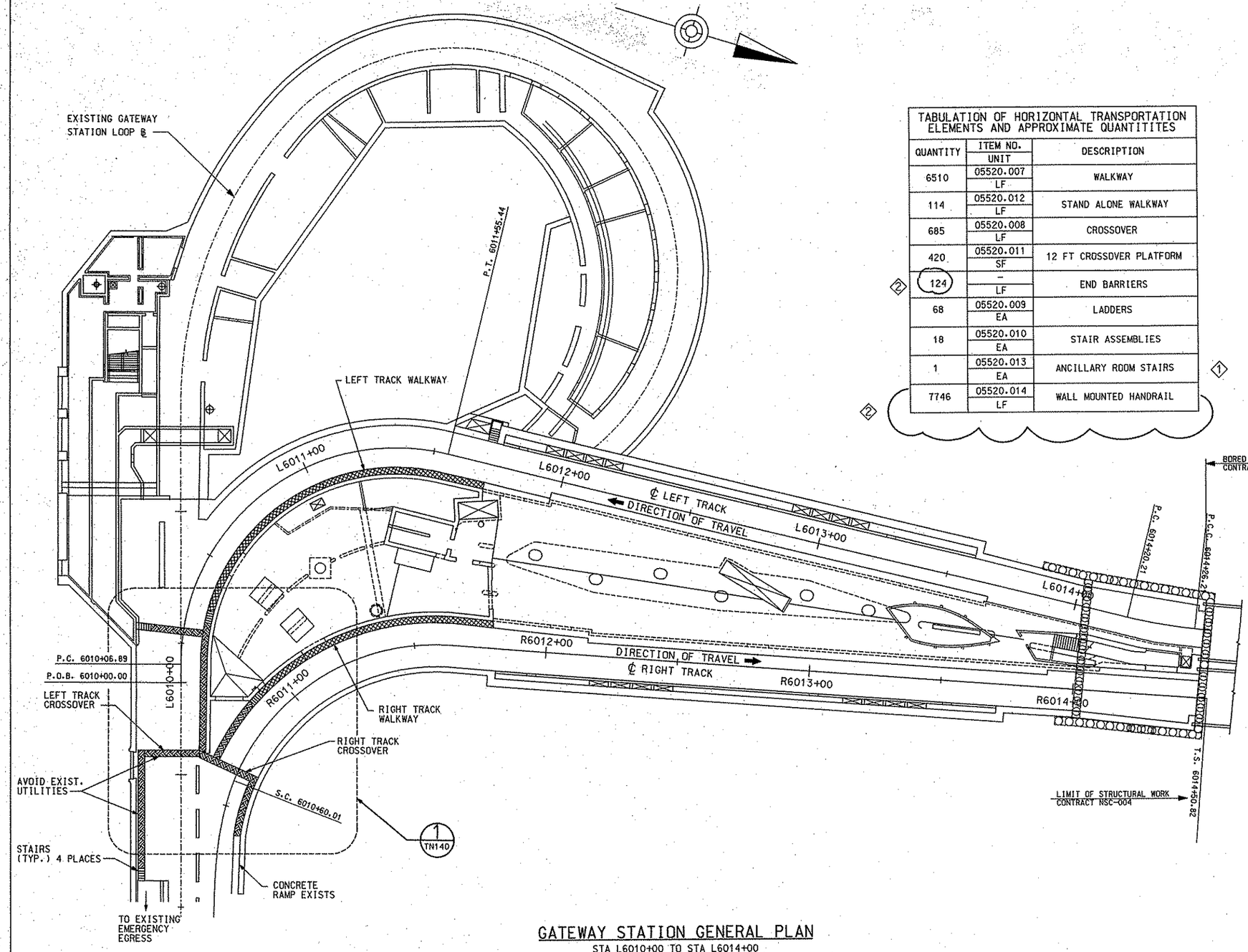
Response 164: PMH switchgear by S&C will be provided by DLC (TP007). Drawing TP013 shows two (2) DLC Switch Pads.

Question 165: Specification 16221 calls for (2) two indoor switches to be mounted in the traction power enclosure, where are these switches located. They are not shown on drawing TP013 sheet 278.

Response 165: Drawing TP008 shows two (2) 27kV fusible load interrupter switches feeding the two (2) auxiliary transformers. The switches are located in the TP enclosure (TP010) at "Auxiliary Transformer Feeder #1" and "Auxiliary Transformer Feeder #2".

Question 166: Drawing TP010 sheet # 276 shows (11) eleven vertical cells and (1) one bus transition cell. The auxiliary transformer feeder #1 only contain a bus feed from breaker 52-PSI & auxiliary transformer feeder #2 cell only contain a bus feed from breaker 52-PS2 The 27kv switchgear design we are proposing allows for bifurcated feeder bus in the rear feeder bus compartments of 52-PS1 & 52-PS2 respectively. This would allow the building to be 80" shorter in length and eliminate the need for supplying the Aux. Transf. feeder #1 & 2 verticals. Would the supply of bifurcated feeder bus in the AC Feeder Breaker cubicles # 1 & #2 be acceptable to the authority?

Response 166: The Contractor shall conform to the design as shown in Contract Documents. Should the Contractor wish to submit an alternate design during the execution of the Work, it will be in accordance with Section 00900.



TABULATION OF HORIZONTAL TRANSPORTATION ELEMENTS AND APPROXIMATE QUANTITITES		
QUANTITY	ITEM NO. / UNIT	DESCRIPTION
6510	05520.007 / LF	WALKWAY
114	05520.012 / LF	STAND ALONE WALKWAY
685	05520.008 / LF	CROSSOVER
420	05520.011 / SF	12 FT CROSSOVER PLATFORM
② 124	– / LF	END BARRIERS
68	05520.009 / EA	LADDERS
18	05520.010 / EA	STAIR ASSEMBLIES
1	05520.013 / EA	ANCILLARY ROOM STAIRS
7746	05520.014 / LF	WALL MOUNTED HANDRAIL

GENERAL NOTES:

1. TN DRAWINGS TO BE READ IN CONJUNCTION WITH CONTRACT DRAWINGS FOR CAST IN PLACE TUNNEL SECTIONS FOR CONTRACTS 003, 004, AND 006.
2. ALL STEEL RELATED TO WALKWAYS AND CROSSOVERS SHALL BE AASHTO M270 (ASTM A709, GR36) HOT DIPPED GALVANIZED.
3. ALL STEEL NUTS, BOLTS & SCREWS RELATED TO WALKWAYS AND CROSSOVERS TO BE SPUN GALVANIZED EXCEPT WHERE NOTED. ALL WASHERS TO BE SPLIT WASHERS IN HARDENED STEEL AND GALVANIZED.
4. THE HEIGHT OF THE WALKWAY IN RELATION TO THE TUNNEL BASE SLAB VARIES WITH SUPERELEVATION.
5. ANCHOR BOLTS TO BE GALVANIZED HILTI HDI DROP-IN ANCHORS OR APPROVED EQUAL.
6. STRUCTURAL BOLTS TO BE TO ASTM A325 WITH MINIMUM TENSILE STRENGTH = 120 KSI.
7. GRATING MANUFACTURER APPROVED NOSING TO BE USED ON GRATING ON STAIRS AND AT THE HEAD OF THE LADDER.
8. SPACING OF LADDERS SHALL BE 100 FEET MAXIMUM.

LEGEND:

WALKWAY

CROSSOVER

GATEWAY STATION GENERAL PLAN

STA L6010+00 TO STA L6014+00

NO.	DATE	DESCRIPTION
②	9/12/08	ADDENDUM 7 – DRAWING MODIFIED
①	7/31/08	ADDENDUM 1 – DRAWING MODIFIED

REVISIONS

THE PREPARATION OF THIS DOCUMENT HAS BEEN FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL TRANSIT ADMINISTRATION, U.S. DEPARTMENT OF TRANSPORTATION, UNDER THE URBAN MASS TRANSPORTATION ACT OF 1964, AS AMENDED. FOR THE PORT AUTHORITY OF ALLEGHENY COUNTY, PENNSYLVANIA.

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER PETER DENNIS MAURITZ PE071163

SIGNATURE

DMJM HARRIS | AECOM
FOUR GATEWAY CENTER
20TH FLOOR
PITTSBURGH, PA. 15222

APPROVED 9/12/08 DATE

DESIGNED	RJS
DRAWN	NPD
CHECKED	WBT
IN CHARGE	DPH
DATE	APRIL 21, 2008
SCALE	1"=20'-0" (20' 10' 0 20')

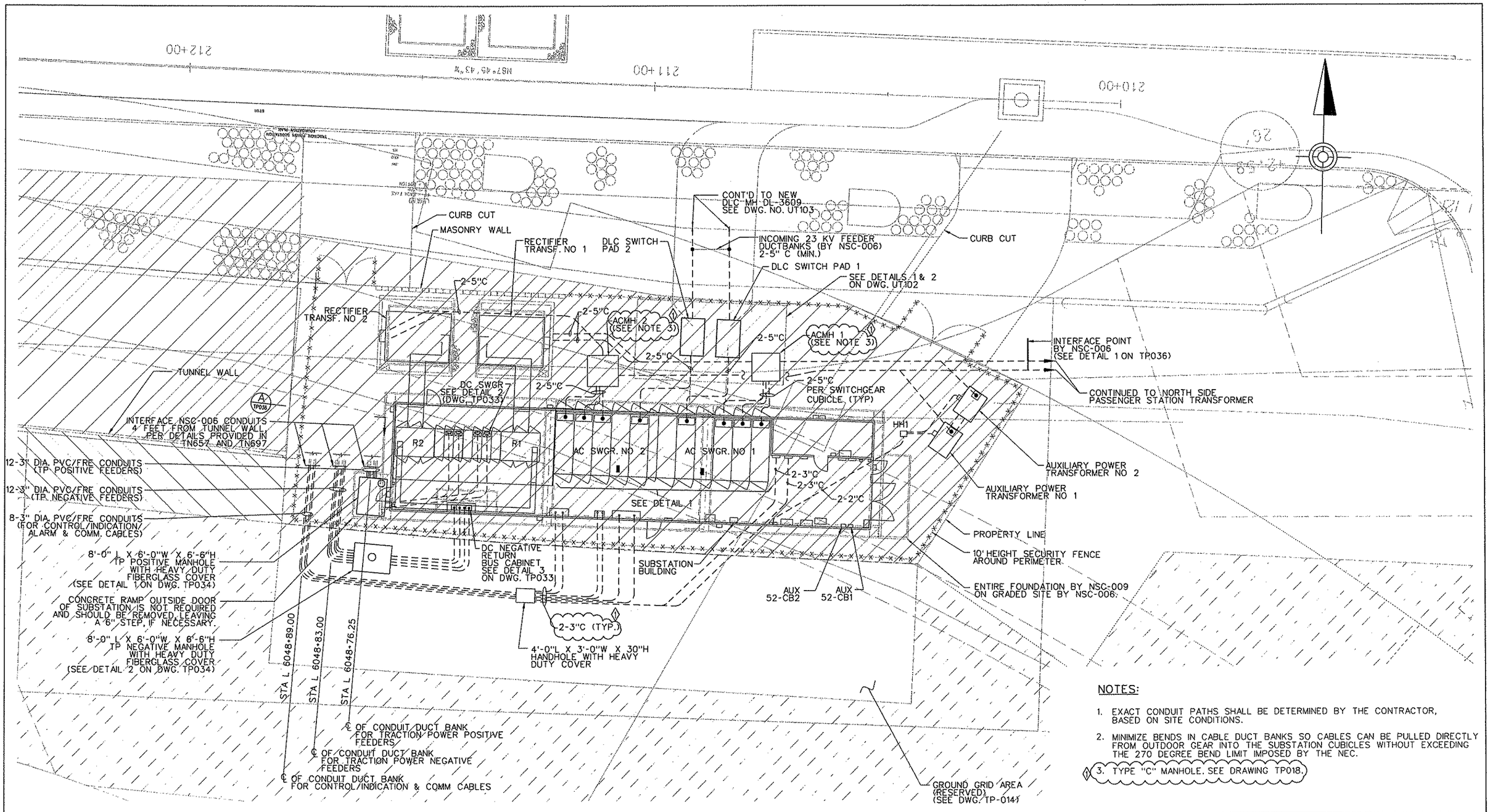
PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH PENNSYLVANIA

NORTH SHORE CONNECTOR
NCS TRAIN SYSTEMS (SYSTEM WIDE)
GATEWAY STATION GENERAL WALKWAY PLAN
STA L6010+00 TO STA L6014+00

Port Authority

CONTRACT NO.	NSC-009
DWG. NO.	TN130
SHT.	54

$DATE$ $TIME$ $FILE$



NOTES:

1. EXACT CONDUIT PATHS SHALL BE DETERMINED BY THE CONTRACTOR, BASED ON SITE CONDITIONS.
2. MINIMIZE BENDS IN CABLE DUCT BANKS SO CABLES CAN BE PULLED DIRECTLY FROM OUTDOOR GEAR INTO THE SUBSTATION CUBICLES WITHOUT EXCEEDING THE 270 DEGREE BEND LIMIT IMPOSED BY THE NEC.
3. TYPE "C" MANHOLE. SEE DRAWING TP018.

PLAN- SUBSTATION RACEWAY LAYOUT

SCALE 0 10

PB AMERICAS, INC.
Two Gateway Center, 18th Fl.,
Newark, N.J. 07102

NO.	DATE	DESCRIPTION
3	9/12/08	ADDENDUM #7 - DRAWING MODIFIED

REVISIONS

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COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER LACHMAN D. KUKREJA PE-049060-R
SIGNATURE

DMJM HARRIS | AECOM
FOUR GATEWAY CENTER
20TH FLOOR
PITTSBURGH, PA. 15222
APPROVED 9/12/08 DATE

DESIGNED	LDK
DRAWN	SB
CHECKED	JSJ
IN CHARGE	DPH
DATE	APRIL 28, 2008
SCALE	AS SHOWN

PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH PENNSYLVANIA

NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
NS SUBSTATION
SITE PLAN

Port Authority

CONTRACT NO. NSC-009
DWG. NO. TP013 SHT. 278

NORTH SHORE TPSS

CONDUIT ID	DWG NO.	FROM	TO	FUNCTION	CONDUIT SIZE	CONDUIT TYPE	CONDUIT LENGTH	CABLE	REMARKS
PSF-101		DLC-23 KV INCOMING LINE #22037	NORTH SHORE SUB 27 KV SWITCHGEAR	23 KV INCOMING FEEDER #1	5"	PVC		3-1/C #500 KCMIL, 25 KV, 1-#4/0G, 600 V	
PSF-102		DLC-23 KV INCOMING LINE #22037	NORTH SHORE SUB 27 KV SWITCHGEAR	23 KV INCOMING FEEDER #1	5"	PVC		SPARE	
PSF-103		DLC-23 KV INCOMING LINE #22046	NORTH SHORE SUB 27 KV SWITCHGEAR	23 KV INCOMING FEEDER #2	5"	PVC		3-1/C #500 KCMIL, 25 KV, 1-#4/0G, 600 V	
PSF-104		DLC-23 KV INCOMING LINE #22046	NORTH SHORE SUB 27 KV SWITCHGEAR	23 KV INCOMING FEEDER #2	5"	PVC		SPARE	
PSF-105		27 KV SWITCHGEAR FEEDER RT1	RECTIFIER TRANSFORMER #1	AC SUPPLY FOR RECTIFIER #1	5"	PVC		3-1/C #2/0 KCMIL, 25 KV, 1-#4G, 600 V	
PSF-106		27 KV SWITCHGEAR FEEDER RT1	RECTIFIER TRANSFORMER #1	AC SUPPLY FOR RECTIFIER #1	5"	PVC		SPARE	
PSF-107		27 KV SWITCHGEAR FEEDER RT2	RECTIFIER TRANSFORMER #2	AC SUPPLY FOR RECTIFIER #2	5"	PVC		3-1/C #2/0 KCMIL, 25 KV, 1-#4G, 600 V	
PSF-108		27 KV SWITCHGEAR FEEDER RT2	RECTIFIER TRANSFORMER #2	AC SUPPLY FOR RECTIFIER #2	5"	PVC		SPARE	
PSF-109		27 KV SWITCHGEAR AUX XFMR FEEDER #1	AUX TRANSFORMER #1	AUX SERVICE FOR TPS SUBSTATION	4"	PVC		3-1/C #1 KCMIL, 25 KV, 1-#2G, 600 V	
PSF-110		27 KV SWITCHGEAR AUX XFMR FEEDER #1	AUX TRANSFORMER #1	AUX SERVICE FOR TPS SUBSTATION	4"	PVC		SPARE	
PSF-111		27 KV SWITCHGEAR AUX XFMR FEEDER #2	AUX TRANSFORMER #2	AUX SERVICE FOR TPS SUBSTATION	4"	PVC		3-1/C #1 KCMIL, 25 KV, 1-#2G, 600 V	
PSF-112		27 KV SWITCHGEAR AUX XFMR FEEDER #2	AUX TRANSFORMER #2	AUX SERVICE FOR TPS SUBSTATION	4"	PVC		SPARE	
PSF-113		23 KV PASSENGER STATION FEEDER #1	NORTH SIDE PASS. STA. SERVICE #1	NORTH SIDE PASS. STA. SERVICE #1	5"	PVC		3-1/C #4/0 KCMIL, 25 KV, 1-#4G, 600 V	
PSF-114		23 KV PASSENGER STATION FEEDER #1	NORTH SIDE PASS. STA. SERVICE #1	NORTH SIDE PASS. STA. SERVICE #1	5"	PVC		SPARE	
PSF-115		23 KV PASSENGER STATION FEEDER #2	NORTH SIDE PASS. STA. SERVICE #2	NORTH SIDE PASS. STA. SERVICE #2	5"	PVC		3-1/C #4/0 KCMIL, 25 KV, 1-#4G, 600 V	
PSF-116		23 KV PASSENGER STATION FEEDER #2	NORTH SIDE PASS. STA. SERVICE #2	NORTH SIDE PASS. STA. SERVICE #2	5"	PVC		SPARE	
TPP-1		OBT 6044+80.5	NORTH SHORE TPSS	POSITIVE FDR 11F04	3"	PVC		1000 KCMIL 2 KV	1
TPP-2		OBT 6044+79	NORTH SHORE TPSS	POSITIVE FDR 11F04	3"	PVC		1000 KCMIL 2 KV	
TPP-3		OBT 6044+77.5	NORTH SHORE TPSS	POSITIVE FDR 11F04	3"	PVC		SPARE	
TPP-4		OBT 6044+76	NORTH SHORE TPSS	POSITIVE FDR 11F04	3"	PVC		SPARE	
TPP-5		IBT 6044+80.5	NORTH SHORE TPSS	POSITIVE FDR 11F03	3"	PVC		1000 KCMIL 2 KV	
TPP-6		IBT 6044+79	NORTH SHORE TPSS	POSITIVE FDR 11F03	3"	PVC		1000 KCMIL 2 KV	
TPP-7		IBT 6044+77.5	NORTH SHORE TPSS	POSITIVE FDR 11F03	3"	PVC		SPARE	
TPP-8		IBT 6044+76	NORTH SHORE TPSS	POSITIVE FDR 11F03	3"	PVC		SPARE	
TPP-9		OBT 6044+00.5	NORTH SHORE TPSS	POSITIVE FDR 11F02	3"	PVC		1000 KCMIL 2 KV	
TPP-10		OBT 6043+99	NORTH SHORE TPSS	POSITIVE FDR 11F02	3"	PVC		1000 KCMIL 2 KV	
TPP-11		OBT 6043+97.5	NORTH SHORE TPSS	POSITIVE FDR 11F02	3"	PVC		SPARE	
TPP-12		OBT 6043+96	NORTH SHORE TPSS	POSITIVE FDR 11F02	3"	PVC		SPARE	
TPP-13		IBT 6044+00.5	NORTH SHORE TPSS	POSITIVE FDR 11F01	3"	PVC		1000 KCMIL 2 KV	
TPP-14		IBT 6043+99	NORTH SHORE TPSS	POSITIVE FDR 11F01	3"	PVC		1000 KCMIL 2 KV	
TPP-15		IBT 6043+97.5	NORTH SHORE TPSS	POSITIVE FDR 11F01	3"	PVC		SPARE	
TPP-16		IBT 6043+96	NORTH SHORE TPSS	POSITIVE FDR 11F01	3"	PVC		SPARE	
TPN-17		OUTBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-1	3"	PVC		1000 KCMIL 2 KV	
TPN-18		OUTBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-1	3"	PVC		1000 KCMIL 2 KV	
TPN-19		OUTBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-1	3"	PVC		SPARE	
TPN-20		OUTBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-1	3"	PVC		SPARE	
TPN-21		OUTBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-2	3"	PVC		1000 KCMIL 2 KV	
TPN-22		OUTBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-2	3"	PVC		1000 KCMIL 2 KV	
TPN-23		OUTBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-2	3"	PVC		SPARE	
TPN-24		OUTBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-2	3"	PVC		SPARE	
TPN-25		INBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-3	3"	PVC		1000 KCMIL 2 KV	
TPN-26		INBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-3	3"	PVC		1000 KCMIL 2 KV	
TPN-27		INBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-3	3"	PVC		SPARE	
TPN-28		INBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-3	3"	PVC		SPARE	
TPN-29		INBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-4	3"	PVC		1000 KCMIL 2 KV	
TPN-30		INBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-4	3"	PVC		1000 KCMIL 2 KV	
TPN-31		INBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-4	3"	PVC		SPARE	
TPN-32		INBOUND RUNNING RAILS	NEGATIVE SWITCHBOARD	NEGATIVE RETURN DN-4	3"	PVC		SPARE	

NOTES:

1. CONTRACTOR TO INSERT SHOP DRAWING SHEET NUMBERS INTO TABLE FOR "DWG NO." CONDUIT LENGTH TO ALSO BE FILLED-IN BY CONTRACTOR.

PB AMERICAS, INC.
Two Gateway Center, 18th Fl.,
Newark, N.J. 07102

NO.	DATE	DESCRIPTION
1	9/12/08	ADDENDUM #1 - DRAWING MODIFIED

REVISIONS

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COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL LACHHAN D. KUKREJA ENGINEER
SIGNATURE

DMJM HARRIS | AECOM
FOUR GATEWAY CENTER
20TH FLOOR
PITTSBURGH, PA. 15222
APPROVED
9/12/08
DATE

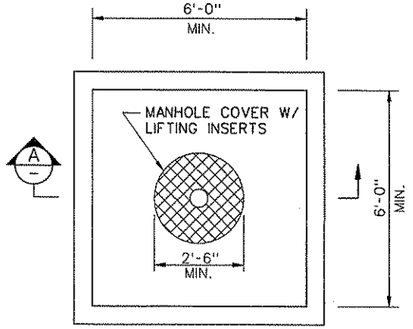
DESIGNED	LDK
DRAWN	SB
CHECKED	JSJ
IN CHARGE	DPH
DATE	APRIL 28, 2008
SCALE	NTS

PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH PENNSYLVANIA

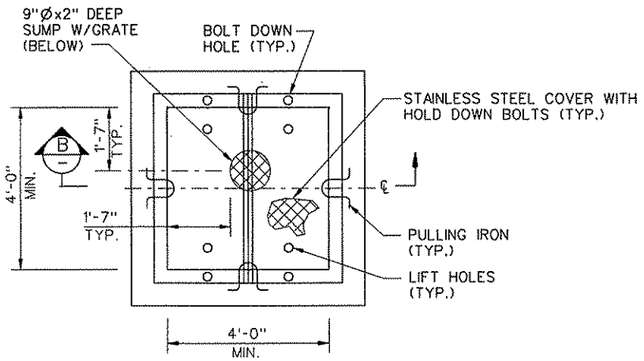
NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
NS SUBSTATION
CONDUIT & CABLE SCHEDULE - SHEET 1

Port Authority

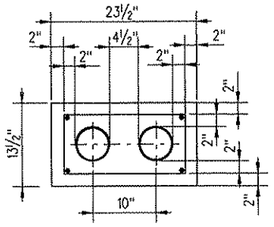
CONTRACT NO. NSC-009
DWG. NO. TP016 SHT. 281



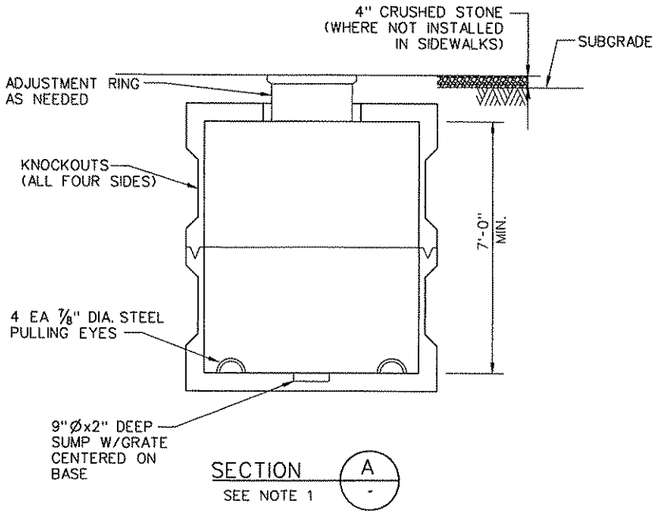
TYPE "C" AND "C-1"
PRECAST MANHOLE
SEE NOTES 1 & 2



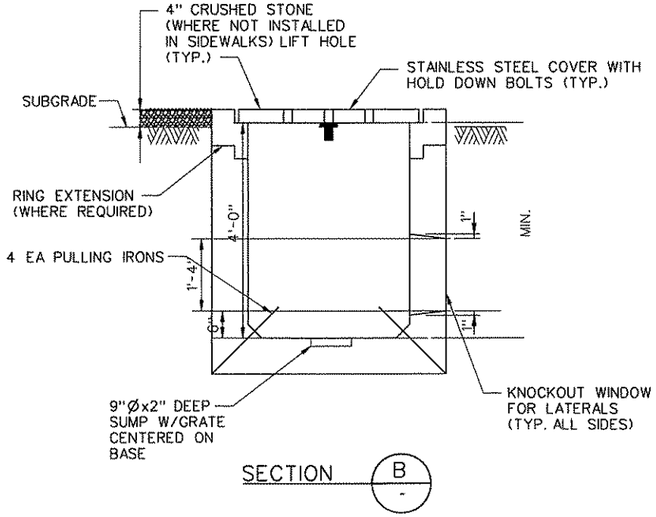
TYPE "D" AND "D-1"
PRECAST MANHOLE
SEE NOTES 1 & 2



TYPICAL 2-WAY DUCT BANK SECTION DETAILS



SECTION A
SEE NOTE 1



SECTION B

NOTES:

1. TYPE "C" MANHOLE AND TYPE "D" HANDHOLE LOADING CRITERIA IS HS-20 (20,000 LBS. AXLE LOAD).
2. TYPE "C-1" MANHOLE AND TYPE "D-1" HANDHOLE LOADING CRITERIA IS E-50 (50,000 LBS. AXLE LOAD).
3. MANHOLES AND HANDHOLES INSTALLED CLOSER THAN 8'-0" TO CENTER LINE OF TRACK SHALL BE TYPE "C-1". OTHERWISE, USE TYPE "C" MANHOLES OR TYPE "D" HANDHOLES.
4. WHERE DUCTBANKS ARE INSTALLED UNDER THE TRACK, THE MINIMUM COVER SHALL BE 5'-0" FROM THE BOTTOM OF THE TIE TO THE TOP OF THE CONCRETE.
5. OTHER DUCTBANK CONFIGURATIONS NOT SHOWN SHALL BE BUILT SIMILAR TO THOSE SHOWN IN TERMS OF ALL REQUIRED CLEARANCES, SPACING AND COVER.
6. ALL CONDUITS IN ENCASED DUCTBANKS TO BE SCHEDULE 40 PVC.
7. REINFORCEMENT STEEL SHALL BE DEFORMED BARS OF NEW BILLET STEEL CONFORMING TO ASTM AG15, GRADE 60. ALL HOOKS SHALL BE STANDARD HOOKS, UNLESS OTHERWISE NOTED.
8. THE CONTRACTOR SHALL SUBMIT DETAILS FOR DUCT BANK CONFIGURATIONS, REQUIRED FOR CONSTRUCTION.

PB AMERICAS, INC.
Two Gateway Center, 18th Fl.,
Newark, N.J. 07102

NO.	DATE	DESCRIPTION
1	9/12/08	ADDENDUM #7 - DRAWING MODIFIED

REVISIONS

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COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL
LACHMAN D. KUKREJA
ENGINEER
PE-044060-R
SIGNATURE

DMJM HARRIS | AECOM
FOUR GATEWAY CENTER
20TH FLOOR
PITTSBURGH, PA. 15222
APPROVED 11/12/08 DATE

DESIGNED	LDK
DRAWN	SB
CHECKED	JSJ
IN CHARGE	DPH
DATE	APRIL 28, 2008
SCALE	NTS

PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH PENNSYLVANIA

NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
NS SUBSTATION
DUCT BANK SECTIONS

Port Authority

CONTRACT NO. NSC-009
DWG. NO. TP018 SHT. 283

INDEX OF ALSO DRAWINGS

CONTRACT NO.	DRAWING NO.	DRAWING TITLE
		OPERATION CONTROL CENTER (OCC)
LRS-98-05	CC0010	OCC Block Diagram
LRS-98-05-R	CC0208	PAAC OCC Network Diagram, Rack 4 Terminal Server Connections
LRS-98-05-R	CC0209	PAAC OCC Network Diagram, Rack 5 Terminal Server Connections
LRS-98-05	CC321	IDF 1st Floor to 2nd Floor Wiring (1 of 8)
LRS-98-05	CC322	IDF 1st Floor to 2nd Floor Wiring (2 of 8)
LRS-98-05	CC323	IDF 1st Floor to 2nd Floor Wiring (3 of 8)
LRS-98-05	CC324	IDF 1st Floor to 2nd Floor Wiring (4 of 8)
LRS-98-05	CC325	IDF 1st Floor to 2nd Floor Wiring (5 of 8)
LRS-98-05	CC326	IDF 1st Floor to 2nd Floor Wiring (6 of 8)
LRS-98-05	CC327	IDF 1st Floor to 2nd Floor Wiring (7 of 8)
LRS-98-05	CC328	IDF 1st Floor to 2nd Floor Wiring (8 of 8)
LRS-98-05	CC330	Terminal Server Wiring (1 of 4)
LRS-98-05	CC331	Terminal Server Wiring (2 of 4)
LRS-98-05	CC332	Terminal Server Wiring (3 of 4)
LRS-98-05	CC333	Terminal Server Wiring (4of 4)
LRS-98-05	CC340	Modem IDF Wiring (1 of 6)
LRS-98-05	CC341	Modem IDF Wiring (2 of 6)
LRS-98-05	CC342	Modem IDF Wiring (3 of 6)
LRS-98-05	CC343	Modem IDF Wiring (4 of 6)
LRS-98-05	CC344	Modem IDF Wiring (5 of 6)
LRS-98-05	CC345	Modem IDF Wiring (6 of 6)
LRS-98-05	CC350	Data IDF Wiring (1 of 7)
LRS-98-05	CC351	Data IDF Wiring (2 of 7)
LRS-98-05	CC352	Data IDF Wiring (3 of 7)
LRS-98-05	CC353	Data IDF Wiring (4 of 7)
LRS-98-05	CC354	Data IDF Wiring (5 of 7)
LRS-98-05	CC355	Data IDF Wiring (6 of 7)
LRS-98-05	CC356	Data IDF Wiring (7 of 7)
LRS-98-05	CC360	VCS IDF Wiring (1 of 8)
LRS-98-05	CC361	VCS IDF Wiring (2 of 8)
LRS-98-05	CC362	VCS IDF Wiring (3 of 8)
LRS-98-05	CC363	VCS IDF Wiring (4 of 8)
LRS-98-05	CC364	VCS IDF Wiring (5 of 8)
LRS-98-05	CC365	VCS IDF Wiring (6 of 8)
LRS-98-05	CC366	VCS IDF Wiring (7 of 8)
LRS-98-05	CC367	VCS IDF Wiring (8 of 8)
LRS-98-02-E	EL901	Ground Floor Power/Systems & Lighting Plan
LRS-98-02-E	EL902	Second Floor Power/Systems & Lighting Plan
LRS-98-02-E	EL903	Third Floor Power/Systems & Lighting Plan
LRS-98-02-E	EL905	Enlarged Plans & Details
LRS-98-02-E	EL906	Enlarged Plans & Details
LRS-98-02-E	EL907	Riser Diagrams, Notes and Schedules
LRS-98-02-E	EL908	Panelboard Schedules
LRS-98-02-E	EL909	Panelboard Schedules
LRS-98-02-E	EL910	Existing Panelboard Schedules
		STAGE 2 LIGHT RAIL TRANSIT SYSTEM FIBER NODES
LRT-006	FM-06-EC-119	System Design (Fiber Optic) By Node Locations.

CONTRACT NO.	DRAWING NO.	SHEET NO.	DRAWING TITLE
			MIDTOWN INTERLOCKING (STAGE 1) ①
CY-111	T1373	668-2	CABLE PLAN
CY-111	T1373	668-76	TRAIN TO WAYSIDE COILS #47, #48
CY-111	T1373	668-W3	RACK 1 TERMINAL BOARDS A, B, & C
			STAGE 1 - TRACKWORK DRAWING
	TRKWRK-18		TRACKWORK DRAWING AT STA. 645+00 TO 675+00 ②
	TRKWRK-20		TRACKWORK DRAWING AT STA. 1031+00 TO 1001+00 (REVERSED)
CY 810	TS 010-0		TRACKWORK STANDARD - DIRECT FIXATION NO. 6 TURNOUT & CROSSOVER ③
CY 810	TS 012-0		TRACKWORK STANDARD - NO. 6 SOLID MANGANESE FLANGE BEARING FROG
CY 810	TS 030-1		SUBWAY-DIRECT FIXATION DETAILS
CY-111	T1373	TS-15	DOUBLE LINE TRACK & SIGNAL PLAN ④

Gannett Fleming
Transit & Rail Systems

NO.	DATE	DESCRIPTION
4	09/12/08	ADDENDUM 7 - DRAWING MODIFIED
3	09/08/08	ADDENDUM 6 - DRAWING MODIFIED
2	09/03/08	ADDENDUM 4 - DRAWING MODIFIED
1	08/20/08	ADDENDUM 3 - DRAWING MODIFIED

REVISIONS

THE PREPARATION OF THIS DOCUMENT HAS BEEN FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL TRANSIT ADMINISTRATION, U.S. DEPARTMENT OF TRANSPORTATION, UNDER THE URBAN MASS TRANSPORTATION ACT OF 1964, AS AMENDED, FOR THE PORT AUTHORITY OF ALLEGHENY COUNTY, PENNSYLVANIA.

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL ENGINEER — JOSEPH C. TRAUM JR.

SIGNATURE

DMJM HARRIS | AECOM
FOUR GATEWAY CENTER
20TH FLOOR
PITTSBURGH, PA. 15222

APPROVED — 9/12/08 DATE

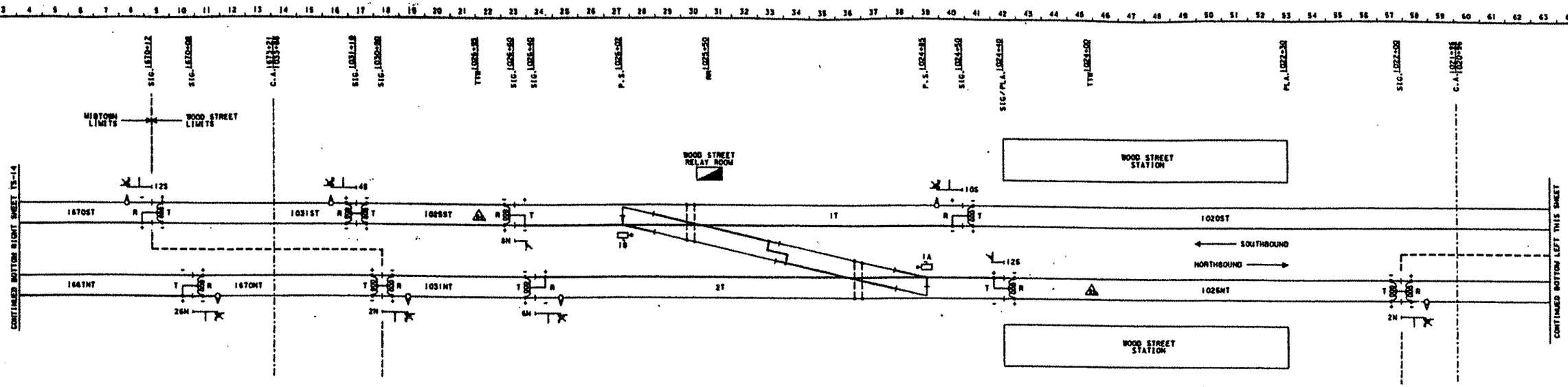
DESIGNED	JC TRAUM
DRAWN	JC TRAUM
CHECKED	CD JONES
IN CHARGE	CD JONES
DATE	APR. 28, 2008
SCALE	NTS

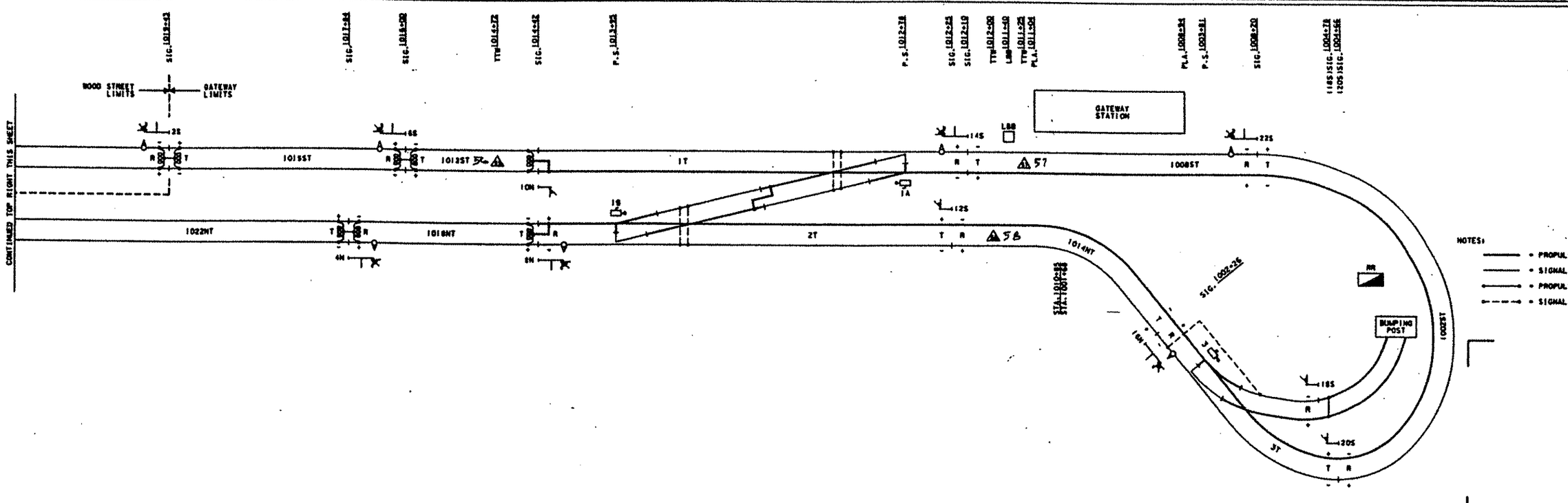
PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH PENNSYLVANIA

NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM-WIDE)
INDEX OF ALSO DRAWINGS FOR NSC CONTRACT INTERFACES
SHEET 1 OF 5

Port Authority

CONTRACT NO.	NSC-009
DWG. NO.	GN006A
SHT.	





REVISIONS

REFERENCES

DOUBLE LINE TRACK & SIGNAL PLAN

PORT AUTHORITY OF ALLEGHENY COUNTY
STAGE I LIGHT RAIL TRANSIT SYSTEM
CONTRACT NUMBER CY-111
CIRCUITS

UNION SWITCH & SIGNAL DIVISION
AMERICAN STANDARD INC.
SWISSVALE, PA 15218

SH TS-15

CONTD ON TS-16

T1373