

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: August 11, 2008

Please find enclosed the following:

- Addendum No. #2 dated August 11, 2008
 - Question and Answers 6, 12, 19, 24, 27, 28, 32-40.
 - August 8, 2008 Bored Tunnel Site Tour Attendance Sheet
-

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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Attention: Ms. Toni Matessa

Port Authority of Allegheny County

North Shore Connector

NSC Train Systems (System Wide)

Contract No. NSC-009

ADDENDUM NO. 2

August 11, 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 00100, Bid Advertisement, Pages 00100-2 through 00100-3. Delete and replace with pages 00100-2 through 00100-3.
2. Section 00400, Bid/Award Forms, Form B, Page B-9. Delete and replace with page B-9.
3. Section 00500, Agreement, Page 00500-18. Delete and replace with page 00500-18.
4. North Shore Connector, North Side Tunnels & Station Shell (NSC-003/006), Gateway Station Shell (NSC-004 R), Aerial Structure, Retained Fill, and Demolition of Miller Printing (NSC-007), and Advanced Rail Systems Procurement – Gateway Double Crossover (Contract No. 3002) Construction Update, Page C-1. Delete and replace with page C-1.

CHANGES TO TECHNICAL PROVISIONS (VOLUME 2)

1. Section 02220, Demolition, Page 02220-17. Delete and replace with page 02220-17.

CHANGES TO TECHNICAL PROVISIONS (VOLUME 3)

1. Section 16120, Low Voltage Power Cables, Page 16120-4. Delete and replace with page 16120-4.
2. Section 16742, SCADA System, Pages 16742-1 through 16742-12. Delete and replace with pages 16742-1 through 16742-14.
3. Section 16889, Tunnel Services Electrical Testing And Commissioning, Pages 16889-8 through 16889-9. Delete and replace with page 16889-8.
4. Section 16890, Tunnel Services Electrical Requirements of Mechanical Equipment, Page 16890-2. Delete and replace with page 16890-2.
5. Section 16891, Tunnel Services Low Voltage Switchboard And Motor Control Center, Page 16891-2. Delete and replace with page 16891-2.
6. Section 16891, Tunnel Services Low Voltage Switchboard And Motor Control Center, Page 16891-12. Delete and replace with page 16891-12.
7. Section 16891, Tunnel Services Low Voltage Switchboard And Motor Control Center, Page 16891-14. Delete and replace with page 16891-14.
8. Section 16891, Tunnel Services Low Voltage Switchboard And Motor Control Center, Page 16891-19. Delete and replace with page 16891-19.
9. Section 16893, Tunnel Services Power Factor Correction, Pages 16893-2 through 16893-4. Delete and replace with pages 16893-2 through 16893-4.
10. Section 16893, Tunnel Services Power Factor Correction, Pages 16893-8 through 16893-9. Delete and replace with pages 16893-8 through 16893-9.
11. Section 16894, Tunnel Emergency Rail Lighting and Lighting Receptacles, Pages 16894-3 through 16894-4. Delete and replace with pages 16894-3 through 16894-4.
12. Section 16895, Tunnel Services Low Voltage AC Variable Speed Drive, Page 16895-2. Delete and replace with page 16895-2.
13. Section 16895, Tunnel Services Low Voltage AC Variable Speed Drive, Page 16895-6. Delete and replace with page 16895-6.
14. Section 16895, Tunnel Services Low Voltage AC Variable Speed Drive, Page 16895-9. Delete and replace with page 16895-9.

CHANGES TO NSC-009 CONTRACT DRAWINGS (VOLUME 1)
(Modified or Added Drawings are attached here to)

1. Drawing No. TK132A, Sheet No. 114A. Drawing Modified.
2. Drawing No. CR100, Sheet No. 563. Drawing Modified.
3. Drawing No. CR101, Sheet No. 564. Drawing Modified.
4. Drawing No. CR104, Sheet No. 567. Drawing Modified.
5. Drawing No. CR105, Sheet No. 568. Drawing Modified.

ARTICLE 1 – ADVERTISEMENT

PORT AUTHORITY OF ALLEGHENY COUNTY

ADVERTISEMENT

Separate sealed Bids for the Work as listed hereinafter will be received at the Purchasing and Materials Management Department of Port Authority of Allegheny County, Heinz 57 Center, 345 Sixth Avenue, Third Floor, Pittsburgh, Pennsylvania, 15222-2527 until 1:30 p.m. on September 24, 2008 and will be publicly opened and read immediately thereafter at the same address.

NORTH SHORE CONNECTOR NSC TRAIN SYSTEMS (SYSTEM WIDE) CONTRACT NO. NSC-009

The Work of this project includes, but is not limited to, the furnishing of all labor, materials, tools, equipment, and incidentals necessary for the construction of the North Shore Connector train systems for the entire length of the light rail system extension. The Work will also include trackwork; high voltage electrical service; signal systems; prefabricated-type outdoor traction power substation and site amenities; overhead contact systems; communications systems; modifications and additions to Authority's Operations Control Center and Pitt Tower facilities; tunnel fire/life safety systems; tunnel ventilation; tunnel emergency walkway facilities; tunnel lighting; and system testing and certification prior to revenue service. In addition, the Work includes the decommissioning of the existing Gateway Station and installation of a double crossover at Wood Street Station.

Bid Documents will be available for public inspection and may be obtained on or after June 27, 2008 at the Port Authority office at the following address:

Port Authority of Allegheny County
Purchasing and Materials Management Department
Heinz 57 Center
345 Sixth Avenue, Third Floor
Pittsburgh, Pennsylvania 15222-2527

Bid Documents are available for purchase as follows: Bid Documents in hard copy form, with half size drawings, upon payment of \$600 per set; and Bid Documents in electronic form on compact disk upon payment of \$15 per set. Payments shall be by Check or Money Order (NO CASH), payable to Port Authority of Allegheny County. Documents will be mailed upon receipt of payment in full. No refunds of payment will be made. Should the purchaser wish to have the Bid Documents delivered via special delivery, such as UPS or FedEx, the purchaser shall provide appropriate account numbers for such special delivery methods.

This Project is subject to financial assistance contracts between Port Authority of Allegheny County and County of Allegheny, Commonwealth of Pennsylvania and the Federal Transit Administration (FTA) of the U. S. Department of Transportation (DOT).

Port Authority, in compliance with 49 C.F.R., Part 26, as amended, implements positive affirmative action procedures to ensure that all Disadvantaged Business Enterprises have the maximum opportunity to participate in the performance of contracts and subcontracts financed, in whole or in part, with federal funds provided for this Project. In this regard, all Bidders shall take all necessary and reasonable steps in accordance with 49 C.F.R., Part 26, to ensure that DBEs have the maximum opportunity to compete for and perform contracts. Bidders shall not discriminate on the basis of race, color, national origin or sex in the award and performance of DOT-assisted contracts. It is a condition of this Contract that all Bidders shall follow the DBE required procedures as set forth in the Bid Documents. If aid is required to involve DBEs in the Work, Bidders are to contact the Port Authority DBE Representative, Edward Greene at (412) 566-5257.

The Bidder's attention is directed to the following contacts for Bidder's questions:

Procedural Questions Regarding Bidding:

Toni Matessa - Port Authority
(412) 566-5148

All other questions relating to the Bid Documents must be submitted by mail or facsimile to:

Port Authority of Allegheny County
Heinz 57 Center
345 Sixth Avenue, Third Floor
Pittsburgh, PA 15222-2527
Attn: Toni Matessa
Fax: (412) 566-5359

In addition, the Bidder's attention is directed to the following schedule of activities for preparation of its Bid:

9:00 a.m. July 15, 2008	Pre-Bid Conference Port Authority of Allegheny County Heinz 57 Center Fifth Floor, Board Room 345 Sixth Avenue Pittsburgh, PA 15222-2527 (Attendance is not mandatory, but strongly recommended)
10:45 a.m.-4:00 p.m. July 15, 2008	Pre-Bid Site Tour of Pitt Tower Facility (10:45 a.m. – 12:00 p.m.) & South Hills Village Operations Control Center (12:45 p.m. – 4:00 p.m.) [immediately following the Pre-Bid Conference] Participants should wear a safety vest Transportation to each facility will be provided by Authority Details available at Pre-Bid Conference
1:30 a.m. to 4:00 a.m. July 16, 2008	Authority Stage I Tunnel (Gateway and Wood Street Stations and Gateway Tunnel Loop) Site Tour. NOTE: <u>This is a night-time tour.</u> Meeting Place: Gateway Station entrance located on the corner of Liberty Ave. and Stanwix Street, Pittsburgh, PA Participants should wear a Hard Hat and Safety Vest and bring a flashlight
10:30 a.m.-12:30 p.m. August 8, 2008	Site Tour of NSC-003/006 Worksite Participants are required to wear a safety vest, hard hat, and boots. Participants will be required to walk up/down stair access into and out of the excavation pits. Participants are required to attend tunnel safety training which will be provided and will begin at 10:30 a.m.. Meeting Place: Mazeroski Way/ West General Robinson Street Intersection (Launch Pit located on the North Shore)
10:30 a.m.-12:30 p.m. August 26, 2008	Site Tour of NSC-003/006 Worksite Participants are required to wear a safety vest, hard hat, and boots. Participants will be required to walk up/down stair access into and out of the excavation pits. Participants are required to attend tunnel safety training which will be provided and will begin at 10:30 a.m.. Meeting Place: Mazeroski Way/ West General Robinson Street Intersection (Launch Pit located on the North Shore)
August 14, 2008	Bidders shall submit Potential Areas of Subcontracting (Form GV) to Port Authority.
1:30 p.m. September 24, 2008	Bids Due Purchasing and Materials Management Department

The Board of Port Authority of Allegheny County reserves the right to reject any or all Bids

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
16742.002	ALARM / INDICATION WIRING	LS	1	LS	1
16750.001	DIGITAL VIDEO SYSTEM	LS	1	LS	1
16889.001	TUNNEL SERVICES ELECTRICAL TESTING AND COMMISSIONING	LS	1	LS	1
16891.001	GATEWAY STATION LOW VOLTAGE SWITCHBOARDS AND MOTOR CONTROL CENTERS	LS	1	LS	1
16891.002	NORTH SIDE STATION LOW VOLTAGE SWITCHBOARDS AND MOTOR CONTROL CENTERS	LS	1	LS	1
16891.003	GATEWAY STATION PLC/RTU SYSTEM FOR TUNNEL SERVICES EQUIPMENT	LS	1	LS	1
16891.004	NORTH SIDE STATION PLC/RTU SYSTEM FOR TUNNEL SERVICES EQUIPMENT	LS	1	LS	1
16892.001	MCC CONTROL SUPPLY DISTRIBUTION UNINTERRUPTIBLE POWER SUPPLY UNIT	LS	1	LS	1
16892.002	TUNNEL CENTRALIZED EMERGENCY LIGHTING SUPPLY UNINTERRUPTIBLE POWER SUPPLY UNIT	LS	1	LS	1
16893.001	TUNNEL SERVICES POWER FACTOR CORRECTION RAIL TUNNEL LIGHTING SYSTEM	EA	5	LS	1
16894.001	RAIL TUNNEL LIGHTING RECEPTACLES	LS	1	LS	1
16894.002	SPARE EMERGENCY LIGHTING UPS AND ALL ASSOCIATED EQUIPMENT	LS	1	LS	1
16895.001	GATEWAY STATION LOW VOLTAGE AC VARIABLE SPEED DRIVE	LS	1	LS	1
16895.002	NORTH SIDE STATION LOW VOLTAGE AC VARIABLE SPEED DRIVE	LS	1	LS	1
16895.003	SPARE LOW VOLTAGE AC VARIABLE SPEED DRIVES AND ALL ASSOCIATED EQUIPMENT	LS	1	LS	1
16950.001	OCC SITE SURVEY WORK	LS	1	LS	1
16950.002	UPGRADE OF THE OCC SYSTEM	LS	1	LS	1

- GG. System Integration Testing involving Authority personnel and equipment will not occur during Peak Revenue Service (Working Days: 6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 6:00 p.m.) and Special Events as prescribed in Article Q of this Section.
- HH. Authority will be performing Pre-Revenue Operations at the completion of milestone work associated with System Integration Testing as described in Article 2.6.A.1.b).4). of this Section. Any additional work associated with the Project will be subject to Authority LRV testing traffic and restrictions associated with an active LRV system. Contractor's remaining work shall be closely coordinated with Authority Pre-Revenue Operations schedules. Coordination shall occur through the Engineer and will be in accordance with Section 01781, "Maintenance and Protection of Authority Traffic" and Section 00700, Article 13.14.
- II. Should situations arise with Authority's Operations which require Authority's immediate attention to maintain Operations, Authority reserves the rights to cancel Contractor's scheduled work within the existing system, OCC and/or Pitt Tower, in order to facilitate Authority requirements to support Operations.
- JJ. Authority has deleted the bored tunnel internal concrete arch lining and waterproofing work from the NSC-003/006 contract. The Contractor shall be required to mount NSC-009 facilities including, but not limited to: conduit, emergency walkways, standpipes, catenaries, and signals to the bored tunnel precast segmental rings. The precast segment reinforcing and geometry Shop Drawings have been included with Appendix C. The Contractor shall be allowed a 3 inch maximum embedment depth into the tunnel segment. All NSC-009 facility attachment locations shall be positioned 4 inches minimum distance from any/all tunnel segmental joint. The tunnel segment concrete design strength is 8,000 psi minimum with actual strength values in the range of 12,000 psi, the tunnel segments have drilling location indicators to allow the Contractor to identify areas free of reinforcing steel (see Submittal 349.6 in Appendix C), and the Contractor shall be allowed to provide attachments to the segment longitudinal installation bolts. The Contractor shall account for the bored tunnel segment requirements in its plan and execution of Work.

2.2 Project Schedule

A. Preliminary Project Schedule

1. The Contractor shall develop and submit for review and approval by the Engineer a preliminary Project Schedule in bar chart format, within fifteen (15) days after receipt of the Notice of Award.
2. This preliminary Project Schedule shall show the Contractor's planned operations for the first ninety (90) days including dates for construction operations, submittals and acquiring permits. The Contractor shall also include a preliminary schedule logic narrative stating the general basis of schedule logic and the Contractor's general approach to the remainder of the Work.

B. Project Schedule

1. The Contractor shall submit for review and approval by the Engineer a Project Schedule and a logic narrative, for the entire duration of the Work, within thirty (30) days after receipt of the Notice to Proceed. The approved preliminary Project Schedule shall be incorporated into the Project Schedule in its entirety.
2. The Project Schedule, and any updates thereto, shall show a logical and coordinated sequence of construction activities. The Project Schedule shall incorporate and identify the following:
 - a) Required completion dates and intermediate required completion dates;

North Shore Connector

North Shore Connector, North Side Tunnels & Station Shell (NSC-003/006), Gateway Station Shell (NSC-004 R), Aerial Structure, Retained Fill, and Demolition of Miller Printing (NSC-007), and Advanced Rail Systems Procurement – Gateway Double Crossover (Contract No. 3002) Construction Update, as of August 11, 2008

Contract NSC-003/006, NSC-004 R, NSC-007, and Contract No. 3002 are currently under construction and will interface with the NSC-009 Work. As a result of the NSC-003/006, NSC-004 R, NSC-007, and Contract No. 3002 construction activities, changes to the NSC-003/006, NSC-004 R, NSC-007, and Contract No. 3002 Contract

Documents have occurred. Known changes include, but are not limited to, utility installations, temporary facility design and installation, cut and cover and bored tunnel design and construction, maintenance and protection of traffic and detour installation and phasing, and Double Crossover Shop Drawings and submittals. The Contractor shall coordinate with the NSC-003/006, NSC-004 R, NSC-007, and Contract No. 3002 contractors and the Engineer to obtain current information before Contractor begins work which could be affected by the NSC-003/006, NSC-004 R, NSC-007, and Contract No. 3002 construction activities.

Table C-1 provides a list of North Shore Connector, North Side Tunnels & Station Shell (NSC-003/006), Gateway Station Shell (NSC-004 R), Aerial Structure, Retained Fill, and Demolition of Miller Printing (NSC-007), and Advanced Rail Systems Procurement – Gateway Double Crossover (Contract No. 3002) Construction Submittals. Submittals and/or portions of Submittals reflecting NSC-003/006, NSC-004 R, NSC-007, and Contract No. 3002 contractor design elements having impact on the NSC-009 Bid are bold and attached as part of Appendix C. Further information on the progress of the NSC-003/006, NSC-004 R, NSC-007, and Contract No. 3002 construction is contained in Table C-1 and available for purchase in accordance with Section 00200, Article 2.6.

Table C-1

Submittal Number	Description	Contract
S-001	Early Procurement Contract IJ Location Drawings	Contract No. 3002
S-040.1	Precast Concrete Segmental Tunnel Lining – Shop Drawings	NSC-003/006
S 349.6	Precast Segment Reinforce Steel Erection Drawing	NSC-003/006

TriGold
Three Gateway Center, 15E, Suite 1550
Pittsburgh, PA 15222
412-497-6250 Office 412-497-6080 Fax

Transmittal # T676 NSC-03/06

TRANSMITTAL MEMORANDUM

To: NSC-JV
DL Clark Building, Second Floor
503 Martindale Street
Pittsburgh, PA 15212
Attn: Mr. Paul Zick

Date: September 14, 2007
FTA Project PA-03-0315
Contract Name N. Side Tunnels & Station Shell
Contract # NSC-003/006

We are forwarding the following: Attached Under Separate Cover

DRAWING NUMBER OR DOCUMENT	NO. COPIES	TITLE OR DESCRIPTION	COMMENTS
03410-1.04.A	<u>2</u>	Precast Concrete Segmental Tunnel Lining – Shop Drawings (S040.1)	See attached sheets

THESE ARE TRANSMITTED AS INDICATED:

SENT BY:

- As Requested Approved as Submitted Certified Mail Air Express
 For Your Information Approved as Noted Priority Mail United Parcel
 For Review and Comment Revise and Resubmit Mail FAX
 Comments Noted Reject and Resubmit Hand Carried Messenger

NOTES: Further to the receipt of the above Submittal 040.1 and the attached drawings, on 12th June 2007, we have reviewed these drawings and confirm that these drawings are accepted as noted subject to the satisfactory conclusion of Submission-285 and S-285.1, which was responded to on the 6/5/07 and 6/8/07 respectively.

CC: Project Files
K. Sheahen – DMJM+Harris
K. Thompson – PAAC

BY: 
TriGold

**Obayashi/Trumbull: NSC-003/006 Contract – Submittal Comments
Submittal # S040.1-R00-NSC-003/006-03410-
Submittal Description: Precast Concrete Segmental Tunnel Lining – Shop Drawings**

North Shore Constructors - Obayashi Trumbull JV
503 Martindale St,
DL Clark Building, 2nd Floor
Pittsburgh, PA 15212
Ph 412-462-9300 Fax 412-462-3002

RECEIVED

MAY 30 2007

McGold
Gateway Center, 2W

Submittal No. 0070-01-003/006-03410-1.04 A(seq-rev-contract#/spec#/Article#)

TRANSMITTAL MEMORANDUM

To: Trigold

Date: 5/29/07

Three Gateway Center, Suite 2W

FTA Project PA-03-0315

Pittsburgh, PA 15222

Contract Name N. Side Tunnels & Station Shell

Attn: Dwight Chewning

Contract # NSC-003/006

We are forwarding the following:

Attached

Under Separate Cover

DRAWING NUMBER OR DOCUMENT	NO. COPIES	TITLE OR DESCRIPTION	COMMENTS
Spec 03410	5	Precast Concrete Segmental Tunnel Lining - Shop Drawings	re-issued for approval (6+1 configuration)

THESE ARE TRANSMITTED AS INDICATED:

SENT BY:

- | | | | |
|--|--|--|--|
| <input type="checkbox"/> As Requested | <input type="checkbox"/> Approved as Submitted | <input type="checkbox"/> Certified Mail | <input type="checkbox"/> Air Express |
| <input type="checkbox"/> For Your Information | <input type="checkbox"/> Approved as Noted | <input type="checkbox"/> Priority Mail | <input type="checkbox"/> United Parcel |
| <input checked="" type="checkbox"/> For Review and Comment | <input type="checkbox"/> Revise and Resubmit | <input checked="" type="checkbox"/> Mail | <input type="checkbox"/> FAX |
| <input type="checkbox"/> Comments Noted | <input type="checkbox"/> Reject and Resubmit | <input checked="" type="checkbox"/> Hand Carried | <input type="checkbox"/> Messenger |

NOTES:

5040.1

CC: 390100 Jobfile
Jobsite,

North Shore Constructors - JV

BY:

OBAYASHI/TRUMBULL J.V.
NORTH SHORE CONSTRUCTORS
CONTRACT NO. NSC-003/006
03410 PRECAST CONCRETE SEGMENTAL FUNNEL LINING_revision 1 (drawing revision 4)

**OBAYASHI/TRUMBULL
NORTH SHORE
CONSTRUCTORS
CONTRACT NO. NSC -003/006**

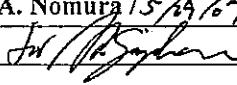
RECEIVED
MAY 30 2007
TriGold
Gateway Center, 2W
Pittsburgh PA

SPEC SECTION 03410

Article 1.04 A

SEGMENT RING SHOP

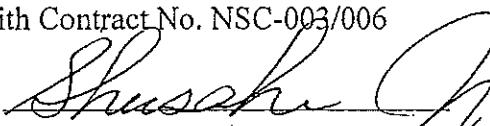
DRAWINGS

Revision	Prepared by		NOTE	Endorsed By / Date
0	Technopref Industry Inc.			A. Nomura / 10/30/06
1	Technopref Industry Inc.	(DWG Revision 4)		A. Nomura 15/09/07 

Expedited review is requested for this submittal.

In Accordance with the Contract Requirement, G.C. 01300, Article 1.6,
I hereby certify the submitted Drawings & Data have been verified
to comply with Contract No. NSC-003/006

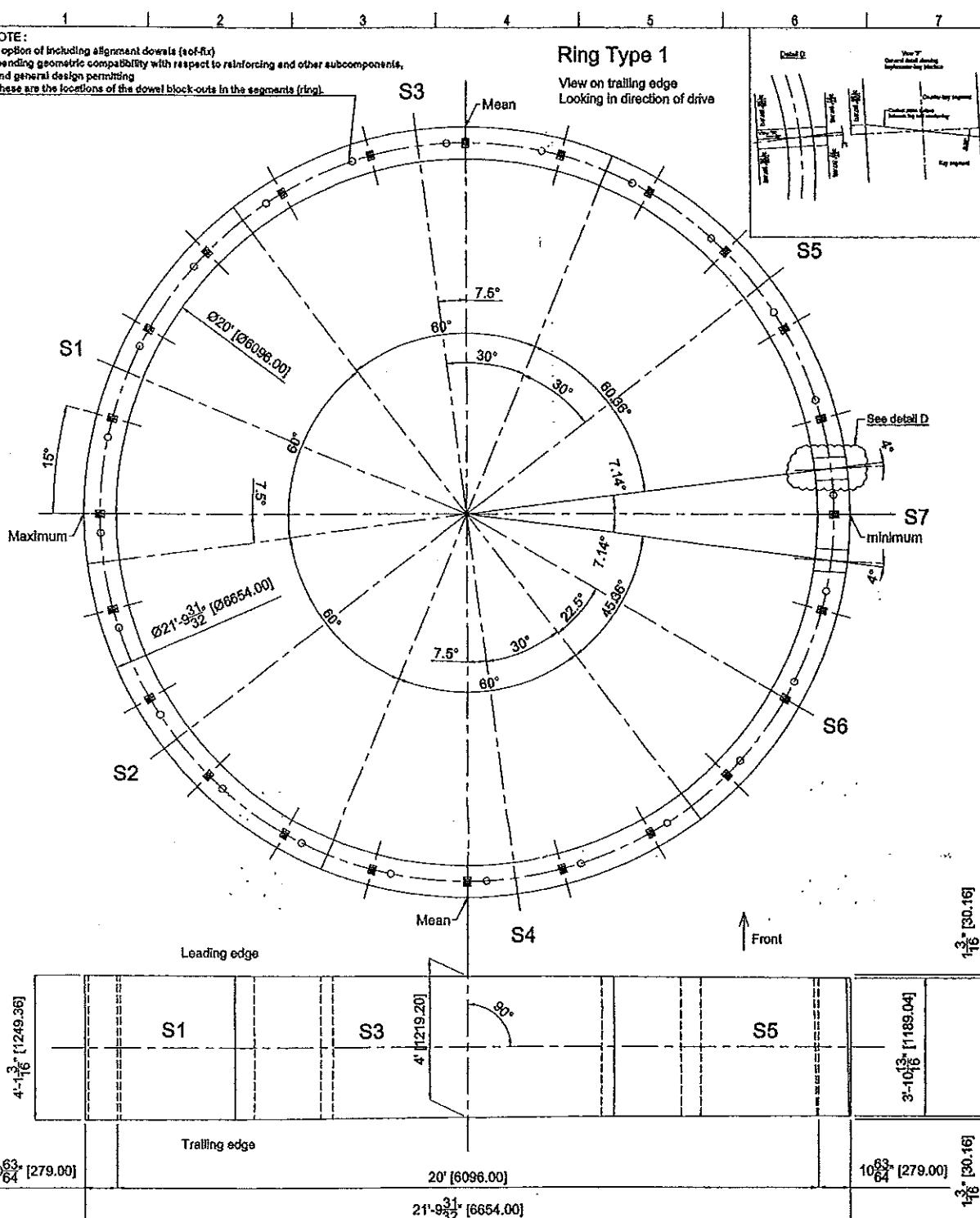
Certified By

 Date 5-24-07

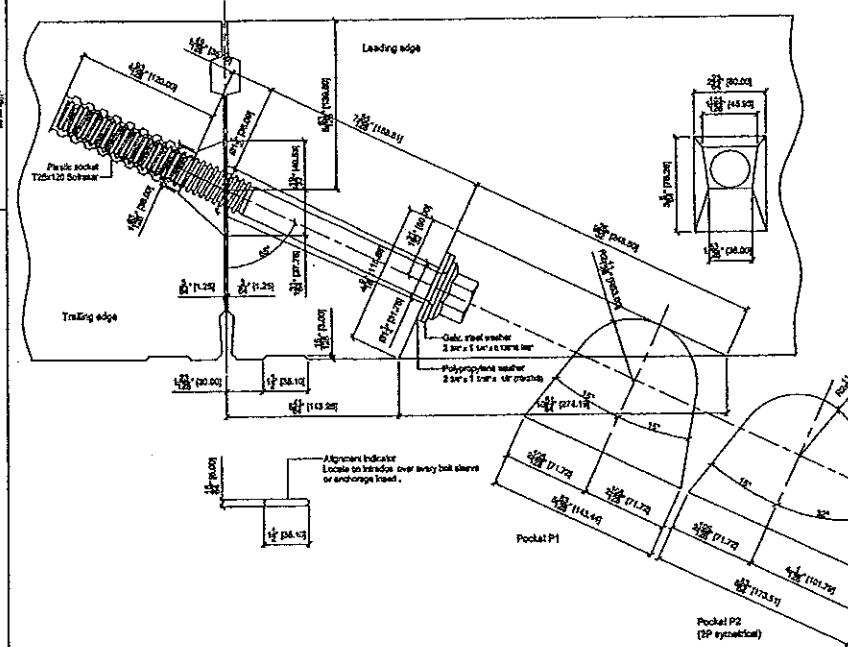
NOTE:
In option of including alignment dowels (not fix)
- pending geometric compatibility with respect to reinforcing and other subcomponents,
and general design permitting
These are the locations of the dowel block-outs in the segments (ring).

Ring Type 1

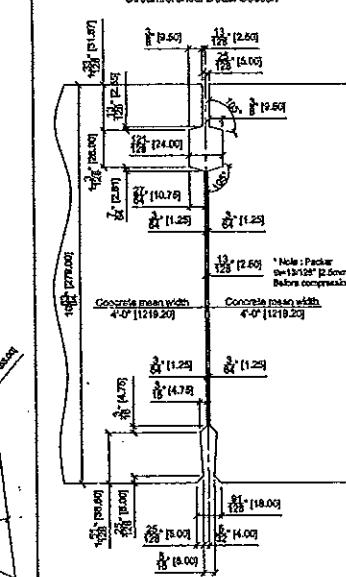
**View on trailing edge
Looking in direction of drive**



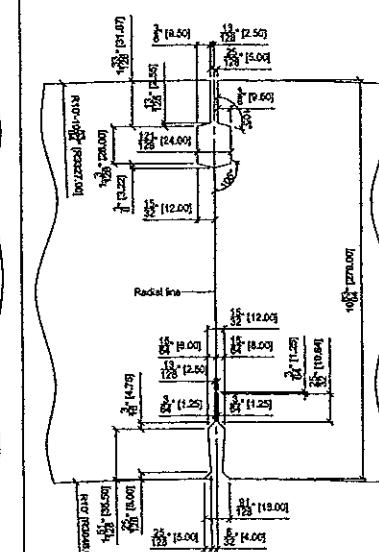
Circumferential Joint Connectors



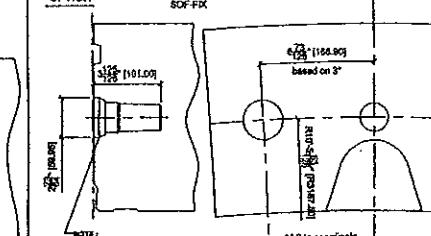
Circumferential Datalink Section



Radial Detail Section



OPTION Confidential Joint Connection Detail



4	Re-issued for approval	2007-05-24	B.M.
3	General revision for NSCJW review	2007-03-23	B.M.
2	General revision	2007-03-07	B.M.
1	Updated , issued for approval	2006-10-26	B.M.
0	Issued for approval	2006-10-24	B.M.
No.	Revisions	Date	By

No.	NOTES
1	MATERIALS: Concrete f_c' (28 days) = 8000 psi
2	ARRANGEMENTS: Crating, Indicators and TBA's specific arrangements

**PORT AUTHORITY OF
ALLEGHENY COUNTY**

ENGINEERS DMJM HARRIS - AECOM
FOUR GATEWAY CENTER
20TH FLOOR
BUTTERFIELD, IL 60520

CONTRACTOR **NORTH SHORE CONSTRUCTION**
 **OBAYASHI TRUMBULL JV**
CLARK BUILDING

PRECAST TUNNEL LINER MANUFACTURER
Technopref TECHNOPREF INDUSTRIES
INDUSTRIES

Project PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SHORE CONNECTOR
NORTH SIDE TUNNELS AND STATION SH
CONTRACT NO. NSC - 003/006
ALLEGHENY RIVER TUNNEL
LAUNCH PIT TO RECEIVING PIT

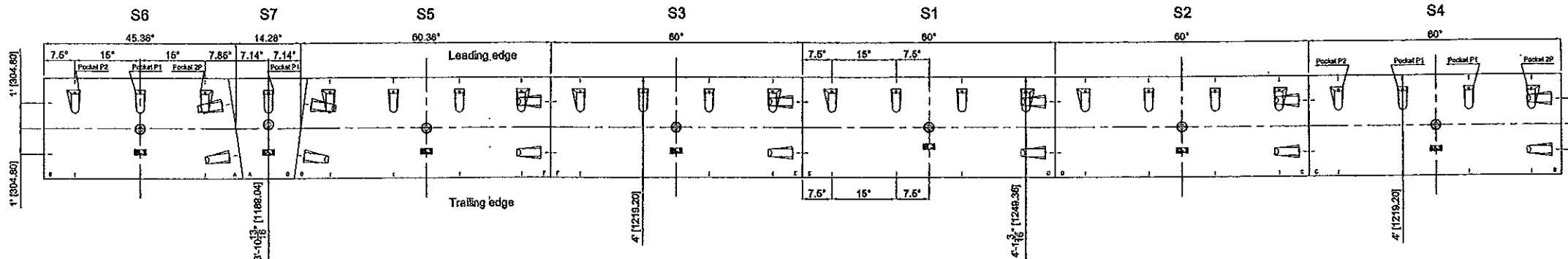
(NSC ~ D03)

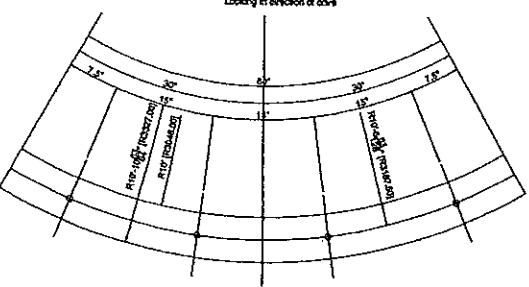
RING TYPE 1 DEFINITION
2 3/8" TAPERED RING / + 1 3/16": - 1 3/

Drawn	A.C.	Revision	4
Checked	L.G.	IFB N°	0000/EPU/00
Approved		Sheet number	

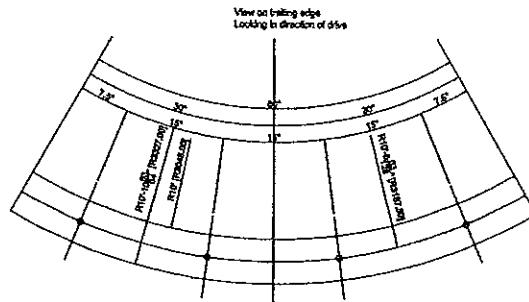
Scale / EPU.0001
17

DEVELOPED PLAN OF INTRABOD



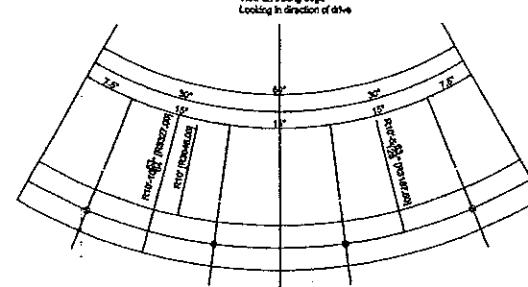


S3 Ring Type 1

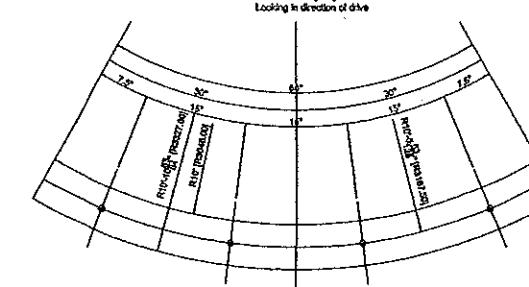


S1 Ring Type

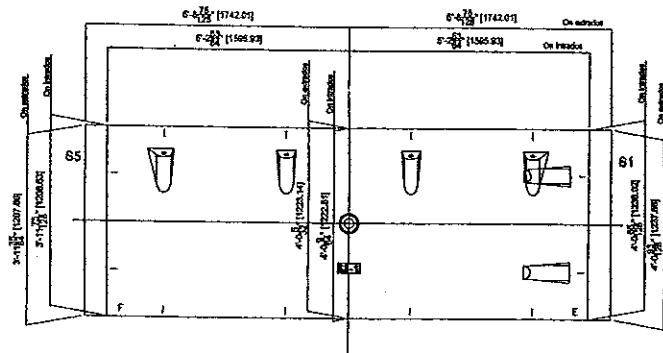
DEVELOPED VIEWS OF THE SEGMENT



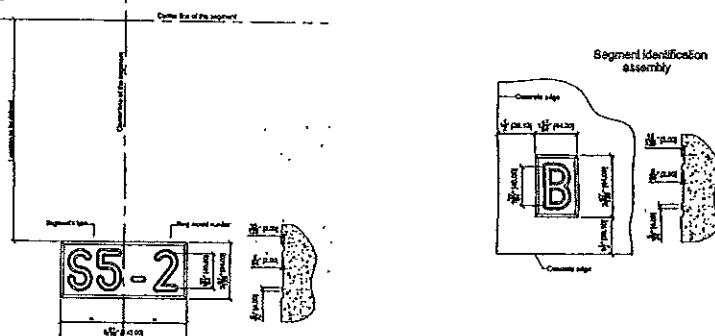
S2 Ring Type



S4 Ring Type 1

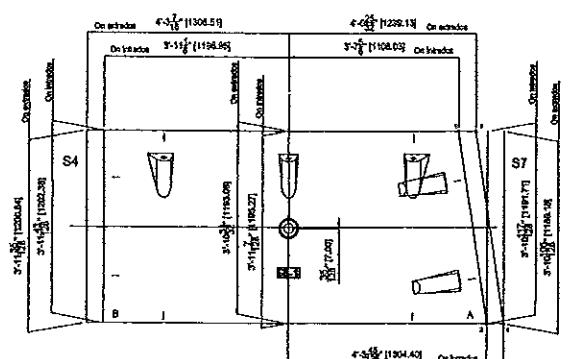


Document Identification



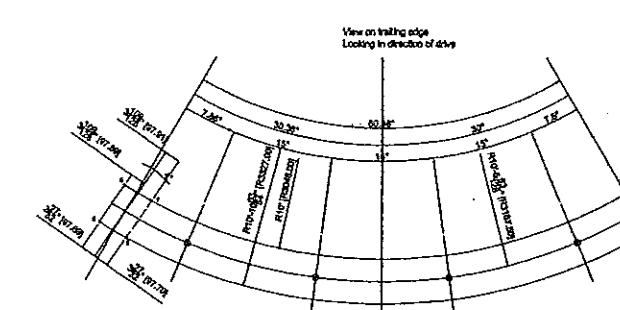
The diagram illustrates the airfoil parameters and lift distribution for a wing section. It shows the chord line, leading edge, trailing edge, and the camber line. The camber is labeled as 1.5% of chord. The leading edge is labeled with 7.4°. The trailing edge is labeled with 1.8°. The airfoil is divided into four segments by vertical lines: the first segment from the leading edge to the first vertical line is labeled 'Root camber'; the second segment is labeled 'Root camber'; the third segment is labeled 'Tip camber'; and the fourth segment is labeled 'Tip camber'. The angle of attack is indicated as 10°. The lift distribution is shown as a series of arcs above the airfoil, with values: 40.0° at the leading edge, 22.4° at the first vertical line, 45.0° at the second vertical line, 23.8° at the third vertical line, and 1.8° at the trailing edge. The total lift coefficient is given as 1.05 C_L. The diagram also includes a coordinate system with x and y axes.

S6 Ring Type 1

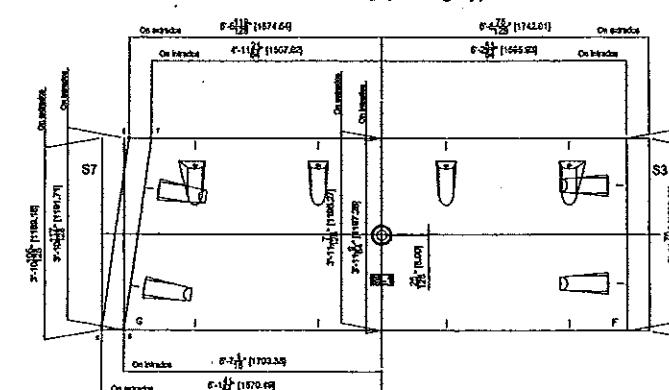


S7 Ring Type

DEVELOPED VIEWS OF THE SEGMENT



S5 Ring Type 1



4	Re-issued for approval	2007-05-24	B.M.
3	General revision for NSCJV review	2007-03-23	B.M.
2	General revision	2007-03-07	B.M.
1	Updated, Issued for approval	2006-10-26	B.M.
0	Issued for approval	2006-10-24	B.M.
No.	Revisions	Date	By

No. **NOTES**

- 1 MATERIALS:**
Concrete f' (28 days) = 8000 psi

2 ARRANGEMENTS:
Drilling Indicators and TBM's specific arrangements

OWNER PORT AUTHORITY OF
ALLEGHENY COUNTY

ENGINEERS DMJM HARRIS - AECOM
FOUR GATEWAY CENTER
20TH FLOOR
BOSTON, MA 02109

PITTSBURGH, PA 15222

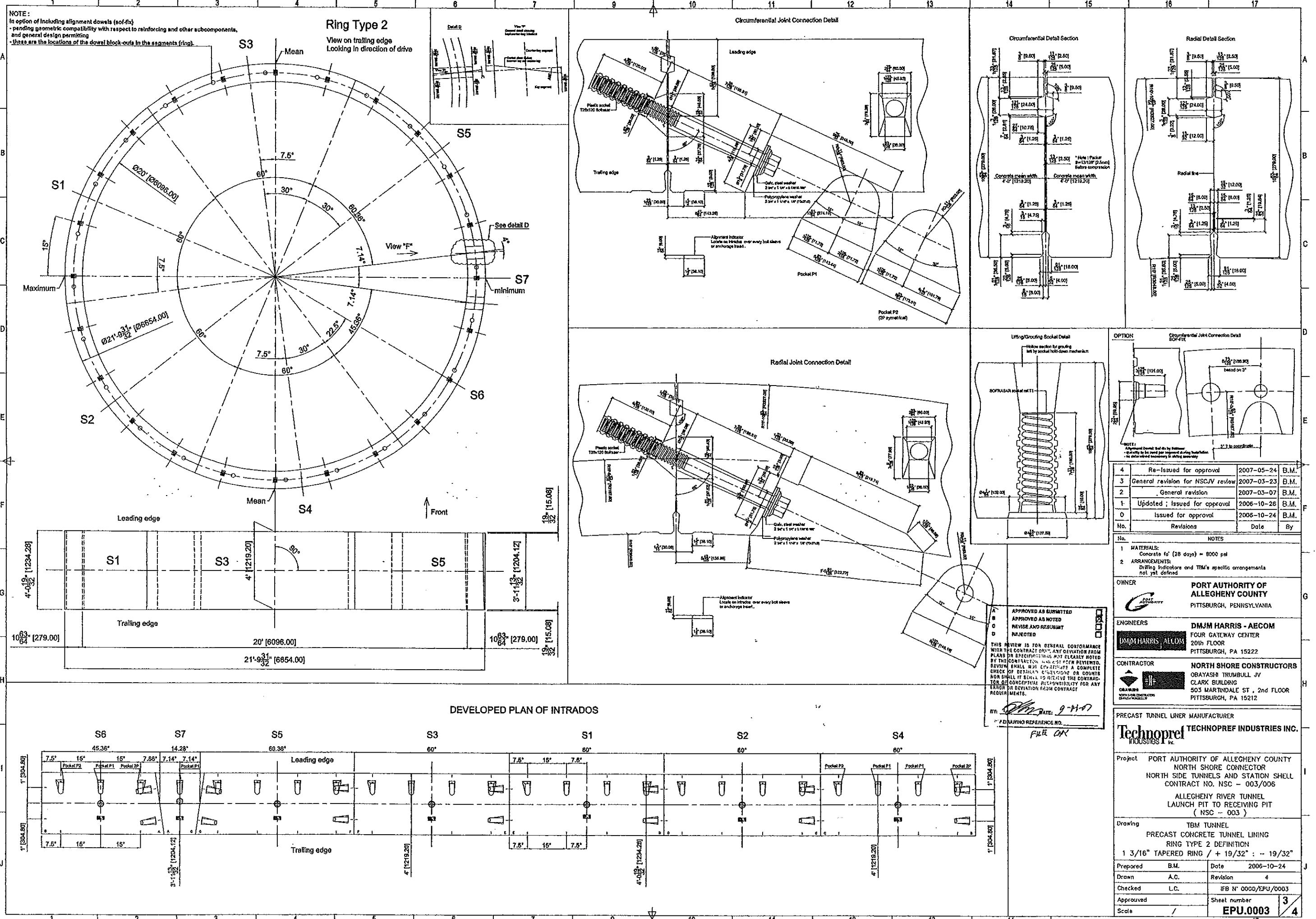
CONTRACTOR	NORTH SHORE CONSTRUCTORS
	OBAYASHI TRUMBULL JV
	CLARK BUILDING
	503 MARTINDALE ST., 2nd FLOOR
	PITTSBURGH, PA 15222

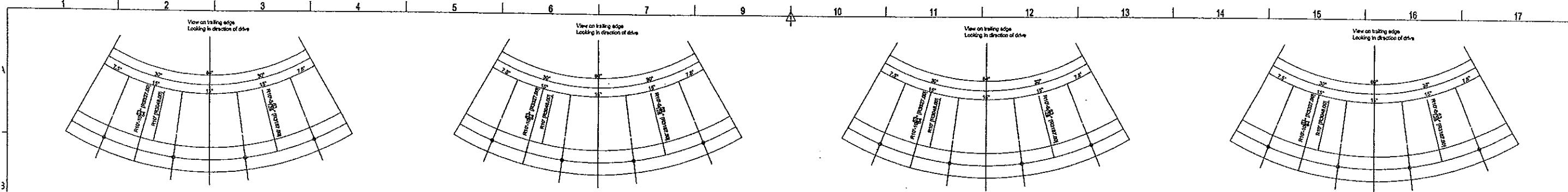
PREFAB TUNNEL LINER MANUFACTURER

TECHNOPREF INDUSTRIES INC.
PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SHORE CONNECTOR
NORTH SIDE TUNNELS AND STATION SHELL
CONTRACT NO. NSC - 003/006
ALLEGHENY RIVER TUNNEL
LAUNCH PIT TO RECEIVING PIT

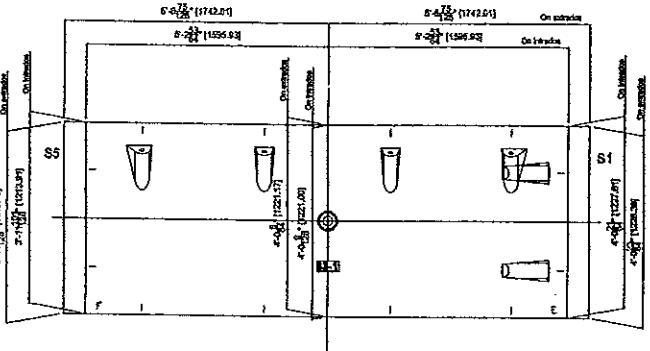
Drawing TBM TUNNEL
PRECAST CONCRETE TUNNEL LINING
RING TYPE 1 - SEGMENT DEFINITIONS
3-1/2" TAPERED CHG. 6-1/2" 11-1/2"

Prepared	B.M.	Date	2006-10-24
Drawn	A.C.	Revision	4
Checked	L.C.	IFB N° 0000/EPU/0002	
Approved		Sheet number	2
Scale	/	EPU.0002	

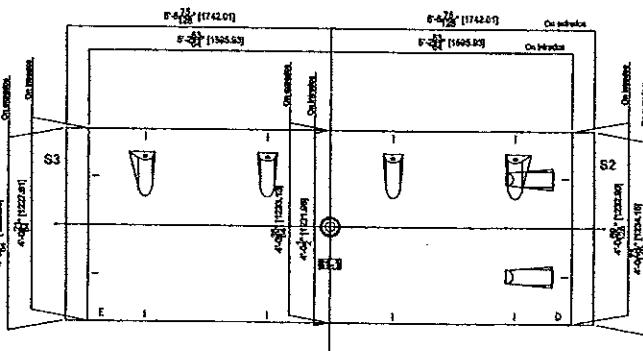




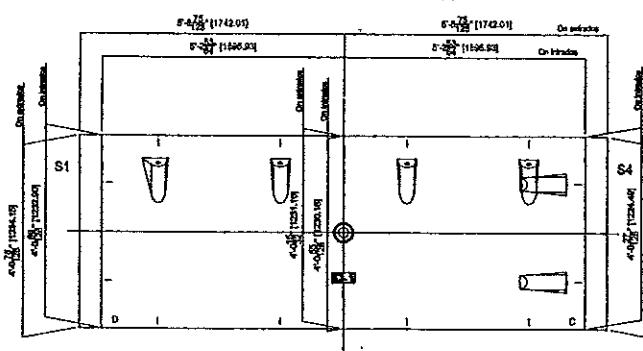
S3 Ring Type 2



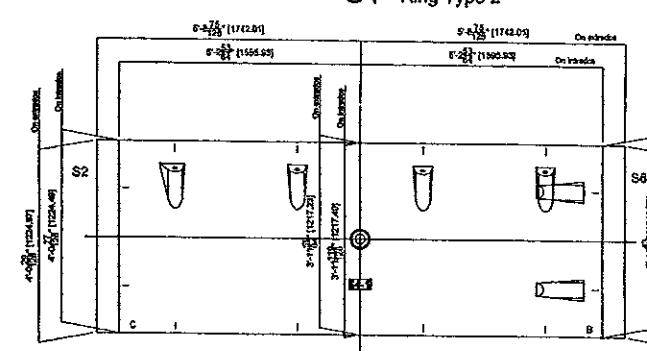
S1 Ring Type 2



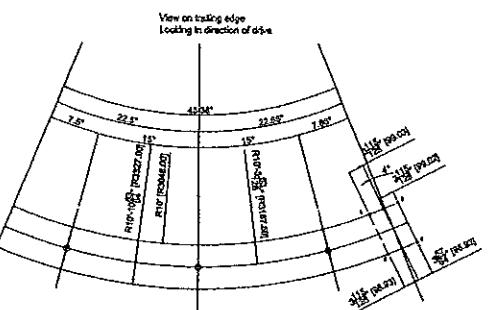
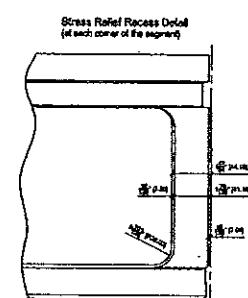
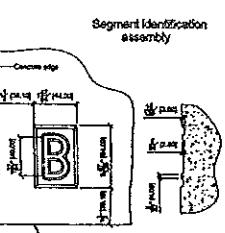
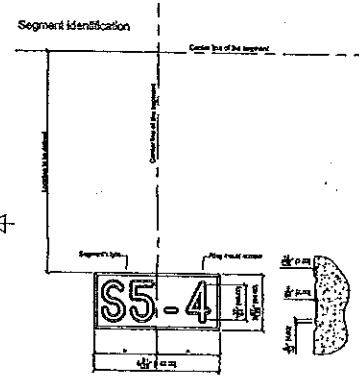
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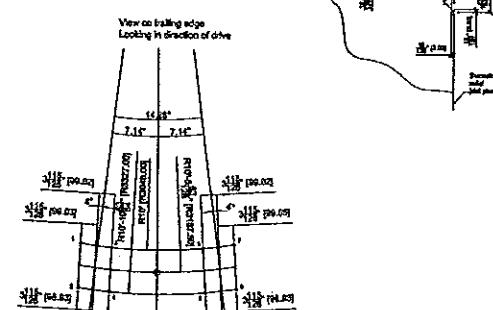
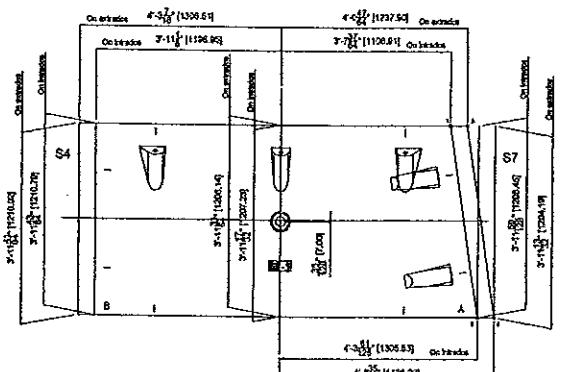
S4 Ring Type 2



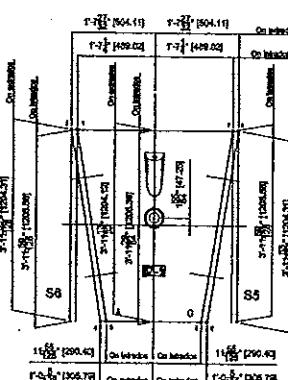
DEVELOPED VIEWS OF THE SEGMENTS



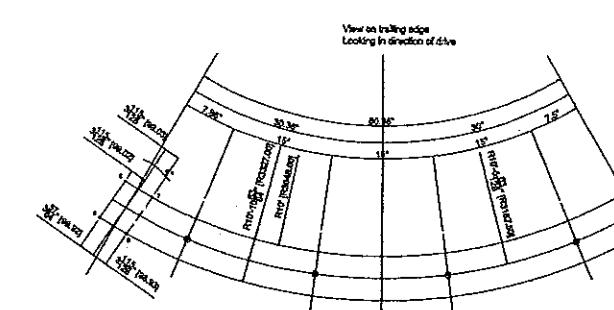
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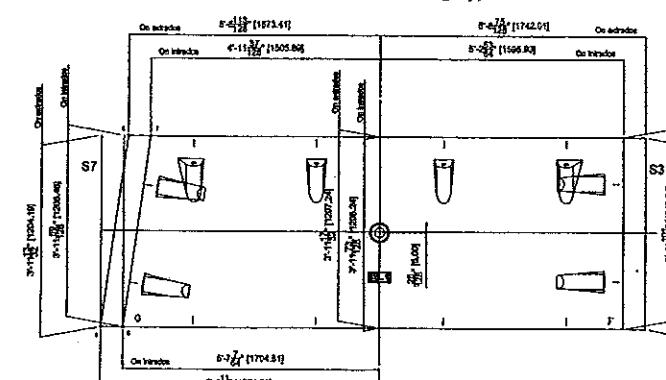
S7 Ring Type 2



DEVELOPED VIEWS OF THE SEGMENTS



S5 Ring Type 2



A APPROVED AS SUBMITTED
B APPROVED AS NOTED
C REVISE AND RESUBMIT
D REJECTED

THIS REVIEW IS FOR GENERAL CONFORMANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS. IT IS NOT CLEARLY NOTED THAT THE CONTRACTOR HAS MADE ANY CHANGES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY CONSTRUCTION ERROR OR DEFICIENCY.

BY: [Signature] DATE: 9-4-07
**CO DRAWING REFERENCE NO. [Signature]

FILE COPY

4	Re-Issued for approval	2007-05-24	B.M.
3	General revision for NSC JV review	2007-03-23	B.M.
2	- General revision	2007-03-07	B.M.
1	Updated, Issued for approval	2006-10-26	B.M.
0	Issued for approval	2006-10-24	B.M.
No.	Revisions	Date	By

NOTES
1 MATERIALS:
Concrete f'c' (28 days) = 6000 psi
2 ARRANGEMENTS:
Driving indicators and TBM's specific arrangements
not yet defined

OWNER
 PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH, PENNSYLVANIA

ENGINEERS
 DJKM HARRIS + AECOM
FOUR GATEWAY CENTER
20TH FLOOR
PITTSBURGH, PA 15222

CONTRACTOR
 NORTH SHORE CONTRACTORS
OBAYASHI TRUMBULL JV
CLARK BUILDING
503 MARTINDALE ST., 2ND FLOOR
PITTSBURGH, PA 15212

PRECAST TUNNEL LINER MANUFACTURER
 Technopref INDUSTRIES INC.
INDUSTRIES INC.

Project PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SIDE TUNNELS AND STATION SHELL
CONTRACT NO. NSC - 003/006
ALLEGHENY RIVER TUNNEL
LAUNCH PIT TO RECEIVING PIT
(NSC - 003)

Drawing TBM TUNNEL
PRECAST CONCRETE TUNNEL LINING
RING TYPE 2 - SEGMENT DEFINITIONS
1 3/16" TAPERED RING / + 19/32" : - 19/32"

Prepared B.M. Date 2006-10-24
Drawn A.C. Revision 4

Checked L.C. IFB N° 0000/EPU/0004

Approved Sheet number 4

Scale / EPU.0004 4

17

North Shore Constructors - Obayashi Trumbull JV
503 Martindale St,
DL Clark Building, 2nd Floor
Pittsburgh, PA 15212
Ph 412-462-9300 Fax 412-462-3002

Submittal No. 0632-06-003/006-03410

TRANSMITTAL MEMORANDUM

RECEIVED

MAR 14 2008

TriGold
Gateway Center, 2W
Pittsburgh, PA

To: Trigold Date: 3/12/08
Three Gateway Center, Suite 2W
Pittsburgh, PA 15222 Contract Name N. Side Tunnels & Station Shell

Attn: Dwight Chewning Contract # NSC-003/006

We are forwarding the following: Attached Under Separate Cover

DRAWING NUMBER OR DOCUMENT	NO. COPIES	TITLE OR DESCRIPTION	COMMENTS
Spec 03410	5	Precast Segment reinforce steel erection drawing	ammendments - a final lump sum package

THESE ARE TRANSMITTED AS INDICATED:

SENT BY:

- As Requested Approved as Submitted Certified Mail Air Express
 For Your Information Approved as Noted Priority Mail United Parcel
 For Review and Comment Revise and Resubmit Mail FAX
 Comments Noted Reject and Resubmit Hand Carried Messenger

NOTES:

changes presented in a final lump sum package - final solution to the reinforcing scheme

CC: 390100 Jobfile, Jobsite

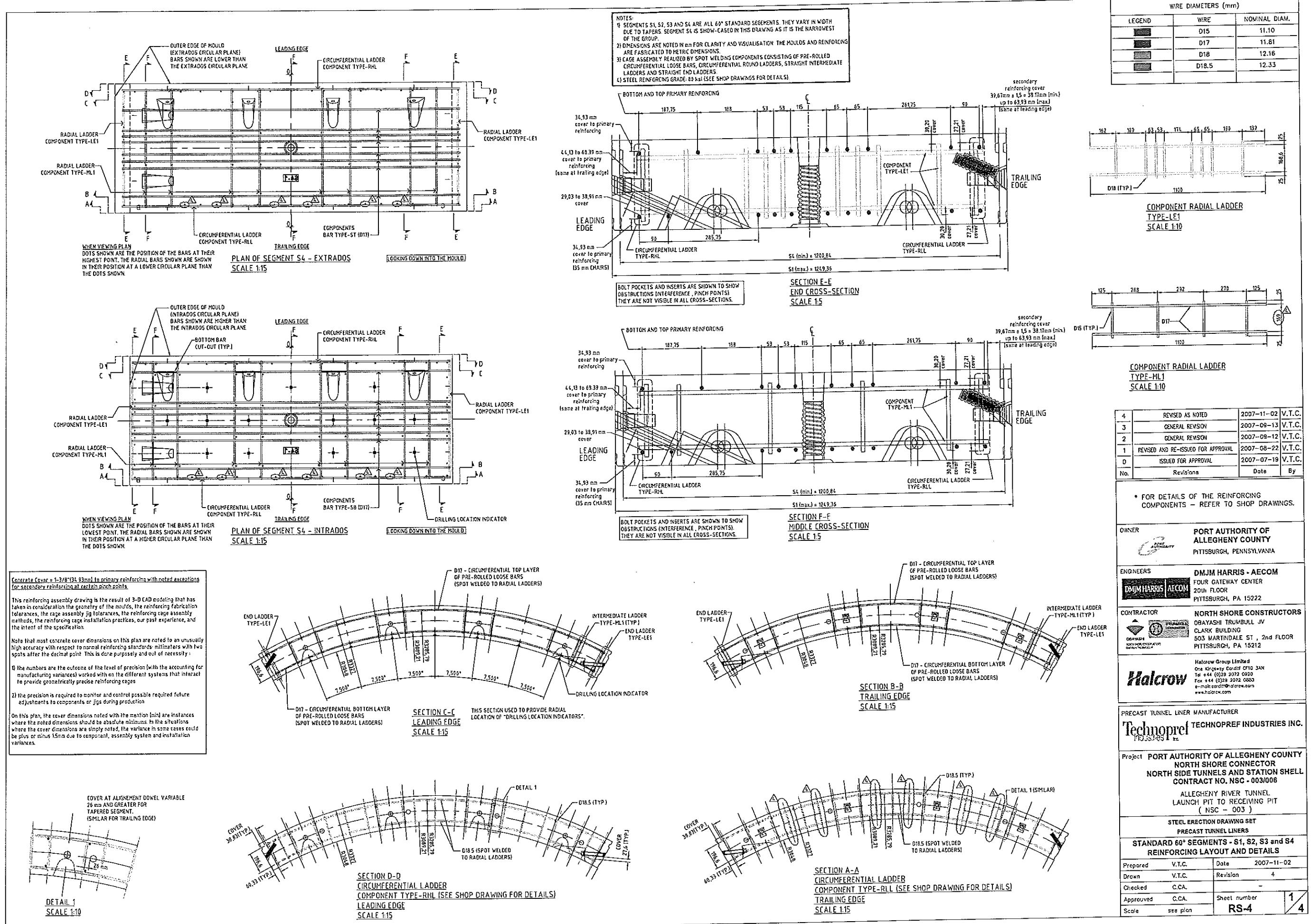
5349.6

North Shore Constructors

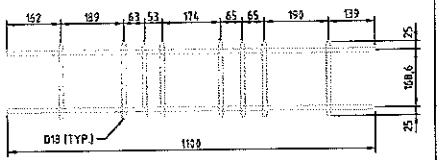
BY: A. Neumann

In Accordance with the Contract Requirements, G.C. 01300, Article 1.6,
I hereby Certify the Submitted Drawings & Data have been verified
To Comply with Contract No. NSC-003/006

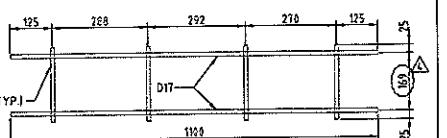
Certified By John A. Neumann Date 3-18-08



WIRE DIAMETERS (mm)		
LEGEND	WIRE	NOMINAL DIAM.
D15	WIRE	11.10
D17	WIRE	11.81
D18	WIRE	12.16
D18.5	WIRE	12.33



COMPONENT RADIAL LADDER
TYPE-LE1
SCALE 1:10



COMPONENT RADIAL LADDER
TYPE-ML1
SCALE 1:10

4	REVISED AS NOTED	2007-11-02	V.T.C.
3	GENERAL REVISION	2007-09-13	V.T.C.
2	GENERAL REVISION	2007-09-12	V.T.C.
1	REVISED AND RE-ISSUED FOR APPROVAL	2007-08-22	V.T.C.
0	ISSUED FOR APPROVAL	2007-07-19	V.T.C.
No.	Revisions	Date	By

* FOR DETAILS OF THE REINFORCING
COMPONENTS - REFER TO SHOP DRAWINGS.

OWNER
[Signature]
PORT AUTHORITY OF
ALLEGHENY COUNTY
PITTSBURGH, PENNSYLVANIA

ENGINEERS
DMJM HARRIS - AECOM
FOUR GATEWAY CENTER
20th FLOOR
PITTSBURGH, PA 15222

CONTRACTOR
NORTH SHORE CONSTRUCTORS
OBAYASHI TRUMBULL JV
CLARK BUILDING
503 MARTINDALE ST., 2nd FLOOR
PITTSBURGH, PA 15212

Halcrow Group United
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Tel +1 212 557 3000
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e-mail: halcrow@halcrow.com
www.halcrow.com

PRECAST TUNNEL LINER MANUFACTURER
Technopref TECHNO PREF INDUSTRIES INC.
HOUSSES & CO.

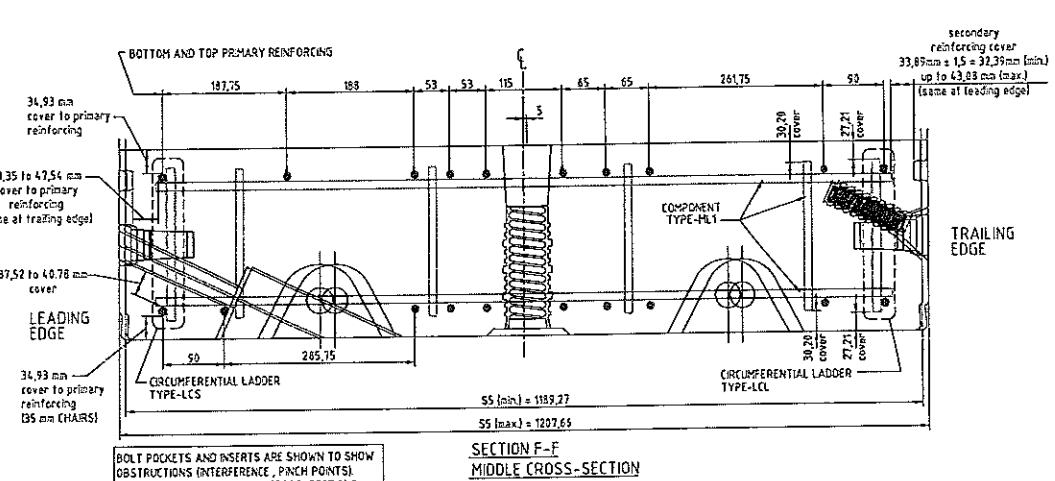
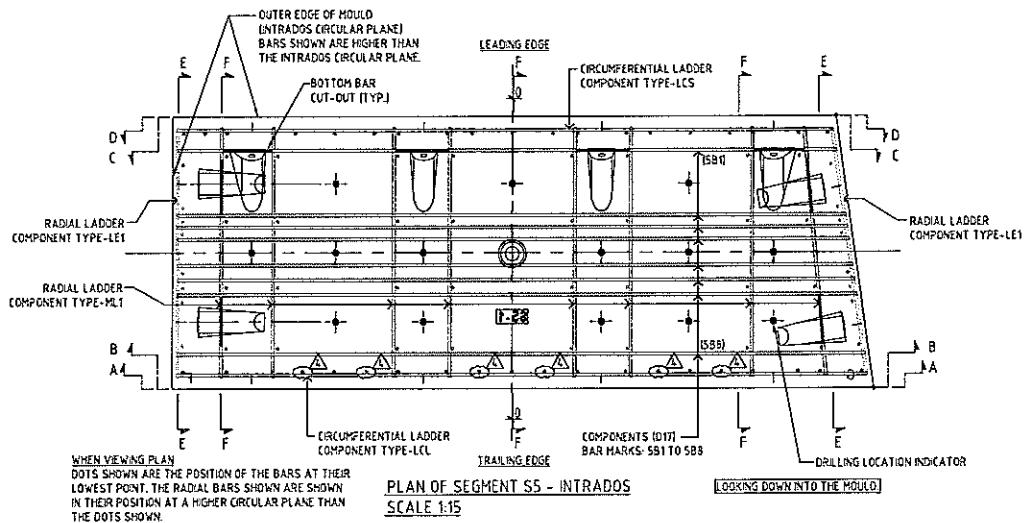
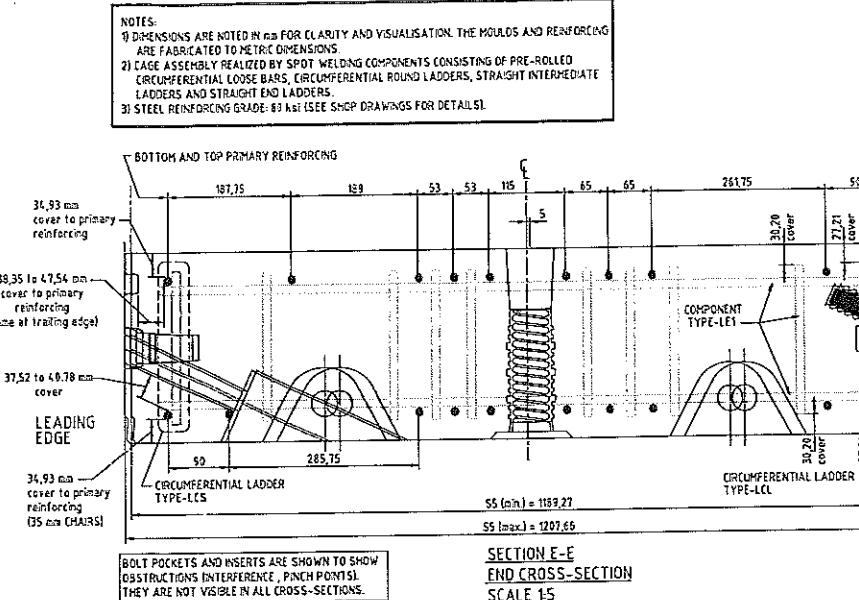
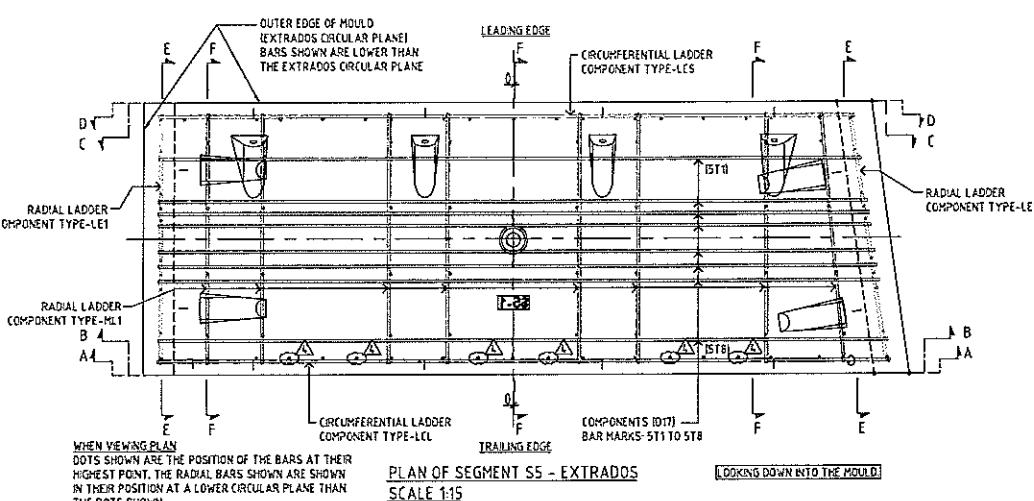
Project PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SHORE CONNECTOR
NORTH SIDE TUNNELS AND STATION SHELL
CONTRACT NO. NSC - 003/006

ALLENTOWN RIVER TUNNEL
LAUNCH PIT TO RECEIVING PIT
(NSC - 003)

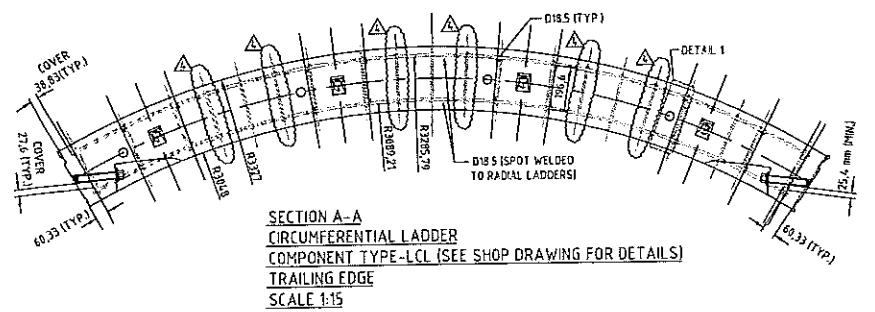
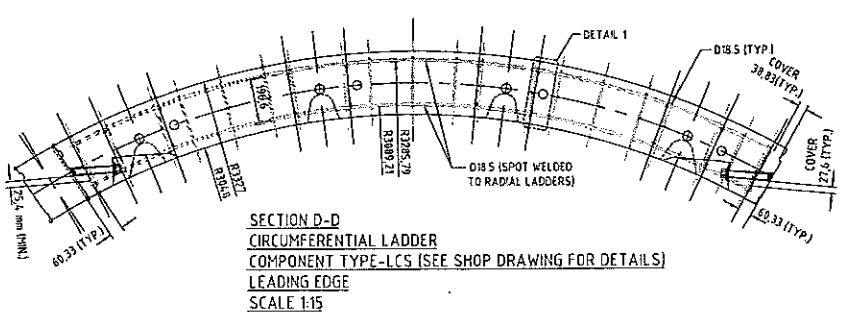
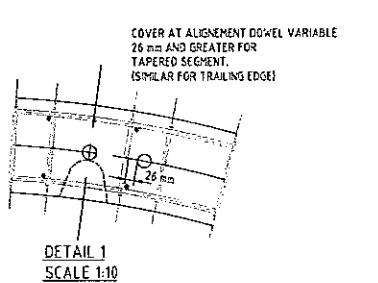
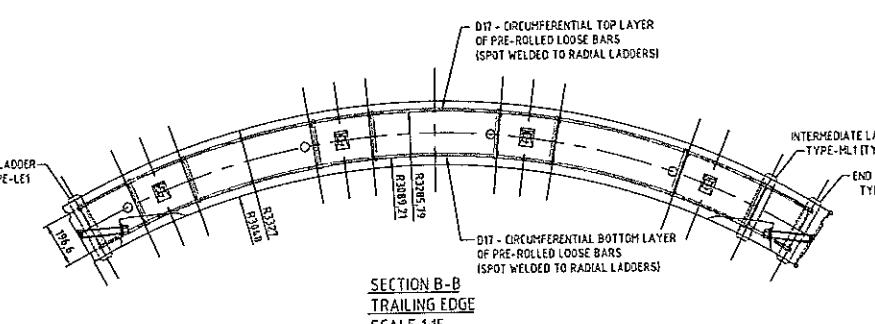
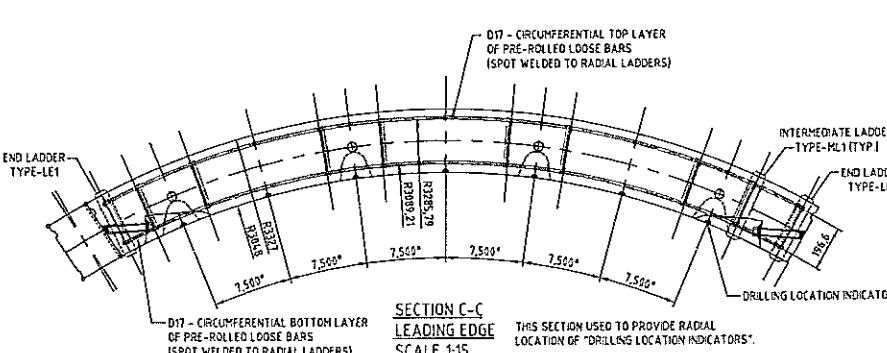
STEEL ERECTION DRAWING SET
PRECAST TUNNEL LINERS

SEGMENT S5 - LARGE COUNTER-KEY [60.36°]
REINFORCING LAYOUT AND DETAILS

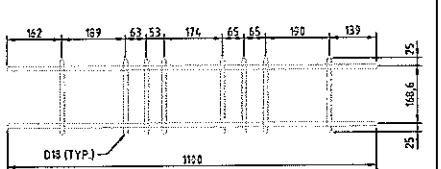
Prepared	V.T.C.	Date	2007-11-02
Drawn	V.T.C.	Revision	4
Checked	C.C.A.	-	
Approved	C.C.A.	Sheet number	
Scale	see plan	RS-5	2/4



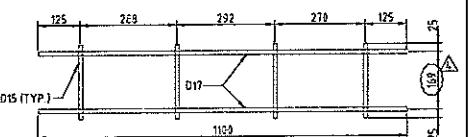
Concrete Cover = 1-3/8" (35.93mm) to primary reinforcing with noted exceptions for secondary reinforcing at certain pinch points.
This reinforcing assembly drawing is the result of 3-D CAD modeling that has taken in consideration the geometry of the moulds, the reinforcing fabrication tolerances, the cage assembly fit tolerances, the reinforcing cage assembly methods, the reinforcing cage installation practices, our past experience, and the intent of the specification.
Note that most concrete cover dimensions on this plan are noted to an unusually high accuracy with respect to normal reinforcing standards: numerals with two spots after the decimal point. This is done purposely and out of necessity:
1) the numbers are the outcome of the level of precision (with the accounting for manufacturing variances) worked with in the different systems that interact to provide geometrically precise reinforcing cages
2) the precision is required to monitor and control possible required future adjustments to components or jigs during production.
On this plan, the cover dimensions noted with the notation (min) are instances where the noted dimensions should be absolute minimums. In the situations where the cover dimensions are simply noted, the variance in some cases could be plus or minus 15mm due to component, assembly system and installation variances.



WIRE DIAMETERS (mm)		
LEGEND	WIRE	NOMINAL DIAM.
D15	WRE	11.10
D17		11.81
D18		12.16
D18.5		12.33



COMPONENT RADIAL LADDER
TYPE-LE1
SCALE 1:10



COMPONENT RADIAL LADDER
TYPE-ML1
SCALE 1:10

4	REVISED AS NOTED	2007-11-02	V.T.C.
3	GENERAL REVISION	2007-09-13	V.T.C.
2	GENERAL REVISION	2007-09-12	V.T.C.
1	REVISED AND RE-ISSUED FOR APPROVAL	2007-08-22	V.T.C.
0	ISSUED FOR APPROVAL	2007-07-19	V.T.C.
No.	Revisions	Date	By

* FOR DETAILS OF THE REINFORCING
COMPONENTS - REFER TO SHOP DRAWINGS.

OWNER
 PORT AUTHORITY OF
ALLEGHENY COUNTY
PITTSBURGH, PENNSYLVANIA

ENGINEERS
 DMJM HARRIS - AECOM
FOUR GATEWAY CENTER
20TH FLOOR
PITTSBURGH, PA 15222

CONTRACTOR
 OBAYASHI TRUMBULL JV
CLARK BUILDING
503 MARTINDALE ST., 2nd FLOOR
PITTSBURGH, PA 15212

Halcrow Group Limited
One Kingsway, Cardiff CF10 3AH
Tel +44 (0)29 2072 0520
Fax +44 (0)29 2072 0580
E-mail: cardiff@halcrow.com
www.halcrow.com

PRECAST TUNNEL LINER MANUFACTURER
 Technopref TECHNO PREF INDUSTRIES INC.
101 S. 36th St., Inc.

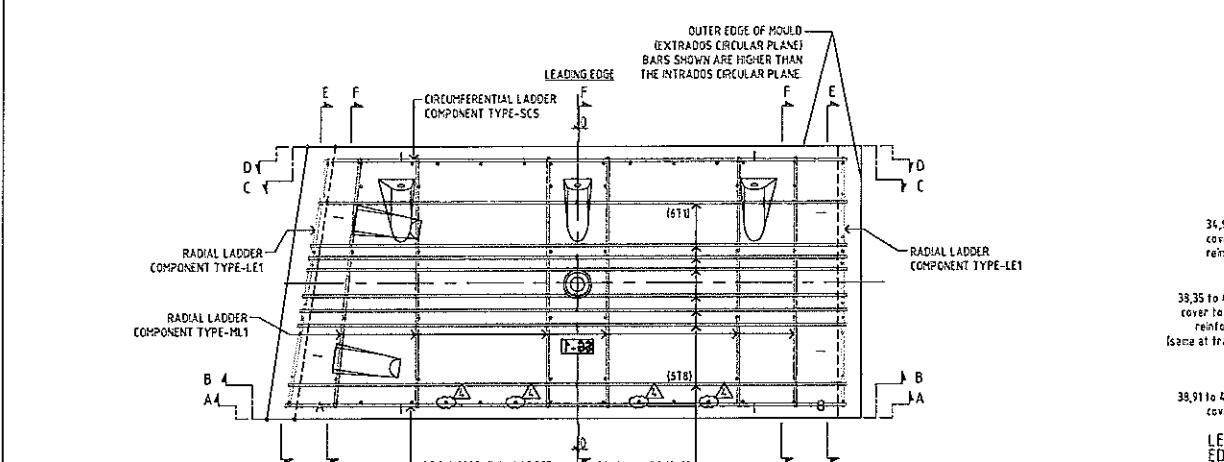
Project PORT AUTHORITY OF ALLEGHENY COUNTY
NORTH SHORE CONNECTOR
NORTH SIDE TUNNELS AND STATION SHELL
CONTRACT NO. NSC - 003/006

ALLEGHENY RIVER TUNNEL
LAUNCH PIT TO RECEIVING PIT
(NSC - 003)

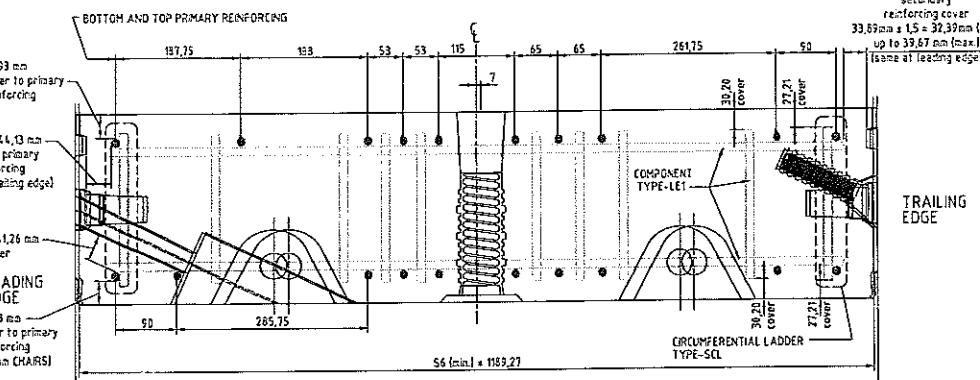
STEEL ERECTION DRAWING SET
PRECAST TUNNEL LINERS

SEGMENT S6 - SMALL COUNTER-KEY [45.36°]
REINFORCING LAYOUT AND DETAILS

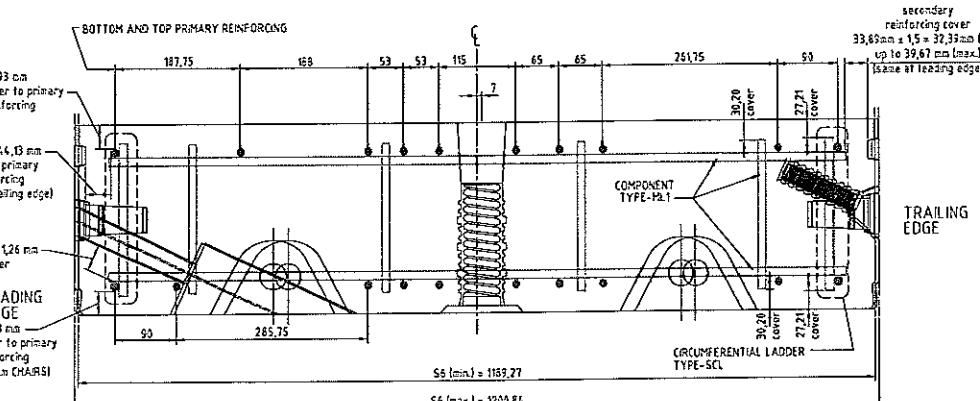
Prepared	V.T.C.	Date	2007-11-02
Drawn	V.T.C.	Revision	4
Checked	C.C.A.		-
Approved	C.C.A.	Sheet number	3
Scale	see plan	RS-6	4



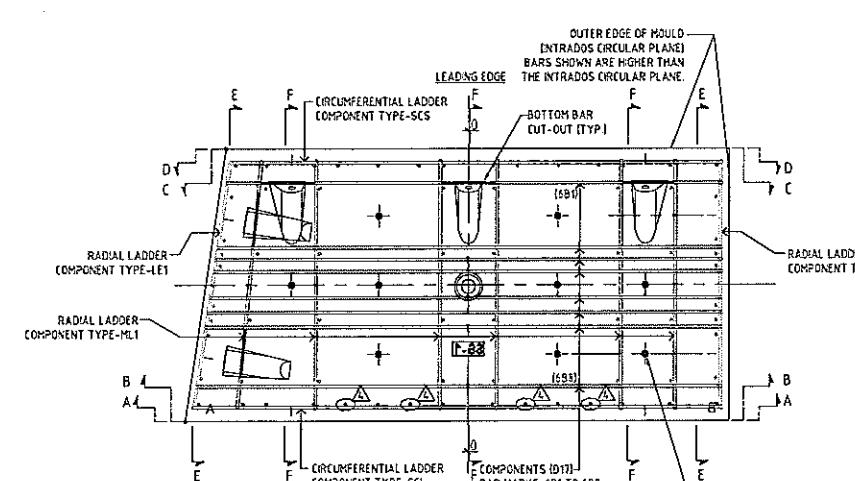
NOTES:
1) DIMENSIONS ARE NOTED IN mm FOR CLARITY AND VISUALISATION. THE MOULDS AND REINFORCING
ARE FABRICATED TO METRIC DIMENSIONS.
2) CAGE ASSEMBLY REALIZED BY SPOT WELDING COMPONENTS CONSISTING OF PRE-ROLLED
CIRCUMFERENTIAL LOOSE BARS, CIRCUMFERENTIAL ROUND LADDERS, STRAIGHT INTERMEDIATE
LADDERS AND STRAIGHT END LADDERS.
3) STEEL REINFORCING GRADE 60 kN (SEE SHOP DRAWINGS FOR DETAILS).



SECTION E-E
END CROSS-SECTION
SCALE 1:5



SECTION F-F
MIDDLE CROSS-SECTION
SCALE 1:5



PLAN OF SEGMENT S6 - INTRADOS
SCALE 1:15

Concrete cover is 1-3/8" (34.93mm) to primary reinforcing with noted exceptions
for secondary reinforcing at certain pinch points.

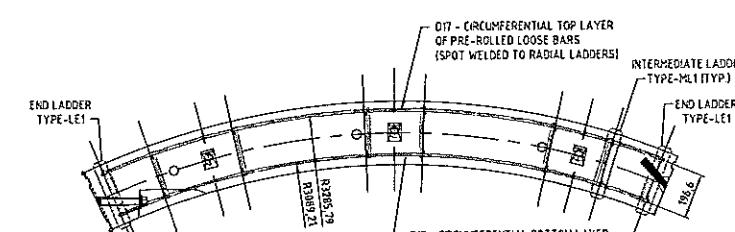
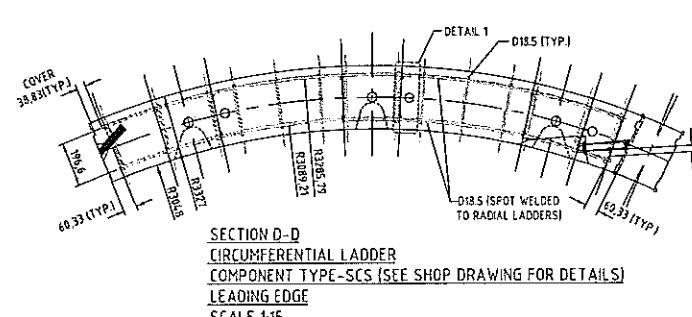
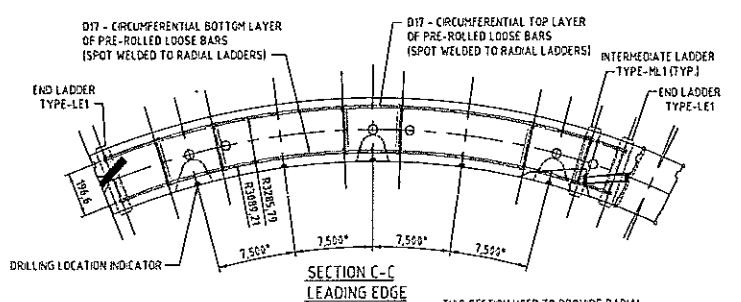
This reinforcing assembly drawing is the result of 3-D CAD modeling that has
taken in consideration the geometry of the moulds, the reinforcing fabrication
tolerances, the cage assembly jig tolerances, the reinforcing cage assembly
methods, the reinforcing cage installation practices, our past experience, and
the intent of the specification.

Note that most concrete cover dimensions on this plan are noted to an unusually
high accuracy with respect to normal reinforcing standards (millimeters with two
spots after the decimal point). This is done purposefully and out of necessity:

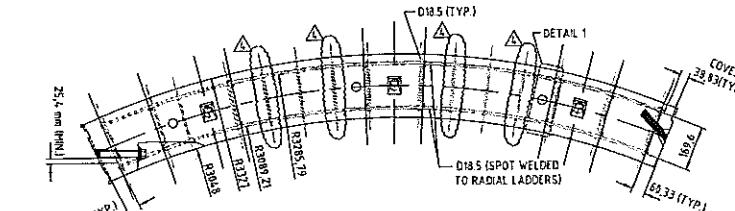
1) The numbers are the outcome of the level of precision (with the accounting for
manufacturing variances) worked with on the different systems that interact
to provide geometrically precise reinforcing cages.

2) The precision is required to monitor and control possible required future
adjustments to components or jigs during production.

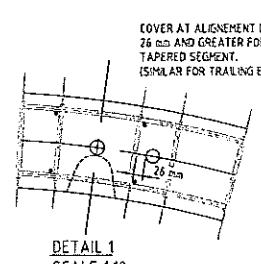
On this plan, the cover dimensions noted with the margin (min) are instances
where the noted dimensions should be absolute minimums. In the situations
where the cover dimensions are simply noted, the variance in some cases could
be plus or minus 15mm due to component, assembly system and installation
variances.



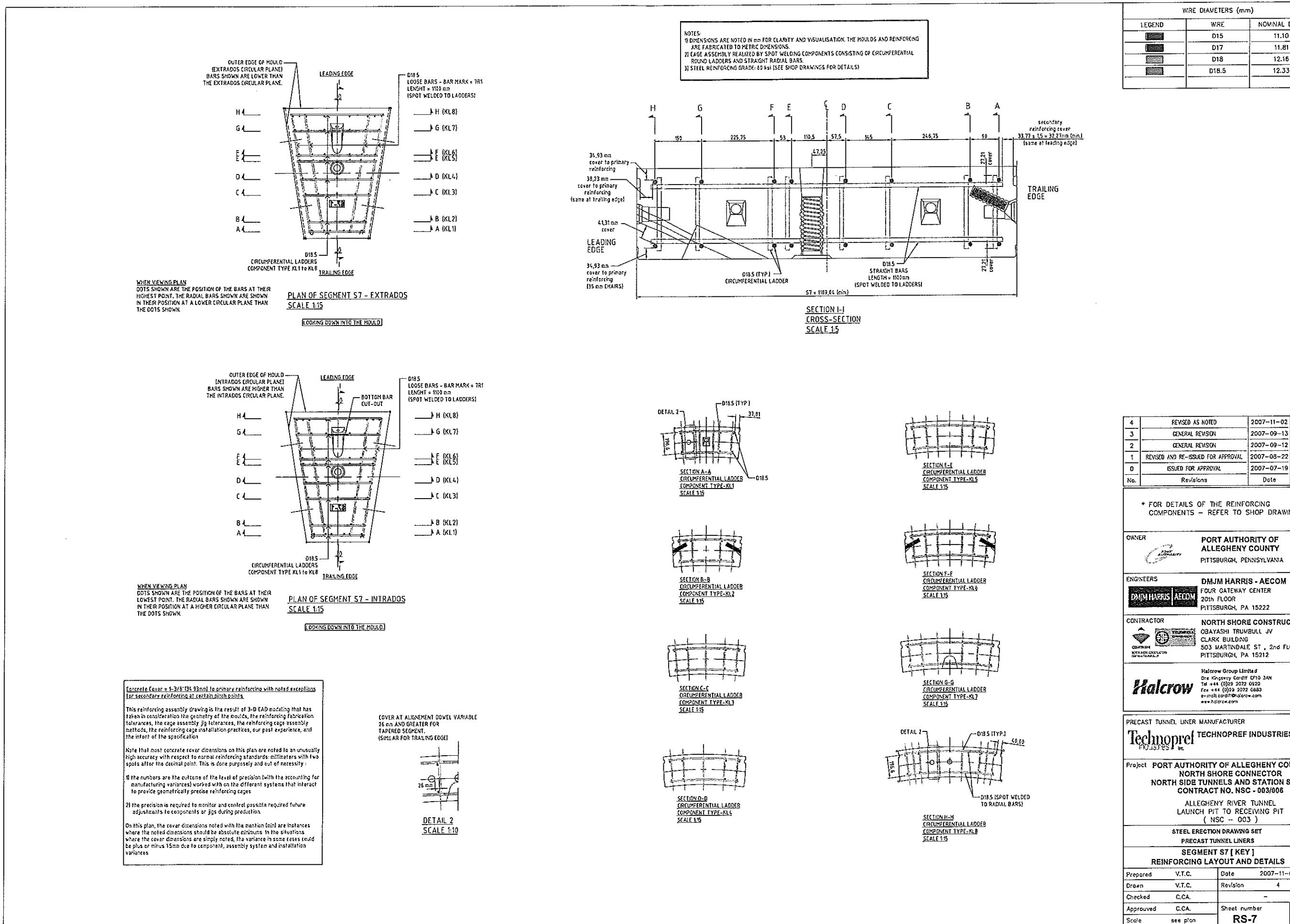
SECTION B-B
TRAILING EDGE
SCALE 1:15

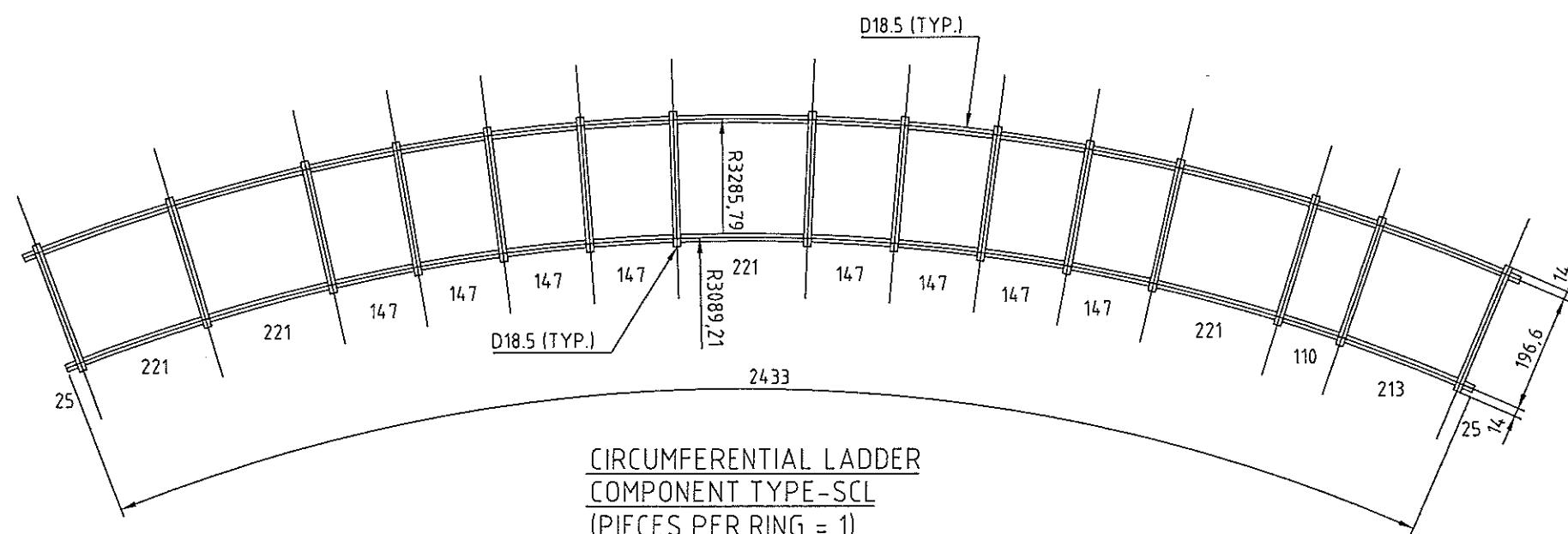


SECTION A-A
CIRCUMFERENTIAL LADDER
COMPONENT TYPE-SCL (SEE SHOP DRAWING FOR DETAILS)
LEADING EDGE
SCALE 1:15



WIRE DIAMETERS (mm)		
LEGEND	WIRE	NOMINAL DIAM.
	D15	11.10
	D17	11.81
	D18	12.16
	D18.5	12.33



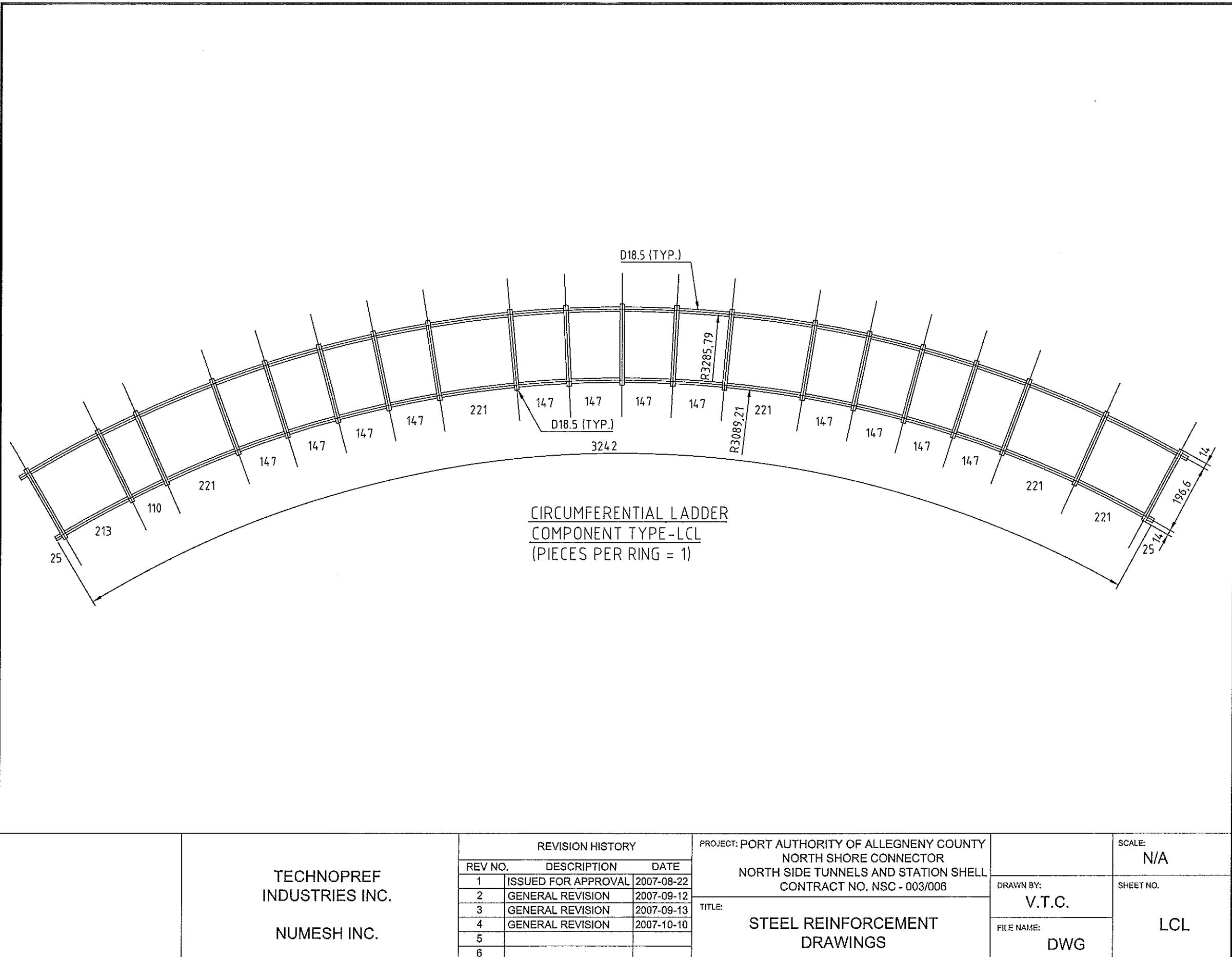


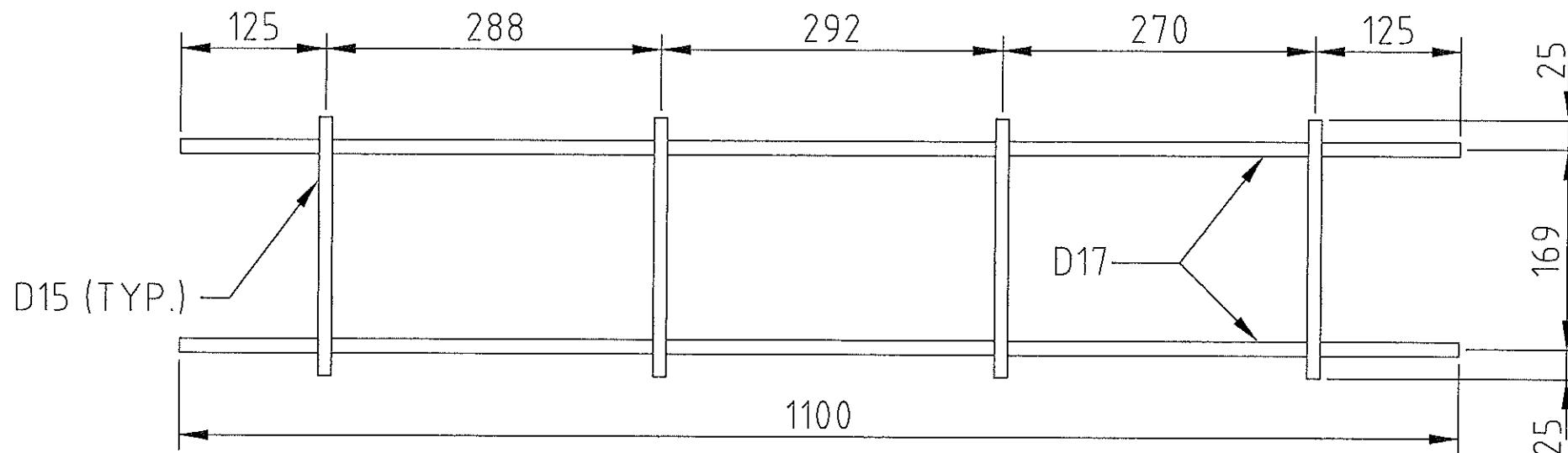
TECHNOPREF INDUSTRIES INC.	NUMESH INC.	REVISION HISTORY			PROJECT: PORT AUTHORITY OF ALLEGHENY COUNTY NORTH SHORE CONNECTOR NORTH SIDE TUNNELS AND STATION SHELL CONTRACT NO. NSC - 003/006	DRAWN BY: V.T.C.	SCALE: N/A
		REV NO.	DESCRIPTION	DATE			
		1	ISSUED FOR APPROVAL	2007-08-22			
		2	GENERAL REVISION	2007-09-12			
		3	GENERAL REVISION	2007-09-13			
		4	GENERAL REVISION	2007-10-10			
		5					
		6					

TITLE: STEEL REINFORCEMENT DRAWINGS

FILE NAME: DWG

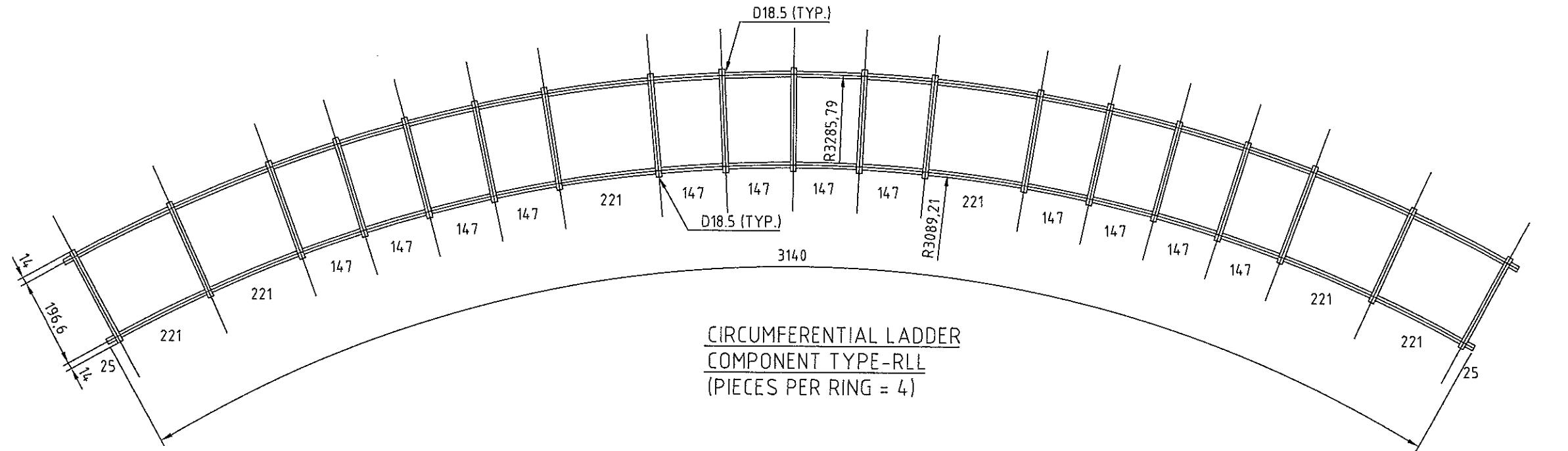
SHEET NO. SCL





RADIAL LADDER
COMPONENT TYPE - ML1
(PIECES PER RING = 46)

TECHNOPREF INDUSTRIES INC. NUMESH INC.	REVISION HISTORY			PROJECT: PORT AUTHORITY OF ALLEGHENY COUNTY NORTH SHORE CONNECTOR NORTH SIDE TUNNELS AND STATION SHELL CONTRACT NO. NSC - 003/006 TITLE: STEEL REINFORCEMENT DRAWINGS	DRAWN BY: V.T.C. FILE NAME: DWG	SCALE: N/A SHEET NO. ML1
	REV NO.	DESCRIPTION	DATE			
	1	ISSUED FOR APPROVAL	2007-08-22			
	2	GENERAL REVISION	2007-09-12			
	3	GENERAL REVISION	2007-09-13			
	4	GENERAL REVISION	2007-10-10			
	5					
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REV NO.	DESCRIPTION	DATE	PROJECT: PORT AUTHORITY OF ALLEGHENY COUNTY NORTH SHORE CONNECTOR NORTH SIDE TUNNELS AND STATION SHELL CONTRACT NO. NSC - 003/006		DRAWN BY: V.T.C.	SCALE: N/A
			TITLE:	FILE NAME: DWG		
1	ISSUED FOR APPROVAL	2007-08-22	STEEL REINFORCEMENT DRAWINGS	RLL		
2	GENERAL REVISION	2007-09-12				
3	GENERAL REVISION	2007-09-13				
4	GENERAL REVISION	2007-10-10				
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TECHNOPREF
INDUSTRIES INC.

NUMESH INC.

3.13 DECOMMISSION AND DEMOLITION SIGNALING SYSTEMS

- A. The Contractor shall not decommission any portion of existing Gateway Interlocking until the new double crossover and turn-back operation at Wood Street Interlocking is in service.
- B. The Contractor shall be responsible for ensuring that the removal of any portion of the existing signaling system at Wood Street and Gateway Interlocking are staged and coordinated so that Authority revenue operations are not impacted by this work.

3.14 DECOMMISSION AND DEMOLITION LEAKY CO-AXIAL CABLES

- A. The Contractor shall not decommission any portion of leaky co-axial cable system within the limits of existing Gateway Station until the new double crossover and turn-back operation at Wood Street Interlocking is in service.

3.15 DECOMMISSION AND DEMOLITION TUNNEL VENTILATION SYSTEM

- A. The Contractor shall be responsible for the decommissioning, removal, cleaning, packing, storage and transport of all tunnel ventilation systems identified in the Contract Documents.
- B. All tunnel ventilation systems shall remain operational until a temporary cut-off wall is constructed by the Contractor, between the existing Gateway Station and Wood Street Station as required by the Contract Documents.
- C. Once the temporary cut-off wall is constructed by the Contractor, the existing ventilation elements at Gateway Station proper and in the Gateway Loop shall be decommissioned. The Contractor shall propose a decommissioning schedule for the tunnel ventilation system. This shall be submitted to the Engineer for approval prior to any demolition activities.
- D. The exiting ventilation fans in the Liberty Avenue Tunnel (GW-EM-9 and GW-EM-10) shall remain operational throughout all stages of the Work. Prior to the milestone date, additional conduit and new cables shall be installed (for GW-EM-9 and GW-EM-10) by the Contractor as shown in the Contract Documents. The Contractor shall convert the service to the relocated path and reconnect into the existing system during a weekend shutdown of Authority Revenue Services. The emergency ventilation fans shall be operational prior to Revenue Service resumption as allotted in Section 00500, Article 2.1.
- E. The decommissioning of the axial ventilation fans and under platform ventilation fans shall include, but not be limited to:
 1. The isolation of power from the MCC room to each item to be decommissioned.
 2. The termination of power and control cables at the equipment.
 3. The removal of dampers, attenuators, evases, and all associated ductwork.
 4. The removal of the fans from mountings.
 5. The removal of fan mountings.
 6. The removal of all associated equipment (e.g. cables, conduit, junction boxes, mountings, etc) from the room that were required as part of the fan installation.
- F. The decommissioning of the jet fans shall include, but not be limited to:
 1. The isolation of power from the MCC room to each jet fan.

E. Or Approved Equal

2.02 WIRE AND CABLE

- A. All station and tunnel life safety circuits wiring shall be Type RHW, 2-hour fire-rated, low smoke, zero halogen, as manufactured by Raychem or approved equal as required by NFPA 130.
- B. All tunnel life safety control and communications circuits wiring shall be UL Listed Type XHHW-2, low smoke, zero halogen, Firewall LSZH as manufactured by Rockbestos-Surprenant or approved equal as required by NFPA 130.
- C. All station and tunnel non-life safety circuits wiring shall be UL Listed Type XHHW-2, low smoke, zero halogen, Firewall LSZH as manufactured by Rockbestos-Surprenant or approved equal as required by NFPA 130.
- D. In addition to 2.02 A, motor cables from the Variable Speed Drives to the motor shall be shielded symmetrical three conductors and three grounding wire cable for VSD applications.
- E. All cable shall be copper. Ground Wire(s) sized in accordance with the NEC.

2.03 NFPA 130 WIRING REQUIREMENTS

- A. All wiring materials within the station shall conform to the requirements of the NEC and, in addition, shall satisfy the requirements of NFPA 130, Sections 5.4.2 through 5.4.9.
- B. All wiring materials within the trainway shall conform to the requirements of the NEC and, in addition, shall satisfy the requirements of NFPA 130, Sections 6.3.3.2.2 through 6.3.3.2.9.

2.04 CONDUITS AND PULL BOXES

- A. Conduits and accessories shall comply with Section 16111, "Conduit" of the Contract Documents. All conduits for tunnel fire life safety equipment shall be rigid metal conduit and comply with NFPA 130.
- B. Pull boxes shall comply with Section 16130, "Raceway and Boxes" of the Contract Documents.

2.05 IDENTIFICATION

- A. In accordance with Section 16075, "Electrical Identification."

SECTION 16742

SCADA SYSTEM

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 the SCADA system, 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. Communications Equipment Room (CER) Remote Terminal Units (RTU)
 2. Traction Power Substation, Circuit Breaker and Tie-Breaker Substation Alarm and Control System (SACS) RTUs
 3. Tunnel ventilation Remote Indication and Control System (RICS) RTUs
 4. Intrusion devices and wiring
 5. Alarm/Indication wiring
 6. Contractor shall furnish all labor, material, equipment, supervision, transportation, and miscellaneous services, whether or not explicitly identified herein, to provide a completely tested and fully functional SCADA system.
 7. The work of this Section includes the installation of all SCADA equipment located in the Communications Equipment Rooms (CER), Traction Power Substations, switching stations and circuit breaker rooms, and Motor Control Centers (MCC).
 8. The work of this Section includes the installation of the serial modems where used and the interconnection between the modem and the PLC as well as the 4W analog channel bank card and the modem.
 9. The work of this Section also includes the installation of the control and indication wiring between the RTU and the remotely controlled and monitored device.
 10. Contractor to provide a system integration test plan, which is coordinated with the OCC system. Refer to Section 16901, "Communications System Test and Inspection."
 11. The work of this Section also includes the integration of all new SCADA equipment into the existing SCADA network and testing with the OCC.
- C. The Contract Documents provide the performance parameters and design criteria to complete the SCADA system. The Contractor shall be responsible to provide a complete design for this portion of the Work.

1.02 RELATED SECTIONS

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

- B. Section 15891, "Tunnel Services Mechanical Testing and Commissioning"
- C. Section 16700, "Communications."
- D. Section 16703, "Carrier Transmission System"
- E. Section 16889, "Tunnel Services Electrical Testing and Commissioning"
- F. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"
- G. Section 16901, "Communication System Inspection and Test."
- H. Section 16950, "OCC Upgrade"

1.03 REFERENCE STANDARDS

- A. EIA Standards 310 and RS-359, RS-232, RS-422 and RS-485.
- B. IEC Standard 529, 68-2-6, 68-2-27, 1000-4-5, 1000-4-11, 1000-4-12 and 664.
- C. UL Standards 508, 664 and 1604.
- D. NFPA Standard 130, "Standard for Fixed Guideway Transit Systems"
- E. NFPA Standard 72, "National Fire Alarm Code"

1.04 SUBMITTALS

- A. Submit shop drawings, product data, printed installation instructions, manufacturer's literature, manufacturers' printed testing and adjusting instructions. Submittals shall include, but not be limited to, the following:
 1. Product Data: Manufacturer's catalog cuts, material specifications, and installation instructions and other pertinent data for all equipment to be furnished. Product data for the RTU shall include the following:
 - a. Central processing unit (CPU)
 - b. Power supplies and inverters
 - c. Modems
 - d. Input/output modules
 - e. Mounting racks/panels
 - f. Power source (surge) protection
 - g. Connectorized terminal interfaces
 - h. Test and diagnostic fixtures
 2. SCADA Equipment Cabinet Shop Drawings:
 - a. Fabrication and assembly details: Enclosure assembly drawings showing the location of all components, such as power supplies and printed circuit card chassis, and subassemblies comprising the components to the level of printed

- circuit cards. The drawings shall identify each component and subassembly by part number and revision level. Each drawing shall include interconnection wiring diagrams showing all interconnecting cables, including ground and power distribution cables. An individual drawing shall be produced for each enclosure (including equipment cabinets and consoles), and a copy of each appropriate drawing shall be stored inside each enclosure, preferably on the door of the enclosure.
- b. Installation details showing layout, mounting, fastening and grounding details.
 - c. Rack elevation drawings for all rack-mounted equipment showing mechanical details, mounting, indicators, interconnecting cables, interconnection devices, arrangement plans and assembly drawings with complete keyed parts lists.
3. RTU/PLC Shop Drawings:
 - a. Block and signal level diagrams for the Traction Power Substation, Life Safety and Communications SCADA PLCs, including detailed cross-reference to other connections.
 - b. All input/output (I/O) connections.
 - c. Power distribution wiring for all input and output data points, PLC's, central processing units and any other electronic equipment provided by the Contractor.
 - d. Data point I/O connections and assignments for each remote PLC location. Each data point shall be listed along with its associated I/O cable, terminal plug coupler and the I/O circuit card.
 4. Wiring diagrams shall show all interconnecting cables between system components and panels. Wiring diagrams and plans shall show wire numbers, wire identification, wire origination point, and wire destination point for each wire.
 5. List of qualified PLC programmers/integrators to be assigned to this project for execution of this task.
 6. Bill of materials that includes a complete list of all cable, equipment and installation materials furnished.
 7. Manufacturer's manuals that define equipment operation, contain schematic diagrams of all circuitry, and define maintenance and alignment procedures for each item of equipment provided.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall ensure that equipment has not been damaged during shipping or storage. Equipment shall be shipped separately from the equipment racks in which they are to be installed. Equipment shall remain in the original packaging until the time of installation. All equipment shall be stored in a protected area until installed.

1.06 EXISTING CONDITIONS

- A. Authority's existing OCC SCADA System provides for the control and monitoring of Authority's tunnel ventilation system and traction power system. The control and

monitoring of the tunnel ventilation system is known as the Remote Indication and Control System (RICS). The control and monitoring of the traction power system is known as Substation Alarm and Control System (SACS).

- B. Authority's OCC SCADA System also monitors alarm and security points in the communications equipment rooms (CER). The Carrier Transmission System (CTS) provides the communications channels that are used by the OCC SCADA System to communicate with all three types of RTUs as shown on Contract Drawing CM043.

1.07 QUALITY ASSURANCE

- A. Material shall conform to the latest IEEE, ASTM, ICEA, UL, NEMA, and ANSI standards. Contractor shall submit evidence to the Port Authority that the material furnished in accordance with these Specifications conforms to the specified standards and recommendations. The labeling of, or listing by UL will be acceptable evidence that material conforms to the requirements of UL. A certification or published specification data statement by a manufacturer, listed as a member of NEMA, to the effect that material conforms to the specified NEMA standards and to these Specifications will be acceptable evidence.
- B. Electrical work shall conform to NFPA 70 (NEC). Codes referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings or specifications shall govern.
- C. Establish and maintain an effective quality control program to ensure compliance with contract requirements; maintain records of the control. The program shall include, as a minimum, submittals, materials, installation, and testing.
- D. The equipment manufacturer shall maintain ISO 9001 or ISO 9002 certification.

1.08 QUALIFICATIONS

- A. The programmer/integrator must have a minimum of five (5) years' experience in the installation, programming, configuration, and software integration of similar PLC equipment.

ARTICLE 2 PRODUCTS

2.01 SYSTEM REQUIREMENTS

- A. The SCADA System consists of Remote Terminal Units (RTUs) and ancillary equipment as shown on Contract Drawing CM043 and as specified herein, to form an integral part of the Communications System. Contractor shall provide CER RTUs for the three new North Shore Connector stations.
- B. The SCADA System will monitor alarms and indications from communications equipment rooms (CERs). The flow of data to and from the CER RTUs will be

controlled by the Operations Control Center (OCC) System which shall be expanded to accommodate the additional NSC RTUs under Section 16950, "OCC Upgrade" of this contract.

- C. Monitoring of CERs shall include but not be limited to the following:
 - a. Intrusion and Security Alarm
 - b. Room High Temperature Alarm
 - c. Cabinet High Temperature Alarm
 - d. UPS System Failure
 - e. 48VDC Power Supply Failure
 - f. Emergency Egress Door Alarm
 - g. Radio System
 - 1. Base Station Power Meter – Low Power
 - 2. Base Station Power Meter – High VSWR
 - 3. Bidirectional Amplifiers Power Meter – LRT Low Power
 - 4. Bidirectional Amplifier Power Meter – LRT High VSWR
 - 5. Bidirectional Amplifier – Major Alarm
 - 6. Bidirectional Amplifier – Minor Alarm
 - 7. Fiber Optic Transceivers Summary Alarm
 - 8. GPS Master Oscillator – Major Alarm
 - 9. GPS Master Oscillator – Minor Alarm
 - h. Ticket Vending (future).
- D. RTU(s) shall be installed in the Communications Equipment Room, Motor Control Center and Traction Power facility at each NSC location as indicated on the Contract Drawings.
- E. The SCADA System shall interface to the OCC SCADA System at the OCC Facility. The OCC SCADA System shall serve as the central controller for the SCADA System.
 - 1. RTUs shall be configured to interface properly with the OCC SCADA System.
 - 2. NSC CTS communications channels shall be used to connect the OCC SCADA System to each remote NSC RTU.
- F. RTUs shall be equipped with the number of I/O points to support the point lists as indicated on the Contract Drawing.
- G. Intrusion detectors and associated wiring shall be installed in the CERs as indicated on the Contract Drawings and Reference Drawings: Gateway Station Finishes Construction Contract NSC-010, North Side Station Finishes Construction Contract NSC-011 and Allegheny Station Finishes Construction Contract NSC-012.
- H. Wiring shall be installed between the RTU and up to 16 contact closure alarm/indication points of other communications subsystems at each CER.
- I. Tunnel Ventilation System Requirements
 - 1. The RTUs for monitoring and control of the tunnel ventilation systems, comprises of a primary and secondary RTU and local control station used as a secondary point of control in situations when the SCADA system at the OCC becomes inoperative. Both the RTU controllers and I/O cards and local control stations are duplicated. The primary RTU has control of the system under normal operating conditions, and fails over to the secondary RTU when there is a fault with the primary. Inputs are monitored by both RTUs and outputs are switched during failure of one RTU.

2. The principal function of the primary and secondary RTU is to control the ventilation system equipment. Both RTUs communicate directly with the OCC, SCADA system. The primary RTU provides control for all modes of operation, while the secondary RTU is used as a 'backup' RTU. The primary and secondary RTUs are identical, functionally in hardware and software programming and setup.
3. The health of the primary RTU is monitored by the secondary RTU via a heartbeat. An output of the secondary RTU is connected to the input of the primary RTU and an output on the primary RTU is connected to an input on the secondary via a hardwire connection. The secondary toggles the input to the primary RTU. When the input is received by the primary RTU, it toggles the input to the secondary RTU. This process continues indefinitely unless one of the RTUs fails. If the primary RTU fails, an alarm will be raised in the SCADA system and the secondary RTU will take over the ventilation control. If the secondary RTU fails (while the primary is still in operation) then an alarm will be raised on the SCADA system.
4. Inputs to the RTUs are not switched. Each input are paralleled at the RTU marshalling terminals and connected to both primary and secondary RTUs. Only the outputs are switched. Upon failure of the Primary RTU, fail over relay are used to switch all outputs from the primary RTU to secondary RTU to control the tunnel ventilation equipment. Only outputs from one RTU at a time are connected to the tunnel ventilation equipment.
5. A heartbeat system will also be implemented via the modbus connection to monitor the communications link. In the event the switch fails, communications between the fan motor monitoring and the tunnel environment monitoring systems will be lost and an alarm needs to be raised in the SCADA system.
6. In the event of a critical failure of RTUs all outputs shall fail to OFF.
7. The RTUs shall also monitor its own diagnostics and fail over to the secondary RTU in the event of a system failure being detected (e.g I/O Cards, Power supply etc.)
8. In the event that communications with the fan monitoring devices (Vibration, RTD Resistance Temperature Detector) is lost, the RTU will drive the fans to a default mode that is unlikely to overheat the fan motors, but will provide adequate ventilation to prevent pollution build-up. Fire mode operations will be unaffected if the monitoring devices cannot communicate to the RTU as the monitoring devices are not used to control the fans during fire mode.
9. In the event that the hardwire control from the primary or secondary RTU to the VSD (VARIABLE SPEED DRIVE) fails (broken cable or failed control power) the VSD will revert to a default speed and direction. The preset speed is programmed into the VSD at commissioning and allows the fans to continue running when communications to the RTUs has been lost.
10. The dampers each has a default setting (fail open, fail closed, fail current position) that they fail to in the event they lose power supply or connection with the RTU.
11. Alarm and trip setpoints for tunnel electrical equipment is to be set in the RTU. For example, the RTD (Resistance Temperature Detector) and vibration level setpoints for the fan motors will be set in the RTU program. Alarms shall be generated at the OCC and local control station touch screens, if these setpoints are exceeded. Setpoints shall be determined on site during commissioning. Acknowledgement of alarms at OCC shall cancel it at the OCC SCADA and local control station touch screen. Fire mode motor speed setpoint will be programmed into the VSD via the local VSD interface. Setpoint changes shall not be available via the operators SCADA screen.

12. There are two sump pumps and one set of level switches associated with each sump. One operates as duty and the other standby. Once the sump level reaches the duty pump level the duty pump starts and runs until the sump reaches pump stop level. If the level of the sump keeps rising and reaches the standby pump level, then the standby pump starts so both pumps are running. If the sump level keeps rising and reaches the high level, then an alarm is generated at the OCC and Local touch screen panel. Both pumps stops when the sump level is reduced to stop pump level. An alarm is also generated if the low level is reached.
13. The RS485 communications link shall be configured as a multidrop topology. The Primary RTU and Secondary RTU shall be configured as Modbus master RTU , and upon failure of the Primary RTU a changeover relay shall switch the two wire RS485 line to the Secondary RTU.
14. Starting of Direct On Line starter fan motors shall be staggered.

J. Tunnel Ventilation System Local Control Station

1. A local control station shall be located in each Headhouse, and implemented via a touch screen controller connected to the RTU/PLC. Control and monitoring of each piece of equipment attached to the local RTU/PLC shall be available via the touch screen controller.
2. Failure and faults with the tunnel ventilation system shall generated alarms on the SCADA system at the OCC and the local touch screen control panels.
3. Both primary and secondary RTU/PLC shall have a touch screen controller associated with it to control and monitor the RTU attached to it.
4. The local control station shall override the OCC SCADA controlling station in all modes, in the event that the OCC controls becomes inoperative or the operation of the emergency tunnel ventilation system components is specifically redirected to local control station.
5. The local control station touch screen controller panel shall be able to individually control each piece of equipment or put it into the same modes of operation as the OCC.

2.02 REMOTE TERMINAL UNITS (RTUS)

- A. The RTU shall be compact, expandable, and equipped with a run/stop switch. The RTU shall be equipped with removable, screw-type terminal strips for inputs and outputs.
- B. The RTU may be comprised of a main RTU unit and expansion units. The expansion units shall be designed specifically for use with the main RTU unit and made by the same manufacturer as the main RTU unit. The RTU shall be equipped with all cabling and hardware required for the main RTU unit and the expansion units to function as an integral unit. The main RTU unit shall be equipped with a minimum of 16 status inputs.
- C. The RTU shall be equipped with the quantity of status inputs shown in the Provisioning Table contained herein at minimum. All RTUs shall be capable of accommodating up to 48 status inputs through the addition of expansion units. Status inputs shall meet the following requirements at minimum:

1. Voltage Range:	0 to 130 VDC
2. Typical Input Current:	7.5 mA
3. Input Resistance:	2.8 Kohms
4. Input Threshold Voltage ON:	15 VDC minimum
5. Input Threshold Voltage OFF:	5 VDC maximum
6. Input Threshold Current ON:	4.5 mA maximum
7. Input Threshold Current OFF	1.5 mA minimum

8. Response Time: 0.5 to 20 ms configurable as regular input
- D. The RTU shall be equipped with a minimum of 11 relay outputs. Relay outputs shall meet the following requirements at minimum:
- | | |
|-----------------------------------|-------------------------------|
| 1. Operating Voltage: | 5 to 130 VDC and 5 to 250 VAC |
| 2. Leakage Current: | 15 mA |
| 3. Maximum Pilot Duty Rating: | 2 A at 24 VDC and 240 VAC |
| 4. Maximum Resistive Load Rating: | 2 A at 24 VDC and 240 VAC |
| 5. Minimum Load: | 1 mA |
| 6. On/Off Response Time: | 15 ms maximum |
- E. The RTU shall be equipped with 1 DC output at minimum. DC outputs shall meet the following requirements at minimum:
- | | |
|-----------------------------------|---|
| 1. Voltage Rating: | 24 VDC, +20%, -79% |
| 2. Maximum Pilot Duty Rating: | 0.75 A at 24 VDC |
| 3. Maximum Resistive Load Rating: | 0.75 A at 24 VDC, 0.5 A at 12 VDC, 0.25A at 5 VDC |
| 4. Output Voltage Drop: | 0.3 VDC maximum |
| 5. On/Off Response Time: | 0.1 ms maximum (24 VDC, 0.2 A) |
| 6. Off State Leakage: | 0.1 mA maximum |
- F. The RTU shall be equipped with a minimum of two single ended analog inputs and four differential analog inputs. Analog inputs shall meet the following requirements at minimum:
1. Input ranges:
 - a. 0 to 10VDC (10.23 VDC max.)
 - b. -10 VDC to +10 VDC (10.23 VDC max.)
 - c. 0 to 20mA and 4 to 20mA (20.47 mA max.)
 2. Resolution:
 - a. 0 to 10VDC Range – 12 bits (1LSB=2.5 mV)
 - b. -10 to +10VDC Range – 12 bits (1LSB=2.5 mV)
 - c. 0 to 20mA and 4 to 20mA Range – 12 bits (1LSB=5 microamps)
 3. Accuracy +/- 1% of full scale over full operating temperature range
 4. Linearity +/-3 LSB maximum
 5. Common mode voltage +/-40 V maximum
 6. Current input impedance 249 Ohm
 7. Voltage input impedance 200 K ohms
 8. Input Filter Time 20 ms to reach 1% error for step input.
- G. The RTU shall be equipped with minimum of one RS-232 serial port. The RS-232 serial port connector type shall be a DB-15 connector. The RTU shall be modem compatible through connection to the RS-232 serial port.
- H. The RTU shall be equipped to store and execute calculation and control algorithms. The RTU program storage shall be battery backed to provide typical memory retention of two months.
- I. The RTU shall be equipped to be powered by 110 VAC. The RTU shall meet the following requirements at minimum:
- | | |
|-------------------------------|---------------|
| 1. Inrush Current: | 15 A maximum |
| 2. Input Current: | 0.1 A typical |
| 3. Input Power Supply Rating: | 35 VA |
- J. The RTU shall be equipped to provide 24 VDC user power to be used by the contact closure alarm points. The 24 VDC user power shall provide up to 200 mA of current.

- K. The RTU shall be capable of being mounted to a blank panel on an equipment rack, either by being mounted directly to the panel or through use of a 35 mm DIN rail.
- L. The main RTU shall be no larger than 6 inches wide x 3.5 inches high. Expansion units shall be no larger than 3.7 inches wide by 3.5 inches high.
- M. The RTU shall be compliant with the following environmental and agency specifications:

1. Safety:	UL508 and UL1604
2. Vibration:	2G @ 57-500 Hz, 0.15 mm p-p @ 10-57 Hz, per IEC 68-2-6
3. Shock:	15G, 11 ms, per IEC 68-2-27
4. Operating Temperature:	0 to 120 degrees F
5. Humidity:	5% to 95%, non-condensing
6. Enclosure protection from dust and splashing water,	per IEC 529
7. EMC Emissions Radiated, Conducted:	47 CFR 15 part 15, subpart J
8. Surge Withstand, Power Supply:	0.5 KV line to ground, 0.5 KV line to line, per IEC 1000-4-12
9. Surge Withstand, Communications Port and Inputs:	1 KV, per IEC 1000-4-5 and IEC 1000-4-12
10. Power Supply Input Variations:	±10%, per IEC 1000-4-11
- N. The RTU shall be equipped and configured to operate properly with the OCC SCADA System. Changes in status of the connected alarm contacts shall be communicated to the OCC SCADA System so that the change is accurately portrayed by the OCC SCADA System. The RTU shall be equipped and configured to use the same communications protocol as the OCC SCADA System.
- O. The RTU shall be comprised of GE Fanuc VersaMax Micro Controller, Part Number IC200UDR005 as a main RTU unit and GE Fanuc VersaMax Expansion Unit, Part Number IC200UEX011 as expansion units, or approved equal.

2.03 MODEM

- A. Modems shall provide point-to-point transmission of four-wire full duplex or 2 wire half duplex operation over a voice grade line.
- B. Modems shall provide an EIA RS-232 data interface to the OCC equipment the RTUs, Central Traffic Control (CTC), and Train to Wayside Controller (TWC) equipment.
- C. Supported data rates shall include QAM 9600 or 4800 bps asynchronous (+1% -2.5%) mode, 0-1800 bps asynchronous Bell 202T mode and 0-1200 bps asynchronous V.23 mode.
- D. Automatic equalization shall be provided to adjust to local cable conditions.
- E. Data format shall be 8 or 9 data bits with one or more stop bits supported.
- F. Transmit signal levels shall be adjustable between +3 dbm and -14 dbm. Receive levels shall be adjustable between +3 dbm and -30 dbm.
- G. Modems shall come in stand-alone and rack mount versions.
- H. Modems shall be powered from 110VAC.
- I. Operating temperature range shall exceed -40 to +158 degrees F.
- J. Modems shall be the Telenetics Model DSP9612 or approved equal.

2.04 WIRE AND CABLE

A. Telephone Cable

1. UL Listed Type MPR/CMR, conforming to ANSI/ICEA S-80-576.
2. Conductors shall be solid tinned annealed copper.
3. Installation shall have color code that complies with the requirements of EIA RS-359.
4. Minimum specifications:

a. Conductor gauge:	22 AWG
b. Shield:	aluminum
c. Capacitance:	22 pF per 1 ft
d. Resistance:	45 ohms per 1000 ft
e. Insulation:	plenum rated, low flame, no smoke
f. Jacket:	plenum rated, low flame, no smoke
g. Pairing:	two twists per 1 foot
h. Temperature rating:	220 degrees F
i. Voltage rating:	300 volts

B. Data Cable, Extended Distance

1. Twisted Pair, RS-232 / RS-422 / RS-485 / DS-0, extended distance, quiet (industrial shielded)
2. Minimum specifications:

a. Conductor gauge:	22 AWG
b. Shield:	foil around each pair with drain wire
c. Distance:	provide error-free communications up to 4000 feet at 9600 bps
d. Capacitance:	12 pF/ft
e. Resistance:	16 ohms per 1000 ft
f. Insulation:	plenum rated, low flame, no smoke
g. Jacket:	plenum rated, low flame, no smoke
h. Temperature rating:	220 degrees F
i. Voltage rating:	300 volts

C. Wiring for Status Inputs, Analog Inputs and Control Points

1. The wire shall be class B stranded tinned copper per ASTM Standards B-3, B-33.
2. Minimum specifications:

a. Conductor gauge:	18 AWG
b. Insulation:	plenum rated, low flame, no smoke
c. Jacket:	plenum rated, low flame, no smoke
d. Temperature rating:	194 degrees F
e. Voltage rating:	600 volts

2.05 SOFTWARE

- A. Contractor shall provide and install software and firmware required for the proper operation of the SCADA System. Software and Firmware to be employed shall be submitted in the Software and Firmware Plan. Refer to Section 16700, "Communications" for software requirements.

- B. Contractor shall provide and install software required to run on the RTUs.

- C. Contractor shall provide a minimum of two copies of RTU programming software. RTU programming software shall meet the following requirements at minimum:

- 1. Designed to configure, administer and program the make and model of RTU to be provided
 2. Windows based - Designed to install and run under all currently supported versions of Microsoft Windows.
 3. Creates and edits RTU logic and associated information
 4. Configures RTU hardware

5. Creates, edits and monitors the execution of ladder or instruction list logic
6. Creates motion and local logic programs
7. Checks syntax
8. Supports serial communications connection to the RTU
9. Views fault tables in the RTU
10. Displays results of actions performed in the programming software in a separate information window
11. RTU programming software shall be GE Fanuc VersaPro Programming Software or approved equal.

2.06 REMOTE TERMINAL UNITS (RTU) FOR TUNNEL VENTILATION

- A. RTUs supplied as part of the mechanical systems work shall comply with the following requirements:
1. RTU Processor
 - a. The RTU processor shall be able to monitor its resident I/O while also being able to communicate with a SCADA network over a serial link.
 - b. The RTU processor will have a program execution speed of no less than 0.8 ms/k bit instructions and 2 ms/k for a standard instruction in a typical program.
 - c. The RTU processor shall have a minimum of one built-in RS232 serial port for programming the RTU and one RS 422/485 serial port. There shall be provided a separate Communications card with a minimum of one RS232 port and one RS422/485 port.
 - d. The RTU shall be equipped and configured to use the same communications protocol as the OCC SCADA System.
 - e. It shall be possible to connect a single industrial terminal to the port to program the respective RTU processor with either on-line or off-line capabilities.
 - f. The remote I/O network which is responsible for communications between the field devices and the RTU platform shall be capable of connecting standard configurable I/O and other compatible intelligent remote I/O devices to the processor. All devices shall be compatible with this communications link.
 - g. The RTU processor will have the capability to support the following language structures;
 - 1) Structured Text
 - 2) Sequential Function Charts
 - 3) Ladder Logic
 - 4) Function Block
 - h. The processor shall support a system protection environment with passwords and privileges.
 - i. The tunnel ventilation RTU shall be comprised of GE Fanuc VersaMax PLC Controller, IC200CPU005 or approved equivalent.
 2. RTU Interface Cards
 - a. The following hardware described shall interface to the field mounted sensors and equipment for control and monitoring.
 - 1) Digital inputs: 120 VAC 16 point module
 - 2) Digital Outputs (relay): Volt-free contact, 2.0 A for 5-265 VAC, 16 point module
 - 3) Analog inputs: 4 -20 mA, ADC 12 bit resolution minimum, > 60dB interference rejection at 60Hz
 - 4) Analog Outputs: 4-20mA
 - 5) Serial Link: RS 232 / V24, RS422 / 485
 3. RTU Hardware Requirements
 - a. RTU Operating Voltages
 - 1) The RTU shall be able to operate at 100% from the following power sources:
 - 2) 100 VAC - 250 VAC
 - 3) The RTU shall operate at the nominal supply frequency of 60 Hz with a 15% variation.
 - b. Environmental Conditions
 - 1) The RTU shall be able to operate in the following conditions:
 - a) Safety: UL508 and UL1604
 - b) Operating Temperature:32 to 140°F

- c) Storage Temperature:-40 to 185°F
 - d) Relative Humidity:5 - 95% (without condensation)
 - e) Operating Shock:15G peak acceleration for 11 +/- 1ms duration
 - f) Non-Operating Shock:50g peak acceleration for 11 +/- 1ms duration
 - g) Vibration Resistance:1G @57-150Hz, 0.012in p-p @10-57Hz
- c. RTU Communications
- 1) The RTU processor specified above shall have the capability of communicating directly with a RTU system master RTU via serial data communications protocol.
 - 2) The Contractor shall supply a RTU interface termination panel for each item of mechanical plant and equipment as detailed in Article 2.03 E of Section 16891, including mechanical plant and equipment incorporating PLC control systems.
 - 3) The RTU processor shall have the capability to communicate to RTU slave via RS485/Modbus Protocol.
- B. PLC/RTU Cabinet
- 1. A double sided cubicle shall be installed at one end of each MCC and shall contain the PLC/RTUs, and input and output units associated with the MCC starters. One side of the cubicles shall be left empty for future PLC/RTU equipment;
 - 2. The wiring between the PLC cabinet and the MCC starters shall be single core panel wiring in accordance with this Section. This wiring shall be terminated directly onto the marshalling terminals of the PLC cabinet and
 - 3. All inputs/outputs from the PLC/RTU shall be wired to the terminals. Marshalling terminals shall be provided for all PLC/RTU cards including spare slots.
- C. Panel View Controller
- 1. A QuickPanel View family of touch screens Controller shall be provided that combines control and visualization into one platform.
 - 2. The touch screen controller shall have the following requirements:
 - a. Display size: 15"
 - b. Display Type: TFT
 - c. Resolution: 1024 x 768 pixels
 - d. Memory: 64M
 - e. Communication: 2x RS232/RS485
 - f. Communication expansion: Versamax expansion I/O
 - g. Environmental Rating: NEMA 4X
 - h. Input Voltage: 120VAC
 - i. Operating temperatures: 14 -104 °F
 - 3. The touch screen controller shall interface directly to RTU via an expansion I/O interface card.

ARTICLE 3 EXECUTION

3.01 GENERAL

- A. Contractor shall coordinate installation requirements through the Engineer to develop and define the interface between the OCC SCADA System and the RTUs installed in the CER, MCC and Traction Power facilities. The interface definition shall address both hardware and software.
- B. Contractor shall furnish and install all auxiliary equipment necessary for the SCADA System to function properly, including, but limited to racks, mounting panels, mounting rails, hardware, terminal blocks, wire, cables and connectors.
- C. Contractor shall furnish and install analog modem where required by local conditions.

- D. All components of the RTUs installed in the communications equipment rooms shall be powered by the Communications System Power Supply.
- E. All components of the RTUs shall be grounded in accordance with the manufacturers' recommendations and the requirements of Section 16700, "Communications."
- F. All wiring shall be secured into harnesses. All wiring including harnesses shall be routed in such a manner as not to obstruct the installation or removal of communications system components, and shall be secured to the rack or cabinet where appropriate for neatness and to reduce strain on components.
- G. Contractor shall arrange the main RTU unit and expansion units on the equipment rack panel so that minimum rack space is occupied while providing sufficient space around components for wiring.
Layout of main RTU and expansion units shall be similar for each application of RTU.

3.02 RTU INPUTS AND OUTPUTS

- A. Contractor shall install wiring between the RTU and alarm/indication points at each CER.
- B. Refer to the Contract Drawings for a list CER SCADA of alarm/indication points to be wired by Contractor.
- C. Any unassigned input points shall be reserved for future use by Authority. A connection terminal for each input shall be provided. Input terminals shall be clearly identified in documentation.
- D. All RTU inputs are to be tested in local and system testing.
- E. All RTU outputs shall be reserved for future use by Authority. A connection terminal for each output shall be provided. Output terminals shall be clearly identified in documentation.
- F. All RTU outputs are to be tested in local and system testing.

3.03 CTS RTU INTERFACE

- A. RTUs shall be connected to OCC SCADA System via RS-232 serial data channels on the NSC CTS.
- B. Where the distance between the RTU and the CTS channel bank exceeds 50 feet, RTU connections shall be made via a 4 wire analog modem connected to a 4W E&M channel interface as described in Section 16703, "Carrier Transmission System" of these Specifications.
- C. All cables and associated hardware including, but not limited to, adapters, connectors and terminal strips required for proper operation of the SCADA Systems are to be provided and installed by Contractor.

3.04 TUNNEL VENTILATION SYSTEM RTU INPUTS AND OUTPUTS

- A. Contractor shall install wiring between the RTU devices as indicated in the Contract Drawings.
- B. Any unassigned input points shall be reserved for future use by Authority. A connection terminal for each input shall be provided. Input terminals shall be clearly identified in documentation.
- C. All RTU inputs are to be tested in local and system testing.
- D. Any unassigned outputs shall be reserved for future use by Authority. A connection terminal for each output shall be provided. Output terminals shall be clearly identified in documentation.

- E. All RTU outputs are to be tested in local and system testing.
- F. Contractor shall assign all I/O addresses for the tunnel ventilation RTU. Provide I/O list indicating address and function for Approval by Engineer.
- G. Contractor shall furnish and install RTU I/O marshalling terminal block as indicated in the Contract Drawings.
- H. Contractor shall install communications wiring and equipment between the RTU devices as indicated in the Contract Drawings.

ARTICLE 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

- A. Item 16742.001 – SCADA System shall be measured as a lump sum unit, complete in place.
- B. Item 16742.002- Alarm/Indication Wiring shall be measured as a lump sum unit, complete in place.

4.02 PAYMENT

- A. Item 16742.001 – SCADA System will be paid at the lump sum price, and shall include the cost of all related work specified in this Section.
- B. Item 16742.002 - Alarm/Indication Wiring will be paid at the lump sum price, and shall include the cost of all related work specified in this Section.

END OF SECTION

- D. Checking of control circuit wiring including internal wiring and field wiring.
- E. Checking alarm, annunciator, DCS and PLC (as appropriate) interconnection circuits.

3.16 SYSTEM PERFORMANCE TESTS

- A. System performance tests shall be performed as specified in Contract Documents Section 15891, "Tunnel Services Mechanical Testing and Commissioning".
- B. In addition to the systems tests above, but not limited to, the following electrical system performance test shall be performed and documented "pass" or "fail".
 1. All ventilation modes as per Contract Drawings MC 400 and MC 404.
 2. Set ventilation modes via SCADA screen at OCC.
 3. Transfer control from OCC to local control touch screens via SCADA screen.
 4. Transfer control from OCC to local control touch screen if communication failure to OCC occurs.
 5. Manually control individual item of equipment via local control station touch screen when it is in local control.
 6. Set ventilation modes via local control touch screen.
 7. Mains power failure to PLC/RTU. UPS powers RTU/PLC.
 8. Communication failure to OCC, PLC/RTU remains in the last set ventilation mode.
 9. Test security of power supply by failure of incoming feeders. Bus ties close and provide power to via the operating feeder.
 10. Primary PLC/RTU failure. Transfer control to secondary PLC/RTU. Once primary PLC/RTU is operational again, control is transferred back from secondary to primary.
 11. Failure of fan monitoring devices (vibration, RTDs) or communication to these devices. Mode of operation of fans unaffected.
 12. Loss of communications between VSD and RTU/PLC. VSD fail to last set speed and direction.
 13. Mains power failure (greater than 90 minutes) to tunnel emergency lighting system. The centralized emergency lighting UPS powers lights for at least 90 minutes.

ARTICLE 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

- A. Item 16889.001 – Tunnel Services Electrical Testing and Commissioning shall be measured as a lump sum unit, complete in place.

4.02 PAYMENT

- A. Item 16889.001 – Tunnel Services Electrical Testing and Commissioning will be paid at the lump sum price and shall include the cost of all work specified in this Section.

END OF SECTION

- N. Section 16889, "Tunnel Services Electrical Testing and Commissioning"
- O. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"
- P. Section 16892, "Tunnel Services Uninterruptible Power Supply"
- Q. Section 16893, "Tunnel Services Power Factor Correction"
- R. Section 16894, "Tunnel Emergency Rail Lighting and Lighting Receptacles"
- S. 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.

- 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. 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.

- c. Circuit breakers which are used for circuit isolation shall be provided with an operating handle with door interlock and interlock defeat, and with "ON/OFF" indication and padlocking facilities as specified for functional units and
- d. The circuit breaker toggle shall be a "trip-free" mechanism and the "tripped" position of the toggle shall be distinct from its "ON" and "OFF" positions.

K. Fuses

- 1. All fuses used for protection of power and control circuits shall be M class unless otherwise specified on the Contract Drawings;
- 2. All fuses for short-circuit protection of motor circuits shall be rated as shown on the relevant Contract Drawings; and
- 3. Fuse holders shall be of the all insulated type with shrouded contacts.

L. Contactors

- 1. All contactors shall be of the molded block type construction and shall satisfy the following requirements:
 - a. Utilization category shall be AC3 unless otherwise specified in Article 2.01 of this Section;
 - b. Normally open and normally closed auxiliary contacts shall be provided as shown on the Contract Drawings;
 - c. Closing coils shall be continuous rated and suitable for use on the control voltage specified in Article 2.01 of this Section;
 - d. Pole faces in the laminated magnetic circuit shall be fitted with suitable shading rings to minimise in-service vibration and hum;
 - e. Contactors shall be suitable for full voltage across-the line starting of 3 phase, 480V motors and shall be adequately sized to suit the kilowatt rating of the motor. The minimum sized contactor shall be rated for 11kW duty;
 - f. Main contacts shall be double break silver alloy or similar and shall be suitable for uninterrupted (continuous) duty. Mechanical endurance shall be at least 5 million no-load operations; and
 - g. Contactors shall have type 2 coordination with their short circuit protective devices in accordance with IEC 947-4-1.

M. Current Transformers

- 1. Current transformers shall be fully encapsulated and shall comply with relevant standards and the following:
 - a. Metering transformers shall have accuracy class and secondary output as specified in Article 2.01 of this Section;
 - b. Protection transformers shall be selected to suit the appropriate protection relay and shall have current ratios as shown on the Contract Drawings.

N. Small Power Transformer

- 1. Dry-type step-down transformers shall be general purpose UL listed, and meet all applicable NEMA, ANSI and IEEE standards.

- c. The restricted ground fault relays shall be located on or adjacent to the main incoming or bus-tie circuit breakers and shall have trip signals for external circuits brought out to separate clearly marked terminals.

R. Control Power Supplies

- 1. A control power supply shall be provided with each main bus of the MCC(s) in accordance with the ratings specified in Article 2.01 of this Section and the following:
 - a. Each power supply shall be of the same make, type and size;
 - b. The control power supply transformer(s) shall be double wound, dry type with a grounded metal screen between windings;
 - c. Secondary circuits for all control transformers shall be provided with a fuse on the active lead and grounding of secondary circuits shall be via a ground link connected to the neutral side of the transformer;
 - d. DC control supplies shall be in accordance with relevant standards; and
 - e. Control power shall be distributed by bus in accordance with this Section. Terminals shall be provided at the top of each tier and separate supplies shall be taken into the individual functional units. The control power supply within functional units shall be separately protected by a fuse.

S. Motor Heater Supplies

- 1. Power supplies for motor anti-condensation heaters shall be available from the respective motor starter compartment in accordance with the following:
 - a. Power supplies shall be provided as shown on the Contract Drawings;
 - b. Power supplies shall be fed from the load side of the functional unit isolator, separately fused and switched by a normally closed contact of the motor contactor;
 - c. The power supplies shall be wired to segregated and fully shrouded heater supply terminals; and
 - d. A danger sign reading, "Motor Heater requires Isolation before Maintenance" shall be fitted within all relevant starter compartments.
- 2. Each MCC shall be provided with an anti-condensation heater with thermostat temperature control. |

T. Instruments and Control Devices

- 1. Instruments and control devices shall be provided as shown on the Contract Drawings and shall comply with the following requirements:
 - a. Direct indicating instruments including voltmeters, ammeters and kW meters shall comply with relevant standards and the following requirements:
 - 1) Instruments shall be flush mounted, industrial grade;
 - 2) Instruments shall be accuracy Class 1.0 unless specified otherwise in – Article 2.01 of this Section or on the Contract Drawings;
 - 3) Instruments shall be generally of the moving iron type with taut band suspension. Moving coil movements shall be used for all instruments used in conjunction with signal transducers; and
 - 4) Where double scaling is required dials shall be reversible with one scale on each face.

- B. Contractor shall select and configure circuit breakers to allow for total discrimination between cascaded circuit breakers upstream and downstream.
- C. Contractor shall configure adjustable trip circuit breakers to avoid false tripping of breakers during motor start up.
- D. The Contractor shall coordinate the study with other Authority Contracts.

3.02 FIELD WIRING

- A. The wiring between the input/output cubicles and the MCC starters shall be single core panel wiring in accordance with this Section. This wiring shall be terminated directly onto the marshalling terminals of the input/output cubicles.

3.03 TESTING

- A. Type Testing
 1. Type test certificates (UL Listed) from a recognized testing agency shall be provided to substantiate that the equipment, which is identical in essential details to that being supplied, has passed all necessary type tests. Type testing shall have been carried out in accordance with relevant standards including internal arcing tests.
- B. Routine Testing
 1. Routine tests to relevant standards shall be carried out on the complete MCC, fully assembled in its final configuration, prior to dispatch and shall include, but not limited to, the following:
 - a. Insulation resistance tests;
 - b. Mechanical operating tests;
 - c. Ductor test of each busbar bolted joint;
 - d. Primary injection testing of all protection relays and current transformers;
 - e. Check of protective circuits;
 - f. Testing of all control and interlock circuits to ensure satisfactory operation;
 - g. Check of all PLC inputs and outputs;
 - h. Check of wiring and terminations; and
 - i. Check of nameplates and labels.

3.04 PACKAGING AND SHIPMENT TO WORKSITE

- A. The equipment, as far as practicable, shall be fully tested and assembled ready for shipment.
- B. The equipment shall be adequately packaged for transporting to the Worksite.
- C. Provisions shall be provided for off loading the equipment by overhead crane or fork truck.

ARTICLE 4 MEASUREMENT AND PAYMENT

- M. Section 16891, "Tunnel Services Low Voltage Switchboard and Motor Control Center"
- N. Section 16892, "Tunnel Services Uninterruptible Power Supply"
- 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. ANSI
- B. IEC
- C. NEMA
- D. NEC
- E. NFPA
- F. UL

1.04 SUBMITTALS

- A. All submittals shall be sealed by a Professional Engineer.
- B. Type test certificates (UL Listed) from a recognized testing authority.
- C. Product Data sheets showing voltage, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- D. Shop Drawings indicating front and side views of enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; electrical characteristics including voltage, trip ratings; all termination numbers and identification of purpose.
- E. Label schedule.

ARTICLE 2 PRODUCTS

2.01 APPLICATION SPECIFIC REQUIREMENTS

ITEM	DESCRIPTION	UNIT	DATA
1	Supply Voltage	VAC	480
2	Supply Frequency	Hz	60

3	Control Voltage	VAC	120
4	Power Factor Correction Unit Rating	kVAR	As Indicated on Single Line Diagram
5	Step Size	kVAR	25
6	Fault Rating	kA	65
7	Ambient Operating Temperature	°F	104
8	Minimum Operating Temperature	°F	32
9	Operating Relative Humidity	%	95
10	Target Power Factor		0.95

2.02 OPERATING CONDITIONS

A. Ratings

1. All equipment and materials shall be suitable for operation under the specified general service conditions as specified in Article 2.01 of this Section.
2. All equipment and materials shall be rated for continuous full load operation under any combination of the Design Environmental conditions specified in Article 2.01 of this Section.

B. Power System

1. The equipment shall be designed and manufactured for normal operation on the power supply system as specified in Article 2.01 of this Section.

C. Equipment Protection

1. All equipment shall have a minimum degree of protection of NEMA 1 unless otherwise specified in Article 2.01 of this Section.
2. All enclosures and assemblies shall be vermin proof.

2.03 POWER FACTOR CORRECTION EQUIPMENT

1. The power factor correction equipment shall be housed in flush fronted, totally enclosed free standing dead front type of enclosures incorporating switchfuse units, reactive relays, control relays, contactors and capacitor banks. The equipment shall be suitable for continuous operation and comply with relevant standards and regulations. The service voltage shall be 277/480v, 3 phase, 4 wire 60Hz unless specified otherwise in Article 2.01 of this Section. The equipment shall be able to interrupt supply at fault conditions as specified in Article 2.01 of this Section.

2. The system shall be suitable for fully automatic power factor correction operation through the switching of a static capacitor bank in KVAR steps as defined in Article 2.01 of this Section
3. Each KVAR step shall be switched on via a contactor rated for switching of capacitive loads. The switching of the capacitor banks shall be controlled by a reactive relay. The capacitor banks shall be sized to provide a corrected power factor of 0.95 under full load conditions. The control circuit shall prohibit over correction of the power factor.
4. The power factor correction system shall include a serial data communications interface for monitoring and diagnostic data transfer to the local SCADA system. In addition to this, the system shall include digital I/O diagnostic fault alarms, and analogue (4-20mA) signals for the remote transmission of power factor values.
5. The power factor correction system shall include a power factor correction controller, with the following features:
 - a. Menu guided operations and display
 - b. Illuminated graphic display
 - c. Four quadrant display
 - d. Display of line parameters (V,I,F,Q,P)
 - e. Voltage and current harmonics
 - f. Monitoring of individual capacitor power values
 - g. Manual/auto operation
 - h. Fault detection and alarming
 - i. Programmable settings

B. Power Factor Correction Miscellaneous Equipment

1. A suitable rated main ground, copper bar shall be run the full length at the base of the enclosure. All cable sheaths, metal conduits and separate cubicles shall be bonded to the ground bar.
2. The power factor correction equipment shall be complete with all operating handles and any special tools. A complete set of drawings shall be installed within a spare compartment of the enclosure and a label fitted to indicate where the drawings are kept.
3. All small wiring cables within each switchboard shall be color coded throughout their length and marked with ferrules of an approved type at each end for identification.
4. All small wiring cables within the enclosure shall be neatly laced and cleated to the panel structure of each switchboard. Where wiring passes through a hole in the metalwork, suitable grommets shall be provided. Through wiring shall be terminated on terminal blocks in each cubicle.
5. All small wiring associated with remote control and indication circuits shall be segregated from the power wiring circuits and shall be suitably screened either by the use of screened cable or conduit or trunking installed within the cubicles.

C. Circuits and Labels

1. The circuit classification shall be as shown on the main distribution single line diagram. A label schedule and layout shall be supplied for approval by the Engineer.

D. Finish

1. The finish of the power factor correction enclosure shall be NEMA 1, finished to the Manufacturer's standard and of a color to be agreed with the Engineer.

E. Isolating Fuse-Switch Units (CFS)

1. Isolating fuse-switches shall conform to relevant standards and the following requirements:

2. All enclosures and equipment shall be identified with white laminated phenolic nameplates and labels engraved with black lettering and complying with the following:
 - a. Lettering shall be of minimum size 13/64 inches;
 - b. Labels shall be detachable and interchangeable;
 - c. All external labels shall be attached by means of screws;
 - d. Fixing holes shall be slotted to allow for expansion and contraction; and
 - e. Minor labels within the enclosure only, may be affixed by an approved adhesive.
3. Push buttons and pilot lights shall be supplied with standard metal engraved labels;
4. Nameplates shall be supplied for identifying each enclosure. Lettering shall be minimum size 1 3/16 inches high engraved black on a white background with an approved text;
5. All shrouds over live equipment and bolt-on covers which provide access to live equipment shall be fitted with red danger labels engraved with white lettering "DANGER XYZ VOLTS" (where XYZ = rated voltage as nominated in Article 2.01 of this Section); and
6. A label schedule and layout shall be supplied for approval by the Engineer.

O. Painting and Corrosion Protection

1. The Contractor's standard painting and corrosion protection system:
 - a. Shall be subject to approval by the Engineer; and
 - b. The color of the final surface coat shall be subject to approval by the Engineer.
2. The equipment shall be delivered with a minimum sample of 1 Gallon of the final surface paint in a sealed container. The container shall be labeled with sufficient information to permit re-ordering.

ARTICLE 3 EXECUTION

3.01 TESTING

A. Installation

1. Install as per manufacturer's instructions.
2. Install required safety labels.
3. Ensure that the power factor correction capacitors and VSD drives are not charged simultaneously to avoid voltage surges which might damage the VSD unit.

B. Type Testing

1. Type test certificates (UL Listed) from a recognized testing authority shall be provided to substantiate that the equipment which is identical in essential details to that being supplied has passed all necessary type tests. Type testing shall have been carried out in accordance with relevant standards including internal arcing tests.

C. Routine Testing

1. Routine tests to relevant standards shall be carried out on the complete power factor correction system, fully assembled in its final configuration, prior to dispatch and shall include the following:
 - a. Insulation resistance tests;
 - b. Mechanical operating tests;
 - c. Ductor test of each busbar bolted joint;
 - d. Primary injection testing of all protection relays and current transformers;
 - e. Check of protective circuits;
 - f. Testing of all control and interlock circuits to ensure satisfactory operation;
 - g. Check of all control system interfaces;
 - h. Check of wiring and terminations; and
 - i. Check of nameplates and labels.

3.02 PACKAGING AND SHIPMENT TO SITE

- A. The equipment, as far as practicable, shall be fully tested and assembled ready for shipment.
- B. The equipment shall be adequately packaged for transporting to site.
- C. Provisions shall be provided for off loading the equipment by overhead crane or fork truck.

3.03 OPERATION WITH VARIABLE SPEED DRIVES (VSD)

- A. Follow manufacturer's instruction for operation of VSD with power factor correction systems.
- B. Ensure that the power factor correction capacitors and VSD drives are not charged simultaneously to avoid voltage surges which might damage the VSD unit.

ARTICLE 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

- A. Item 16893.001 – Tunnel Services Power Factor Correction shall be measured as an each unit, complete in place.

4.02 PAYMENT

- A. Item 16893.001 – Tunnel Services Power Factor Correction will be paid at the unit price and shall include the cost of all work specified in this Section.

END OF SECTION

- B. The enclosure shall have a minimum degree of protection of NEMA 4X unless otherwise specified in Article 2.01 of this Section. Gaskets shall be temperature resistant synthetic rubber and resistant to the atmosphere in the rail tunnel.
- C. All tunnel luminaires components shall be of low smoke and halogen free manufacture.
- D. All lighting power circuit cables shall be fire resistant and of low smoke and halogen free manufacture and be installed in steel conduit.
- E. All enclosures and assemblies shall be vermin proof.
- F. Duplex Receptacle
 - 1. Duplex Receptacle shall be weather proof with heavy duty surface mount cast device box with cover.

2.04 LIGHTING TECHNICAL REQUIREMENTS

- A. General
 - 1. Luminaires mounting and positioning including maximum and minimum height requirements shall comply with the relevant Contract Drawings.
- B. UPS Emergency Lighting
 - 1. Emergency lights shall be supplied from a dedicated UPS unit. UPS units shall automatically switch to battery backup in the event of a power outage.
 - 2. In the event of a power outage emergency lighting shall be maintained for a minimum period of 90 minutes.
 - 3. Minimum emergency lighting levels on egress walkways shall be 2.7 lux minimum in accordance with NFPA 130.
 - 4. Emergency Lighting UPS shall be UL924 listed.
- C. Duplex Receptacle
 - 1. Duplex receptacle shall be 120VAC, 20A, 2 pole 3 wires, NEMA WD 6 5-20R with integral ground fault circuit interrupter.

2.05 SPARES

- A. The Contractor shall provide a spare Emergency Lighting UPS for the type installed.
- B. The spares shall be suitably packed for handling and for long term storage in accordance with manufacturer recommendations that have been approved by the Engineer and coordinated with Authority. Clear identification of the equipment shall be provided on the packaging. The Contractor shall be responsible for the transport and off-loading of any spares to a site nominated by Authority.

ARTICLE 3 EXECUTION

3.01 LUMINAIRES

- A. Contractor shall furnish and install all equipment necessary for the tunnel emergency lighting to function properly, including but not limited to luminaires, mountings brackets, light sources and fixings in accordance with the Contract Drawings.

3.02 DUPLEX RECEPTACLES

- A. Contractor shall furnish and install all equipment necessary for the tunnel receptacles to function properly, including but not limited to duplex receptacles, weather proof heavy duty surface mount device box in accordance with the Contract Drawings.

3.03 TESTING

- A. Tests to relevant standards shall be carried out on the complete lighting system, fully assembled in its final configuration:
 1. Insulation resistance tests;
 2. Ground continuity tests;
 3. Check of protective circuits;
 4. Operational test of all luminaries;
 5. Emergency lighting levels;
 6. Check of wiring and terminations; and
 7. Battery operated emergency system discharge test to establish the capacity of the batteries.
- B. Tests to relevant standards shall be carried out on the complete duplex receptacles, fully assembled in its final configuration:
 1. Insulation resistance tests;
 2. Ground continuity tests;
 3. Check of GFCI protective circuits;
 4. Check of wiring and terminations.

3.04 PACKAGING AND SHIPMENT TO WORKSITE

- A. The equipment, as far as practicable, shall be fully tested and assembled ready for shipment.
- B. The equipment shall be adequately packaged for transporting to the Worksite.

ARTICLE 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

- A. Item 16894.001 – Rail Tunnel Lighting System shall be measured as a lump sum unit, complete in place.
- B. Item 16894.002 – Rail Tunnel Lighting Receptacles shall be measured as a lump sum unit, complete in place.
- C. Item 16894.003 – Spare Emergency Lighting UPS and all Associated Equipment shall be measured as a lump sum unit, complete in place.

4.02 PAYMENT

- A. Item 16894.001 – Rail Tunnel Lighting System will be paid at the lump sum price and shall include the cost of all related work specified in this Section.
- B. Item 16894.002 – Rail Tunnel Lighting Receptacles will be paid at the lump sum price and shall include the cost of all related work specified in this Section.
- C. Item 16894.003 – Spare Emergency Lighting UPS and all Associated Equipment will be paid at the lump sum price and shall include the cost of all related work specified in this Section.

END OF SECTION

- L. 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/startup 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

- 8. Short Circuits
 - 9. Ground Faults
 - 10. Overload
 - 11. VVVF Output Open Circuit
 - 12. Single Phasing
- E. All analogue input circuits, and all two-wire transmitter type analogue output circuits shall be protected within the controller against reverse polarity connection.
- F. All analogue output circuits of locally powered equipment shall be protected within the controller such that short-circuits or open-circuit connection of the output, while the controller is powered on, shall not cause damage to the controller. Analogue outputs shall be insulated from ground.

2.05 SPARES

- A. The Contractor shall provide a spare Variable Speed Drive for each type installed.
- B. The spares shall be suitably packed for handling and for long term storage in accordance with manufacturer recommendations that have been approved by the Engineer and coordinated with Authority. Clear identification of the equipment shall be provided on the packaging. The Contractor shall be responsible for the transport and off-loading of any spares to a site nominated by Authority.

ARTICLE 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

- A. All equipment shall be installed in readily accessible positions.
- B. The Variable Speed Drive (VSD) controllers will be installed in areas and under conditions as detailed in Article 2.01 of this Section and the Contract Drawings.
- C. All fastenings shall be cadmium plated, zinc plated or galvanized. Spring and flat washers shall be provided under nuts or bolt heads where necessary. Other fastenings shall be securely locked. Each bolt or stud shall be shortest standard length, which will show at least one full thread beyond its nut after assembly. Studs shall be screwed home at least 1 ¼ diameters.
- D. All equipment shall be installed according to the Manufacturer's instructions in addition to the requirements stated herein.
- E. All equipment shall be installed so that accuracy and reliability shall not be impaired due to vibration, pulsation, temperature, or contamination.
- F. Ramp time for VSD controllers shall comply with NFPA 130.

3.02 CABLING

- A. All cabling shall comply with NEC standards and the following requirements.
- B. Cables requiring additional support or protection shall be enclosed in galvanized steel screwed conduit. PVC conduit shall not be used.

- A. Item 16895.001 – Gateway Station Low Voltage AC Variable Speed Drive shall be measured as a lump sum unit, complete in place.
- B. Item 16895.002 – North Side Station Low Voltage AC Variable Speed Drive shall be measured as a lump sum unit, complete in place.
- C. Item 16895.003 – Spare Low Voltage AC Variable Speed Drives and all Associated Equipment shall be measured as a lump sum unit, complete in place.

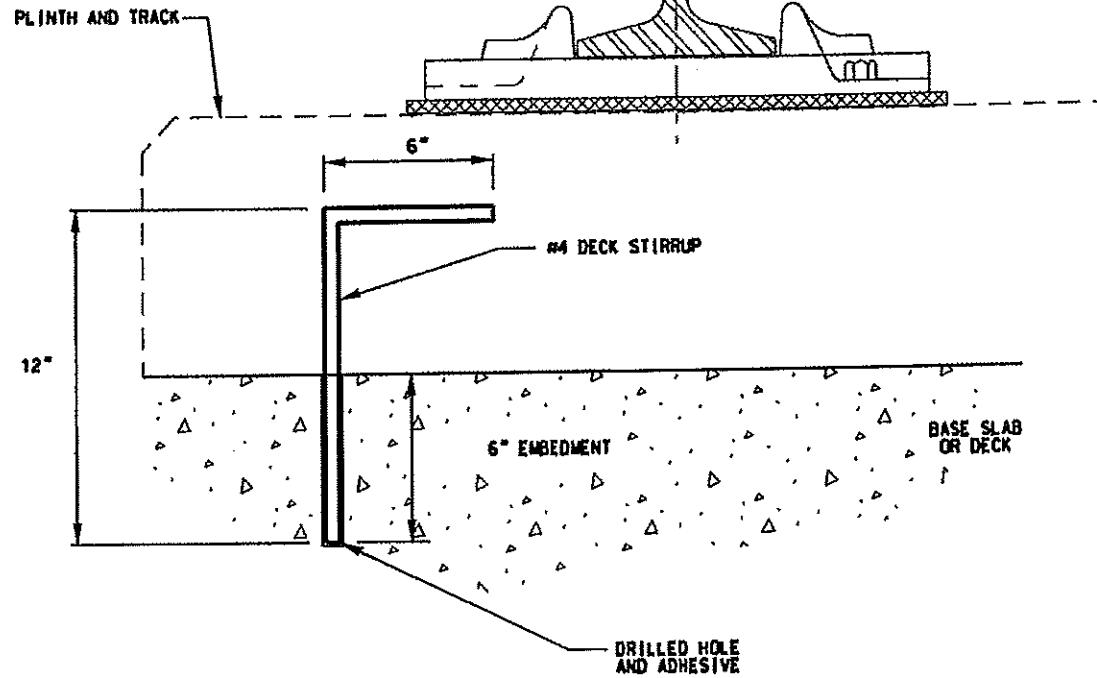
4.02 PAYMENT

- A. Item 16895.001 – Gateway Station Low Voltage AC Variable Speed Drive will be paid at the lump sum price and shall include the cost of all related work specified in this Section.
- B. Item 16895.002 – North Side Station Low Voltage AC Variable Speed Drive will be paid at the lump sum price and shall include the cost of all related work specified in this Section.
- C. Item 16895.003 – Spare Low Voltage AC Variable Speed Drives and all Associated Equipment will be paid at the lump sum price and shall include the cost of all related work specified in this Section.

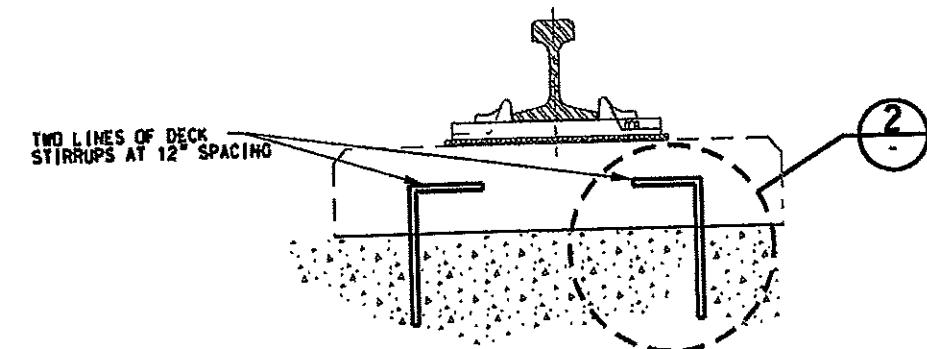
END OF SECTION

BILL OF MATERIAL

ITEM	DESCRIPTION	QUANTITY
1	#4 DECK STIRRUP EPOXY COATED	AS REQ'D



TYPICAL DETAIL "L" SHAPED DECK STIRRUP



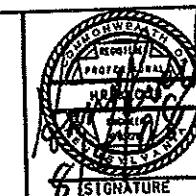
TYPICAL PLINTH

NOTES:

1. FOR PLINTH & TRACK DETAILS REFER TO TK131, TK132 AND TK146.
2. FOR INSTALLATION AND TESTING OF DECK STIRRUPS, REFER TO 03630.
3. FOR PLINTH LAYOUT REFER TO 02452.
4. FOR SPECIAL WORK AND NON-STANDARD PLINTHS, ADJUST DECK STIRRUP SPACING TO 12"x12" PATTERN.

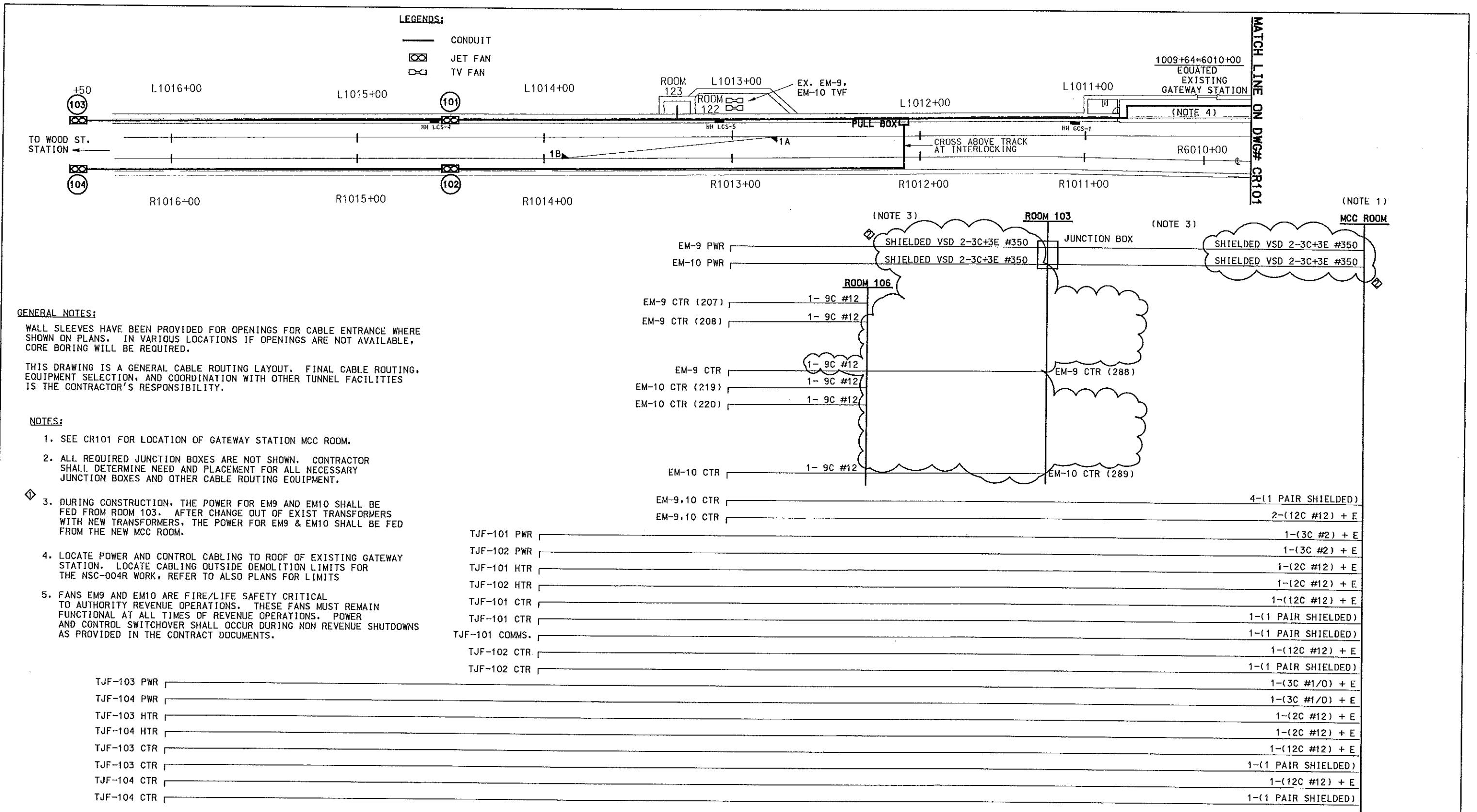
NO.	DATE	DESCRIPTION	REVISIONS
8/05/08	ADDENDUM 2 - DRAWING MODIFIED		

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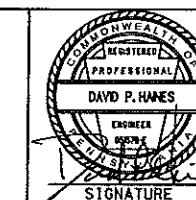
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APPROVED 8.6.08
DATE APR. 28, 2008
SCALE NTS

PORT AUTHORITY OF ALLEGHENY COUNTY PITTSBURGH, PENNSYLVANIA	NORTH SHORE CONNECTOR NSC TRAIN SYSTEM (SYSTEM WIDE) TYPICAL TRACK SECTIONS PLINTH ANCHOR DETAILS
Port Authority	CONTRACT NO. NSC-009 DWG NO. TK132A SHT. 11A



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	<input checked="" type="checkbox"/>	7/31/08	ADDENDUM 1 - DRAWING MODIFIED
NO. DATE		DESCRIPTION	
REVISIONS			

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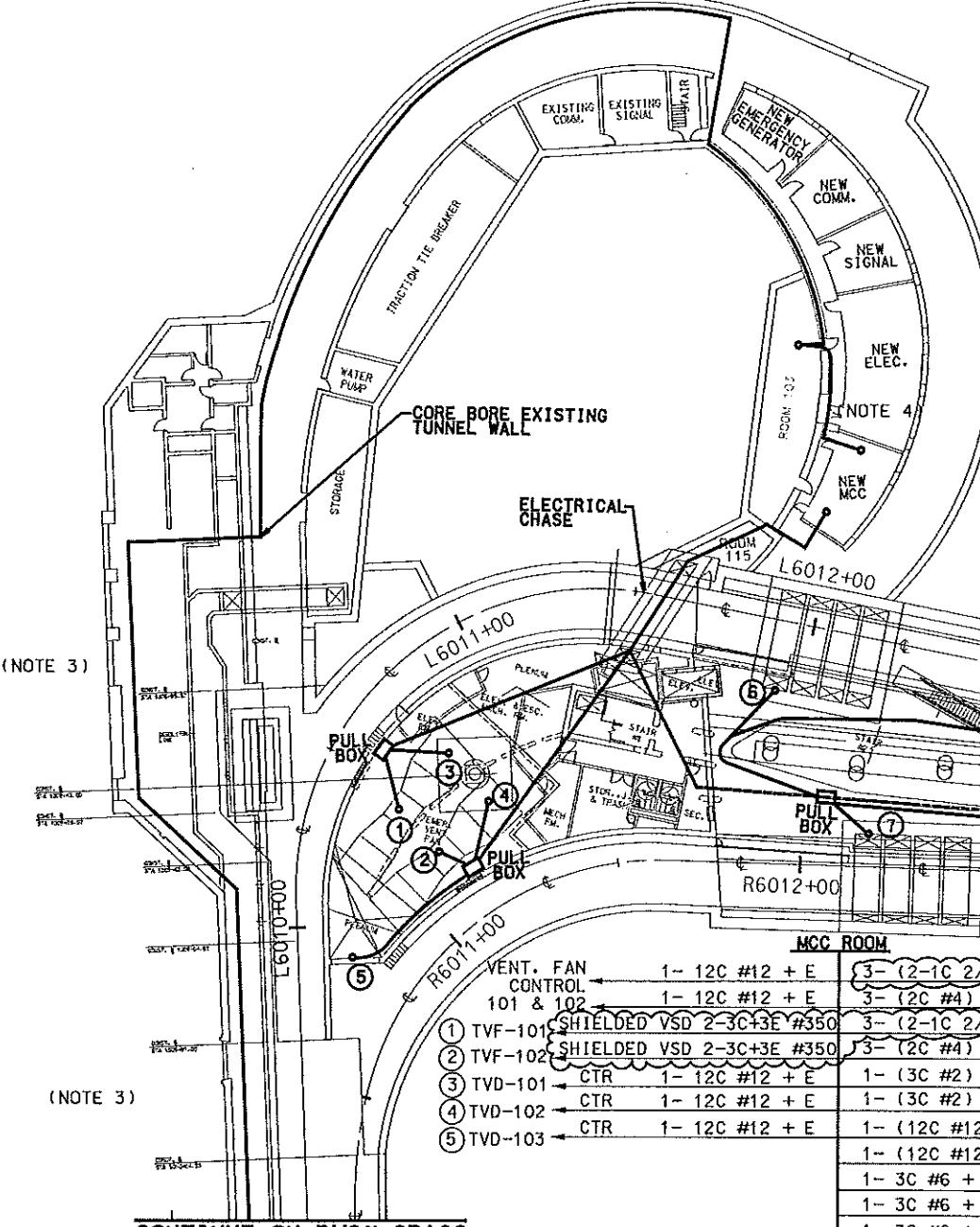
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PITTSBURGH, PA. 15222

APPROVED **8-8-08**
DATE

DESIGNED	MAUNSEL
DRAWN	GTR
CHECKED	DPH
IN CHARGE	DPH
DATE	APR. 28, 2008
SCALE	NTS

PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH **PENNSYLVANIA**

NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
ELECTRICAL CABLE ROUTING PLAN
GATEWAY STATION



CONTINUE ON DWG# CR100

TVF-101 CTR	1-1 PAIR #14 SHIELDED	TVD-104 (6)
TVF-101 COMMS.	1-1 PAIR #14 SHIELDED	TVD-105 (7)
TVF-101 HTR	1-2C #12 + E	TVD-106 (8)
TVF-102 CTR	1-1 PAIR #14 SHIELDED	TVD-107 (9)
TVF-102 HTR	1-2C #12 + E	TVD-108 (10)
TVD-101 PWR	1-3C #6 + E	TVD-109 (11)
TVD-102 PWR	1-3C #6 + E	TVD-110 (12)
TVD-103 PWR	1-3C #6 + E	TVD-111 (13)
		TVD-112 (14)
		TVD-113 (15)
		TVD-106 CTR
		TVD-107 CTR
		TVD-108 CTR
		TVD-109 CTR
		TVD-110 CTR
		TVD-111 CTR
	1-12C #12 + E	TVD-112 CTR
	1-12C #12 + E	TVD-113 CTR
		TVD-104 CTR
		TVD-105 CTR

NOTES:

1. ALL REQUIRED JUNCTION BOXES ARE NOT SHOWN. CONTRACTOR SHALL DETERMINE NEED AND PLACEMENT FOR ALL NECESSARY JUNCTION BOXES AND OTHER CABLE ROUTING EQUIPMENT.
2. DURING CONSTRUCTION, THE POWER FOR EM9 AND EM10 SHALL BE FED FROM ROOM 103. AFTER CHANGE OUT OF EXISTING TRANSFORMERS WITH NEW TRANSFORMERS, THE POWER FOR EM9 & EM10 SHALL BE FED FROM THE MCC ROOM.
3. LOCATE POWER AND CONTROL CABLING TO ROOF OF EXISTING GATEWAY STATION. LOCATE CABLING OUTSIDE DEMOLITION LIMITS FOR THE NSC-004R WORK. REFER TO ALSO PLANS FOR LIMITS
4. FANS EM9 AND EM10 ARE FIRE / LIFE SAFETY CRITICAL TO AUTHORITY REVENUE OPERATIONS. THESE FANS MUST REMAIN FUNCTIONAL AT ALL TIMES OF REVENUE OPERATIONS. POWER AND CONTROL SWITCHOVER SHALL OCCUR DURING NON REVENUE SHUTDOWNS AS PROVIDED IN THE CONTRACT DOCUMENTS.
5. NEW CABLES DISTRIBUTED FROM NEW MCC ROOM TO NEW GATEWAY STATION AND BORED TUNNELS SHALL RUN IN CONDUIT OUT OF THE MCC ROOM ALONG CEILING AND DROP DOWN INTO THE ELECTRICAL CHASE. THE CONDUIT SHALL RUN THROUGH THE CHASE IN THE DESIGNATED AREA AS SHOWN IN THE NSC-004R CONDUIT PLANS (SEE ALSO PLANS).
 - A) TVF 101 AND 102, TVD 101-103 SHALL BE FED THROUGH TWO EMBEDDED DUCT BANKS TO PULL BOXES (009) LOCATED IN THE FAN ROOM.
 - B) TVD 104-107 SHALL BE FED THROUGH EMBEDDED DUCT BANK TO PULL BOX(009) LOCATED UNDER THE PLATFORM NEAR STA R6012+10. ROUTE TVD POWER AND CONTROL TO TVD UNDER PLATFORM AS SHOWN.
 - C) TVD 108-111 SHALL BE FED THROUGH EMBEDDED DUCT BANK TO 2 PULL BOXES(009) LOCATED WITHIN VERTICAL PLENUM.
 - D) TK LIGHTING SHALL BE FED THROUGH EMBEDDED DUCT BANK TO 2 EXIST. PULL BOXES LOCATED ON TUNNEL WALL AT BORED TUNNEL INTERFACE. FROM PULL BOX, CABLES AND CONDUIT SHALL BE ATTACHED TO TUNNEL WALLS AND AS SHOWN IN THE CONTRACT DOCUMENTS.
 - E) TVD 112-113 AND SUMP PUMPS 101-102 SHALL BE FED THROUGH EMBEDDED DUCT BANK TO EXIST. PULL BOX LOCATED NEAR SUMP ROOM LOCATED AT THE NORTHERN END OF THE STATION.

CONTINUE ON DWG# CR102

L.TK LIGHT MAINTENANCE PHASE A, B, C
L.TK LIGHT UPS PHASE A, B, C
R.TK LIGHT MAINTENANCE PHASE A, B, C
R.TK LIGHT UPS PHASE A, B, C

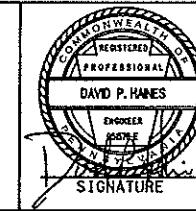
GENERAL NOTE
WALL SLEEVES HAVE BEEN PROVIDED FOR OPENINGS FOR CABLE ENTRANCE WHERE SHOWN ON PLANS. IN VARIOUS LOCATIONS IF OPENINGS ARE NOT AVAILABLE, CORE BORING WILL BE REQUIRED.

THIS DRAWING IS A GENERAL CABLE ROUTING LAYOUT. FINAL CABLE ROUTING, EQUIPMENT SELECTION, AND COORDINATION WITH OTHER TUNNEL FACILITIES IS THE CONTRACTOR'S RESPONSIBILITY.

LEGEND

- EMBEDDED CONDUIT PROVIDED BY NSC-004 R
- CONDUIT
- PULL BOX
- EXISTING PULL BOX PROVIDED BY NSC-004 R

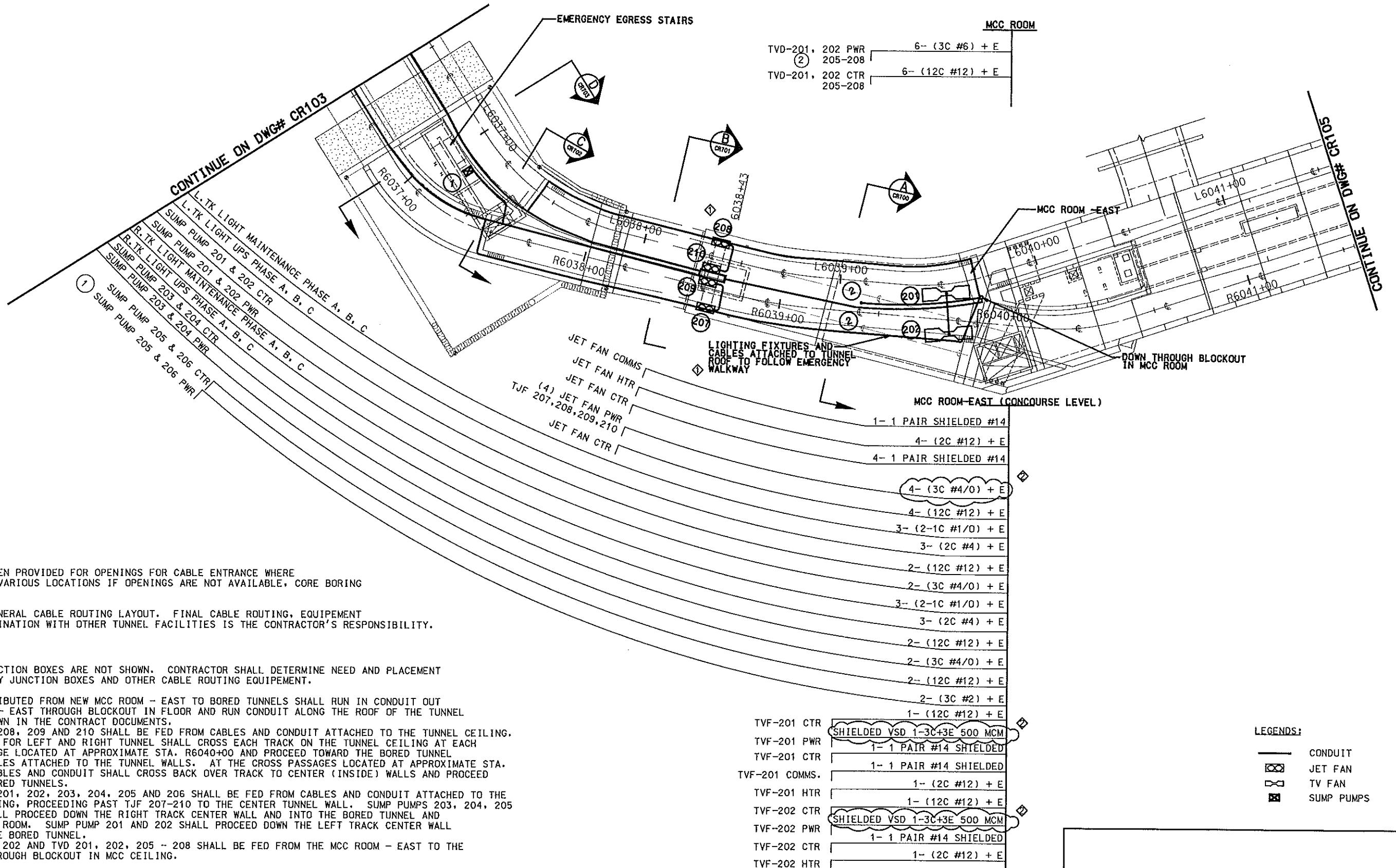
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APPROVED 8-11-08
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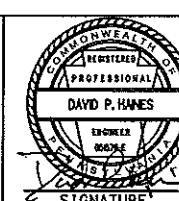
PORT AUTHORITY OF ALLEGHENY COUNTY
PENNSYLVANIA
NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
ELECTRICAL CABLE ROUTING PLAN
GATEWAY STATION TO TUNNEL
Port Authority
CONTRACT NO. NSC-009
DWG. NO. CR101 SHT. 564

NO.	DATE	DESCRIPTION	REVISIONS
3/5/08		ADDENDUM 2 - DRAWING MODIFIED	
7/31/08		ADDENDUM 1 - DRAWING MODIFIED	



NO.	DATE	DESCRIPTION	REVISIONS
<input checked="" type="checkbox"/>	8/5/08	ADDENDUM 2 - DRAWING MODIFIED	
<input checked="" type="checkbox"/>	7/31/08	ADDENDUM 1 - DRAWING MODIFIED	

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DAVID P. HANES
PROFESSIONAL ENGINEER
PEPCO
APPROVED
S-8-08
DATE

DESIGNED BY MAUNSELL
DRAWN BY GFTR
CHECKED BY DPH
IN CHARGE BY DPH
DATE APR. 28, 2008
SCALE BY NTS

PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH, PENNSYLVANIA
NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
ELECTRICAL CABLE ROUTING PLAN
NORTH SIDE STATION

Port Authority
CONTRACT NO. NSC-009
DWG. NO. CR104 SHT. 567

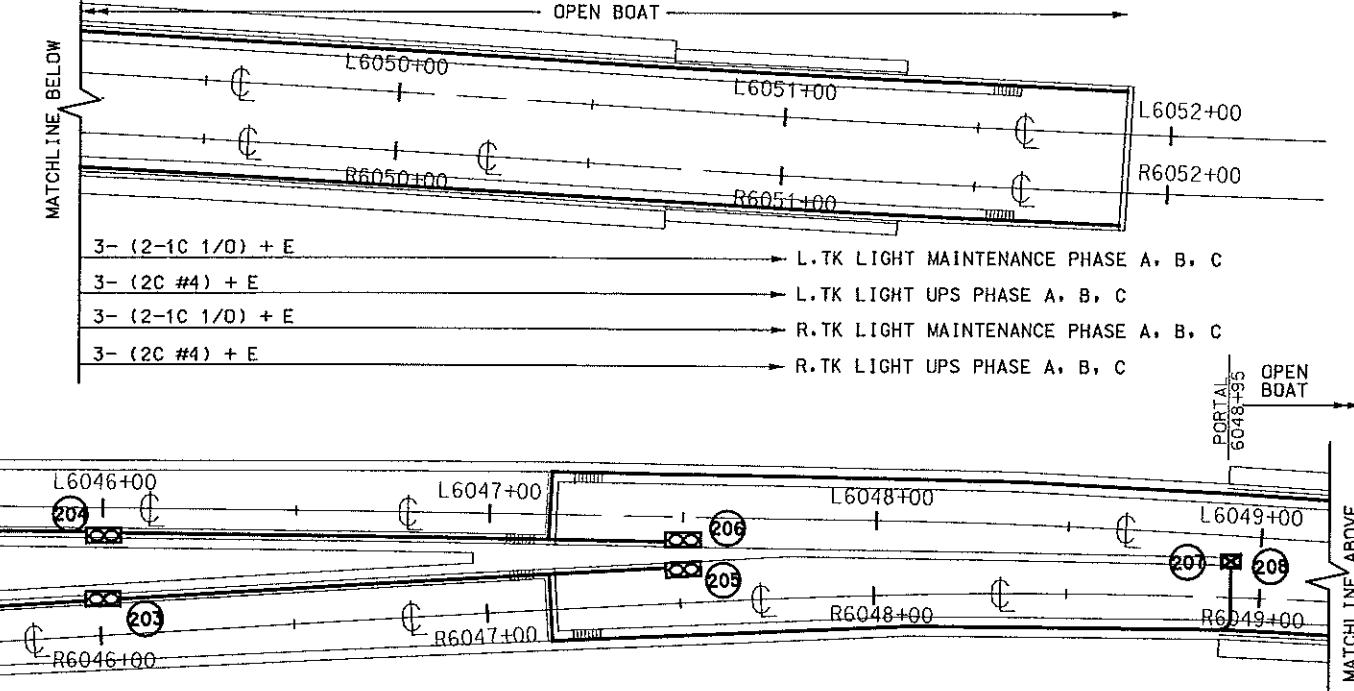
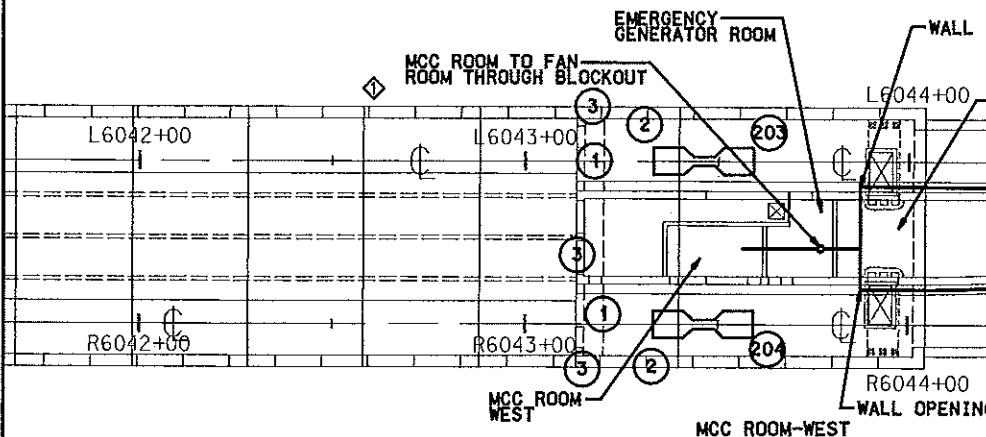
CONTINUE ON DWG# CR104

LEGENDS:	
—	CONDUIT
—	EMBEDDED CONDUIT
□	JET FAN
□	TV FAN
☒	SUMP PUMPS

GENERAL NOTES:

WALL SLEEVES HAVE BEEN PROVIDED FOR OPENINGS FOR CABLE ENTRANCE WHERE SHOWN ON PLANS. IN VARIOUS LOCATIONS IF OPENINGS ARE NOT AVAILABLE, CORE BORING WILL BE REQUIRED.

THIS DRAWING IS A GENERAL CABLE ROUTING LAYOUT. FINAL CABLE ROUTING, EQUIPMENT SELECTION, AND COORDINATION WITH OTHER TUNNEL FACILITIES IS THE CONTRACTOR'S RESPONSIBILITY.



MATERIALS & QUANTITIES		DESCRIPTION		NOTES	
TVF 203	SHIELDED VSD 1-3C+3E 500 MCM	3- (2-1C 1/0) + E			L.TK LIGHT MAINTENANCE PHASE A, B, C
TVF 204	SHIELDED VSD 1-3C+3E 500 MCM	3- (2C #4) + E			L.TK LIGHT UPS PHASE A, B, C
TVF 203 CTR	1- 12C #12 + E	3- (2-1C 1/0) + E			R.TK LIGHT MAINTENANCE PHASE A, B, C
TVF 203 CTR	1- 1 PAIR #14 SHIELDED	3- (2C #4) + E			R.TK LIGHT UPS PHASE A, B, C
TVF 203 COMMS.	1- 1 PAIR #14 SHIELDED	(2- (3C #1/0) + E)	TJF 201, 202 PWR	1. ALL REQUIRED JUNCTION BOXES ARE NOT SHOWN. CONTRACTOR SHALL DETERMINE NEED AND PLACEMENT FOR ALL NECESSARY JUNCTION BOXES AND OTHER CABLE ROUTING EQUIPMENT.	
TVF 203 HTR	1- 2C #12 + E	2- 12C #12 + E	TJF 201, 202 CTR		
		2- 1 PAIR #14 SHLD	TJF 201, 202 CTR	2. NEW CABLES DISTRIBUTED FROM NEW MCC ROOM - WEST TO THE TUNNEL AND BOAT SECTION SHALL RUN IN CONDUIT OUT OF THE MCC ROOM THROUGH THE EMERGENCY GENERATOR ROOM AND ELECTRICAL ROOM, OUT THE WALL OPENINGS ON EITHER SIDE OF THE ELECTRICAL ROOM WALLS, OUT INTO THE TUNNEL ALONG TUNNEL CEILING AND WALLS TO SERVICE THE TK LIGHTING, TJF 201, 202, 203, 204, 205 AND 206, SUMP PUMPS 207 AND 208.	
		2- 2C #12 + E	TJF 201, 202 HTR	A. TK LIGHTING AND SUMP PUMP SERVICE SHALL CROSS FROM INSIDE TUNNEL WALLS TO OUTSIDE TUNNEL WALLS AT THE WALKWAY CROSS PASSAGES LOCATED AT APPROXIMATE STA. L6047+10 AND R6047+10.	
		2- 1 PAIR #14 SHLD	TJF 201 COMMS.		
		(2- (3C #1/0) + E)	TJF 203, 204 PWR	3. NEW CABLES DISTRIBUTED FROM MCC ROOM - WEST TO TVF 203 AND 204 AND TVD 203, 204, 209 - 213 SHALL RUN THROUGH BLOCKOUT PROVIDED BETWEEN EMERGENCY GENERATOR ROOM AND FAN ROOM.	
		2- 12C #12 + E	TJF 203, 204 CTR		
		2- 1 PAIR #14 SHIELDED	TJF 203, 204 CTR		
		2- 2C #12 + E	TJF 203, 204 HTR		
TVF 204 CTR	1- 12C #12 + E				
TVF 204 CTR	1- 1 PAIR #14 SHIELDED				
TVF 204 HTR	1- 2C #12 + E				
① TVD 212, 213 PWR	2- 3C #2 + E				
TVD 212, 213 CTR	2- 12C #12 + E	1- (3C 1/0) + E	TJF 205, 206 PWR		SSP 207 PWR
		1- 12C #12 + E	TJF 205, 206 CTR		SSP 207 CTR
		1- (3C 1/0) + E	TJF 205, 206 CTR		SSP 208 PWR
② TVD 203, 204 PWR	5- 3C #6 + E	1- 12C #12 + E	TJF 205, 206 HTR		SSP 208 CTR
(3) TVD 203, 204 CTR 209- 211	5- 12C #12 + E				

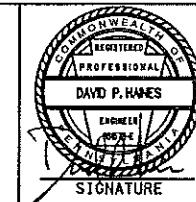
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3/5/08 ADDENDUM 2 - DRAWING MODIFIED
7/31/08 ADDENDUM 1 - DRAWING MODIFIED

NO. DATE

DESCRIPTION

REVISIONS



DMJM HARRIS | AECOM

FOUR GATEWAY CENTER
20TH FLOOR
PITTSBURGH, PA. 15222

DATE APR. 28, 2008

SCALE NTS

APPROVED 8-3-08
DATE

PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH, PENNSYLVANIA

NORTH SHORE CONNECTOR
NSC TRAIN SYSTEM (SYSTEM WIDE)
ELECTRICAL CABLE ROUTING PLAN
NORTH SIDE TO ALLEGHENY STATION

Port Authority

CONTRACT NO. NSC-009

DWG. NO. CR105

SHT. 668

**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 6: Temporary power (ref. Sec. 01787). Is an index available of the current equipment to be transferred to the Follow-On Contractor?

Response 6: No, the current temporary facilities servicing the NSC-003/006 worksite are not the final temporary facilities to be turned over to the NSC-009 Contractor. Port Authority is reviewing this question and if a change to the Bid Documents is required it will be issued as an addendum.

Question 12: Regarding equipment that is already in service on PAAC property (OCC). Must the contractor submit detailed equipment data for this equipment?

Response 12: Yes, as it applies to the OCC site survey described in Section 16950, Article 1.01.B.2

Question 19: 13577 paragraph 2.02.C.18.b requires compiler upgrade for 10 years after final acceptance. Is retesting required and who is responsible for the retesting?

Response 19: Upon receipt of the Final Acceptance Certificate the Contractor would be responsible for the compiler upgrade. Retesting will be performed by Authority.

Question 24: Ref Section 0500, Article 2.1.O – Please clarify the intent of this section. Is it the Authority's intent to charge the contractor \$56.00/hr for escort services for all track occupancy? Is the escort required for the full duration of track occupancy or only to gain occupancy? Is this

requirement for only revenue track? Would the Authority consider creating a PDA Bid Line item for this?

Response 24: Authority escort will be required to assist the Contractor for all existing track entry, exit, and switch operations. Escorts are not required for the duration of the Contractor's entry, as long as the previously mentioned operations are not required. This requirement applies to all existing Authority track. Authority will not create a PDA for this item of Work.

Question 27: Section 15887-3 Corrosion Protection for Fans and Dampers. Is there a protection method defined acceptable? Are there underground temperatures and humidity levels specified?

Response 27: The selected corrosion protection method shall account for 100% humidity levels and subject to annual outdoor air temperature ranges relative to the City of Pittsburgh. The Contractor shall propose and detail an appropriate corrosion protection method to ensure an equipment service life of not less than 20 years based on reasonable maintenance suitable for underground tunnel application.

Question 28: Table 15888-1 silencer insertion losses are not defined. Does this mean the contractor must have a sound consultant to test final sound levels once installed?

Response 28: Port Authority is reviewing this question and if a change to the Bid Documents is required it will be issued as an addendum.

Question 32: Existing Gateway to Wood Street 37C #14 express cable. Is this cable to be replaced all the way to from Gateway to Wood Street or just from Gateway to the tunnel line break box (LBB). Also is the LBB to be replaced with a new box?

Response 32: The cable is to be replaced from the Gateway Signal Room to the LBB. The existing LBB will be reused.

Question 33: Our Company intends on submitting a prime bid on the above-referenced project. In order to effectively do this, we request a four-week extension to the current bid date of August 27, 2008. This is a very complex project and this extension of time will allow us as well as our numerous and varied/disciplined Subcontractors and Vendors, some of which being disadvantaged business enterprise (dbe) owned, more time to develop a more detailed and cost effective price proposal for which the Port Authority of Allegheny County will surely benefit.

This time will also allow for the distribution, comprehension and clarification of the forth-coming addendum and other future addendums as well as the original contract documents.

Response 33: See Addendum 2

Question 34: Due to the complexity and the design build requirements of the various system components as well as subcontractor & supplier vacation schedules will the PAAC consider a 30 day extension to the bid date?

Response 34: See Addendum 2

Question 35: Please clarify the scope limits of the Gateway Tie Breaker Room (Dwg. TP111) and Allegheny Breaker Room (Dwg. TP2111). What contract is responsible for the construction of the:

1. Battery rooms
2. Glastic wall installation
3. Epoxy insulated floor

Response 35: CMU walls and doors for the battery rooms are by other Authority Contractors, see ALSO Plans for additional information. Glastic wall installation and epoxy insulated floor are by NSC-009. (See Section 16210)

Question 36: Section 16210, Art. 2.24 Furniture – In what and/or how many rooms is the listed furniture required?

Response 36: This is required at the North Side Substation in the main room. Furniture is not required in the TPSS battery room.

Question 37: We have received several notices that various electrical equipment suppliers/manufactures, are unable to meet our requested quotation date for there bids due to key personnel being out on vacation.

We would like to request a thirty (30) day extension of the bid due date, to insure that we receive the most competitive costing for your project.

Response 37: See Addendum 2

Question 38: Bid Item 16221.001 – TPSS 27 KV Interrupter Switches. Where are the five (5) switches located?

Response 38: Port Authority is reviewing this question and if a change to the Bid Documents is required it will be issued as an addendum.

Question 39: Due to the size and complexity of this project, we would like to request a 30 day extension to the current bid date of August 27, 2008.

Response 39: See Addendum 2

Question 40: I am having trouble finding the drawings that locate the specific count and location of the Patron Emergency Telephones, Equipment Room PAAC Telephones, and Fire Control Panel Telephones. Additionally you reference CR Drawings for the location of the Blue Light phones In the tunnels and elevated structures. I have found the drawings noted as CMO37-41 but actual counts and locations are yet to be identified.

I assume the stations counts identified for Gateway — North Side and Allegheny in 2.01 —. Page 16721-14 includes the above mentioned phones.

Please help me find these drawing so I can complete my response to section 16721 process.

Response 40: Quantity and location for each type of device for each station is shown on CM075 through CM077.

Quantity of blue light and their locations within the tunnel are shown on CR300 through CR307.

PORT AUTHORITY OF ALLEGHENY COUNTY

SITE VISIT - BORED TUNNEL

SUBJECT: NORTH SHORE CONNECTOR – NSC TRAIN SYSTEMS (SYSTEM WIDE)

CONTRACT NO. NSC-009

DATE: FRIDAY, AUGUST 8, 2008 – 10:30 a.m. – 12:30 p.m.

ATTENDANCE SHEET

Representative	Company	Mailing Address	Phone / Fax
James R. Gossman	PA	7500 University Avenue Pittsburgh, PA 15213	412-681-0109
CRAIG FOEHINGER	PAIA		412-566-5168
Mark H. Berg	PAC	100 Calumet St. Eighty Four, PA 15330	412-566-5372 724-239-2400 -2400 ext
Layne Abel	OneFour Twenty	500 South Ave., 15th Fl. NY, NY 10016	
Bob McPherson	HDS		212-545-5431
Tim Swift	SSOT		412-771-3400 x333
Jeff Betzler	TECH	Safety	412-497-0266
MARK PORTE	PA		11

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Representative	Company	Mailing Address	Phone / Fax
GreshamSteller	Delta Railroad WELINGTON BOB PENNWHITH POWER CORP	2648 West Prospect Aspinwall, PA 15204 10134 Butler Street (412) 246-7459	440-992-2997 440-992-1311 (F)
Bob J. Golink	G.W. Peoples	1024 Rte 519 Suite 200 Eighty First St 16372	724-223-7807 724-223-2961 FAX
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