

**COUNTY OF WESTCHESTER
NEW YORK**

DIVISION OF ENGINEERING

ADDENDUM NO. 6

CONTRACT NO. 20-517

**REHABILITATION OF GLEN ISLAND APPROACH BRIDGE
OVER NEW ROCHELLE HARBOR (BIN 3348880)
NEW ROCHELLE, NEW YORK**

The attention of the bidder is directed to the following changes, additions, and/or substitutions affecting the above referenced contract.

I. RE: THE PLANS

REMOVE Drawing E-03 (Sheet No. 165 of 212) and **REPLACE** with the attached Drawing E-03 (Sheet No. 165 of 212) labelled Revision No. 1.

REMOVE Drawing E-04 (Sheet No. 166 of 212) and **REPLACE** with the attached Drawing E-04 (Sheet No. 166 of 212) labelled Revision No. 1.

REMOVE Drawing E-12 (Sheet No. 174 of 212) and **REPLACE** with the attached Drawing E-12 (Sheet No. 174 of 212) labelled Revision No. 1.

REMOVE Drawing E-17 (Sheet No. 179 of 212) and **REPLACE** with the attached Drawing E-17 (Sheet No. 179 of 212) labelled Revision No. 1.

REMOVE Drawing E-34 (Sheet No. 196 of 212) thru Drawing E-39 (Sheet No. 201 of 212) and **REPLACE** with the attached Drawing E-34 (Sheet No. 196 of 212) thru Drawing E-39 (Sheet No. 201 of 212) labelled Revision No. 1.

REMOVE Drawing E-45 (Sheet No. 207 of 212) thru Drawing E-50 (Sheet No. 212 of 212) and **REPLACE** with the attached Drawing E-45 (Sheet No. 207 of 212) thru Drawing E-50 (Sheet No. 212 of 212) labelled Revision No. 1.

II. RE: THE SPECIFICATIONS

REMOVE the specification for Item 599.063000WE – Bridge Electrical and Control System and **REPLACE** with the attached specification for Item 599.063000WE – Bridge Electrical and Control System) labelled Addendum No. 6 – Cont. No. 20-517.

III. RE: REQUESTS FOR INFORMATION

See the attached summary of comments.

ALL PROVISIONS OF THE CONTRACT NOT AFFECTED BY THE FOREGOING SHALL
REMAIN IN FULL FORCE AND EFFECT.

COUNTY OF WESTCHESTER
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION

By: Hugh J. Greechan Jr., P.E.
Commissioner

Dated: Friday, April 26, 2024
WHITE PLAINS, NEW YORK

SUBMITTALS

1. MANUFACTURERS DATA AND/OR SHOP DRAWING DATA SHALL BE SUBMITTED FOR ALL MANUFACTURED AND PURCHASED ITEMS OF NEW PARTS AND COMPONENTS.
2. SUBMITTALS FOR EACH MANUFACTURED ITEM SHALL BE MANUFACTURER'S DESCRIPTIVE LITERATURE, DRAWINGS, DIAGRAMS, PERFORMANCE AND CHARACTERISTIC CURVES, CATALOG CUTS AND SHALL INCLUDE THE MANUFACTURER'S NAME, TRADENAME, CATALOG MODEL OR NUMBER, NAMEPLATE DATA, SIZE, CERTIFIED LAYOUT DIMENSIONS, CAPACITY, SPECIFICATION REFERENCE AND ALL OTHER INFORMATION NECESSARY TO ESTABLISH CONTRACT COMPLIANCE.
3. FULLY DETAILED SHOP DRAWINGS AND ASSEMBLY DRAWINGS SHALL BE PROVIDED. THESE DRAWINGS SHALL BE SUBMITTED TO THE COUNTY OF WESTCHESTER FOR REVIEW AND APPROVAL. COMMENCEMENT OF WORK IN THE ABSENCE OF APPROVED SHOP DRAWINGS SHALL BE AT THE CONTRACTOR'S RISK.

QUALIFICATIONS, PERSONNEL AND FACILITIES

1. FOR THE FABRICATION, INSTALLATION, ALIGNING, CLEANING, TESTING AND ALL OTHER WORK REQUIRED BY THE SCOPE OF WORK, THE FABRICATOR SHALL USE ADEQUATE NUMBERS OF SKILLED, TRAINED AND EXPERIENCED ELECTRICIANS AND SERVICE PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE REQUIREMENTS AND METHODS SPECIFIED FOR THE PROPER EXECUTION OF WORK.
2. ELECTRICIANS AND SERVICE PERSONNEL SHALL BE PROPERLY EQUIPPED WITH ALL NECESSARY INSTRUMENTS TO ASSURE THAT RELATED COMPONENTS HAVE BEEN PROVIDED WITHIN ACCEPTABLE TOLERANCES AND TO MAKE ALL NECESSARY ADJUSTMENTS FOR ATTAINING THE SPECIFIED RATINGS.

CODES AND STANDARDS

1. WORK UNDER NEW ITEMS SHALL COMPLY WITH ALL APPLICABLE REQUIREMENTS OF THE LATEST EDITION OF CODES AND STANDARDS ISSUED BY, BUT NOT LIMITED TO, THE FOLLOWING ORGANIZATIONS AND PUBLICATIONS WHOSE ABBREVIATIONS SHALL BE AS SHOWN:

1.1. AMERICAN INSTITUTE OF STEEL CONSTRUCTION - AISC

1.2. AMERICAN IRON AND STEEL INSTITUTE - AISI

1.3. ASSOCIATION FOR IRON AND STEEL TECHNOLOGY - AIST

1.4. AMERICAN WELDING SOCIETY - AWS

1.5. ILLUMINATING ENGINEERING SOCIETY - IES

1.6. AMERICAN NATIONAL STANDARDS INSTITUTE - ANSI

1.7. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS - AASHTO

1.8. AMERICAN SOCIETY FOR TESTING AND MATERIALS - ASTM

1.9. INTERNATIONAL BUILDING CODE - IBC

1.10. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS - IEEE

1.11. INSULATED CABLE ENGINEERS ASSOCIATION - ICEA

1.12. INSULATED POWER CABLE ENGINEERS ASSOCIATION - IPCEA

1.13. NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION - NECA

1.14. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION - NEMA

1.15. INTERNATIONAL ELECTRICAL TESTING ASSOCIATION - NETA

1.16. NATIONAL FIRE PROTECTION ASSOCIATION - NFPA

1.16.1. NFPA 70: NATIONAL ELECTRICAL CODE - NEC

1.16.2. NFPA 70E: STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE

1.16.3. NFPA 79: ELECTRICAL STANDARD FOR INDUSTRIAL MACHINERY

1.16.4. NFPA 101: LIFE SAFETY CODE

1.16.5. NFPA 780: STANDARD FOR INSTALLATION OF LIGHTNING PROTECTION SYSTEMS

1.17. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION - OSHA

1.18. UNDERWRITER'S LABORATORY - UL

1.19. ALL OTHER APPLICABLE LOCAL RULES AND ORDINANCES
2. THE WORK SHALL MEET THE REQUIREMENTS OF ALL OTHER CODES AND STANDARDS AS SPECIFIED IN THE CONTRACT DOCUMENTS. WHERE CODES AND STANDARDS ARE MENTIONED FOR ANY ITEM, IT IS INTENDED TO CALL PARTICULAR ATTENTION TO THEM, IT IS NOT INTENDED THAT ANY OTHER CODES AND STANDARDS BE OMITTED IF NOT MENTIONED.
3. THE FOLLOWING IS A LIST OF THE CONTRACT DOCUMENT SPECIFICATIONS:

3.1. 599.063000WE MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM

3.2. 683.090700WE MOVABLE BRIDGE STANDBY GENERATOR

3.3. 599.142500WE MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS

3.4. 599.142600WE MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS INSTALLATION

3.5. 599.064000WE MOVABLE BRIDGE ELECTRICAL TESTING

3.6. 680.79300001 REMOVE TRAFFIC SIGNAL HEAD OR PEDESTRIAN SIGNAL HEAD

3.7. 680.82250301 REMOVE STEEL EMBEDDED TRAFFIC SIGNAL POLE

3.8. 670.60 PHOTOELECTRIC CONTROLS

3.9. 670.81 REMOVE AND DISPOSE OF LAMPPOST ASSEMBLY

3.10. 680.621630 TRAFFIC SIGNAL POLE - MAST ARM

3.11. 680.6712 TRAFFIC SIGNAL POLE – POST TOP MOUNT

3.12. 680.810101 TRAFFIC SIGNAL MODULE – 12 INCH RED BALL, LED

3.13. 680.810103 TRAFFIC SIGNAL MODULE – 12 INCH YELLOW BALL, LED

3.14. 680.810105 TRAFFIC SIGNAL MODULE – 12 INCH GREEN BALL, LED

3.15. 680.810107 TRAFFIC SIGNAL SECTION – TYPE I, 12 INCH

3.16. 680.810308 INSTALL BALL LED TRAFFIC SIGNAL MODULE

3.17. 680.8111 TRAFFIC SIGNAL BRACKET ASSEMBLY

3.18. 680.8220 FLASHING BEACON SIGN ASSEMBLY

3.19. 680.10000007 INSTALL TRAFFIC SIGNAL POLE, ALL SIZES

MOVABLE BRIDGE PROJECT COORDINATOR

1. ALL OF THE FOLLOWING MOVABLE BRIDGE PROJECT COORDINATOR REQUIREMENTS SHALL BE CONSIDERED INCIDENTAL TO THE WORK AND BE PAID FOR UNDER VARIOUS PAY ITEMS LISTED IN PARAGRAPH 8 BELOW, AS IS RELEVANT.
2. THE CONTRACTOR SHALL SUPPLY A SINGLE PERSON RESPONSIBLE FOR ALL DUTIES DEFINED BELOW, WHO SHALL BE DESIGNATED AS THE MOVABLE BRIDGE PROJECT COORDINATOR.
3. THE CONTRACTOR SHALL HIRE A MOVABLE BRIDGE PROJECT COORDINATOR (MBPC) WHO SHALL BE A NEW YORK STATE LICENSED PROFESSIONAL ENGINEER. A RESUME OF THE INDIVIDUAL'S EXPERIENCE AND WRITTEN EVIDENCE OF COMMITMENT TO THE CONTRACT SHALL BE SUBMITTED PRIOR TO AWARD OF CONTRACT. THE MBPC SHALL HAVE PRIOR PROFESSIONAL EXPERIENCE IN COORDINATING A MINIMUM OF TWO RECENT STRUCTURAL-MECHANICAL-ELECTRICAL PROJECTS FOR MOVABLE BRIDGES. THE PROJECT SIZE SHALL BE MAJOR REHABILITATION OF STRUCTURAL ELEMENTS AND COMPLETE REPLACEMENT OF DRIVE MACHINERY AND ELECTRICAL CONTROL SYSTEMS, WITH A CONSTRUCTION COST OF AT LEAST \$8 MILLION FOR EACH QUALIFYING PROJECT. SHOULD AN ACCEPTABLE INDIVIDUAL NOT BE FOUND WITHIN THE CONTRACTOR'S PERMANENT STAFF, CONSIDERATION WILL BE GIVEN TO AN INDIVIDUAL HIRED ESPECIALLY FOR THIS POSITION. UNDER ALL CIRCUMSTANCES, PRIOR MOVABLE EXPERIENCE IS MANDATORY, AS DESCRIBED ABOVE. WRITTEN EVIDENCE OF THE WILLINGNESS OF THE MBPC TO COMMIT FULLY THROUGHOUT THE DURATION OF THE PROJECT SHALL BE OFFERED TO THE ENGINEER AS PART OF THE QUALIFICATION FOR THE INDIVIDUAL. THE MBPC SHALL NOT BE CHANGED WITHOUT PRIOR APPROVAL OF THE ENGINEER AND UNTIL A SUCCESSOR HAS BEEN APPROVED BY THE ENGINEER.
4. THE MBPC SHALL HAVE THE RESPONSIBILITY OF COORDINATING ALL CONSTRUCTION WORK ON THE MOVABLE BRIDGE PORTIONS OF THE PROJECT, FROM SHOP DRAWING PREPARATION AND REVIEW THROUGH FIELD WORK AND FINAL ACCEPTANCE. THE MBPC SHALL BE TASKED WITH MAINTAINING THE SCHEDULE OF THE MOVABLE BRIDGE WORK BY ENSURING THE CONTRACTOR AND ALL SUBCONTRACTORS PERFORM THEIR WORK IN A TIMELY AND ORGANIZED MANNER, AND AT ALL TIMES ARE WORKING TOWARD THE COMMON GOAL OF FINISHING THE PROJECT IN A WORKMANLIKE MANNER AND IN ACCORDANCE WITH THE APPROVED SCHEDULE AND IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.
5. THE MBPC SHALL PARTICIPATE IN THE DEVELOPMENT OF THE CRITICAL PATH METHOD (CPM) SCHEDULING, TO ASSURE ADEQUATE PLANNING AND EXECUTION OF THE MOVABLE BRIDGE WORK. THE SCHEDULE SHALL ALLOW ADEQUATE TIME TO REVIEW THE INDIVIDUAL SUBMITTALS.
6. THE MBPC SHALL ALSO REVIEW AND CONFIRM ACCURATE INFORMATION TO BE USED FOR OPERATING AND MAINTENANCE MANUAL CONTENT AS WELL AS INFORMATION FOR OPERATING AND MAINTENANCE TRAINING.
7. THE MBPC SHALL BE RESPONSIBLE FOR THE COORDINATION OF ALL STRUCTURAL, MECHANICAL, AND ELECTRICAL CONSTRUCTION WORK ON THE TEMPORARY MOVABLE BRIDGE PORTIONS OF THE PROJECT, FROM SHOP DRAWING PREPARATION AND REVIEW THROUGH FIELD WORK, ACCEPTANCE, OPERATION, AND DECOMMISSIONING. THE MBPC SHALL BE TASKED WITH MAINTAINING THE SCHEDULE OF THE TEMPORARY MOVABLE BRIDGE WORK BY ENSURING THE CONTRACTOR AND ALL SUBCONTRACTORS PERFORM THEIR WORK IN A TIMELY AND ORGANIZED MANNER, AND AT ALL TIMES ARE WORKING IN A WORKMANLIKE MANNER IN ACCORDANCE WITH THE APPROVED SCHEDULE AND IN CONFORMANCE WITH THE CONTRACT DOCUMENTS.
8. THE MBPC SHALL BE RESPONSIBLE FOR COORDINATION OF ALL WORK INCLUDED IN BUT NOT LIMITED TO THE FOLLOWING PAY ITEMS, AS WELL AS ANY STRUCTURAL WORK PERFORMED ON THE MOVABLE BRIDGE:

PAY ITEM	PAY ITEM DESCRIPTION
8.1. 599.061201WE	REHABILITATE SPAN DRIVE MACHINERY
8.2. 599.061202WE	REFURBISH TRUNNION
8.3. 599.061205WE	REPLACE SPAN LOCKS AND MISCELLANEOUS REPAIRS
8.4. 599.061301WE	BRIDGE BALANCE
8.5. 599.063000WE	MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM
8.6. 599.064000WE	MOVABLE BRIDGE ELECTRICAL TESTING
8.7. 619.0501	TEMPORARY STRUCTURES AND APPROACHES NO 1
8.8. 683.090700WE	MOVABLE BRIDGE STANDBY GENERATOR
8.9. THIS LINE IS INTENTIONALLY LEFT BLANK	
8.10. 599.142600WE	MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCT INSTALLATION
8.11. 670.81	REMOVE AND DISPOSE OF LAMPPOST ASSEMBLY
8.12. 680.10000007	INSTALL TRAFFIC SIGNAL POLE, ALL SIZES
9. THE COORDINATION FUNCTIONS AND RESPONSIBILITIES OF THE MBPC SHALL INCLUDE BUT NOT BE LIMITED TO:

9.1. COORDINATION OF SHOP DRAWINGS AS REQUIRED FROM ALL SUPPLIERS, FABRICATORS AND SUBCONTRACTORS.

9.2. EXCHANGE OF NECESSARY DATA RELATED TO THE MOVABLE BRIDGE PORTION OF THE PROJECT BETWEEN SUBCONTRACTORS.

9.3. SUBSTITUTION OF ALTERNATE BRANDS OF COMPONENTS, SUBSTANTIATION OF EQUIVALENCY, AND COORDINATION OF APPROVALS TO ALL REVISIONS NECESSITATED BY THE SUBSTITUTION.

9.4. SUBMITTALS OF SHOP DRAWINGS, CATALOG CUTS, MANUFACTURER'S LITERATURE, AND ALL OPERATING AND MAINTENANCE MANUAL CONTENT IN A TIMELY MANNER.

9.5. CERTIFYING THAT ALL MATERIALS, CONSTRUCTION METHODS AND PERFORMANCE OF WORK ARE IN CONFORMANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

9.6. EXPEDITING DELIVERIES AND SHOP TESTING OF TIME CRITICAL MATERIALS AND EQUIPMENT.

9.7. COORDINATING ALL STRUCTURAL, MECHANICAL, AND ELECTRICAL FIELD WORK, INCLUDING TEMPORARY MOVABLE BRIDGE, TEMPORARY CHANNEL CLOSURES, TEMPORARY SUPPORTS, BRACINGS, JACKING, INSTALLATIONS, AND REMOVALS.
10. THE MBPC SHALL ATTEND ALL MEETINGS INVOLVING THE MOVABLE BRIDGE CONSTRUCTION PROJECT AND ATTENDED BY ANY COMBINATION OF CONTRACTOR, SUBCONTRACTOR, MATERIAL SUPPLIERS, AND THE ENGINEER. THE MBPC SHALL BE THE INDIVIDUAL TO WHOM ALL QUESTIONS RELATING TO THE CONSTRUCTION OF THE MOVABLE BRIDGE SHALL BE ADDRESSED.

TEMPORARY BRIDGE REQUIREMENTS

1. ALL OF THE FOLLOWING TEMPORARY BRIDGE REQUIREMENTS SHALL BE PAID FOR UNDER PAY ITEM 619.0501.
2. DESIGN, CONSTRUCT, COMMISSION, OPERATE, INSPECT AND MAINTAIN THE TEMPORARY MOVABLE SPAN IN ACCORDANCE WITH THE AASHTO STANDARD SPECIFICATION FOR MOVABLE HIGHWAY BRIDGES 1988 AND AASHTO MOVABLE BRIDGE INSPECTION, EVALUATION AND MAINTENANCE MANUAL. SPAN LOCKS ARE NOT REQUIRED FOR NON-COUNTERWEIGHTED TEMPORARY MOVABLE SPAN. TRAFFIC GATES ARE REQUIRED ON BOTH SIDES OF THE MOVABLE SPAN AND BARRIER GATE(S) ARE REQUIRED UNLESS THE SPAN OR OTHER LARGE MASS ELEMENT OBSTRUCTS A VEHICLE FROM DRIVING OFF THE APPROACH SPAN.
3. MOVABLE BRIDGE PROJECT COORDINATOR PROVIDED UNDER THE ELECTRICAL SPEC AND PAY ITEM SHALL BE REQUIRED TO COORDINATE THE REQUIREMENTS OF THE TEMPORARY BRIDGE AND ITS OPERATION AND MAINTENANCE.
4. AASHTO MOVABLE BRIDGE INSPECTION, EVALUATION AND MAINTENANCE MANUAL SHALL APPLY TO THE OPERATION, INSPECTION, AND MAINTENANCE OF THE TEMPORARY MOVABLE SPAN. IN PARTICULAR THE CONTRACTOR SHALL BE RESPONSIBLE FOR SAFE OPERATION DEFINED IN PART 1 AND MAINTENANCE DEFINED IN PART 4 OF THIS MANUAL. SPECIAL ATTENTION SHALL BE GIVEN TO COMPLETE INSPECTION OF THE OPERATING ROPES. AT 5 YEARS OF SERVICE A THOROUGH INSPECTION OF THE COMPLETE LENGTHS OF OPERATING ROPES SHALL BE PERFORMED. THE ENGINEER WILL INSPECT THE MOVABLE SPAN ONCE PER YEAR IN ACCORDANCE WITH PARTS 2 AND 3 AND PROVIDE MAINTENANCE AND REPAIR RECOMMENDATIONS TO THE CONTRACTOR TO BE IMPLEMENTED WITHIN THE STATED TIME PERIOD.
5. THE TEMPORARY BRIDGE CONTROL SYSTEM SHALL HAVE FULL INTERLOCKING AS DESCRIBED BY AASHTO.
6. SUBMIT THE TEMPORARY MOVABLE SPAN OPERATION AND MAINTENANCE MANUAL FOR REVIEW BY THE ENGINEER.
7. SUBMIT PURPOSED START-UP PROCEDURE/CHECKLIST FOR REVIEW BY THE ENGINEER.
8. COMMISSIONING OF THE TEMPORARY BRIDGE FOR OPERATION SHALL ONLY BE ACCEPTED AFTER DEMONSTRATING 10 CONSECUTIVE DAYS WITH A MINIMUM OF 5 OPENING PER DAY, WITHOUT ANY FAILURES OR WARNINGS/ALARMS. THE 10 DAY PERIOD SHALL START OVER AFTER ISSUES CAUSING FAILURES/ALARMS ARE ADDRESSED.
9. BARGE MOUNTED CRANE FOR EMERGENCY OPERATION NOT PERMITTED UNLESS UNDER SPECIAL REQUEST DUE TO A MAJOR FAILURE SUCH AS A BROKEN OPERATING ROPE.
10. THE TEMPORARY MOVABLE SPAN WHEN OPEN FOR MARINE VESSELS NAVIGATION SHALL PROVIDE AN OPEN CHANNEL OF 59'-4" WIDE AND UNLIMITED VERTICAL CLEARANCE.
11. MAXIMUM OF 17 MINUTES FOR NORMAL COMPLETE CYCLE OF OPERATION, AND 45-MINUTES FOR EMERGENCY COMPLETE CYCLE OF OPERATION, ROADWAY TRAFFIC INTERRUPTION TIME WITHOUT PASSAGE OF MARINE VESSEL THROUGH OPEN CHANNEL. NORMAL COMPLETE CYCLE OF OPERATION IS DEFINED AS THE TIME FROM TRAFFIC LIGHTS TURNING FROM GREEN TO RED AND BACK TO GREEN. OPERATION INCLUDES; LOWERING GATES, OPEN AND CLOSE THE MOVABLE SPAN TO AND FROM ITS FULL OPEN POSITION FOR AN OPEN CHANNEL AND BACK TO SEATED, RAISING THE GATES, AND OTHER ANCILLARY EQUIPMENT OPERATION. EMERGENCY OPERATION IS THE SAME AS NORMAL OPERATION EXCEPT PERFORMED IF A NORMAL DRIVE FAILURE OCCURS.
12. THE SERVICE LIFE OF THE TEMPORARY MOVABLE SPAN SHALL BE A MINIMUM OF 5 YEARS. PROVIDE; ONE SPARE SET OF BRAKE SHOES AND LINERS FOR EACH SIZE BRAKE, ONE SPARE TRAFFIC GATE ARM, GEAR REDUCER OIL OF EQUAL VOLUME TO ITS RESERVOIR CAPACITY. AFTER 5 YEARS OF SERVICE ONE SET OF OPERATING ROPES.
13. THE MAX OPERATING WIND SPEED AS DEFINED BY AASHTO, 10 PSF WIND LOAD ON THE MOVABLE SPAN AND 20 PSF WIND ON THE OPEN SPAN WHILE STATIONARY.
14. THE USE OF A TEMPORARY SUBMARINE CABLE OR AERIAL CABLE IS PROHIBITED, FOR BOTH POWER AND CONTROL. THE TEMPORARY SYSTEM SHOULD DETAIL TEMPORARY POWER ARRANGEMENT FROM THE EXISTING SWITCHGEAR HOUSE AND THE POWER HOUSE ACROSS THE CHANNEL. CONTRACTOR IS REQUIRED TO FIELD VERIFY AND SUBMIT FOR REVIEW AND APPROVAL THE POWER DISTRIBUTION SCHEME FOR THE FAR SIDE OF THE BRIDGE BASED ON THE CONTRACTORS TEMPORARY BRIDGE FAR SIDE POWER REQUIREMENTS. TEMPORARY SERVICE FROM CON EDISON ON EITHER OR BOTH SIDES IS ACCEPTABLE, IF DESIRED.
15. A WIRELESS COMMUNICATION SYSTEM SHALL BE USED TO CONTROL AND RECEIVE FEEDBACK FROM THE FAR DEVICES FOR THE TEMPORARY BRIDGE SUCH AS THE FAR BARRIER GATES, WARNING GATES, AND TRAFFIC SIGNALS.
16. DROOP CABLE SYSTEMS AND NAVIGATION LIGHTING SYSTEMS WILL ALSO NEED TO BE DETAILED BY THE CONTRACTOR NYS LICENSED ELECTRICAL ENGINEER REPRESENTATIVE.
17. THE EXISTING 150KVA SERVICE ALLOWS ONLY ONE BRIDGE TO OPERATE AT TIME. COORDINATION BETWEEN OPERATION OF EXISTING BRIDGE AND TEMPORARY BRIDGE IS REQUIRED UNLESS AN ALTERNATE TEMPORARY UTILITY SERVICE IS OBTAINED THROUGH CONEDISON.
18. THE CONTRACTOR SHALL HIRE A NYS LICENSED ELECTRICAL ENGINEER TO DEVELOP AND SIGN AND SEAL THE TEMPORARY BRIDGE OPERATING SYSTEM.
19. A TEMPORARY BRIDGE FROM A TEMPORARY BRIDGE VENDOR MAY ONLY COME WITH A CONTROL DESK AND AN MCC. CONTRACTOR SHALL HAVE TO FURNISH AND INSTALL, INCLUDING BUT NOT LIMITED TO; ALL STARTERS, ALL WIRING, NAVIGATION LIGHTING, ROADWAY LIGHTING, EMERGENCY GENERATOR HOOKUP, WIRELESS COMMUNICATION SYSTEM FOR CONTROL BETWEEN NEAR AND FAR SIDES, DROOP CABLING, ALL CONDUIT AND TERMINAL BOXES, ETC.



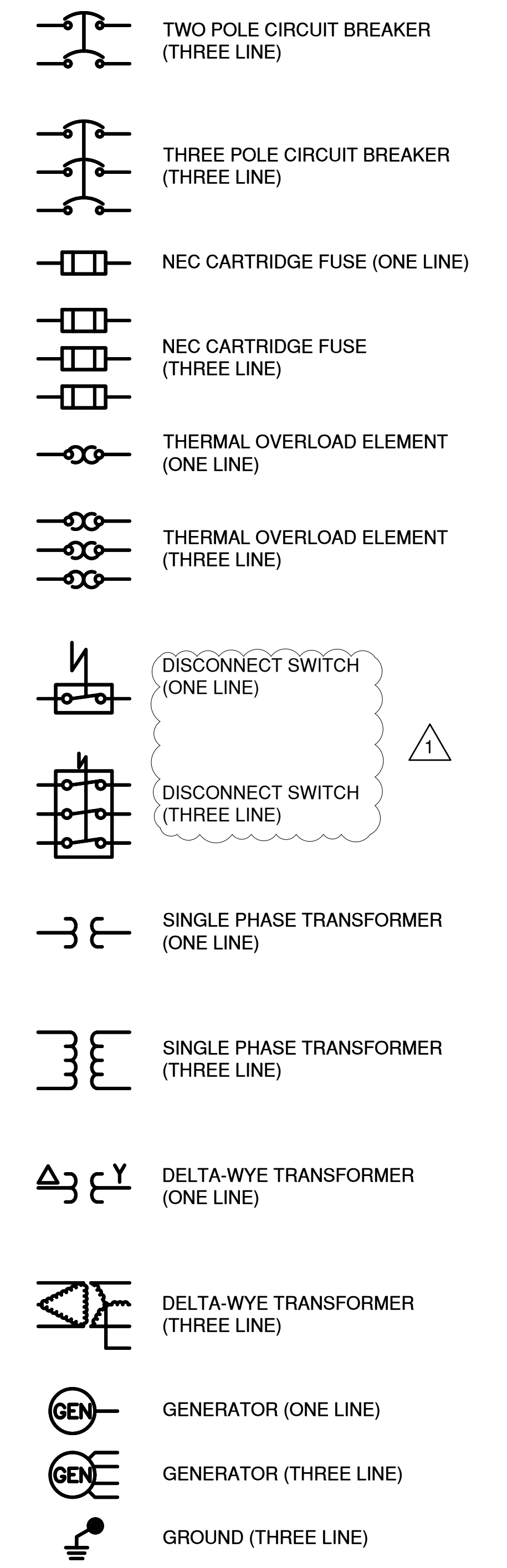
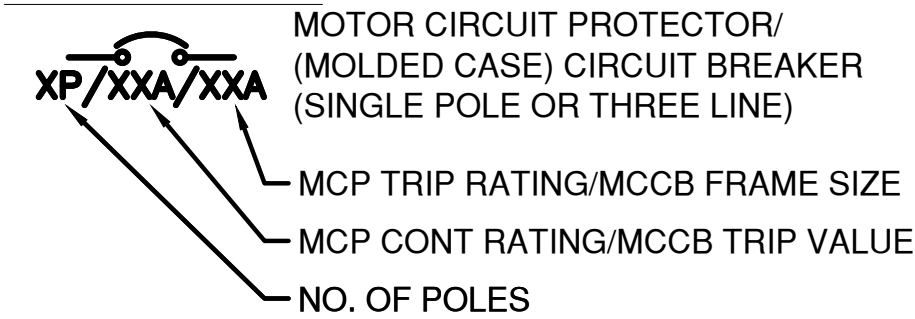
CONSULTANT INFORMATION



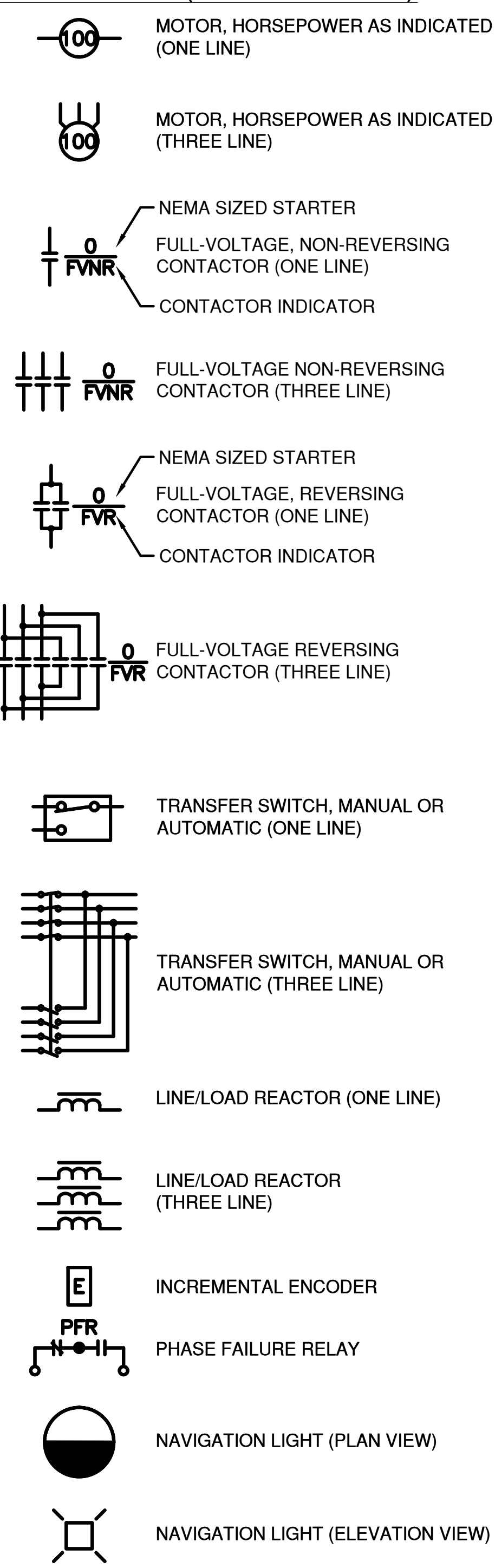
IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY J. AMBROS, PE

1	4/24/24	JA	TK	SCOPE REVISED	RECORD DRAWING CERTIFICATION		WESTCHESTER COUNTY, NEW YORK DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION DIVISION OF ENGINEERING Rehabilitation of Glen Island Approach Bridge over New Rochelle Harbor, City of New Rochelle ELECTRICAL GENERAL NOTES 3	CONTRACT NUMBER 20-517	SHEET NUMBER E-03
					<input type="checkbox"/> AS BUILT – CHANGES AS NOTED <input type="checkbox"/> AS BUILT – NO CHANGES			SHEET NO. 165 OF 212	
					CONTRACTOR NAME _____ SIGNATURE _____ TITLE _____ DATE _____			PROJECT COORDINATOR NAME _____ SIGNATURE _____ TITLE _____ DATE _____	
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION				SCALE: AS SHOWN DATE: 03/08/2024 DPW FILE NO. _____ 5-04-E-600-0	

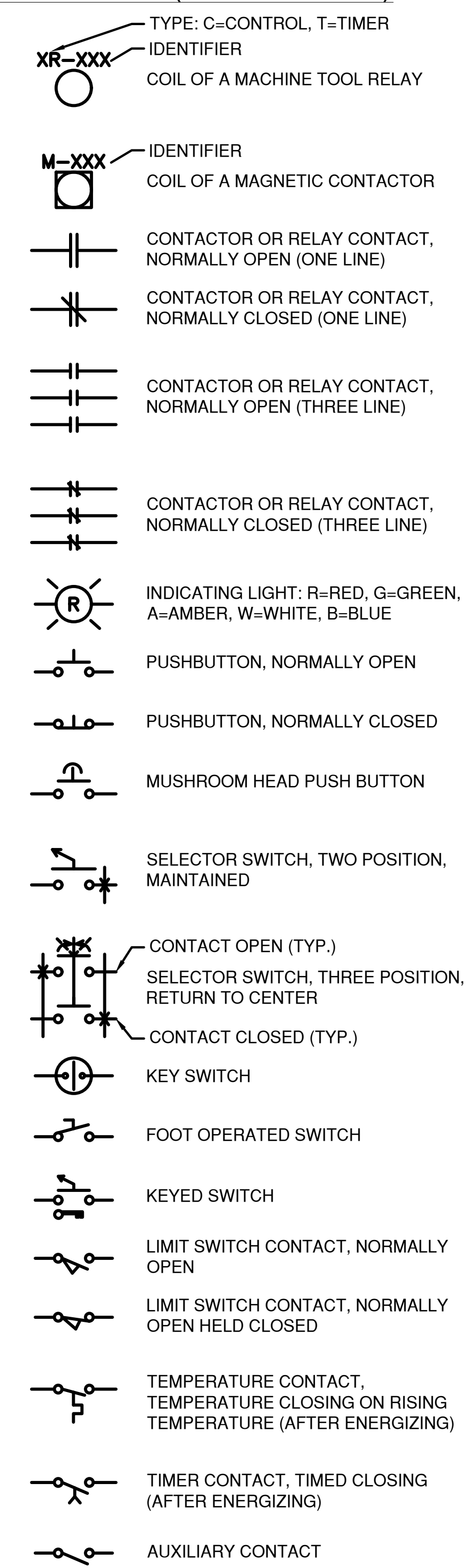
SYMBOLS



SYMBOLS (CONTINUED)



SYMBOLS (CONTINUED)



ABBREVIATIONS

A/AMP	AMPERE
AC	ALTERNATING CURRENT/AIR CONDITIONING
ACM	ASBESTOS CONTAINING MATERIAL
ADMIN	ADMINISTRATION
AF	AMPERE FRAME
AFF	ABOVE FINISHED FLOOR
ALT	ALTERNATE
AM	AMMETER
APPROX	APPROXIMATE
AT	AMP TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
BLDG	BUILDING
C	CONDUIT/CELSIUS
CAB	CABINET
CAT	CATALOG
CB	CIRCUIT BREAKER
CCTV	CLOSED-CIRCUIT TELEVISION
CD	CONTROL DESK
CFPM	CUBIC FEET PER MINUTE
CH	CONTROL HOUSE
CKT	CIRCUIT
COMM	COMMUNICATIONS
CONC	CONCRETE
CONN	CONNECT, CONNECTION
CONT	CONTINUATION
CL	CENTERLINE
CLS	CLASS
CPU	CENTRAL PROCESSING UNIT
CT	CURRENT TRANSFORMER
CTRL	CONTROL
CU	COPPER
DBR	DYNAMIC BRAKING RESISTOR
DC	DIRECT CURRENT
DCTC	DROOP CABLE TERMINAL CABINET
DIA	DIAMETER
DIAG	DIAGRAM
DIM	DIMENSION
DISC/DS	DISCONNECT
DIST	DISTRIBUTION/DISTANCE
DN	DOWN
DP	DISTRIBUTION PANELBOARD
DRV	DRIVE
DS	DISCONNECT SWITCH
DWG	DRAWING
E	EAST
EA	EACH
EF	EXHAUST FAN
EFF	EFFICIENCY
ELEC	ELECTRICAL
ELEV	ELEVATION
EM	EMERG, EMERGENCY
EO	ELECTRICALLY OPERATED
EOT	END-OF-TRAVEL
EPR	ETHYLENE PROPYLENE RUBBER
EQUIP	EQUIPMENT
ETC	ETCETERA
EXH	EXHAUST
EXIST	EXISTING
E-STOP	EMERGENCY STOP
FB	FLOORBEAM
FD	FIRE DEPARTMENT
FDR	FEEDER
FF	FORCE FIT
FL	FLOOD LIGHT
FLEX	FLEXIBLE
FT	FOOT, FEET
FU	FUSE
FUT	FUTURE
FVNR	FULL-VOLTAGE NON-REVERSING
FVR	FULL-VOLTAGE REVERSING

ABBREVIATIONS

GRD/GND	GROUND
GALV	GALVANIZED
GEN	GENERATOR
GEN-SW	GENERATOR SWITCH
GFR	GROUND FAULT RELAY
GPM	GALLONS PER MINUTE
GND	GROUND
GR	GRADE
GRN	GREEN
HEX	HEXAGONAL
HMI	HUMAN-MACHINE INTERFACE
HOA	HAND OFF AUTO
HOR	HORIZONTAL
HP	HORSEPOWER
HS	HIGH STRENGTH
HTR	HEATER
HV	HIGH VOLTAGE
HW	HARDWIRED
HZ	HERTZ
ID	INNER DIAMETER
IWRC	INDEPENDENT WIRE ROPE CORE
I/O	INPUT/OUTPUT
JB	JUNCTION BOX
KCMIL	THOUSAND CIRCULAR MILS
KV	KILOVOLT
KVA	KILOVOLT-AMPERE
KW	KILOWATT
LBS	POUNDS
LCF	LOCATIONAL CLEARANCE FIT
LF	LINEAR FEET
LFMC	LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT LIGHTING PANEL
LP	LIMIT SWITCH
LS	LOCATIONAL TRANSITION FIT
LTF	LIGHTING
LTG	LOW VOLTAGE
LV	LEVEL
LVL	LOW VOLTAGE POWER CIRCUIT BREAKER
LVPCB	
MAINT	MAINTENANCE
MANUF	MANUFACTURER
MAX	MAXIMUM
MB	MOTOR BRAKE
MCC	MOTOR CONTROL CENTER
MCCB	MOLDED CASE CIRCUIT BREAKER
MCP	MOTOR CIRCUIT PROTECTOR
MDP	MAIN DISTRIBUTION PANEL
MECH	MECHANICAL
MH	MANHOLE
MIN	MINIMUM
MINCH	MILLI-INCHES
MIT	MITIGATION
MMB	MAIN MOTOR BRAKE
MO	MANUALLY OPERATED
MPZ	MINI-POWER ZONE
MR	MACHINERY ROOM
MS	MAIN SWITCH
MTD	MOUNTED
MTR	MOTOR
MTS	MANUAL TRANSFER SWITCH
MV	MEDIUM VOLTAGE
MYB	MACHINERY BRAKE

ABBREVIATIONS

N	NORTH
NA	NOT AVAILABLE
NATS	NON-AUTOMATIC TRANSFER SWITCH
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE (LATEST EDITION)
NECA	NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NESC	NATIONAL ELECTRICAL SAFETY CODE
NETA	NATIONAL ELECTRIC TESTING ASSOCIATION
NEUT	NEUTRAL
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NOM	NOMINAL
NO.	NUMBER
NPS	NATIONAL PIPE STRAIGHT
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OAE	OR APPROVED EQUAL
OC	ON CENTER
OCPD	OVER CURRENT PROTECTION DEVICE
ODIA	OUTER DIAMETER
OEM	ORIGINAL EQUIPMENT MANUFACTURER
OF	OPTICAL FIBER
OL	OVERLOAD
OP	OPERATOR
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
P	POLE
PB	PULLBOX
PFR	PHASE FAILURE RELAY
PH	PHASE
PL	PLATE
PM	POWER/PHASE MONITOR
PNL	PANEL
PRH	PRECIPITATION HARDENED
PRI	PRIMARY
PSI	POUNDS PER SQUARE INCH
PT	POINT
PTT	PUSH TO TEST
PWR	POWER
QTY	QUANTITY
RECPT	RECEPTACLE
RC	REMOTE CONTROL
RCC	REMOTE CONTROL CABINET
RCP	REMOTE CONTROL PANEL
RCS	REMOTE CONTROL SWITCH
REF	REFERENCE
REM	REMOTE
RGS	RIGID GALVANIZED STEEL
RM	ROOM
RMC	RIGID METAL CONDUIT
RPM	REVOLUTIONS PER MINUTE
RSR	REMOTE SELECTOR SWITCH
RSF	RUNNING AND SLIDING FIT
RST	RESET

ABBREVIATIONS

S	SOUTH
SC	SUBMARINE CABLE
SCHED	SCHEDULE
SCTC	SUBMARINE CABLE TERMINAL CABINET
SD	SLOWDOWN
SEC	SECONDARY
SECT	SECTION
SHLD	SHIELDED
SIH	SIGNAL INSTRUMENT HOUSE
SL	SPAN LOCK
SM	SINGLE MODE
SP	SPARE, SUMP PUMP
SPD	SURGE PROTECTIVE DEVICE
SS	STAINLESS STEEL
STDBY	STAND-BY
STD	STANDARD
STN	STATION
STRUC	STRUCTURE
SUSP	SUSPENDED
SVC	SERVICE
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMMETRICAL
S/G	SOLID GROUND
S/N	SOLID NEUTRAL
TB	TERMINAL BOX
TEFC	TOTALLY ENCLOSED FAN COOLED
TEL	TELEPHONE
TEMP	TEMPERATURE, TEMPORARY
TENV	TOTALLY ENCLOSED NON VENTILATED
TERM	TERMINAL
TOR	TOP OF RAIL
TRANSF	TRANSFORMER
TRNS	TRANSFER
TRK	TRACK
TS	TRANSFER SWITCH
TTB	TELEPHONE TERMINAL BOX
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TW	TWISTED
TWR	TOWER
TYP	TYPICAL
UINCH	MICROINCHES
UL	UNDERWRITERS LABORATORY
UNK	UNKNOWN
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTED POWER SUPPLY
UTIL	UTILITY
V	VOLT OR VOLTAGE
VA	VOLT-AMPERE
VAC	AC VOLTAGE
VDC	DC VOLTAGE
VERT	VERTICAL
VS	VOLTMETER SWITCH
VM	VOLTMETER
W	WIRE, WIDTH, WEST, WATTS
WP	WEATHER-PROOF
XHHW	CROSS-LINKED HIGH HEAT WATER RESISTANT INSULATED WIRE

IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY J. AMBROS, PE

1	4/24/24	JA	TK	UPDATE FOR CLARITY
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

RECORD DRAWING CERTIFICATION			
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<input type="checkbox"/> AS BUILT – NO CHANGES			
CONTRACTOR		PROJECT COORDINATOR	
NAME _____	NAME _____	NAME _____	NAME _____
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TITLE _____	TITLE _____	TITLE _____	TITLE _____

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WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
DIVISION OF ENGINEERING

Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle

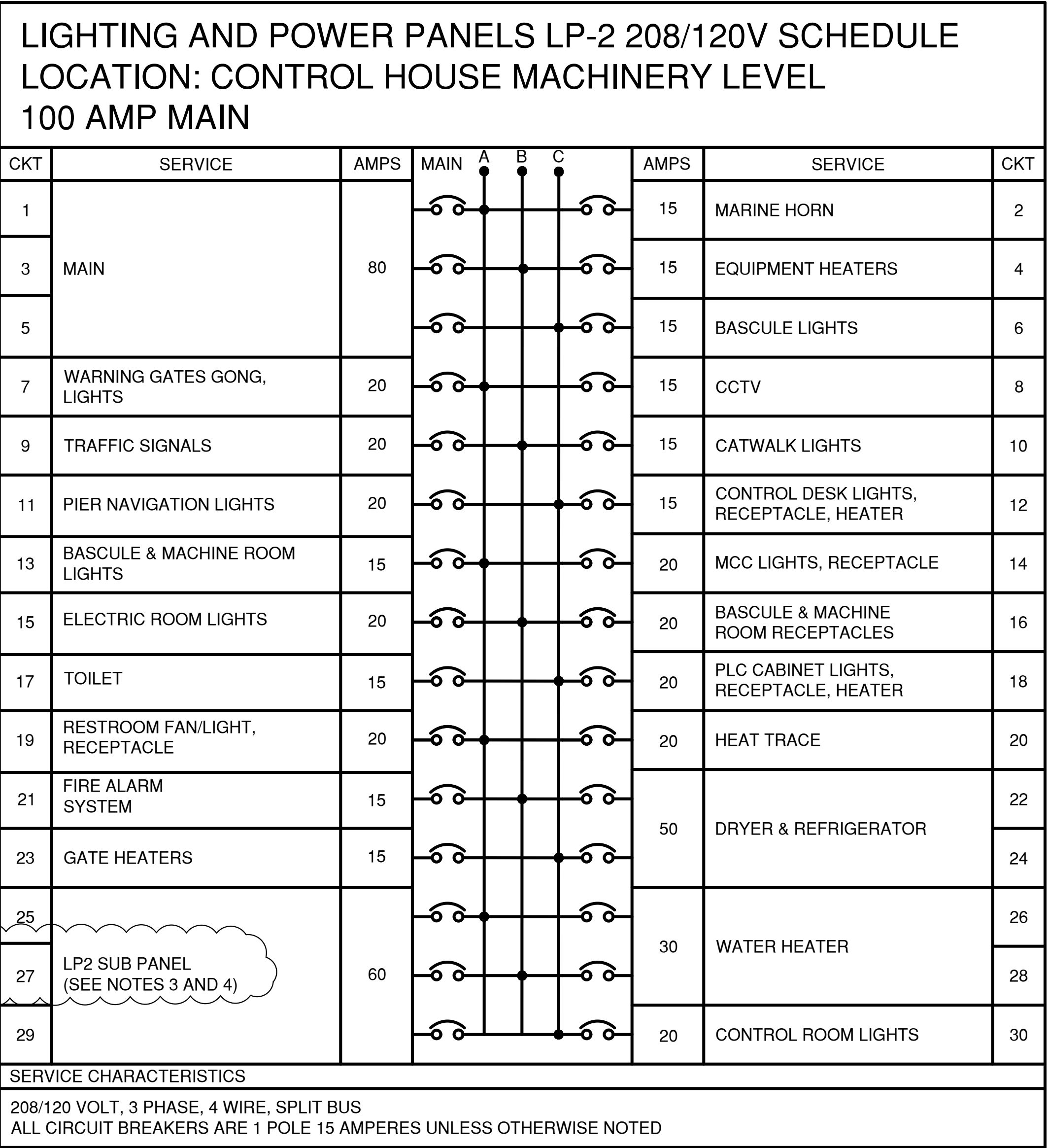
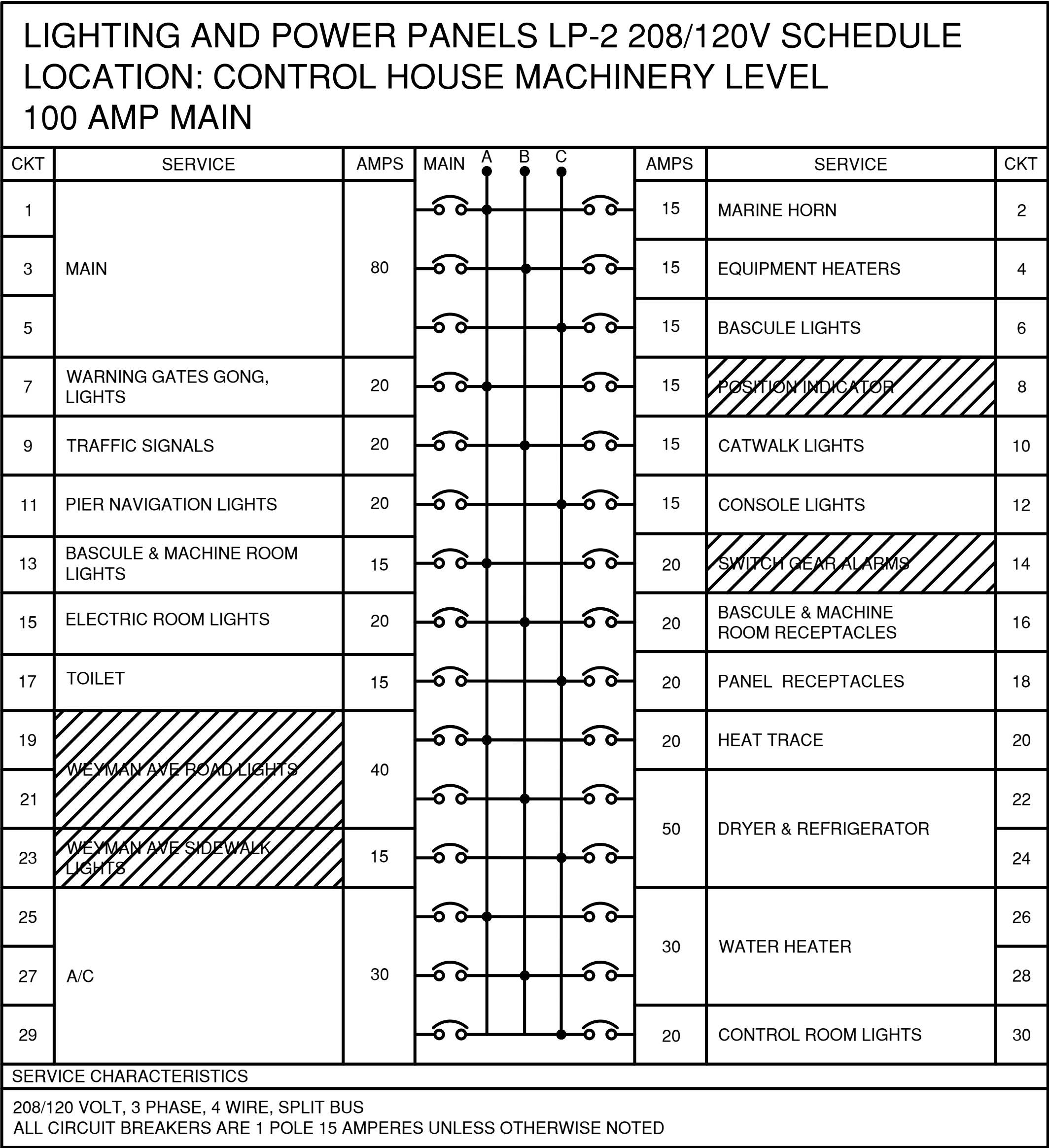
ELECTRICAL

LEGEND & ABBREVIATIONS

CONTRACT NUMBER 20-517	SHEET NUMBER E-04
SHEET NO. 166 OF 212	
SCALE: AS SHOWN DATE: 03/08/2024	
DPW FILE NO.	REV. NO. 1

5-04-E-601-0

DPW FILE NO.
5-04-E-609-0



LP2 SUB TO BE NEMA 4X
RATED 100A MIN.
3PH 208/120V

NOTES:

1. INFORMATION, SCHEMATICS, AND LAYOUTS SHOWN ON THIS DRAWING WERE OBTAINED IN PART OR WHOLE FROM THE EXISTING DOCUMENTS. THE INFORMATION SHOWN IS APPROXIMATE. EQUIPMENT, CONDUIT, CONTROL SYSTEM MODIFICATIONS, AND WIRING REPLACEMENT WORK SHOWN IS INTENDED TO BE USED TO SHOW LEVEL OF EFFORT FOR ELECTRICAL WORK AND FOR CONTRACTORS USE IN DETERMINING MEANS AND METHODS TO PERFORM THE WORK. CONTACTOR SHALL FIELD VERIFY ALL EXISTING AND NEW WORK SHOWN.

2. WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 599.064000WE - MOVABLE BRIDGE ELECTRICAL TESTING

3. AC SUBPANEL SHALL HAVE A 2 POLE 30A CIRCUIT BREAKER FOR THE OUTDOOR 3 TON AC UNIT, A 2 POLE 15A CIRCUIT BREAKER FOR THE TWO INDOOR AIR HANDLERS CONNECTED TO THE 3 TON UNIT, A 2 POLE 15A CIRCUIT BREAKER FOR THE 1.5 TON AC UNIT, AND A SINGLE POLE 15A CIRCUIT BREAKER FOR THE CONDENSATE PUMP.

4. CONTRACTOR SHALL FIELD VERIFY THE EXISTING AIR CONDITIONING LOAD SHEDDING AND FIELD WIRING

IN CHARGE OF D. DELUCA, PE

CHECKED BY A. NOBLE, PE

MADE BY J. AMBROS, PE

EXISTING LP2

ARRANGEMENT AND MODIFY IT SO THE NEW AC UNITS CAN BE REPLACED WITHIN THE EXISTING INFRASTRUCTURE AND LOAD SHEDDING SCHEME. THERE IS AN EXISTING LOAD SHEDDING CONTACTOR FOR THE AC UNIT IN THE EXISTING MCC AND IS WIRED TO 480V. THE EXISTING AC UNIT IS 208V AND POWERED THROUGH EXISTING PANEL LP2. THIS DISCREPANCY MUST BE FIELD INVESTIGATED AND THE FINDINGS MUST BE SUBMITTED, ALONG WITH A RECOMMENDATION FOR ACHIEVING SAME FOR THE NEW UNITS, FOR REVIEW AND RESOLUTION TO THE ENGINEER. THE CONTRACTOR SHALL ULTIMATELY BE REQUIRED TO ARRANGE THE NEW AC UNITS TO LOAD SHED UPON BRIDGE OPERATION SIMILAR TO HOW THE EXISTING INTERLOCKING OPERATES AND SHALL INCLUDE ALL COSTS TO DO SO (INCLUDING BUT NOT LIMITED TO FIELD INVESTIGATION) WITHIN THEIR BID PRICE.

1	4/24/24	JA	TK	SCOPE REVISED
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

RECORD DRAWING CERTIFICATION

☐ AS BUILT – CHANGES AS NOTED

☐ AS BUILT – NO CHANGES

CONTRACTOR

PROJECT COORDINATOR

NAME _____

SIGNATURE _____

TITLE _____ DATE _____

NAME _____

SIGNATURE _____

TITLE _____ DATE _____

MODIFICATIONS TO EXISTING LP2

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Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle
ELECTRICAL
PROPOSED MODIFICATIONS TO LP2

CONTRACT NUMBER 20-517

SHEET NUMBER E-17

SHEET NO. 179 OF 212

SCALE: AS SHOWN
DATE: 03/08/2024

DPW FILE NO. 5-04-E-614-0

REV. NO. 1



- IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY J. AMBROS, PE

1	4/24/24	JA	TK	UPDATE FOR CLARITY
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

NAME _____

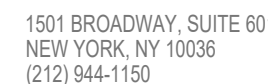
SIGNATURE _____

TITLE _____ DATE _____

NAME _____

SIGNATURE _____

TITLE _____ DATE _____



PROPOSED CONDUIT BLOCK DIAGRAM 2

DPW FILE NO.	REV NO.
5-04-E-632-0	1

COND NO	FROM EQUIPMENT	TO EQUIPMENT	COND SIZE	NO. AND SIZE OF CONDUCTORS	GND	SPARE
1	SERVICE DISCONNECT SWITCH	AUTOMATIC TRASNFER SWITCH (ATS)	EXISTING			
2	GENERATOR	AUTOMATIC TRASNFER SWITCH (ATS)	2-1/2"	4#4/0	#2	-
3	GENERATOR	ELECTRICAL ROOM WIREWAY	3/4"	2#12	#12	2#12
4	PORTABLE GENERATOR HOOK UP	TAPBOX WITH INTEGRAL MANUAL TRANSFER SWITCH (MTS)	CABLES FROM PORTABLE GENERATOR			
5	AUTOMATIC TRASNFER SWITCH (ATS)	DISTRIBUTION PANEL DP-1	EXISTING	4#4/0	#2	-
6	AUTOMATIC TRASNFER SWITCH (ATS)	ELECTRICAL ROOM WIREWAY	1"	13#12	#12	2#12
7	DISTRIBUTION PANEL DP-1	MANUAL TRANSFER SWITCH (MTS)	2-1/2"	4#4/0	#2	-
8	MANUAL TRANSFER SWITCH (MTS)	MOTOR CONTROL CENTER (MCC)	NOTE 3	4#4/0	#2	-
9	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY		4#3/0	#4	-
10	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY	1"	3#4	#10	-
11	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY	1"	3#4	#10	-
12	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY	3/4"	9#12	#12	-
13	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY	3/4"	9#12	#12	-
14	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY	3/4"	9#12	#12	-
15	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY	3/4"	6#12	#12	-
16	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY	2"	53#12	#12	6#12
17	PLC CABINET	ELECTRICAL ROOM WIREWAY	3"	121#12	#12	12#12
18	TRANSFORMER TX-LP2	ELECTRICAL ROOM WIREWAY	3/4"	4#10	#12	-
19	TRANSFORMER TX-LP2	PANTLBOARD LP2	1-1/2"	4#1	#6	-
20	PANTLBOARD LP2	ELECTRICAL ROOM WIREWAY	1"	12#12	#12	-
21	PANTLBOARD LP2	ELECTRICAL ROOM WIREWAY	1"	14#12	#12	-
22	PANTLBOARD LP2	CCTV CABINET	3/4"	2#12	#12	-
23	CCTV CABINET	ELECTRICAL ROOM WIREWAY	3/4"	2#12	#12	-
24	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 11 (TB-NLIGHT-11)	ELECTRICAL ROOM WIREWAY	2"	46#12	#12	4#12
25	PANTLBOARD LP2	NEAR SIDE PIER LIGHT TERMINAL BOX 3 (TB-N-PIER3)	3/4"	2#12	#12	-
26	EXISTING MOUNTED PULLBOX IN ELECTRICAL ROOM	ELECTRICAL ROOM WIREWAY	EXISTING	4#12, 3#8	#10	-
27	EXISTING MOUNTED PULLBOX IN ELECTRICAL ROOM	PIT HEATER DISCONNECT SWITCH	3/4"	4#12	#12	-
28	CONTROL DESK	ELECTRICAL ROOM WIREWAY	1-1/2"	39#12	#12	4#12
29	MAIN DISTRIBUTION PANEL (MDP)	ELECTRICAL ROOM WIREWAY	2"	4#3/0	#4	-
30	MAIN DISTRIBUTION PANEL (MDP)	ELECTRICAL ROOM WIREWAY	1"	11#10	#10	-
31	MAIN DISTRIBUTION PANEL (MDP)	ELECTRICAL ROOM WIREWAY	3/4"	6#12, 3#10	#10	-
32	DRIVE CABINET A	ELECTRICAL ROOM WIREWAY	1"	3#4	#8	-
33	DRIVE CABINET A	ELECTRICAL ROOM WIREWAY	1"	3#4	#8	-
34	DRIVE CABINET A	ELECTRICAL ROOM WIREWAY	1"	12#12	#12	2#12
35	DRIVE CABINET A	DYNAMIC BRAKING RESISTOR A	HIGH TEMP SIZED PER MANUFACTURER, 2#12			
36	DRIVE CABINET B	ELECTRICAL ROOM WIREWAY	1"	3#4	#8	-
37	DRIVE CABINET B	ELECTRICAL ROOM WIREWAY	1"	3#4	#8	-
38	DRIVE CABINET B	ELECTRICAL ROOM WIREWAY	1"	12#12	#12	2#12
39	DRIVE CABINET B	DYNAMIC BRAKING RESISTOR B	HIGH TEMP SIZED PER MANUFACTURER, 2#12			
40	PLC CABINET	FULLY SEATED LIMIT SWITCH (LS-SP-FS)	3/4"	4#12	#12	2#12
41	PLC CABINET	OVER-TRAVEL LIMIT SWITCH (LS-SP-OT)	3/4"	4#12	#12	2#12
42	SPAN MOTOR B DISCONNECT SWITCH (DS-MTRB)	ELECTRICAL ROOM WIREWAY	1"	6#12	#8	2#12
43	SPAN MOTOR B DISCONNECT SWITCH (DS-MTRB)	SPAN MOTOR B	1-1/2"	3#4, 4#12	#8	2#12
44	SPAN MOTOR B ENCODER	ELECTRICAL ROOM WIREWAY	1"	3#16TSP	#12	-
45	SPAN MOTOR A DISCONNECT SWITCH (DS-MTRA)	ELECTRICAL ROOM WIREWAY	1"	6#12	#8	2#12
46	SPAN MOTOR A DISCONNECT SWITCH (DS-MTRA)	SPAN MOTOR A	1-1/2"	3#4, 4#12	#8	2#12
47	SPAN MOTOR A ENCODER	ELECTRICAL ROOM WIREWAY	1"	3#16TSP	#12	-
48	MACHINERY BRAKE B DISCONNECT SWITCH (DS-MHBB)	ELECTRICAL ROOM WIREWAY	3/4"	7#12	#12	2#12
49	MACHINERY BRAKE B	MACHINERY BRAKE B DISCONNECT SWITCH (DS-MHBB)	3/4"	5#12	#12	2#12
50	MACHINERY BRAKE A DISCONNECT SWITCH (DS-MHBA)	ELECTRICAL ROOM WIREWAY	3/4"	7#12	#12	2#12
51	MACHINERY BRAKE A	MACHINERY BRAKE A DISCONNECT SWITCH (DS-MHBA)	3/4"	5#12	#12	2#12
52	MACHINERY BRAKE B LIMIT SWITCH TERMINAL BOX (TB-MHBB-LS)	ELECTRICAL ROOM WIREWAY	3/4"	4#12	#12	2#12
53	MACHINERY BRAKE B LIMIT SWITCH TERMINAL BOX (TB-MHBB-LS)	MACHINERY BRAKE A SET LIMIT SWITCH (LS-MYBA1)	3/4"	4#12	#12	-
54	MACHINERY BRAKE B LIMIT SWITCH TERMINAL BOX (TB-MHBB-LS)	MACHINERY BRAKE A HAND RELEASE LIMIT SWITCH (LS-MYBA3)	3/4"	4#12	#12	-

COND NO	FROM EQUIPMENT	TO EQUIPMENT	COND SIZE	NO. AND SIZE OF CONDUCTORS	GND	SPARE
55	MACHINERY BRAKE B LIMIT SWITCH TERMINAL BOX (TB-MHBB-LS)	MACHINERY BRAKE A RELEASE LIMIT SWITCH (LS-MYBA2)	3/4"	4#12	#12	-
56	MACHINERY BRAKE A LIMIT SWITCH TERMINAL BOX (TB-MHBA-LS)	ELECTRICAL ROOM WIREWAY	3/4"	4#12	#12	2#12
57	MACHINERY BRAKE A LIMIT SWITCH TERMINAL BOX (TB-MHBA-LS)	MACHINERY BRAKE B SET LIMIT SWITCH (LS-MYBB1)	3/4"	4#12	#12	-
58	MACHINERY BRAKE A LIMIT SWITCH TERMINAL BOX (TB-MHBA-LS)	MACHINERY BRAKE B HAND RELEASE LIMIT SWITCH (LS-MYBB3)	3/4"	4#12	#12	-
59	MACHINERY BRAKE A LIMIT SWITCH TERMINAL BOX (TB-MHBA-LS)	MACHINERY BRAKE B RELEASE LIMIT SWITCH (LS-MYBB2)	3/4"	4#12	#12	-
60	AUXILIARY MOTOR DISCONNECT SWITCH (DS-MTR-AUX)	ELECTRICAL ROOM WIREWAY	3/4"	9#12	#12	2#12
61	AUXILIARY MOTOR DISCONNECT SWITCH (DS-MTR-AUX)	AUXILIARY MOTOR	3/4"	7#12	#12	2#12
62	AUXILIARY MOTOR	ELECTRICAL ROOM WIREWAY	3/4"	4#12	#12	2#12
63	FIXED DROOP CABLE TERMINAL CABINET	ELECTRICAL ROOM WIREWAY	1"	13#12	#12	2#12
64	MOVABLE DROOP CABLE TERMINAL CABINET	SPAN ROTARY CAM LIMIT SWITCH W/ENCODER	1"	10#12	#12	2#12
65	MOVABLE DROOP CABLE TERMINAL CABINET	NAVIGATION LIGHT TERMINAL BOX 1 (TB-NAVLT-1)	3/4"	3#12	#12	2#12
66	NAVIGATION LIGHT TERMINAL BOX 1 (TB-NAVLT-1)	NAVIGATION LIGHT TERMINAL BOX 2 (TB-NAVLT-2)	3/4"	3#12	#12	2#12
67	NAVIGATION LIGHT TERMINAL BOX 1 (TB-NAVLT-1)	NAVIGATION LIGHT 1	3/4"	3#12	#12	-
68	NAVIGATION LIGHT TERMINAL BOX 2 (TB-NAVLT-2)	NAVIGATION LIGHT 2	3/4"	3#12	#12	-
69	EXISTING MOUNTED PULLBOX IN ELECTRICAL ROOM	SUMP PUMP CONTROL PANEL	3/4"	3#8	#10	-
70	SUMP PUMP CONTROL PANEL	SUMP PUMP 1	3/4"	3#12	#12	-
71	SUMP PUMP CONTROL PANEL	SUMP PUMP 2	3/4"	3#12	#12	-
72	NEAR SIDE PIER LIGHT TERMINAL BOX 3 (TB-N-PIER3)	NEAR SIDE PIER LIGHT TERMINAL BOX 2 (TB-N-PIER2)	3/4"	2#12	#12	2#12
73	NEAR SIDE PIER LIGHT TERMINAL BOX 3 (TB-N-PIER3)	NEAR SIDE PIER LIGHT 3	3/4"	2#12	#12	-
74	NEAR SIDE PIER LIGHT TERMINAL BOX 2 (TB-N-PIER2)	NEAR SIDE PIER LIGHT TERMINAL BOX 1 (TB-N-PIER1)	3/4"	2#12	#12	2#12
75	NEAR SIDE PIER LIGHT TERMINAL BOX 2 (TB-N-PIER2)	NEAR SIDE PIER LIGHT 2	3/4"	2#12	#12	-
76	NEAR SIDE PIER LIGHT TERMINAL BOX 1 (TB-N-PIER1)	NEAR SIDE PIER LIGHT 1	3/4"	2#12	#12	-
77	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 11 (TB-NLIGHT-11)	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 12 (TB-NLIGHT-12)	2"	30#12	#12	3#12
78	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 11 (TB-NLIGHT-11)	NEAR SIDE ROADWAY LIGHT 19C	3/4"	2#12	#12	-
79	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 12 (TB-NLIGHT-12)	NEAR SIDE ONCOMING WARNING GATE TERMINAL BOX (TB-NONWG)	2"	24#12	#12	3#12
80	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 12 (TB-NLIGHT-12)	NEAR SIDE ROADWAY LIGHT 20B	3/4"	2#12	#12	-
81	NEAR SIDE ONCOMING WARNING GATE TERMINAL BOX (TB-NONWG)	NEAR SIDE TRAFFIC SIGNAL 1 TERMINAL BOX (TB-NTRAF1)	2"	6#12	#12	2#12
82	NEAR SIDE ONCOMING WARNING GATE TERMINAL BOX (TB-NONWG)	NEAR SIDE ONCOMING WARNING GATE	1-1/2"	18#12	#12	2#12
83	NEAR SIDE TRAFFIC SIGNAL 1 TERMINAL BOX (TB-NTRAF1)	NEAR SIDE TRAFFIC SIGNAL 1	3/4"	4#12	#12	2#12
84	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 11 (TB-NLIGHT-11)	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 21 (TB-NLIGHT-21)	2"	28#12	#12	3#12
85	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 21 (TB-NLIGHT-21)	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 22 (TB-NLIGHT-22)	2"	28#12	#12	3#12
86	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 21 (TB-NLIGHT-21)	NEAR SIDE ROADWAY LIGHT 2B	3/4"	2#12	#12	-
87	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 22 (TB-NLIGHT-22)	NEAR SIDE OFFGOING WARNING GATE TERMINAL BOX (TB-NOFFWG)	2"	22#12	#12	3#12
88	NEAR SIDE ROADWAY LIGHT TERMINAL BOX 22 (TB-NLIGHT-22)	NEAR SIDE ROADWAY LIGHT 1A	3/4"	2#12	#12	-
89	NEAR SIDE OFFGOING WARNING GATE TERMINAL BOX (TB-NOFFWG)	NEAR SIDE TRAFFIC SIGNAL 2 TERMINAL BOX (TB-NTRAF2)	3/4"	4#12	#12	2#12
90	NEAR SIDE OFFGOING WARNING GATE TERMINAL BOX (TB-NOFFWG)	NEAR SIDE OFFGOING WARNING GATE	1-1/2"	18#12	#12	2#12
91	NEAR SIDE TRAFFIC SIGNAL 2 TERMINAL BOX (TB-NTRAF2)	NEAR SIDE TRAFFIC SIGNAL 2	3/4"	4#12	#12	2#12
92	NEAR SUBMARINE CABLE TERMINAL CABINET	ELECTRICAL ROOM WIREWAY	2"	64#12	#12	7#12
93	NEAR SUBMARINE CABLE TERMINAL CABINET	ELECTRICAL ROOM WIREWAY	2"	64#12	#12	7#12
94	NEAR SUBMARINE CABLE TERMINAL CABINET	ELECTRICAL ROOM WIREWAY	3/4"	4#12, 1 FIBER A, 1 FIBER B	#6	2#12
95	FAR SUBMARINE CABLE TERMINAL CABINET	FAR SIDE PIER LIGHT TERMINAL BOX 1 (TB-F-PIER1)	3/4"	2#12	#12	2#12
96	FAR SIDE PIER LIGHT TERMINAL BOX 1 (TB-F-PIER1)	FAR SIDE PIER LIGHT 1	3/4"	2#12	#12	-

NOTES:

1.

PLEASE NOTE THAT THE CONTRACTOR IS BIDDING ON A LUMP SUM BID ITEM FOR ALL CONDUIT AND CABLE FOR A MOVABLE BRIDGE. THE CONTRACTOR IS REQUIRED TO SUPPLY ALL CABLE AND CONDUIT FOR A COMPLETE SYSTEM WHETHER SHOWN ON THE CONTRACT DRAWINGS OR NOT. THE CABLE AND CONDUIT SHOWN ON THESE SET OF PLANS IS TO SUPPLY AN ORDER OF MAGNITUDE OF THE TOTAL REQUIRED. CONTRACTOR SHALL BE REQUIRED TO INCLUDE IN THEIR BID THE COST FOR ALL CABLE AND CONDUIT FOR THE SYSTEM. NO CHANGE ORDERS SHALL BE ALLOWED FOR ADDITIONAL CABLE AND CONDUIT, WHICH IS FOR THE THE ORIGINAL SYSTEM INTENT SHOWN ON THESE DRAWINGS.
2.

REQUIRED CABLE AND CONDUIT FOR INDOOR LIGHTING, EMERGENCY LIGHTING, EXIT SIGNS, FIRE ALARM SYSTEM, HVAC, TOILET PUMP, CONDENSATE PUMP, RESTROOM EXHAUST FAN/LIGHT, HOT WATER HEATER, AND RECEPTACLES NOT SHOWN. CONTRACTOR SHALL SUPPLY AT NO ADDITIONAL COST. THE CONTRACTOR SHALL MODIFY THE EXISTING POWER DISTRIBUTION AS REQUIRED TO SERVICE THESE LOADS.

3.

CONTRACTOR WILL BE RESPONSIBLE TO LOCATE THE EXISTING CONDUIT, RUN A NEW CONDUIT FROM DP-1, AND INSTALL THE NEW TAP BOX WITH INTEGRAL MTS. THE EXISTING CONDUIT IS TO BE INTERCEPTED TO THE NEAREST COUPLING AND NEW CONDUIT INSTALLED UP TO THE NEW TAP BOX.
4.

FIBER A IS SINGLE-MODE FIBER BUNDLE, FIBER B IS MULTI-MODE FIBER BUNDLE

IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY J. AMBROS, PE

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DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION

DIVISION OF ENGINEERING

Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle

ELECTRICAL

PROPOSED CONDUIT AND CABLE SCHEDULE 1

CONTRACT NUMBER
20-517

SHEET NUMBER
E-36

SHEET NO. 198 OF 212

SCALE: AS SHOWN
DATE: 03/08/2024

DPW FILE NO.
5-04-E-633-0

REV. NO.
1

COND NO	FROM EQUIPMENT	TO EQUIPMENT	COND SIZE	NO. AND SIZE OF CONDUCTORS	GND	SPARE
97	FAR SIDE PIER LIGHT TERMINAL BOX 2 (TB-F-PIER2)	FAR SIDE PIER LIGHT TERMINAL BOX 1 (TB-F-PIER1)	3/4"	2#12	#12	2#12
98	FAR SIDE PIER LIGHT TERMINAL BOX 2 (TB-F-PIER2)	FAR SIDE PIER LIGHT 2	3/4"	2#12	#12	-
99	FAR SIDE PIER LIGHT TERMINAL BOX 3 (TB-F-PIER3)	FAR SIDE PIER LIGHT TERMINAL BOX 2 (TB-F-PIER2)	3/4"	2#12	#12	2#12
100	FAR SIDE PIER LIGHT TERMINAL BOX 3 (TB-F-PIER3)	FAR SIDE PIER LIGHT 3	3/4"	2#12	#12	-
101	FAR SUBMARINE CABLE TERMINAL CABINET	SPAN LOCK 1 TERMINAL BOX (TB-SL1)	1"	15#12	#12	2#12
102	SPAN LOCK 1 TERMINAL BOX (TB-SL1)	SPAN LOCK 1 DISCONNECT SWITCH (DS-SL1)	1"	9#12	#12	2#12
103	SPAN LOCK 1 DISCONNECT SWITCH (DS-SL1)	SPAN LOCK 1	2"	7#12	#12	2#12
104	SPAN LOCK 1 TERMINAL BOX (TB-SL1)	SPAN LOCK 1 PULLED LIMIT SWITCH (LS-SL1-P)	3/4"	2#12	#12	-
105	SPAN LOCK 1 TERMINAL BOX (TB-SL1)	SPAN LOCK 1 DRIVEN LIMIT SWITCH (LS-SL1-D)	3/4"	2#12	#12	-
106	FAR SUBMARINE CABLE TERMINAL CABINET	SPAN LOCK 2 TERMINAL BOX (TB-SL2)	1"	15#12	#12	2#12
107	SPAN LOCK 2 TERMINAL BOX (TB-SL2)	SPAN LOCK 2 DISCONNECT SWITCH (DS-SL2)	1"	9#12	#12	2#12
108	SPAN LOCK 2 DISCONNECT SWITCH (DS-SL2)	SPAN LOCK 2	3/4"	7#12	#12	2#12
109	SPAN LOCK 2 TERMINAL BOX (TB-SL2)	SPAN LOCK 2 PULLED LIMIT SWITCH (LS-SL2-P)	3/4"	2#12	#12	-
110	SPAN LOCK 2 TERMINAL BOX (TB-SL2)	SPAN LOCK 2 DRIVEN LIMIT SWITCH (LS-SL2-D)	3/4"	2#12	#12	-
111	FAR SUBMARINE CABLE TERMINAL CABINET	FAR SIDE ROADWAY LIGHT TERMINAL BOX 11 (TB-FLIGHT-11)	2"	46#12	#10	5#12
112	FAR SIDE ROADWAY LIGHT TERMINAL BOX 11 (TB-FLIGHT-11)	FAR SIDE OFFGOING BARRIER GATE TERINAL BOX (TB-FOFFBG)	2"	46#12	#10	5#12
113	FAR SIDE ROADWAY LIGHT TERMINAL BOX 11 (TB-FLIGHT-11)	FAR SIDE ROADWAY LIGHT 18A	3/4"	2#12	#12	-
114	FAR SIDE OFFGOING BARRIER GATE TERINAL BOX (TB-FOFFBG)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 13 (TB-FLIGHT-13)	2"	26#12	#10	3#12
115	FAR SIDE OFFGOING BARRIER GATE TERINAL BOX (TB-FOFFBG)	FAR SIDE OFFGOING BARRIER GATE	1-1/2"	20#12	#10	2#12
116	FAR SIDE ROADWAY LIGHT TERMINAL BOX 13 (TB-FLIGHT-13)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 14 (TB-FLIGHT-14)	2"	26#12	#10	3#12
117	FAR SIDE ROADWAY LIGHT TERMINAL BOX 13 (TB-FLIGHT-13)	FAR SIDE ROADWAY LIGHT 16C	3/4"	2#12	#12	-
118	FAR SIDE ROADWAY LIGHT TERMINAL BOX 14 (TB-FLIGHT-14)	FAR SIDE OFFGOING WARNING GATE TERINAL BOX (TB-FOFFWG)	2"	26#12	#10	3#12
119	FAR SIDE ROADWAY LIGHT TERMINAL BOX 14 (TB-FLIGHT-14)	FAR SIDE ROADWAY LIGHT 15A	3/4"	2#12	#12	-
120	FAR SIDE OFFGOING WARNING GATE TERINAL BOX (TB-FOFFWG)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 15 (TB-FLIGHT-15)	2"	8#12	#12	2#12
121	FAR SIDE OFFGOING WARNING GATE TERINAL BOX (TB-FOFFWG)	FAR SIDE OFFGOING WARNING GATE	1-1/2"	18#12	#10	2#12
122	FAR SIDE ROADWAY LIGHT TERMINAL BOX 15 (TB-FLIGHT-15)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 16 (TB-FLIGHT-16)	2"	8#12	#12	2#12
123	FAR SIDE ROADWAY LIGHT TERMINAL BOX 15 (TB-FLIGHT-15)	FAR SIDE ROADWAY LIGHT 14B	3/4"	2#12	#12	-
124	FAR SIDE ROADWAY LIGHT TERMINAL BOX 16 (TB-FLIGHT-16)	FAR SIDE TRAFFIC SIGNAL 1 TERMINAL BOX (TB-FTRAF1)	3/4"	4#12	#12	2#12
125	FAR SIDE ROADWAY LIGHT TERMINAL BOX 16 (TB-FLIGHT-16)	FAR SIDE ROADWAY LIGHT 13A	3/4"	2#12	#12	-
126	FAR SIDE TRAFFIC SIGNAL 1 TERMINAL BOX (TB-FTRAF1)	FAR SIDE TRAFFIC SIGNAL 1	3/4"	4#12	#12	2#12
127	FAR SUBMARINE CABLE TERMINAL CABINET	FAR SIDE ROADWAY LIGHT TERMINAL BOX 21 (TB-FLIGHT-21)	2"	48#12	#10	5#12
128	FAR SIDE ROADWAY LIGHT TERMINAL BOX 21 (TB-FLIGHT-21)	FAR SIDE ONCOMING BARRIER GATE TERINAL BOX (TB-FONBG)	2"	48#12	#10	5#12
129	FAR SIDE ROADWAY LIGHT TERMINAL BOX 21 (TB-FLIGHT-21)	FAR SIDE ROADWAY LIGHT 3C	3/4"	2#12	#12	-
130	FAR SIDE ONCOMING BARRIER GATE TERINAL BOX (TB-FONBG)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 23 (TB-FLIGHT-23)	2"	28#12	#10	3#12
131	FAR SIDE ONCOMING BARRIER GATE TERINAL BOX (TB-FONBG)	FAR SIDE ONCOMING BARRIER GATE	1-1/2"	20#12	#10	2#12
132	FAR SIDE ROADWAY LIGHT TERMINAL BOX 23 (TB-FLIGHT-23)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 24 (TB-FLIGHT-24)	2"	28#12	#10	3#12
133	FAR SIDE ROADWAY LIGHT TERMINAL BOX 23 (TB-FLIGHT-23)	FAR SIDE ROADWAY LIGHT 5B	3/4"	2#12	#12	-
134	FAR SIDE ROADWAY LIGHT TERMINAL BOX 24 (TB-FLIGHT-24)	FAR SIDE ONCOMING WARNING GATE TERINAL BOX (TB-FONWG)	2"	28#12	#10	3#12

COND NO	FROM EQUIPMENT	TO EQUIPMENT	COND SIZE	NO. AND SIZE OF CONDUCTORS	GND	SPARE
135	FAR SIDE ROADWAY LIGHT TERMINAL BOX 24 (TB-FLIGHT-24)	FAR SIDE ROADWAY LIGHT 6C	3/4"	2#12	#12	-
136	FAR SIDE ONCOMING WARNING GATE TERINAL BOX (TB-FONWG)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 25 (TB-FLIGHT-25)	2"	10#12	#12	2#12
137	FAR SIDE ONCOMING WARNING GATE TERINAL BOX (TB-FONWG)	FAR SIDE ONCOMING WARNING GATE	1-1/2"	18#12	#10	2#12
138	FAR SIDE ROADWAY LIGHT TERMINAL BOX 25 (TB-FLIGHT-25)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 26 (TB-FLIGHT-26)	2"	10#12	#12	2#12
139	FAR SIDE ROADWAY LIGHT TERMINAL BOX 25 (TB-FLIGHT-25)	FAR SIDE ROADWAY LIGHT 7A	3/4"	2#12	#12	-
140	FAR SIDE ROADWAY LIGHT TERMINAL BOX 26 (TB-FLIGHT-26)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 27 (TB-FLIGHT-27)	2"	10#12	#12	2#12
141	FAR SIDE ROADWAY LIGHT TERMINAL BOX 26 (TB-FLIGHT-26)	FAR SIDE ROADWAY LIGHT 8B	3/4"	2#12	#12	-
142	FAR SIDE ROADWAY LIGHT TERMINAL BOX 27 (TB-FLIGHT-27)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 28 (TB-FLIGHT-28)	2"	10#12	#12	2#12
143	FAR SIDE ROADWAY LIGHT TERMINAL BOX 27 (TB-FLIGHT-27)	FAR SIDE ROADWAY LIGHT 9C	3/4"	2#12	#12	-
144	FAR SIDE ROADWAY LIGHT TERMINAL BOX 28 (TB-FLIGHT-28)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 29 (TB-FLIGHT-29)	2"	10#12	#12	2#12
145	FAR SIDE ROADWAY LIGHT TERMINAL BOX 28 (TB-FLIGHT-28)	FAR SIDE ROADWAY LIGHT 10A	3/4"	2#12	#12	-
146	FAR SIDE ROADWAY LIGHT TERMINAL BOX 29 (TB-FLIGHT-29)	FAR SIDE ROADWAY LIGHT TERMINAL BOX 30 (TB-FLIGHT-30)	2"	10#12	#12	2#12
147	FAR SIDE ROADWAY LIGHT TERMINAL BOX 29 (TB-FLIGHT-29)	FAR SIDE ROADWAY LIGHT 11B	3/4"	2#12	#12	-
148	FAR SIDE ROADWAY LIGHT TERMINAL BOX 30 (TB-FLIGHT-30)	FAR SIDE TRAFFIC SIGNAL 2 TERMINAL BOX (TB-FTRAF2)	2"	6#12	#12	2#12
149	FAR SIDE ROADWAY LIGHT TERMINAL BOX 309 (TB-FLIGHT-30)	FAR SIDE ROADWAY LIGHT 12C	3/4"	2#12	#12	-
150	FAR SIDE TRAFFIC SIGNAL 2 TERMINAL BOX (TB-FTRAF2)	FAR SIDE TRAFFIC SIGNAL 2	3/4"	4#12	#12	2#12
151	FAR SUBMARINE CABLE TERMINAL CABINET	SPAN LOCK PLATFORM LIGHTS AND RECEPTACLE	3/4"	2#12	#12	-
152	ROADWAY LIGHTING PANEL	ELECTRICAL ROOM WIREWAY	3/4"	9#12	#12	-
153	NEAR SIDE TRAFFIC SIGNAL 1 TERMINAL BOX (TB-NTRAF1)	NEAR SIDE ADVANCE WARNING SIGNAL	2"	2#12	#12	-
154	FAR SIDE ROADWAY LIGHT TERMINAL BOX 30 (TB-FLIGHT-30)	FAR SIDE ADVANCE WARNING SIGNAL	2"	2#12	#12	-
155A	FAR SUBMARINE CABLE TERMINAL CABINET	ADMIN BULDING FIBER JUNCTION BOX (PB-F-ADMIN)	3/4"	1 FIBER A	-	-
155B	ADMIN BULDING FIBER JUNCTION BOX (PB-F-ADMIN)	ADMIN BULDING FIBER JUNCTION BOX (JB-F-ADMIN)	NOTE 3	1 FIBER A	-	-
156	FAR SIDE ROADWAY LIGHT TERMINAL BOX 12 (TB-FLIGHT-12)	FAR SIDE ROADWAY LIGHT 17B	3/4"	2#12	#12	-
157	FAR SIDE ROADWAY LIGHT TERMINAL BOX 22 (TB-FLIGHT-22)	FAR SIDE ROADWAY LIGHT 4A	3/4"	2#12	#12	-
158	SPAN LOCK 1 TERMINAL BOX (TB-SL1)	SPAN LOCK 1 HAND CRANK LIMIT SWITCH (LS-SL1-HCI)	3/4"	2#12	#12	-
159	SPAN LOCK 2 TERMINAL BOX (TB-SL2)	SPAN LOCK 2 HAND CRANK LIMIT SWITCH (LS-SL2-HCI)	3/4"	2#12	#12	-
160	FAR SIDE ROADWAY LIGHT TERMINAL BOX 12 (TB-FLIGHT-12)	FAR SIDE OFFGOING BARRIER GATE TERINAL BOX (TB-FOFFBG)	2"	46#12	#12	3#12
161	FAR SIDE ROADWAY LIGHT TERMINAL BOX 22 (TB-FLIGHT-22)	FAR SIDE ONCOMING BARRIER GATE TERINAL BOX (TB-FONBG)	2"	48#12	#12	5#12
162	MOTOR CONTROL CENTER (MCC)	ELECTRICAL ROOM WIREWAY	1"	1#16TSP, 1 CAT6E	#12	-
163	PLC CABINET	ELECTRICAL ROOM WIREWAY	1"	1#16TSP, 1 CAT6E	#10	-
164	CCTV CABINET	ELECTRICAL ROOM WIREWAY	1-1/2"	9 CAT6E, 1 FIBER B	#12	-
165	CONTROL DESK	ELECTRICAL ROOM WIREWAY	1-1/2"	6 CAT6E	#12	-
166	DRIVE CABINET A	ELECTRICAL ROOM WIREWAY	2"	3#16TSP, 2 CAT6E	#12	-
167	DRIVE CABINET B	ELECTRICAL ROOM WIREWAY	2"	3#16TSP, 2 CAT6E	#12	-
168	FIXED DROOP CABLE TERMINAL CABINET	ELECTRICAL ROOM WIREWAY	3/4"	1 CAT6E	#10	-
169	MOVABLE DROOP CABLE TERMINAL CABINET	SPAN ROTARY CAM LIMIT SWITCH W/RESOLVER	3/4"	1 CAT6E	#12	-
170	ROADWAY LIGHTING TRASNFORMER	ELECTRICAL ROOM WIREWAY	3/4"	4#12	#12	-
171	ROADWAY LIGHTING TRASNFORMER	ROADWAY LIGHTING PANEL	3/4"	4#12	#12	-
172	AUX MOTOR CHAIN DRIVE ENGAGED LIMIT SWITCH	ELECTRICAL ROOM WIREWAY	3/4"	2#12	#12	-
173	PANELBOARD LP2	AC SUBPANEL	3/4"	3#6	#10	-
A	SUMP PUMP CONTROL PANEL	FLOAT SWITCH (X3)	MANUFACTURER'S FLEXIBLE CABLE			

NOTES:

1. PLEASE NOTE THAT THE CONTRACTOR IS BIDDING ON A LUMP SUM BID ITEM FOR ALL CONDUIT AND CABLE FOR A MOVABLE BRIDGE. THE CONTRACTOR IS REQUIRED TO SUPPLY ALL CABLE AND CONDUIT FOR A COMPLETE SYSTEM WHETHER SHOWN ON THE CONTRACT DRAWINGS OR NOT. THE CABLE AND CONDUIT SHOWN ON THESE SET OF PLANS IS TO SUPPLY AN ORDER OF MAGNITUDE OF THE TOTAL REQUIRED. CONTRACTOR SHALL BE REQUIRED TO INCLUDE IN THEIR BID THE COST FOR ALL CABLE AND CONDUIT FOR THE SYSTEM. NO CHANGE ORDERS SHALL BE ALLOWED FOR ADDITIONAL CABLE AND CONDUIT, WHICH IS FOR THE THE ORIGINAL SYSTEM INTENT SHOWN ON THESE DRAWINGS.
2. REQUIRED CABLE AND CONDUIT FOR INDOOR LIGHTING, EMERGENCY LIGHTING, EXIT SIGNS, FIRE ALARM SYSTEM, HVAC, TOILET PUMP, CONDENSATE PUMP, RESTROOM EXHAUST FAN/LIGHT, HOT WATER HEATER, AND RECEPTACLES NOT SHOWN. CONTRACTOR SHALL SUPPLY AT NO ADDITIONAL COST. THE CONTRACTOR SHALL MODIFY THE EXISTING POWER DISTRIBUTION AS REQUIRED TO SERVICE THESE LOADS.

IN CHARGE OF D. DELUCA, PE

CHECKED BY A. NOBLE, PE

MADE BY J. AMBROS, PE

3. SEE NOTES ON SHEET E-50.
4. FIBER A IS SINGLE-MODE FIBER BUNDLE, FIBER B IS MULTI-MODE FIBER BUNDLE

1	4/24/24	JA	TK	UPDATE FOR CLARITY
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

RECORD DRAWING CERTIFICATION

☐ AS BUILT – CHANGES AS NOTED

☐ AS BUILT – NO CHANGES

CONTRACTOR

PROJECT COORDINATOR

NAME _____

SIGNATURE _____

TITLE _____ DATE _____

NAME _____

SIGNATURE _____

TITLE _____ DATE _____

CONSULTANT SEAL

CONSULTANT INFORMATION

1501 BROADWAY, SUITE 601
NEW YORK, NY 10036
(212) 944-1130

WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
DIVISION OF ENGINEERING

Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle

ELECTRICAL

PROPOSED CONDUIT AND CABLE SCHEDULE 2

CONTRACT NUMBER
20-517

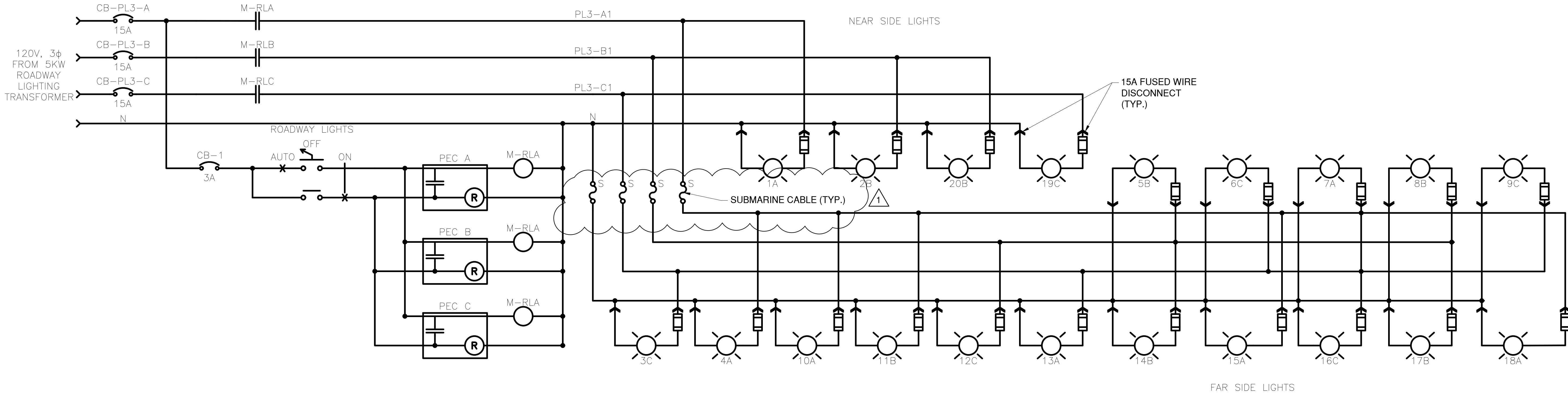
SHEET NUMBER
E-37

SHEET NO. 199 OF 212

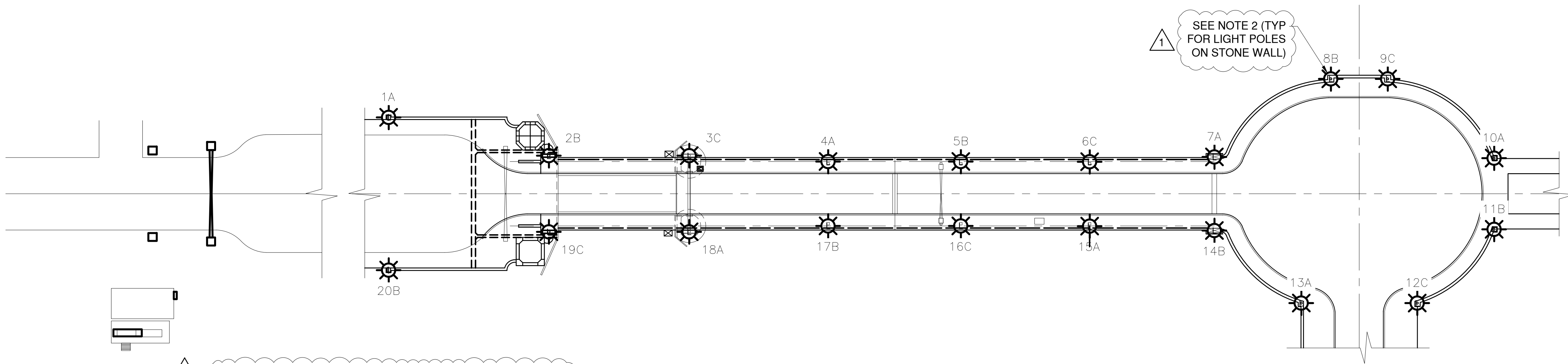
SCALE: AS SHOWN
DATE: 03/08/2024

DPW FILE NO.
5-04-E-634-0

REV. NO.
1



ROADWAY LIGHTING PANEL
N.T.S



ROADWAY LIGHTING PLAN
N.T.S

NOTES:

1. WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 599.142500WE - MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS, 599.142600WE - MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS INSTALLATION, 599.064000WE - MOVABLE BRIDGE ELECTRICAL TESTING, 680.79300001 - REMOVE TRAFFIC SIGNAL HEAD OR PEDESTRIAN SIGNAL HEAD, 680.82250301 - REMOVE STEEL EMBEDDED TRAFFIC SIGNAL POLE, 670.60 - PHOTOELECTRIC CONTROLS, 670.81 - REMOVE AND DISPOSE OF LAMPPOST ASSEMBLY, 680.621630 - TRAFFIC SIGNAL POLE - MAST ARM, 680.6712 - TRAFFIC SIGNAL POLE - POST TOP MOUNT, 680.810101 - TRAFFIC SIGNAL MODULE - 12 INCH RED BALL, LED, 680.810103 - TRAFFIC SIGNAL MODULE - 12 INCH YELLOW BALL, LED, 680.810105 - TRAFFIC SIGNAL MODULE - 12 INCH GREEN BALL, LED, 680.810107 - TRAFFIC SIGNAL SECTION - TYPE I, 12 INCH, 680.810308 - INSTALL BALL LED TRAFFIC SIGNAL MODULE, 680.8111 - TRAFFIC SIGNAL BRACKET ASSEMBLY, 680.8220 - FLASHING BEACON SIGN ASSEMBLY, 680.10000007 - INSTALL TRAFFIC SIGNAL POLE, ALL SIZES
2. CONTRACTOR SHALL UTILIZE EXISTING CONDUITS EMBEDDED IN STONEWALL. FURNISH AND INSTALL NEW CONDUCTORS, AND NEW JUNCTION BOXES LEADING UP TO THE LIGHTS.

IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY J. AMBROS, PE

1	4/24/24	JA	TK	SCOPE REVISED, CLARITY
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

RECORD DRAWING CERTIFICATION			
<input type="checkbox"/> AS BUILT - CHANGES AS NOTED <input type="checkbox"/> AS BUILT - NO CHANGES			
CONTRACTOR		PROJECT COORDINATOR	
NAME _____	NAME _____	NAME _____	NAME _____
SIGNATURE _____	SIGNATURE _____	SIGNATURE _____	SIGNATURE _____
TITLE _____	TITLE _____	TITLE _____	TITLE _____



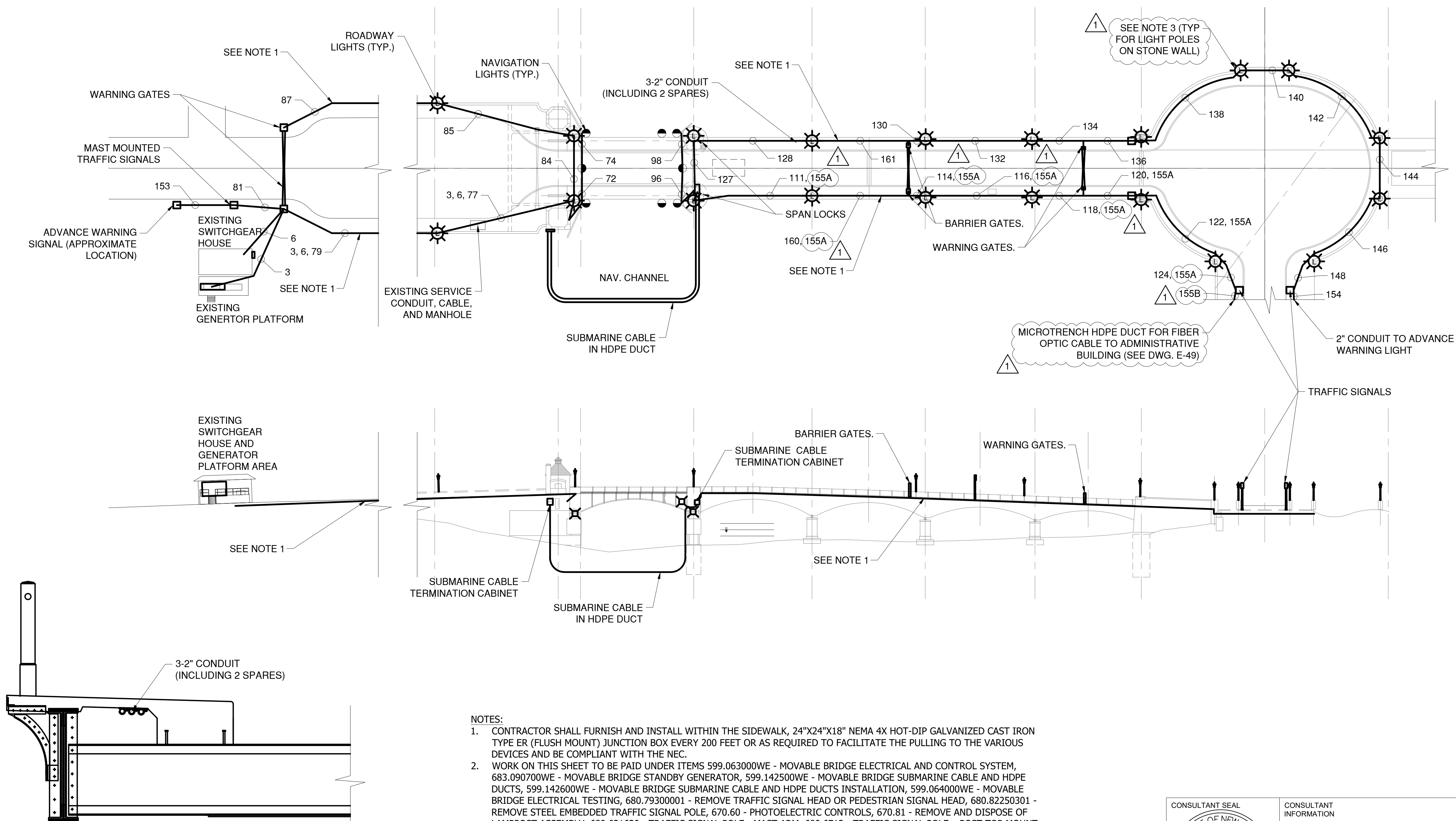
CONSULTANT INFORMATION



1501 BROADWAY, SUITE 601
NEW YORK, NY 10036
(212) 944-1150

WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
DIVISION OF ENGINEERING
Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle
ELECTRICAL
PROP'D ROADWAY LIGHTING LAYOUT & CONTROL

CONTRACT NUMBER 20-517	SHEET NUMBER E-38
SHEET NO. 200 OF 212	
SCALE: AS SHOWN	
DATE: 03/08/2024	
DPW FILE NO.	REV. NO. 1
5-04-E-635-0	



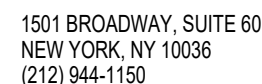
1. CONTRACTOR SHALL FURNISH AND INSTALL WITHIN THE SIDEWALK, 24"x24"x18" NEMA 4X HOT-DIP GALVANIZED CAST IRON TYPE ER (FLUSH MOUNT) JUNCTION BOX EVERY 200 FEET OR AS REQUIRED TO FACILITATE THE PULLING TO THE VARIOUS DEVICES AND BE COMPLIANT WITH THE NEC.
2. WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 683.090700WE - MOVABLE BRIDGE STANDBY GENERATOR, 599.142500WE - MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS, 599.142600WE - MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS INSTALLATION, 599.064000WE - MOVABLE BRIDGE ELECTRICAL TESTING, 680.79300001 - REMOVE TRAFFIC SIGNAL HEAD OR PEDESTRIAN SIGNAL HEAD, 680.82250301 - REMOVE STEEL EMBEDDED TRAFFIC SIGNAL POLE, 670.60 - PHOTOELECTRIC CONTROLS, 670.81 - REMOVE AND DISPOSE OF LAMPOST ASSEMBLY, 680.621630 - TRAFFIC SIGNAL POLE - MAST ARM, 680.6712 - TRAFFIC SIGNAL POLE - POST TOP MOUNT, 680.810101 - TRAFFIC SIGNAL MODULE - 12 INCH RED BALL, LED, 680.810103 - TRAFFIC SIGNAL MODULE - 12 INCH YELLOW BALL, LED, 680.810105 - TRAFFIC SIGNAL MODULE - 12 INCH GREEN BALL, LED, 680.810107 - TRAFFIC SIGNAL SECTION - TYPE I, 12 INCH, 680.810308 - INSTALL BALL LED TRAFFIC SIGNAL MODULE, 680.8111 - TRAFFIC SIGNAL BRACKET ASSEMBLY, 680.8220 - FLASHING BEACON SIGN ASSEMBLY, 680.10000007 - INSTALL TRAFFIC SIGNAL POLE, ALL SIZES
3. CONTRACTOR SHALL UTILIZE EXISTING CONDUITS EMBEDDED IN STONEWALL. FURNISH AND INSTALL NEW CONDUCTORS, AND NEW JUNCTION BOXES LEADING UP TO THE LIGHTS.

1	4/24/24	JA	TK	SCOPE REVISED, CLARIFY
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

NAME _____

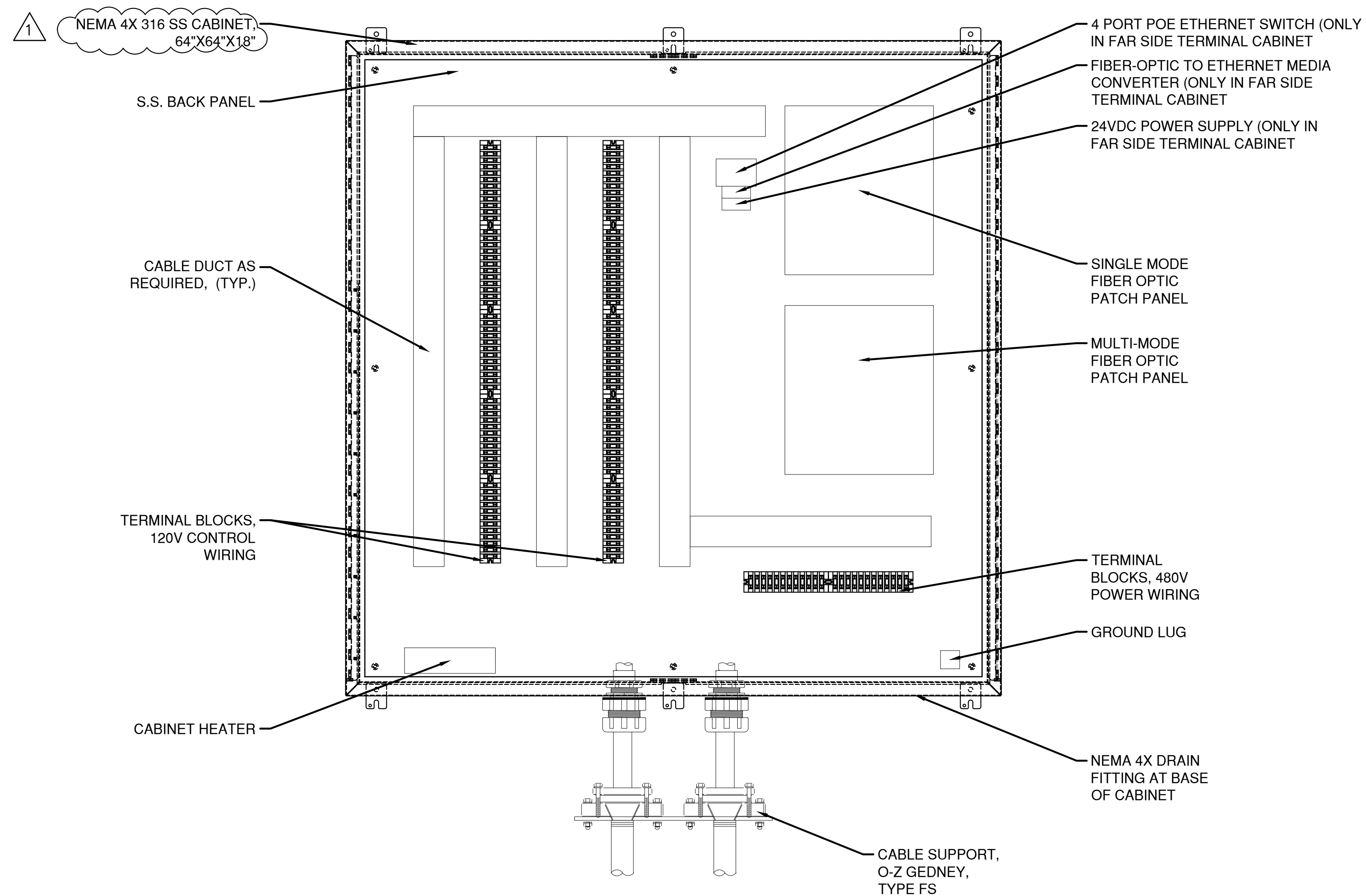
SIGNATURE _____

TITLE _____ DATE _____

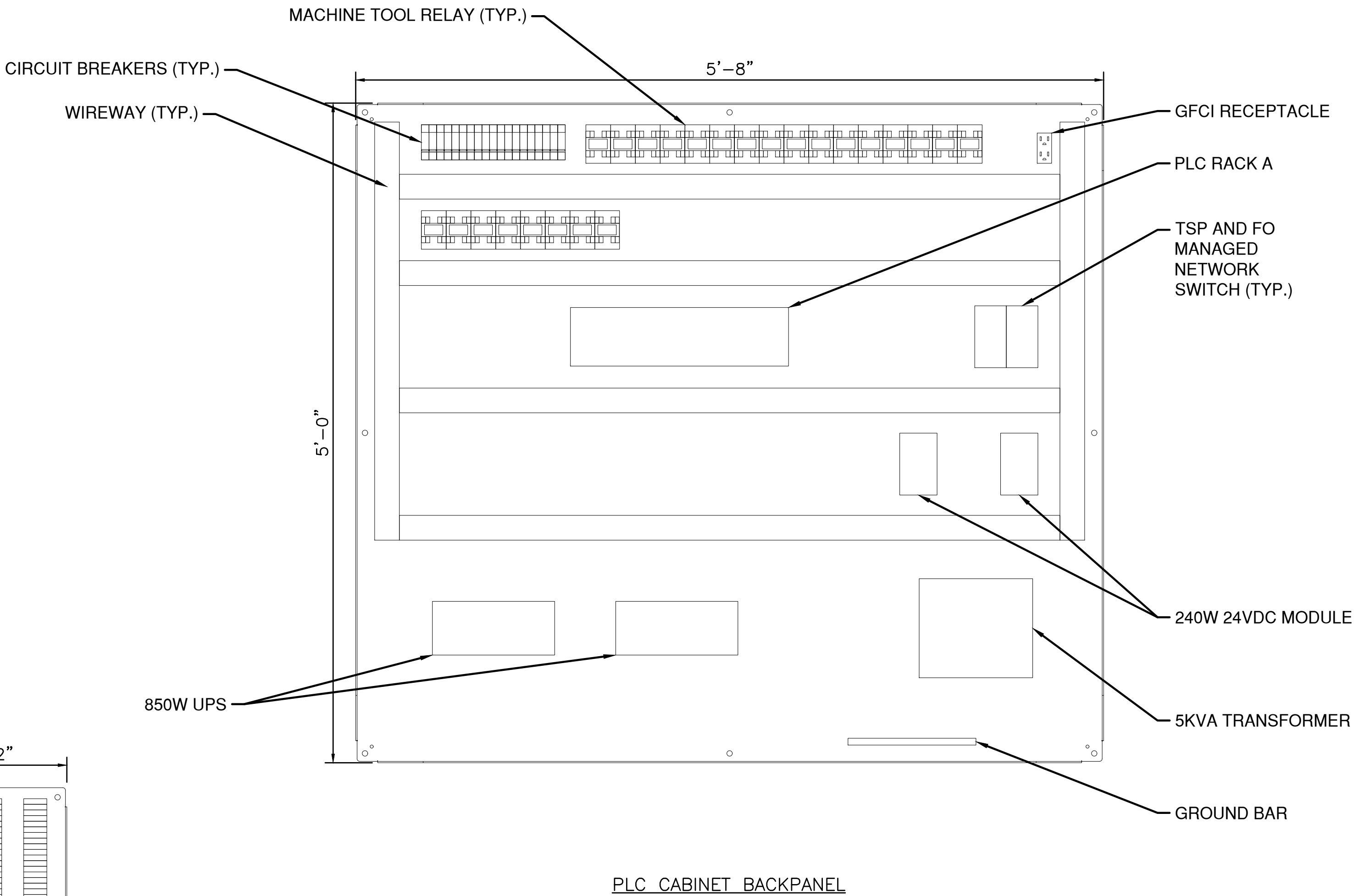
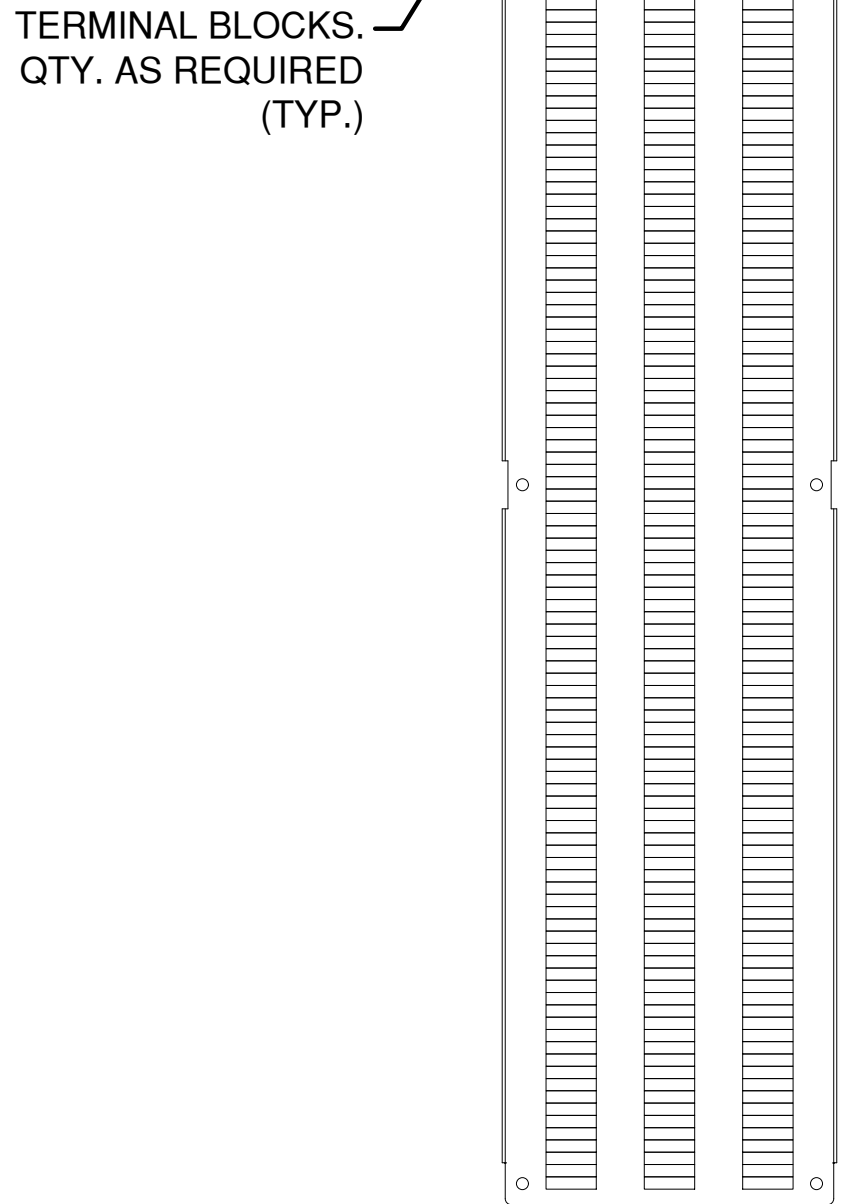
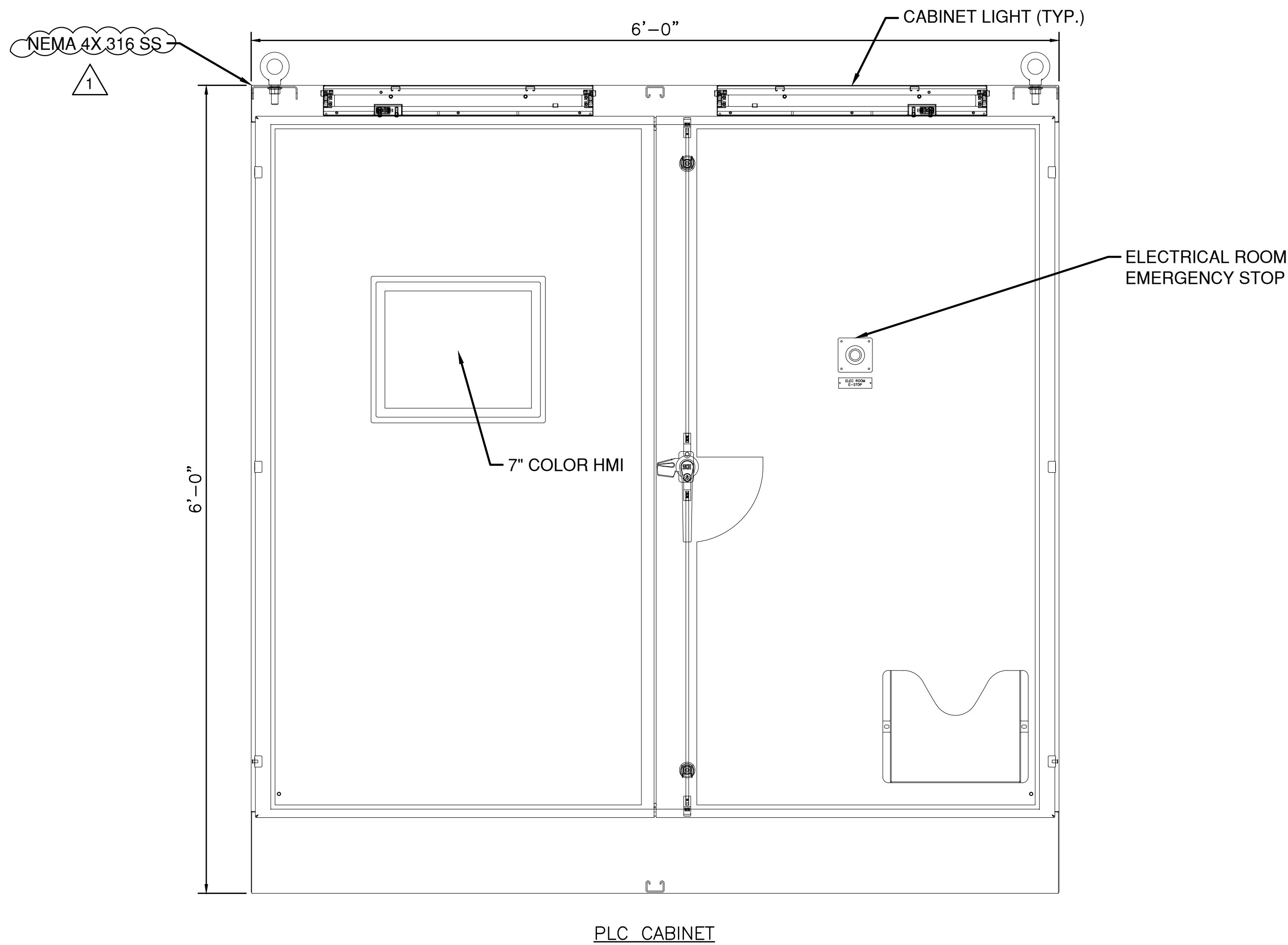


PROPOSED ROADWAY CONDUIT LAYOUT

RE NO 1



- NOTES:**
1. THE CONTRACTOR SHALL FURNISH AND INSTALL SUBMARINE CABLES AND TERMINAL CABINETS AS SPECIFIED AND SHOWN ON DRAWINGS E-05 AND E-11
 2. THE CONTRACTOR IS RESPONSIBLE TO FURNISH AND INSTALL SUBMARINE CABLES AND TERMINAL CABINETS AS REQUIRED OF SUFFICIENT SIZE AND QUANTITY TO PROPERLY ROUTE CONDUCTORS ACROSS THE CHANNEL.
 3. ALL FIBER OPTIC CABLE ENTERING THE ENCLOSURE SHALL IMMEDIATELY ENTER FLEXIBLE NON-METALLIC INNER DUCT CONDUIT.
 4. WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 599.142500WE - MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS, 599.142600WE - MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS INSTALLATION



- NOTES:
1. WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 599.064000WE - MOVABLE BRIDGE ELECTRICAL TESTING

CONSULTANT SEAL

CONSULTANT INFORMATION

1501 BROADWAY, SUITE 601
NEW YORK, NY 10036
(212) 944-1130

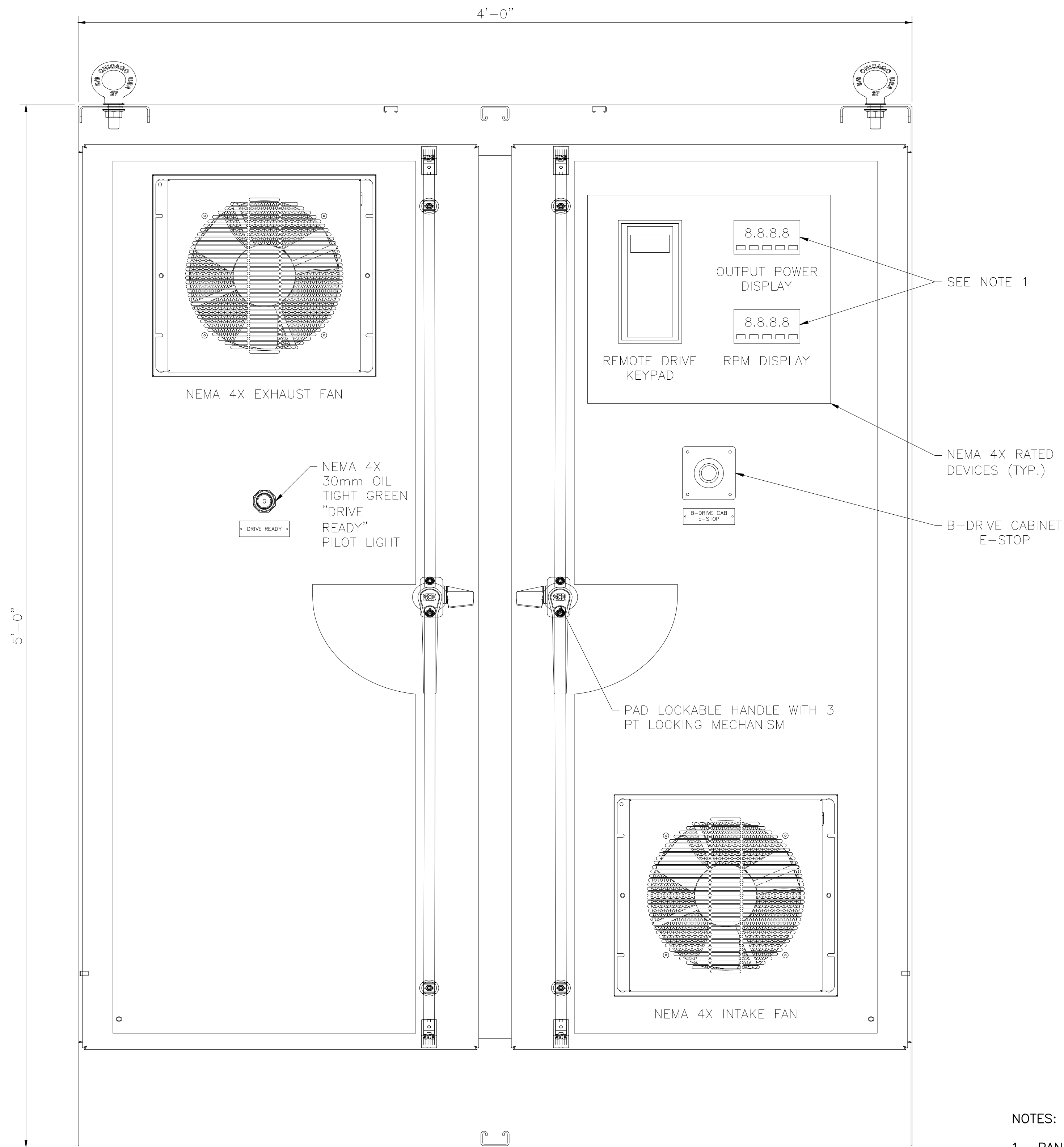
WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
DIVISION OF ENGINEERING
Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle
ELECTRICAL
PROPOSED CABINET LAYOUT

CONTRACT NUMBER 20-517	SHEET NUMBER E-46
SHEET NO. 208 OF 212	
SCALE: AS SHOWN DATE: 03/08/2024	
DPW FILE NO. 5-04-E-643-0	REV. NO. 1

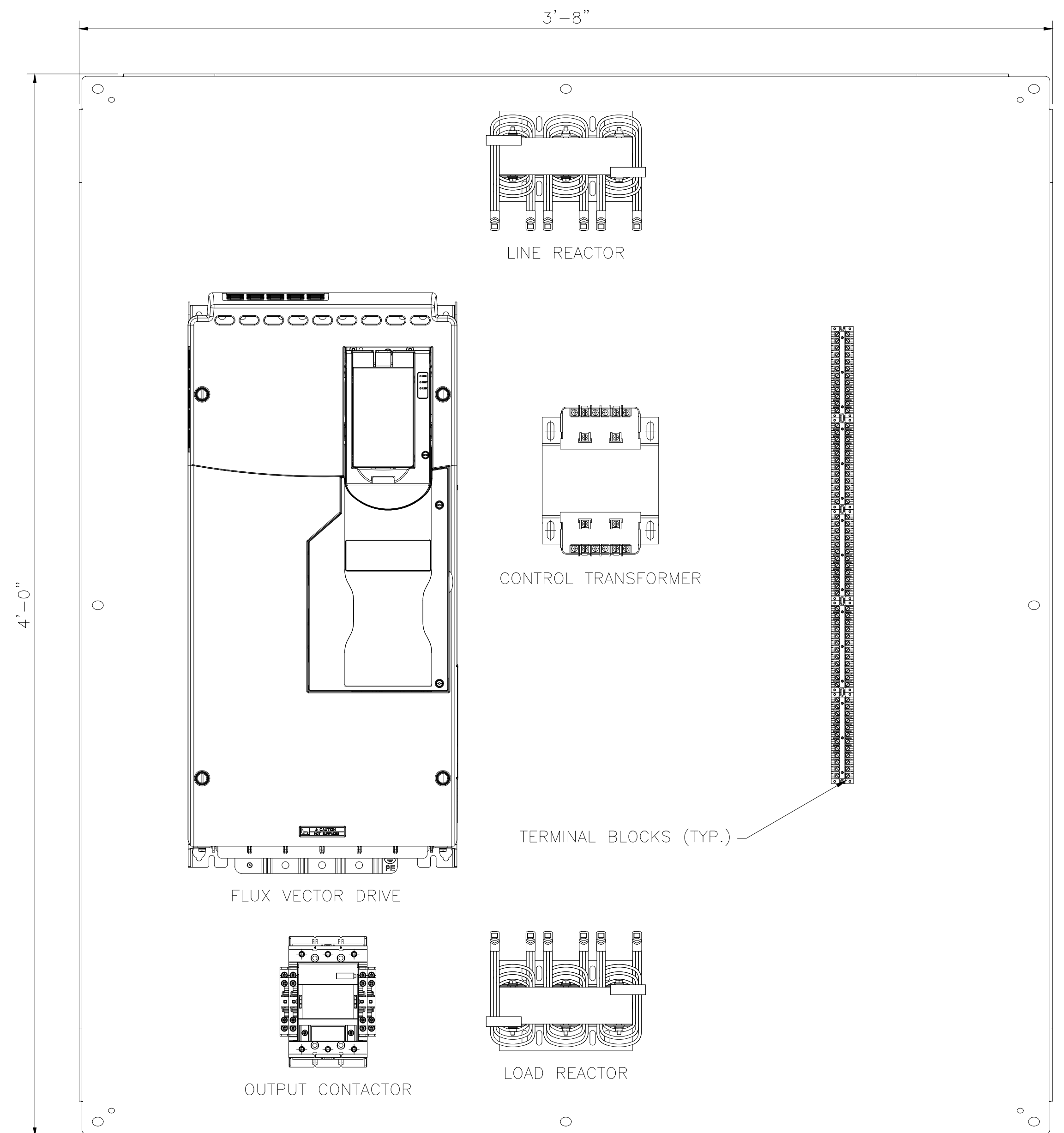
IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY A. MORFIN/CHAVEZ

1	4/24/24	JA	TK	SCOPE REVISED
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

RECORD DRAWING CERTIFICATION			
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CONTRACTOR		PROJECT COORDINATOR	
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TITLE _____	TITLE _____		
	DATE _____	DATE _____	



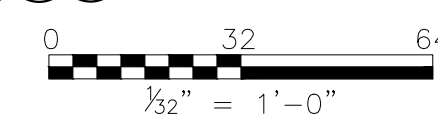
SPAN DRIVE CABINET
SCALE: 3" = 1'-0"



SPAN DRIVE CABINET BACKPANEL
SCALE: 3" = 1'-0"

NOTES:

- PANEL DISPLAY METERS WILL BE PROVIDED WITH ALL SCALING AND ACCESSORIES/PROGRAMMING AS REQUIRED.
- WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 599.064000WE - MOVABLE BRIDGE ELECTRICAL TESTING
- ALL CABINETS TO BE NEMA 4X 316 SS.




IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY A. MORFIN/CHAVEZ


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CONSULTANT SEAL



CONSULTANT INFORMATION



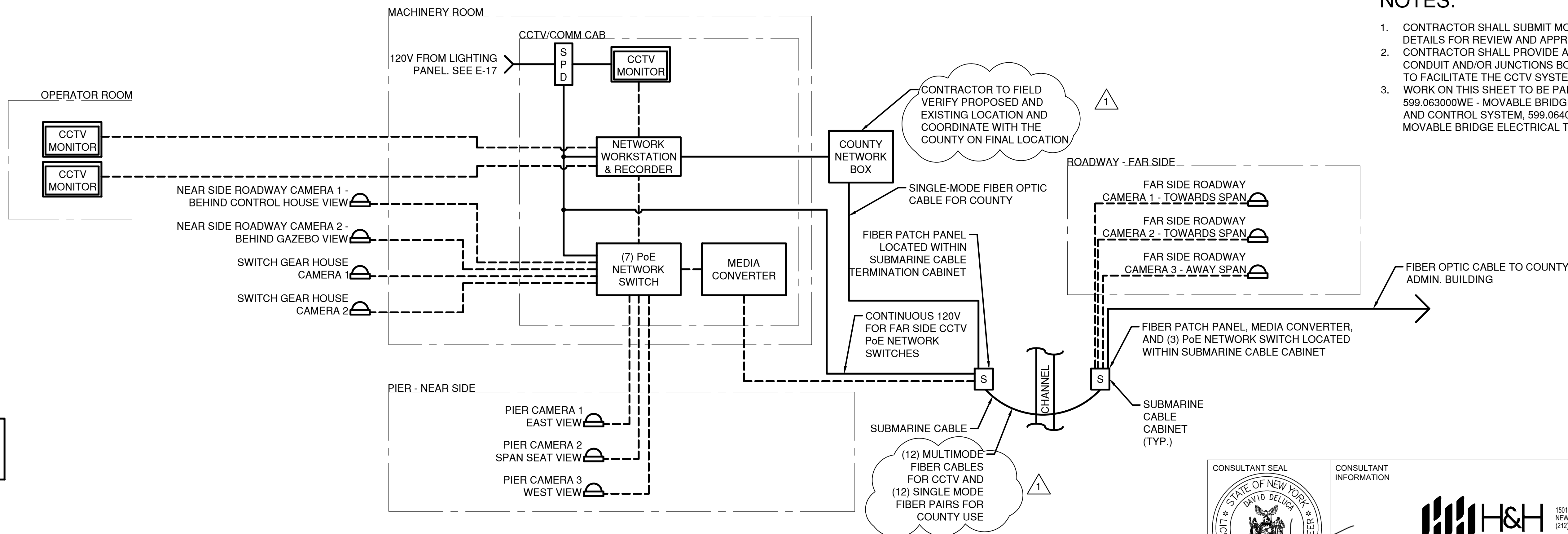
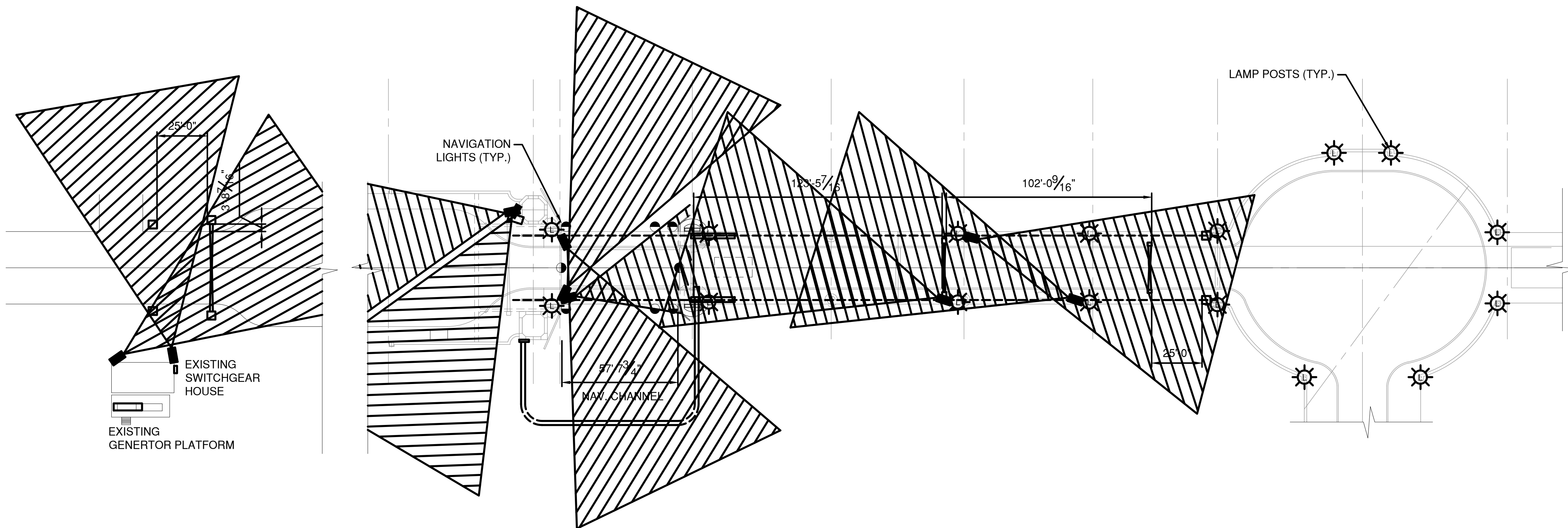
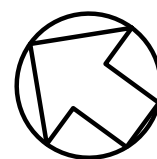
1501 BROADWAY, SUITE 601
NEW YORK, NY 10036
(212) 944-1130

WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
DIVISION OF ENGINEERING

Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle
ELECTRICAL

PROPOSED DRIVE CABINET LAYOUT

CONTRACT NUMBER 20-517	SHEET NUMBER E-47
SHEET NO. 209 OF 212	
SCALE: AS SHOWN DATE: 03/08/2024	
DPW FILE NO.	REV. NO.
5-04-E-644-0	1



NOTES:

1. CONTRACTOR SHALL SUBMIT MOUNTING DETAILS FOR REVIEW AND APPROVAL.
2. CONTRACTOR SHALL PROVIDE ANY ADDITIONAL CONDUIT AND/OR JUNCTIONS BOXES REQUIRED TO FACILITATE THE CCTV SYSTEM.
3. WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 599.064000WE - MOVABLE BRIDGE ELECTRICAL TESTING

CCTV LAYOUT

SCALE: NTS



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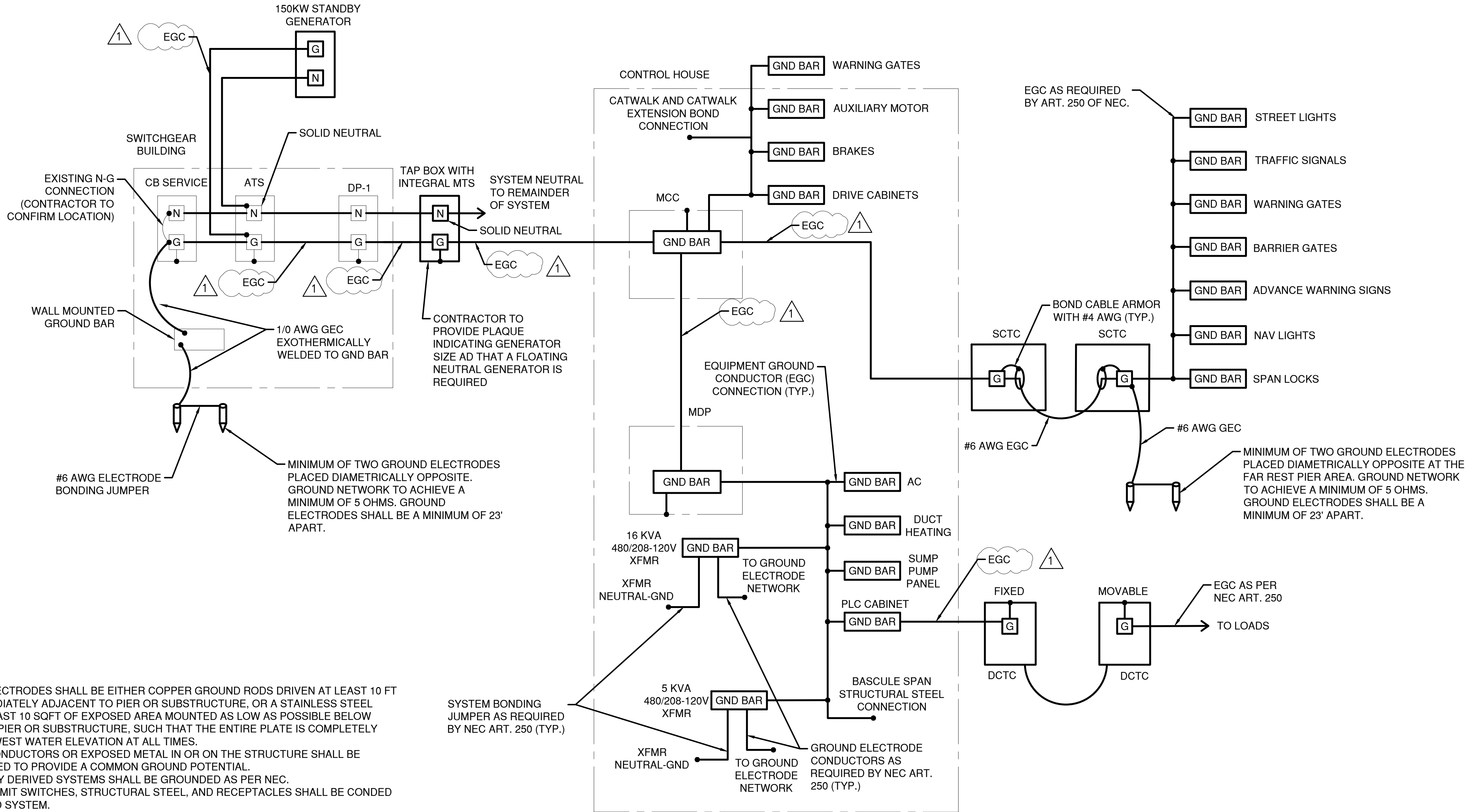
IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY J. AMBROS, PE

1	4/24/24	JA	TK	SCOPE REVISED
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

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TITLE	TITLE	TITLE	TITLE
DATE	DATE	DATE	DATE

WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
DIVISION OF ENGINEERING
Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle
ELECTRICAL
PROPOSED CCTV LAYOUT

CONTRACT NUMBER 20-517	SHEET NUMBER E-48
SHEET NO. 210 OF 212	
SCALE: AS SHOWN DATE: 03/08/2024	
DPW FILE NO. 5-04-E-645-0	REV. NO. 1



- NOTES
- 1. GROUNDING ELECTRODES SHALL BE EITHER COPPER GROUND RODS DRIVEN AT LEAST 10 FT INTO MUD IMMEDIATELY ADJACENT TO PIER OR SUBSTRUCTURE, OR A STAINLESS STEEL PLATE OF AT LEAST 10 SQFT OF EXPOSED AREA MOUNTED AS LOW AS POSSIBLE BELOW WATER ON THE PIER OR SUBSTRUCTURE, SUCH THAT THE ENTIRE PLATE IS COMPLETELY BELOW THE LOWEST WATER ELEVATION AT ALL TIMES.
 - 2. ALL GROUND CONDUCTORS OR EXPOSED METAL IN OR ON THE STRUCTURE SHALL BE INTERCONNECTED TO PROVIDE A COMMON GROUND POTENTIAL.
 - 3. ALL SEPARATELY DERIVED SYSTEMS SHALL BE GROUNDED AS PER NEC.
 - 4. ALL LIGHTING, LIMIT SWITCHES, STRUCTURAL STEEL, AND RECEPTACLES SHALL BE CONDED TO THE GROUND SYSTEM.
 - 5. CROSSING LINES ARE ELECTRICALLY CONNECTED ONLY IF A DOT (•) IS SUPERIMPOSED OVER THE INTERSECTION OF THE LINES.
 - 6. THE "Y" IN TRANSFORMER SYMBOLS REFERS TO THE "Y" SECONDARY WINDING.
 - 7. ALL GROUNDING MATERIAL IS COPPER, UNLESS OTHERWISE NOTED.
 - 8. ALL AVAILABLE ELECTRODES SHALL BE BONDED.
 - 9. WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 683.090700WE - MOVABLE BRIDGE STANDBY GENERATOR, 599.142500WE - MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS, 599.142600WE - MOVABLE BRIDGE SUBMARINE CABLE AND HDPE DUCTS INSTALLATION, 599.064000WE - MOVABLE BRIDGE ELECTRICAL TESTING

GLEN ISLAND PARTIAL GROUNDING RISER

N.T.S.

IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY C. AUBERT

1	4/24/24	JA	TK	UPDATED FOR CLARITY
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

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DATE _____	DATE _____
PROJECT COORDINATOR	
NAME _____	NAME _____
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TITLE _____	TITLE _____
DATE _____	DATE _____

CONSULTANT SEAL

CONSULTANT INFORMATION

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WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
DIVISION OF ENGINEERING
Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle
ELECTRICAL
PARTIAL GROUNDING RISER

CONTRACT NUMBER 20-517	SHEET NUMBER E-49
SHEET NO. 211 OF 212	
SCALE: AS SHOWN DATE: 03/08/2024	
DPW FILE NO. 5-04-E-646-0	REV. NO. 1



- NOTES:
1. FIBER OPTIC CABLE SHALL BE SINGLE-MODE, TYPE MC IDENTIFIED FOR DIRECT BURIAL, AND UTILIZE MICROTRENCHING WITH HDPE DUCTS INSTALLATION. MICROTRENCHING AS DESCRIBED HERE IS A "SAW CUT" WHICH CAN BE ANYWHERE FROM ½" TO 3" WIDE, AND UP TO 24" IN DEPTH. THIS MICRO TRENCH WOULD ACCEPT REDUCED DIAMETER MICRODUCT PATHWAYS. ALL INSTALLED FIBER DUCTS SHALL BE LOCATABLE.
 2. CONTRACTOR SHALL PROVIDE PULL BOXES AS NECESSARY.
 3. THE FIBER JUNCTION BOX IS TO BE INSTALLED IN THE FRONT LAWN OF THE ADMINISTRATION BUILDING IMMEDIATELY ADJACENT TO THE ROADWAY, APPROXIMATELY 20FT SOUTH OF THE CROSSWALK.
 4. COORDINATE WITH WESTCHESTER COUNTY FOR THE FIBER ROUTE BETWEEN THE FAR SIDE SUBMARINE CABLE TERMINAL CABINET AND THE ADMINISTRATION BUILDING.
 5. CONTRACTOR SHALL MARK-OUT AND COORDINATE WITH ANY UTILITIES IN THE AREA.
 6. CONTRACTOR SHALL RESTORE THE TRENCHED AREA TO PRE-EXISTING CONDITION UPON COMPLETION.
 7. WORK ON THIS SHEET TO BE PAID UNDER ITEMS 599.063000WE - MOVABLE BRIDGE ELECTRICAL AND CONTROL SYSTEM, 599.064000WE - MOVABLE BRIDGE ELECTRICAL TESTING

CONSULTANT SEAL

CONSULTANT INFORMATION

1501 BROADWAY, SUITE 601
NEW YORK, NY 10036
(212) 944-1150

WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
DIVISION OF ENGINEERING

Rehabilitation of Glen Island Approach Bridge
over New Rochelle Harbor, City of New Rochelle
ELECTRICAL

PROP'D ADMIN BLDG FIBER OPTIC CABLE ROUTE

CONTRACT NUMBER
20-517

SHEET NUMBER
E-50

SHEET NO. 212 OF 212

SCALE: AS SHOWN
DATE: 03/08/2024

DPW FILE NO.
5-04-E-647-0

REV. NO.
1

IN CHARGE OF D. DELUCA, PE
CHECKED BY A. NOBLE, PE
MADE BY J. AMBROS

1	4/24/24	JA	TK	UPDATED FOR CLARITY
REVISION NUMBER	DATE	MADE BY	APP'D BY	REVISION

RECORD DRAWING CERTIFICATION			
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TITLE _____	TITLE _____	TITLE _____	TITLE _____

ITEM 599.063000WE BRIDGE ELECTRICAL AND CONTROL SYSTEM

DESCRIPTION

This specification covers the fabrication and installation of the bridge power, control, and electrical machinery for the Glen Island Bridge as well as the removal and lawful disposal of the material/devices being replaced.

Conformance

Electrical equipment and its installation shall conform to the requirements of the latest revision of the American Association of State Highway Transportation Officials (AASHTO), except as may be otherwise provided herein. In addition, it shall conform to the requirements of the current National Electrical Code (NEC), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratory (UL), Institute of Electrical and Electronics Engineers (IEEE) and to any applicable local rules and ordinances.

Obtain any required permits and approvals of all Departments or Agencies having jurisdiction.

Scope of Work

The work covered by this Item consists of furnishing, installing, and placing in satisfactory operating condition the complete electrical systems for permanent operation of the bridge and auxiliaries as indicated on the Plans, called for in these Specifications, or as required for complete pieces of work. The major pieces of equipment or systems covered include, but are not limited to, the span drive motors and brakes, limit switches, programmable logic controller (PLC), power distribution and motor control equipment, navigation lights, span motors, vector motor drives, complete raceway and conductor systems, traffic gates and signals, roadway luminaires, and monitoring equipment. The scope of work will also include the lawful demolition/removal and disposal of the existing equipment that is being replaced/removed.

The cost of removal of existing items, as shown on plans, or if items are replaced as called out in this specification, shall be included in the bid price of this item.

It is the intent and purpose of these Specifications to cover and include all apparatus and appliances to properly install, wire, connect, equip, test, adjust, and put into approved working order the respective portions of the electrical work herein specified. Furnish any incidental apparatus, appliance, material, or labor not herein specifically mentioned or included, but that the Engineer deems necessary to comply with the requirements of the related documents and referenced standards or codes, just as if specifically mentioned in these Specifications and without extra cost.

The alignment and fastening of electrical equipment to be incorporated into the bridge machinery, such as motors, brakes, rotary limit switches, and position encoders, is included under the appropriate machinery item.

Compatibility with Existing Equipment Work under this item requires connection of new/rehabilitated items to existing components to remain. The Contractor shall perform field visits and verifications necessary to ensure that the materials and methods being proposed will be completely compatible with the existing equipment to remain, and that all original system functions will be returned to operation at the completion of the Contract work.

ITEM 599.063000WE BRIDGE ELECTRICAL AND CONTROL SYSTEM

It is noted that, in certain cases, it may not be possible to locate new components which fully integrate and provide compatible operation with existing equipment/components to remain. In this case, the Contractor may propose alternate methods including replacement/alteration of existing system components that are not shown to be replaced or modified in the Contract Documents. The Contractor shall make a submittal to the Engineer, who shall have the sole discretion regarding approval of the alternate methods. Where approved by the Engineer, the alternate methods shall be considered to be for the Contractor's benefit, and the Contractor shall not receive additional payment for the changes in work performed. Any costs associated with ensuring integration of the proposed work/equipment to existing systems, such that the existing systems are restored to original functionality, shall be borne by the Contractor and included in the bid price of this item.

Working Drawings and Samples

Provide shop drawings and operation and maintenance manuals as specified herein.

Prepare and submit for review working drawings in accordance with the approved project schedule. Provide the following working drawings in accordance with the provisions of the Contract:

- Certified dimension prints of all motors, span brakes, brake wheels, limit switches, and other electrical apparatus external to the control panels.
- Complete schematic wiring diagrams, including all power, control, and lighting connections. Identify electrical devices and each wire between devices by an individual designation of letters, numbers, or a combination of both; and use such designations wherever the devices or wires appear on other drawings. Include a complete set of catalog cuts for materials furnished for review at time of schematic submittal.
- Layout drawings and internal connection diagrams of the control panels.
- A schedule of electrical apparatus which lists each electrical device by its designation as shown on the schematic wiring diagram and states for each device its rating, number of poles or contacts, function, catalog number, and location.
- Complete interconnection diagrams for all electrical apparatus and equipment used in the operation of the spans and their auxiliaries. The diagrams shall be of the point-to-point type and shall show the external connections of all devices and equipment. The control system vendors shop drawings shall include complete drawings of terminal block layouts to allow the contractor to properly develop interconnect drawings. Computer-generated interconnection lists will not be acceptable in lieu of a true interconnection diagram.
- A complete schematic conduit and cable diagram or diagrams showing the interconnection of all devices and equipment, including ducts and junction boxes, and showing all multi conductor cables. Show the size of each conduit, and the wire number of each conductor in multi conductor cables on the diagrams. Suitably number or letter each conduit and multi conductor cable and show percent wire fill. As built the final installed length.
- A complete set of layout and installation drawings for the electrical work showing the location and installation, including support and mounting details, of all electrical apparatus and equipment. Make these drawings to scale and show the exact location of all conduits, cables, wiring ducts, boxes, motors, brakes, limit switches, disconnect switches, and other electrical equipment and the method of supporting them on the structure.
- Outline drawings and mounting details of all navigation lights and air horns.
- Detail drawings showing the construction and mounting details of all wiring troughs and raceways.
- A complete list of all spare parts furnished as part of the Contract.

ITEM 599.063000WE BRIDGE ELECTRICAL AND CONTROL SYSTEM

- Material listing and specifications for programmable controller, including input/output units, programming terminal, and equipment for interfacing.
- The programmable controller program listings in ladder-rung formats. Describe circuit functions; identify all contacts and outputs by word description and by number designation. Number ladder rungs sequentially for reference. Fully document and comment the ladder diagram and identify and list internal ladder logic relay contacts usage in other rungs. Reference inputs and outputs to locations of signals on interconnection diagram. Include a full cross-reference report.
- Any other drawings, which may, in the opinion of the Engineer, be necessary to show the electrical work.

Where specific manufacturers catalog numbers and/or class/type/form are noted on the contract document, these items need not be submitted for review, so long as these exact devices are utilized. For contactors, starters, pilot devices, circuit breakers, disconnect switches and control relays, any NEMA rated device that meets the required ratings from Square D, Allen-Bradley, Siemens, or General Electric may be utilized without submitting for review, save that the Engineer reserves the right to reject as unsuitable, during the shop inspection or in the field, devices or equipment that in his sole opinion do not meet the requirements of the contract documents. Any rejected equipment or device shall be replaced with Engineer approved equipment or device at no additional cost to the County or impact with the construction schedule. In addition, using the pre-approved equipment and material does not relieve the contractor of the requirements to properly integrate this equipment into a complete, fully operational system.

On certified dimension prints of the apparatus, state in the certification the name of the job, the application of the apparatus, device designation, number required, right-hand or left-hand assembly, electrical rating, number of poles or contacts, material, finish, and any other pertinent data to show that the apparatus meets the specified requirements.

Upon completion of the work, correct all electrical shop or working drawings to show the work as constructed and provide one (1) set of Mylar reproducibles. In addition, submit in computerized file form in Adobe Acrobat (pdf) Format all electrical schematics, ladder diagrams, internal ladder logic diagrams, systems documentation, dimension drawings of equipment, and devices submitted by the electrical systems vendor.

Submit for inspection and test, if directed by the Engineer, samples of any apparatus or device, which is proposed for use as a part of the electrical installation.

Instruction Books and Manuals

Furnish to the Engineer seven bound copies and a CD, one of which remains with the Design Consultant Engineer, of an instruction manual with the title "Operation and Maintenance Manual, Volume 1, Operation of Electrical Equipment," containing the following:

- Table of Contents.
- Detailed, technical operating instructions, which cover span operation, manual operation, span operation with PLC disabled, etc.
- Detailed description of all control equipment including instructions to achieve optimum settings of all limit switches, detectors, etc.
- Description of control, which shall describe in full the functions of all protective devices, limit switches, contactors, relays, PLC and associated equipment and all other electrical equipment used, both in the power service and in the control system, in connection with each step in the operating sequence. Use wire and apparatus numbers appearing on the wiring diagrams in this description for identifying the various devices and circuits.

ITEM 599.063000WE BRIDGE ELECTRICAL AND CONTROL SYSTEM

To augment the description of control and operations, include reference drawings showing locations of equipment. Include a layout of control apparatus in the machinery rooms. Cross-reference all descriptions with reference drawings.

Furnish to the Engineer seven bound copies and a CD, one of which remains with the Design Consulting Engineer, of a book with the title "Operation and Maintenance Manual, Volume 2, Maintenance of Electrical Equipment," containing the following:

- Table of Contents.
- Maintenance instructions for the electrical equipment, including warnings and precautions to be observed during maintenance actions. All preventive maintenance procedures are to be outlined and a chart listing all maintenance procedures in chronological order shall be provided.
- Set of descriptive leaflets, bulletins, maintenance instructions, and drawings covering all approved items of equipment furnished and installed under the item "Bridge Electrical Work."
- A troubleshooting flow chart for troubleshooting the bridge electrical system shall be provided to facilitate the diagnosing and correcting of malfunctions.
- Instructions for diagnosing malfunctions of the programmable control system and for detecting failures in the external controls connected thereto.
- Reduced size prints of working drawings, including all schematic wiring diagrams, control console and control panel layouts and connection diagrams.
- PLC schematic wiring, relay logic, PLC input/output hardwire diagram, PLC logic and PLC ladder diagrams.
- Control console and control panel layouts and wiring diagrams.
- Composite schedule of electrical apparatus.
- Complete spare parts list.
- Test data, equipment, criteria, and performance curves for all span drive motors.
- Conduit layout and installation drawings.
- Names, addresses, and telephone numbers of vendors and suppliers.
- PLC software program and manufacturers manuals for all PLC hardware.

Assemble the material for the operation and maintenance manuals to form a booklet for each volume with heavy plastic covers. Assemble each booklet in a three-ring binder, approximately 229 mm by 305 mm with 76mm "D" rings, with a vinyl cover to allow insertable Title Sheets. Neatly entitle each booklet with a descriptive title, the name of the bridge, the Owner, the location, year of installation, Contractor, and Designer. Include easily legible copies of drawings in black on a white background. Submit the arrangements of the booklets, the method of binding, material to be included, and the text to the Engineer for approval. Complete the final bound volumes of the instruction books and make them available at the bridge site for use during the field-testing period hereinafter specified for the electrical work.

Number and list by section in the Table of Contents all literature and descriptive materials included in any manual.

Separate each section/subsection with tabbed divider sheets. Suitably title each tab. Use 20 pound, 3 hole pre-punched loose leaf paper and reinforced with plastic or cloth tape.

Related Sections

Conform to applicable requirements from the following construction specification sections:

0603631A - Operating Machinery

ITEM 599.063000WE BRIDGE ELECTRICAL AND CONTROL SYSTEM

MATERIALS

Equipment and Material Provisions

Provide all new equipment and materials. Provide equipment, materials, and workmanship that is first-class in every particular and that is manufactured and erected to the satisfaction of the Engineer. Provide a warrantee for the in-service working of the electrical installations for one year following project acceptance. If the Contractor has any objection to any feature of the electrical equipment as designed and laid out, he must state his objection at once in writing to the Engineer, otherwise his objection will be ignored if offered as an excuse for malfunctioning of the equipment or for defective or broken apparatus.

Provide each piece of electrical equipment and apparatus with a corrosion-resisting metal nameplate on which is stamped the name of the manufacturer and the rating or capacity of the equipment or apparatus.

Use corrosion-resisting material such as stainless steel, for all metal parts of the installation, except parts that are specified to be structural steel. Use cast-iron, malleable iron, or steel with a hot-dip galvanized finish where specified herein.

Provide vibration proof mounting hardware, wire, and cable terminals.

Submit for approval as soon as possible details of any departures from the Plans or the Specifications that are deemed necessary by the Contractor, and reasons therefore on. No such departures shall be made nor work started without approval of the Engineer.

Material requirements for specific apparatus, equipment, and materials are found in the articles under the section "Construction Details" in this item.

Bridge Control System Vendor

Use a single, qualified control system vendor for the manufacture and/or furnishing and assembly of all apparatus and equipment comprising the bridge control systems, including, but not limited to, drives, motors, brakes, limit switches, motor controls, control cabinets, special control panels, programmable controllers, interfacing equipment, laptop hardware for local troubleshooting, and other apparatus required to provide a complete functioning system. The vendor shall assemble the control panels and console at an Underwriters Laboratory approved Facility in accordance with UL 508.

The control system vendor is required to have experience in providing electrical control systems for movable bridges of various types, including bascule, vertical-lift, swing bridges, and control systems, including AC vector motor drives and programmable controllers. The control system vendor shall be of a caliber and background similar to that of Panatrol Corp, Burr Ridge, IL, (630) 655-4700, Faith Technologies APC Group, Menasha, WI, (920) 783-1500, Dmytryka Jacobs Engineering, Toledo, OH, (419) 380-4900, or approved equal. Identify a minimum of five movable bridges for which the system vendor has provided complete systems, including solid-state drive motor control and programmable controller logic within the past 10 years.

The following applies to the control system vendor:

- Assume complete system responsibility for the integrated functioning of all components to provide a satisfactory assembled system operating in accordance with specified requirements.
- Assume responsibility for the detailed schematics and fabrication of the total control systems to ensure compatibility of equipment and suitability for the intended system functioning.
- Assume responsibility for developing the program for the Programmable Logic Controller (PLC) based on the performance specification for operation of the bridges.

ITEM 599.063000WE BRIDGE ELECTRICAL AND CONTROL SYSTEM

- Assume responsibility for developing and integrating PanelView operator display and diagnostic screens.
- Provide supervisory assistance in the installation of equipment to ensure maximum reliability and ease of maintenance.
- During testing of the electrical systems, it may be found that deviations from the performance specifications are required for optimum bridge operation. Include all hardware and software required for these modifications in the control system vendor scope of work at no additional cost to the County.
- Provide a field service staff having the capability of providing services for field coordination of construction and final adjustments to the drive system. Upon final acceptance of the bridges, provide on-call warranty service for a period of 1 year. Field staff shall be capable of responding to an emergency within 6 hours.

Provide written certification of compliance with specified requirements for the control system vendor. Include this certification in the bid documents. The certification shall be subject to approval by the Engineer.

Factory Inspection and Testing

The control cabinets and other apparatus fabricated or assembled by the control system vendor shall be subjected to shop inspection to demonstrate compliance with all specified requirements. The inspection is intended as a means of facilitating the work and avoiding errors, and it is expressly understood that it will not relieve the Contractor of responsibility for imperfect material or workmanship.

Assemble and temporarily interconnect for operational testing at the plant of the control system vendor the power and control cabinets and drives with programmable controllers with all required interfacing equipment. Limit switches shall be simulated with temporary switches, and reduced horsepower motors shall be connected to the drives. The testing is intended to demonstrate proper programmed operation of all bridge drives and auxiliary equipment in accordance with specified requirements for system functioning, including the programmable controllers, vector drives, and all control relays and motor starters.

Special testing shall include complete verification, adjustment, and testing of the regulator circuits and equipment using regulator simulators as necessary.

Perform all tests required herein in the presence of the Engineer or his authorized representative. Do not ship any equipment from the factory until it has been released for shipment by the Engineer. Provide notification sufficiently in advance of the date of the tests so that arrangements can be made for the Engineer to be present at the tests.

During the witnessed inspection, the Engineer will check nameplate legends, conductor identifications, instrument scales, escutcheon plate engraving, and all other details of construction for conformity with specified requirements.

Panelboards

Main Distribution Panelboards (MDP)

Main distribution panelboards will conform to the following standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

Main distribution panelboards with main circuit breakers up to 600A will be NEMA 4X Main distribution panelboards with main circuit breakers over 600A will be NEMA 3R rated.

Main distribution panelboards will be rated for 200A minimum and include a main circuit breakers. Bussing will be tin plated. The main distribution panel will be supplied with an internal surge suppression device.

ITEM 599.063000WE BRIDGE ELECTRICAL AND CONTROL SYSTEM

The surge suppression device will be rated for 480/277VAC and will be UL1283 listed. The surge suppression device will be rated for at least 120kA per phase and will have discrete 10 mode circuitry. The surge suppression devices will be encapsulated. The lead wires from the SPD will be kept to a minimum. All MDPs will have a minimum short circuit rating of 65KAIC at 480VAC.

Lighting Panelboards

Each lighting panelboard will be of the dead-front type and will be provided with quick-make, quick-break, thermal-trip, E-frame, branch circuit breakers. Each breaker will trip free of the operating handle, and the handle will indicate the position of the breaker. Each panelboard will be provided with a circuit breaker in the mains and with a full-sized neutral bar. All branch circuits will be numbered, and a typewritten directory will be provided on the inside of each door. Circuit breakers will meet the requirements of UL Standard 489.

All lighting panelboards will be 120/208, 3-phase, 4-wire panels surface or flush mounted as called out on the Plans. Panelboard enclosures will be code gauge galvanized steel with ANSI 61 light gray enamel finish. Panel boards will be NEMA 4X rated, with copper lugs and tin plated copper busses. Panelboards will be approved equal to Siemens P2, Cooper Crouse-Hinds XLPB series or Square-D Type QO.

Span Drive Motors

The span drive motor shall be AC induction type, squirrel cage type, vector duty motor. The motor shall be built in strict accordance with NEMA publication MG 1 and designed for use with Variable Frequency Drive AC closed loop vector controllers. They shall be 3 phase 60 Hertz, with moisture resistance insulation, 120° F temperature rise, and capable of instant reversing. Ratings shall be as follows:

Horsepower: 60 HP

Nominal Voltage: 480 VAC primary

Nominal speed: 1200 RPM

Duty: 60 minutes

Frame size: *

Insulation: H

Service Factor: 1.15

* Frame size shall be coordinated with the motor and drive manufacturer for accuracy

The motor shall be totally enclosed non-ventilated (TENV) construction, with re-greaseable ball bearings, moisture resistant insulation and internal space heater sized by the manufacturer. The space heater shall operate at 120 VAC and mounted in the lower portion of the motor. The motor shall have a special extended shaft as shown on the mechanical contract drawings to accommodate the motor brake and a rear mounted encoder on the other. The motor shaft shall be cadmium plated. A drain hole of not less than ½ inch diameter shall be provided at the bottom of the motor, fitted with a suitable drain plug.

All windings shall be copper. The motor shall be capable of having a minimum breakdown torque of 200% of full load torque. The motor must have a speed range of 1000:1 and be capable of providing full torque at zero speed. Motor design shall be low inertia and slip design. A normally closed temperature sensor shall be embedded in the windings.

Motor encoder shall be an industrial type (glass encoder wheels are not acceptable). The encoder shall have a resolution of minimum 1024 ppr and be compatible with the Variable Frequency Drive vector controls. The encoder shall be 24V DC operated. The encoder shall have dual output differential line driver modules with 24V DC signal. A separate terminal box with terminal strip for feedback unit shall be provided. Encoders shall not be connected or wired through motor junction box. Encoder shall be factory-installed at the plant of the motor manufacturer and approved by both the Engineer and the drive manufacturer. Encoders shall be approved equal to the Avtron Encoders AV850. The motor must comply with NEMA MG1 for dimensions, face runout, and shaft runout. Encoder shall be supplied with the optional outboard

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seal plate for through-shaft mounting. The encoder through-shaft projection from the accessory mounting piece shall be coordinated and as recommended by the encoder manufacturer.

The motor box shall be liberally sized and located to avoid interference with the machinery. The conduit boxes shall be sized in accordance with the requirements of the NEMA MG 1 2016 PART

All field wiring brought into motor box shall be terminated on terminal blocks with insulated, ring tongue lugs of the proper size.

The motor shall be designed and manufactured in the United States of America. Span Drive Motors shall be manufactured by ABB Baldor, Marathon Electric, Reuland Electric, WEG Motors, or approved equal.

The motor shall be manufactured to the following standards:

- IEEE Marine Standards No. 45.
- American Bureau of Shipping (A.B.S.).
- U.S. Coast Guard Inspection Service.
- NEMA MG-1

Span drive motor shall also be provided with the following features in order to meet the requirements of these Specifications:

- All aluminum parts chemical film and zinc chromate primer.
- Stainless steel Cadmium plate shaft and hardware (FED QQ P 416).
- Double Sealed ball bearings.
- Seal all joints and eye bolt holes.
- Sealed leads in terminal box.
- Shaft seals.
- Removable drain plugs.
- Final coat of epoxy paint.
- Corrosion resistant coating rotor and stator laminations.
- Stainless steel nameplate with all applicable NEMA MG 1 information.
- Super 'H' insulation including protection against fungus growth.
- NEMA MG-1 Design B
- Motors shall have windings vacuum pressure impregnated three times with severe seacoast or open ocean rated epoxy.

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- The motor frame shall be finished with a corrosion resistant paint or coating. Exposed unpainted metal surfaces shall be of a corrosion resistant material.

An in-sight disconnect switch shall be provided within range view of each the motor as specified elsewhere. The 120-volt strip heater in each motor frame shall be wired to the normally open auxiliary contact in the corresponding motor disconnect switch.

Motor must be designed to operate at carrier frequencies up to 30 kHz and designed to be controlled with a flux vector drive. All motors shall be dynamically balanced. The Contractor shall ensure that the span motor is electrically and mechanically compatible with the span drive as approved by the span drive manufacturer.

Squirrel Cage Auxiliary Drive Motor

The span drive auxiliary motor will be an AC induction type, squirrel cage type motor. The motor will be built in strict accordance with NEMA publication MG 1. It will be 3 phase 60 Hertz, with moisture resistance insulation, 120° F temperature rise, and capable of instant reversing. Ratings will be as follows:

- Horsepower: 7.5 HP
- Nominal Voltage: 480 VAC primary
- Nominal speed: 1800 RPM
- Duty: 60 minutes
- Frame size: *
- Insulation: H
- Service Factor: 1.15

* Frame size will be coordinated with the motor manufacturer for accuracy.

The motors will be totally enclosed non-ventilated (TENV) construction, with re-greaseable ball bearings, moisture resistant insulation and internal space heater sized by the manufacturer. The space heater will operate at 120 VAC and be mounted in the lower portion of the motor. The motor will have a special extended shaft as shown on the mechanical contract drawings to accommodate the motor coupling and motor brake on one end. The motor will have a special hexagonal extended shaft as shown on the mechanical contract drawings on the rear of the motor to accommodate a socket drill so that the span could be manually operated in the event of a motor failure. The motor shafts will be cadmium plated. A drain hole of not less than ½ inch diameter will be provided at the bottom of the motor, fitted with a suitable drain plug.

All windings will be copper. The motor will feature a NEMA Design D torque speed curve characteristics and will be capable of having a breakdown torque minimum of 275% of full load torque. A normally closed temperature sensor will be embedded in the windings.

Each motor box will be liberally sized and located to avoid interference with the machinery. The conduit boxes will be sized in accordance with the requirements of the NEMA MG 1 2016 PART 11. All field

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wiring brought into motor box will be terminated on terminal blocks with insulated, ring tongue lugs of the proper size.

The motor will be designed and manufactured in the United States of America. Span Drive Motors will be manufactured by ABB Baldor, Marathon Electric, Reuland Electric, WEG Motors, or approved equal.

Auxiliary motor will be manufactured to the following standards:

- IEEE Marine Standards No. 45.
- American Bureau of Shipping (A.B.S.).
- U.S. Coast Guard Inspection Service.
- NEMA MG-1

Auxiliary Span drive motor will also be provided with the following features in order to meet the requirements of these Specifications:

- All aluminum parts chemical film and zinc chromate primer.
- Stainless steel Cadmium plate shaft and hardware (FED QQ P 416).
- Double Sealed ball bearings.
- Seal all joints and eye bolt holes.
- Sealed leads in terminal box.
- Shaft seals.
- Removable drain plugs.
- Final coat of epoxy paint.
- Corrosion resistant coating rotor and stator laminations.
- Stainless steel nameplate with all applicable NEMA MG 1 information.
- Super 'H' insulation including protection against fungus growth.
- NEMA MG-1 Design D
- Motor will have windings vacuum pressure impregnated three times with severe sea coast or open ocean rated epoxy.
- The motor frame will be finished with a corrosion resistant paint or coating. Exposed unpainted metal surfaces will be of a corrosion resistant material.
- An in-sight disconnect switch will be provided within range view of each motor as specified elsewhere. The 120-volt strip heater in each motor frame will be wired to the normally open auxiliary contact in the corresponding motor disconnect switch.

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- Auxiliary span motor will be rated to be back driven up to and including 3600RPM.

Span Brakes

Furnish and install two 10" electrohydraulic thruster type machinery brakes as shown on the plans. The brakes shall act upon brake wheels press fit onto shafts as called out on the mechanical drawings. See the machinery specifications for details.

Provide spring-set, thruster-released, shoe-type, open brakes with corrosion-resisting fittings. Brake shall have the drum size and torque requirements as listed on the Plans, with permanent torque setting limited as required.

Furnish all brake wheels with the brakes by the brake manufacturer. Leave the bores undersize, and ship the wheels to the machinery manufacturer who shall finish-bore and press the wheels onto the gearbox input shaft.

Equip each brake with a hand release, which will not change the torque setting or require removable levers or wrenches. Locate the hand release mechanism on the side of the brake away from the main reducer. (Right hand and left hand units are required.) Provide each hand release with a lever type limit switch for interlocking purposes as described under "Interlocking." It shall not be possible to set the hand release of the brakes without tripping these switches. Switches shall be Cutler-Hammer Series E50, NEMA 6P+ with epoxy potted cord sets or approved equal.

In addition to the hand release limit switch, mount two lever type limit switches on each brake. One shall indicate that the brake is fully set, the other that the brake is fully released. Assure that the brake released limit switch (which shall have two normally open contacts) trips when the brake is electrically released or hand released. The brake set limit switch shall have one normally open and one normally closed contact and shall trip when the brake is fully set. Switches shall be Cutler-Hammer Series E50, NEMA 6P+ with epoxy potted cord sets or approved equal.

Each thruster actuator shall be provided with a time delay valve adjustable between 0 and 5 seconds for setting the brake. Only an internal time delay valve constructed of stainless steel is acceptable. Adjustment must be infinitely adjustable between the minimum and maximum settings. These adjustments must be allowable with the brake in full service. Set the down-stroke time delays of the thrusters in such a manner that the brakes will not be applied simultaneously should electric power fail while the span is in motion. Adjust the intervals between the setting of the brakes to obtain smooth stopping of the span in the shortest possible time.

Provide the oil used in the thruster operating chambers of the brakes to be of a grade as recommended by the manufacturer and approved by the Engineer. It shall have a free operating temperature range between -40 degrees and 66 degrees Celsius.

Provide 480-volt, three-phase, 60 Hertz, totally enclosed, squirrel cage motors controlled by magnetic contactors with manual-reset thermal overload relays to actuate the thrusters. The rated stalled thrust of each thruster shall be not less than 135 percent of the thrust actually required to release the brake with the torque adjusted to the continuous rated value.

All exposed ferrous material shall be treated with a nitrocarburising process. This process shall improve wear resistance, lower the coefficient of friction and greatly reduce the tendency to weld or seize with a metallic counterpart. It shall also vastly improve corrosion resistance properties. The nitriding process

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shall produce a thick E-Nitrite layer of at least 12µm. Painting and other finishes are not an acceptable replacement for Nitriting.

Equip each brake with a NEMA 3R enclosure, which encloses the entire brake assembly, including the brake thruster unit, and the brake wheel, and should not prevent brake hand release operation.

The brakes shall be type MBT/E as manufactured by Mondel Engineering or approved equal by Bubenzer or Ametek.

Vector Motor Drives

The drives shall be properly sized based on the full load ampere rating of the motors and shall allow for 150% overload for 60 seconds. The correctly sized drive, meeting all the requirements, shall be provided at no additional cost to the County.

Vector drives must be four quadrant drives and shall be capable to run in speed and torque mode with adjustable torque limits in all four quadrants.

To minimize electrical and acoustical noise, and to eliminate low speed cogging, a minimum switching frequency of 15 kHz shall be used. The drive shall not "cog" at any frequencies with a 1,000:1 speed regulation. There shall be no sudden frequency shifts and associated acoustical noise shifts as the output frequency is varied between 0 and 60Hz.

The drive's input displacement power factor shall be 0.98 or better over the entire operating frequency and load range. Efficiency shall be measured 96% minimum at rated load. The Contractor shall provide manufacturers typical test results or calculations with submittal to verify efficiency and power factor.

The drives shall be provided with input reactors as specified by the drive manufacturer.

Output reactors shall be supplied as required per drive and motor manufacturer recommendations.

The vector drives shall have, but not be limited to the following features:

- Manufacturer provided ethernet communications module to allow transfer of all commands and operational data/faults to the PLC network
- High speed analog inputs
- Allow for smooth and instantaneous connection into rotating loads, regardless of commanded direction, without the need for any speed feedback.
- Inertia Ride-Through to allow for tripless operation during a prolonged power outage by using the rotating energy stored in high inertia, low-friction loads.
- Provide a torque proving circuit to ensure proper control of the load when transferring control between the drive and a mechanical brake.
- Slip Compensation to provide a minimum 0.5% speed regulation without feedback hardware.
- Encoder Feedback to provide $\pm 2\%$ regulation and the ability to hold full load at zero speed.
- Solid state output ground fault protection shall be provided.
- Adaptive electronic motor overload protection shall be provided which shall protect both the motor and the drives at all frequencies. This overload must be UL approved. Electronic thermal overload circuits which only protect the motor at full speed shall not be acceptable. The drive shall sense the load and speed and shall recalibrate the thermal trip curve to insure low speed motor protection. The initial trip point shall be adjustable from at least 40% of the drive continuous rating to account for motor magnetizing current.
- Input surge protection

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- Input and output phase loss detection
- Output short circuit protection
- Four programmable digital dry contact outputs for Drive Trouble, Drive Running, Drive Ready, Spare.
- Programmable current limit.
- Remote drive reset contact.
- Minimum of 1,000:1 controllable constant torque speed range when in closed loop mode. Speed regulation shall be 0.01% or better over the entire speed range.
- Minimum of 2 second power loss ride-through capability. In the event of a loss of three-phase power lasting 2 seconds or less, the drive must maintain operation and prevent nuisance trips upon return of power.

The 'Drive Trouble' fault condition shall cause the drives to shut off and shall be annunciated to the PLC control system through the Ethernet connection. All faults shall be transmitted to the PLC. The conditions that shall cause a drive shutdown fault are at minimum as follows:

- Blown fuse.
- Instantaneous overcurrent trip.
- DC bus overvoltage.
- DC bus undervoltage.
- Excessive ambient drive heat sink over temperature.
- External fault input.
- Internally diagnosed, control failure.
- Motor thermal overload.
- Drive thermal overload.

The drives shall employ modular PC board design for ease of troubleshooting. All connectors must be polarized type and clearly marked on both the connector and PC board to ensure proper connection.

Each drive shall be provided with a door-mounted LCD Human Interface module station with the following minimum features:

- Remote versions for panel mount application
- Large and easy to read 7 line x 21 character backlit display
- Alternate function keys for shortcuts to common tasks
- "Calculator-like" number pad for fast and easy data entry
- Control keys for local start, stop, speed, and direction

All drive functions shall be programmable from the door-mounted keypad. The keypad shall be equipped with EEPROM and be removable so that the parameters can be downloaded into another drive.

The drives shall be provided with heavy duty dynamic braking resistors capable of providing 100% braking on a continuous basis and 150% dynamic braking for 60 seconds. The resistors shall be provided with NEMA 3R enclosures.

The drives shall be Magnetek G+ Series 4, no substitutions will be permitted.

Programmable Logic Controller (PLC)

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Control logic functions shall be performed by a PLC system, which shall provide for operation of the bridge and its auxiliaries in accordance with the system functioning specified herein and the control logic shown on the Plans.

The PLC control system shall be capable of full diagnostics and monitoring. It shall be able to assist in troubleshooting and indicate failures and alarms. All aspects of the control system/electrical infrastructure shall be monitored. Items to be included, but not be limited to, are communications protocols, circuit breakers, fuses, disconnect switch positions, overloads, starters, limit switches, drives, misc. faults, operational time outs, interlocking, error states, contradictory conditions, pushbuttons, selector switches, pilot lights, timers, relays, contactors, etc. The Contractor shall provide for the diagnostic and troubleshooting functionality of the system and any additional wiring/conduit/logic that may be necessary whether shown explicitly on the Contract documents or not.

The PLC shall be an Allen Bradley (AB) CompactLogix brand PLC with components, hardware and remote input/output drops or approved equal by Modicon or Siemens. The PLC shall be of modular construction, provide high-speed peer-to-peer networking, and be programmable with ladder logic.

Modules are defined herein as devices that plug into a chassis and are keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules as well as safeguard against the insertion of a module into the wrong slot or chassis via an electronic method for identifying a module. Electronic keying performs an electronic check to ensure that the physical module is consistent with what was configured. The PLC shall have downward compatibility whereby all new module designs can be interchanged with all similar modules in an effort to reduce obsolescence. The PLC shall have the ability to be updated electronically to interface with new modules.

All hardware of the PLC shall operate at an ambient temperature of 0 to 60 degrees C (32 to 140 degrees F), with an ambient temperature rating for storage of -40 to +85 degrees C (- 40 to +185 degrees F). The PLC hardware shall function continuously in the relative humidity range of 5% to 95% with no condensation. The PLC system shall be described and tested to operate in a high electrical noise environment.

The PLC shall have the capability of addressing up to 48 nodes. It shall also have the ability to communicate with up to 256 connections that contain I/O. Each input and output module shall be self-contained and housed within a chassis. The PLC shall include as an optional feature the capability of addressing remote input and output modules on EtherNet/IP or equivalent.

The PLC shall use multiple independent, asynchronous scans. These concurrent scans shall be designated for processing of input and output information, program logic, and background processing of other controller functions. Input and output devices located in the same backplane (local I/O) as the CPU will produce at the rate of the configured RPI (Requested Packet Interval), and for discrete input modules enabled for Change Of State (COS), at the time any point changes state.

The PLC shall have the ability to communicate with multiple remote I/O racks or devices configured with multiple I/O modules. Networks that allow remote I/O include EtherNet/IP or equivalent. It shall be possible to communicate with remote I/O racks or other PLCs via fiber optic cable by inserting fiber optic converters into the links. The fiber link must support distances up to 82,000 cable feet (25KM). Redundant fiber optic cabling shall be an option.

The PLC shall have the ability to support data communications networks in the same chassis by using Ethernet/IP.

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The PLC shall have one dedicated Universal Serial Bus port communicating at 12mb/sec. The USB port is a device only programming port. USB ports must be usable for programming and data monitoring purposes.

The CPU shall be a self-contained unit and will provide control program execution and support remote or local programming. This device will also supply I/O scanning and inter-controller and peripheral communication functions. The operating system firmware shall be contained in non-volatile memory. An option shall be possible to store both the user program and system firmware in a removable non-volatile memory for backup/restore purposes. The operating system firmware can be updated via a separate software update tool to allow for easy field updates. The controllers shall allow the operating system to be updated using a suitably configured removable non-volatile memory card. The controller shall contain a minimum of 2 Mbytes of user memory.

The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating a “green” (OK) indicator when no fault is detected and a “red” (OK) indicator (Blinking or Solid) when a fault is detected or by way of a display screen scrolling an error code and message. The front panel on the Controller shall include color LED indicators or 4-digit display showing the following status information:

- Program or Run mode of the controller
- The fault status of the controller.
- I/O status
- Secure Digital (SD) activity
- Force LED

The front panel of the Controller shall include a mounted keyswitch. The key shall select the following Controller modes: RUN – No control logic edits possible, program always executing; PROGRAM – Programming allowed, program execution disabled; and REMOTE – Programming terminal can make edits and change controller mode, including test mode, whereby the logic executes and inputs are monitored, but edits are not permanently active unless assembled. The front panel of the Controller shall include a USB port, to support upload and download, online edits, firmware upgrades, and bridging to other modules in the same chassis.

All system modules, local and remote chassis shall be designed to provide for free airflow convection cooling. No internal fans or other means of cooling, except heat sinks, shall be permitted. All system modules including the controller may be removed from the chassis or inserted in to the chassis while power is being supplied to the chassis without faulting the controller or damaging the modules. This is known as Removal and Insertion Under Power (RIUP). Alternately a software configurable option shall exist to fault the controller if required.

Program Creation and Storage

Memory state shall be selectable to allow for the most economical match to the intended application. It shall be possible to upgrade to a controller with a larger memory size simply by saving the program, upgrading the controller and downloading the program to the new system without having to make any program changes.

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The controller will write all variable data to internal nonvolatile memory storage (Flash) during the power down cycle. The controller shall provide the capability to use commercially available, removable nonvolatile memory storage. The card shall be available from the supplier as an industrial rated device suitable for use in the same environment as the controller.

The controller will have the ability to store the user program, controller firmware and firmware for all other modules residing in the same chassis to the removable nonvolatile memory card. Additionally, when memory is restored a user selectable option to be restored in Run mode or Program mode shall be provided. The controller shall have the capability to insure, that if required modules in the chassis are flashed using the firmware files stored on the removable nonvolatile memory card, to the correct revision level for the project. The removable nonvolatile memory card shall support a Windows file system allowing multiple files to be stored on the card. The user can manually trigger the controller to save or load from the card and also configure the controller to load from the card on power up. The operator should be able to backup volatile memory, including data and program logic onto a personal computer storage device.

All user memory in the controller not used for program storage shall be allocable from main memory for the purpose of data storage. The PLC system shall be capable of storing 4 data types:

- Predefined
- User-defined
- Module-defined
- Add-on defined

Predefined data types include the following: alarm, axis, bool, cam, cam-profile, control, coordinate system, counter, etc. User defined data is limited to structures. Each structure contains one or more data definitions called members. Object includes a structure for each I/O module and system or module specific information (hidden from user). Add-on defined data type includes the Local and Parameter tags of the add-on instruction. It does not include the logic. Any data can be displayed in ASCII, Binary, Octal, Hexadecimal, or Decimal radices. Function-specific data types such as PID, Axis, Axis Group or Message shall have dedicated displays available annotating the meaning of specific control bits and words within them and allowing for selective control where appropriate.

If instructions or entire rungs are intentionally deleted from an existing logic program, the remaining program shall be automatically repositioned to fill this void. Whenever contacts or entire rungs are intentionally inserted into an existing program, the original program shall automatically be repositioned to accommodate the enlarged program. All rung comments shall maintain their original links.

The number of times a normally open (N.O.) and/or normally closed (N.C.) contact of an internal output can be programmed shall be limited only by the memory state to store these instructions. The number of times a timer or counter can be programmed shall be limited only by the memory state to store these instructions. Controller programs shall have immediate access to the sub elements of control structures by address and sub element mnemonic, such as timer accumulator value, timer done bit, or PID Process Variable value.

The programming format shall be IEC 1131-3 compliant Ladder Diagram (LD). The controller shall organize user applications as Tasks, which can be specified as continuous, periodic, or event based.

Variables within the controller shall be referenced as unique, default or user defined tags. Tag naming convention shall adhere to specifications in IEC 1131-2. Tags may be created off-line, on-line and at the same time the routine logic is entered. The system shall have the capability to store user tags names in the controller. Tags shall be available to all tasks in the controller (Controller Scoped) or limited in scope to the routines within a single program (Program Scoped) as defined by the user. Any tag shall have the ability to be aliased by another tag, which is defined and has meaning to the user. The ability to program control logic via tags of the Programmable Logic Controller System shall exist.

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It shall be possible to program ladder diagram rungs with the following restrictions:

- Series instruction count limited only by user memory
- Branch extensions limited only by user memory
- Branch nesting to six levels

The capability shall exist to interleave input and output instruction types on the same contiguous rung in the ladder diagram rungs. The capability shall exist to change a contact from normally open to normally closed, add instructions, change referenced tags, etc. It shall not be necessary to delete and reprogram the entire ladder diagram rung. It shall be possible to insert ladder diagram rungs anywhere in the program, even between existing rungs, insofar as there is sufficient memory to accommodate these additions. A single program command or instruction shall suffice to delete an individual ladder diagram rung from memory. It shall not be necessary to delete the rung contact by contact. A clock/calendar feature shall be included within the CPU. Access to the time and date shall be from the programming terminal or user program.

Latch functions shall be internal and programmable. The system shall have the capability to address software timers and software counters in any combination and quantity up to the limit of available memory. All management of these instructions into memory shall be handled by the CPU. Instructions shall permit programming timers in the "ON" or "OFF" delay modes. Timer programming shall also include the capability to interrupt timing without resetting the timers. Counters shall be programmable using up-increment and down-increment. Timer instructions shall have a time base of 1.0 milliseconds. The timing range of each timer shall be from 0 to 2,147,483,648 increments. It shall be possible to program and display separately the timer's preset and accumulated values.

The Programmable Logic Controller System shall use a signed double integer format ranging from -2,147,483,648 to +2,147,483,648 for data storage of the counter preset and accumulated values. The Programmable Logic Controller System shall store data in the following formats:

- Boolean values (0 or 1).
- Short Integer Numbers ranging from -128 to +127.
- Integer Numbers ranging from -32,768 to +32,767.
- Double Integer Numbers ranging from -2,147,483,648 to +2,147,483,647.
- Floating Point Numbers consisting of eight significant digits. For numbers larger than eight digits, the CPU shall convert the number into exponential form with a range of plus/minus 1.1754944 E -38 to plus/minus 3.402823 E +38.
- Long Integer Numbers consisting of 64 bits.

The capability shall exist to organize data in the form of User Defined Data Structures. All aforementioned data types, as well as others, can be used in such structures along with embedded arrays and other User Defined Structures.

The Programmable Logic Controller System shall have support for integer and floating point signed math functions consisting of addition, subtraction, multiplication, division, square root, negation, modulus, and absolute value. Trigonometric instructions supported must include Sine, Cosine, Tangent, Inverse Sine, Inverse Cosine, and Inverse Tangent. These instructions must fully support floating-point math. Additional

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floating point instructions supported must include Log 10, Natural Log, and Exponential. It shall be possible to complete complex, combined calculations in a single instruction, such as flow totalizing or equations of the format $((A+((B-C)*D))|E)$.

File function instructions supported shall also include Sort, Average and Standard Deviation. Value arrays shall be limited in size only by the amount of available memory. Arrays shall be configurable with one, two or three dimensions. The CPU shall support indexed addressing of array elements. Array element manipulation instructions such as "array copy" (COP), "array copy with data integrity" (CSP) and "array fill" (FLL), "array to array" (MOV), "element to array" (FAL), "array to element" (FAL), and "first in-first out" (FIFO) shall be supported by the system. The four function and math instructions and instructions for performing "logical OR", "logical AND", "exclusive OR", and comparison instructions such as "less than", "greater than", and "equal to" shall be included within the system. All instructions shall execute on either single words or array elements.

For any module specifically associated with the Programmable Automation Controller, it shall be possible to configure operation and query the current status of all channels through controller scoped tags without any programming.

The system shall contain instructions, which will construct word shift registers (SQI, SQO, and SQL). Additional instructions shall be provided to construct synchronous bit shift registers (BSR and BSL).

The Programmable Logic Controller System shall have a jump instruction which will allow the programmer to jump over portions of the user program to a portion marked by a matching label instruction.

The Programmable Logic Controller System shall have the ability to provide a master system clock and the 1588 PTP v2 CIP Sync object to allow time synchronization and transport and routing of a system clock to the control system and motion axes in a local chassis or on an Ethernet/IP network.

It shall be a function of the CPU to automatically manage all data types. For example, if a word stored in an Integer tag is transferred into a Floating Point tag, the CPU shall convert the integer value into floating point prior to executing the transfer.

In applications requiring repeatable logic it shall be possible to place such logic in a subroutine section. Instructions which call the subroutine and return to the main program shall be included within the system. It shall be possible to program several subroutines and define each subroutine by a unique program file designator. The controller will support nesting of subroutines up to available stack at the moment of the call. It shall be possible to pass selected values (parameters) to a subroutine before its execution. The number of these parameters is limited only by available memory. This allows the subroutine to perform mathematical or logical operations on the data and return the results to the main program upon completion. These subroutines will be accessed by jump-to-subroutine instructions.

The system shall have the capability to enter rung comments above ladder diagram rungs. These comments may be entered at the same time the ladder logic is entered. The program shall be fully commented.

The capability shall exist for adding, removing, or modifying logic during program execution in routines of LD, FBD, SFC, and ST languages. When changes to logic are made or new logic is added it shall be possible to test the edits of such logic before removal of the prior logic occurs. It shall be possible to manually set (force) either on or off all hardwired discrete input or output points from the programming panel. It shall also be possible to manually set (force) an analog input or output to a user specified value. Removal of these forced I/O points shall be achieved either individually or totally through selected keystrokes. The programming terminal shall be able to display forced I/O points.

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A means to program a fault recovery routine shall exist. When a major system fault (Controller Fault) occurs in the system, the controller fault recovery routine shall be executed and then the system shall determine if the fault has been eliminated. If the fault is eliminated, program execution resumes. If the fault still exists, the system will shut down. The capability shall exist for each program to have its own fault routine for program fault recovery. Each having the same features as the controller based fault routine. An instruction shall be available to give the control program diagnostic information, state control, and sequencing of a process simultaneously, while allowing the capability of user-friendly state programming techniques.

An instruction shall be supported to incorporate closed loop control systems. The "proportional", "integral", and "derivative" elements shall be accessible to the user in order to tune a closed loop system. This instruction must fully support floating-point math.

The system shall support both bit and word level diagnostic instructions.

To facilitate conditional event detection programming, output instructions shall include "one shot" instructions, which may be triggered on either low-to-high (rising) or high-to-low (falling) rung conditions. To facilitate debugging, an "always false" instruction shall exist which may be utilized to temporarily inhibit the execution of control logic.

The controller shall support Master Control Reset (Relay) type functionality to selectively disable sections of logic.

The controller shall include direct support of FOR-NEXT loop constructions.

Controller files will have the ability to be exported and edited in L5k, (text) format or XML format.

Uninterruptible Power Supply (UPS):

The UPS shall be a DIN rail mounted unit that will maintain power to the PLC system for ten minutes in the event of a short power outage. It shall be rated for 120 VAC, 60 hz. It shall be sized by the control system vendor and calculations shall be submitted for approval. It shall have a simulated sinewave output. It shall have short circuit and overcurrent protection. It shall be provided with a sealed, non-spillable, maintenance free lead acid battery. It shall have an operating temperature range of 0 °C to 50 °C. It shall be provided with a communications port for Industrial Ethernet protocol to allow for communication with the PLC and a USB communication port. The UPS unit shall provide automatic bypass and an audible alarm upon UPS failure.

It shall have the following certifications and compliances:

- Low Voltage Directive: EN62040-1
- EMC Directive: EN62040-2
- Class 1 Division 2 - ANSI ISA 12.12.01/CSA 213
- RoHS Compliant
- UL 60950, E137632, CUL/CSA-C22.2, No. 234-M90.
- UL Recognized Component, UPS Equipment

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- UL 1778 5th Ed., CSA C22.2 No. 107.3
- Suitable for UL 508 at full load output (no derating) and Industrial Control Equipment Applications CSA C22.2 No. 107.1
- Overvoltage Cat III, Pollution Degree III

The UPS unit shall be approved equal to a Sola/Emerson SDU AC-A series.

Noise Filter

The Contractor shall furnish and install one active tracking noise filter on the input of each PLC rack. The noise filter shall be a series connected high frequency noise filter with transient protection. It shall offer hard wired connection to all critical loads and rated for an industrial environment and equipment. It shall reduce mode transient to +/- 2 volts, have a surge capacity of 45,000 amps, provide transient protection in all modes (line to neutral, line to ground, and neutral to ground), have an LED power indication, and be UL approved. The 120VAC MCOV shall be rated 150 VRMS. The line frequency response time shall be less than 0.5 nano-seconds. The operating temperature shall be -40°F to 115°F at full load. The unit shall be capable of protecting against a peak surge current of 15,000amps in all modes. The noise filter shall be the Islatrol® IC+/LRIC+ Series manufactured by Emerson Electric or engineer approved equal.

Laptop Computer

A laptop computer shall be provided to allow the PLC and vector drive programs to be modified as required in the future. The laptop computer shall be a Dell Latitude 7490 or engineer approved equal. It shall have the following features at a minimum:

- 8th Gen Intel® Core™ i5-8250U Processor (Quad Core, 6MB Cache, 1.6GHz,15W)
- Windows 10 Pro 64bit English
- Intel® UHD Graphics 620 with Displayport over USB Type-C with Core I5-8250U
- 8GB, 1x8GB, DDR4 2400MHz Memory
- M.2 256GB SATA Class 20 Solid State Drive
- 14.0" FHD 1920 x 1080 Anti-Glare,Non Touch HD CAM/Mic, WWAN/WLAN, Mag Alloy back
- Internal English Keyboard, Backlit
- Intel® Dual-Band Wireless-AC 8265 Wi-Fi + BT 4.2 Wireless Card (2x2)
- (4-cell) 60 Whr Express Charge Capable
- 3 Years Hardware Warranty with Onsite/In-Home Service after Remote Diagnosis
- 65W AC Adapter, 3-pin
- Nylon Carrying Case

The unit shall be an intelligent terminal, functioning both as a programming and a data terminal. It shall permit PLC programming, including loading, editing, and monitoring ladder diagram programs in memory by entering through the keyboard and monitoring on the display. Program instructions shall be in the form of standard symbols similar to those used for electromagnetic control equipment.

The laptop shall have the latest editions of Microsoft Word and Excel preinstalled, along with software packages required for programming, viewing, and interfacing and any other software tools

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required for the PLC, HMI and vector drives. The Contractor shall include all CD-ROM's, manuals and other materials. The Contractor shall provide all licenses and original CD-ROM or Disk copies with the computer for all software installed.

Managed Ethernet/Fiber Optic Switch

1. All ethernet switches will be of the managed type. Ethernet switches will be industrial rated and have at a minimum of 8 - 10/100 Base ethernet ports and 4 - 100 Base fiber multimode ports with ST connectors. Ethernet switch will be capable of operating in -40 Deg C to 70 Deg C. It will have ESD and surge protection on all built in ports. It will be auto sensing 10/100 Base TX, duplex, and MDIX. It will have a power input range of 10-49VDC. It will be able to store 8000 MAC addresses. It will have the following fully managed features:

- a. SNMP v1, v2, v3 and web browser management
- b. EtherNet/IP CIP messaging
- c. Web configuration
- d. 802.1Q tag VLAN and Port VLAN
- e. 802.1p QoS and Port QoS
- f. Port Trunking
- g. Port Mirroring
- h. Local Port IP Addressing
- i. 802.1AB-2005 LLDP (Link Layer Discovery Protocol)
- j. Port Security – MAC Address Based Filtering

Human Machine Interfaces (HMI)

1. HMI will be capable of operating within the operating range of 0-55 Deg C. HMI enclosure will be rated NEMA 4X and provided with a protective cover. HMI will have a color TFT LCD touch sensitive display. The diagonal display size will be 15" and utilize a 4:3 aspect ratio. Touchscreen will be analog resistive. The HMI will have a minimum of 512MB RAM, 512MB Storage, and 80 MB nonvolatile storage. Each HMI will be equipped with dual 10/100 Base-T ethernet ports. HMI will also feature 2 USB ports and one SD card slot. HMI will be equipped with all necessary operating system/software such as the latest required windows operating system and FactoryTalk View Studio.
2. The HMIs will be utilized for monitoring purposes, maintenance operations, and bypass control options. The HMIs are connected to the PLC control system. By means of the HMI the user can operate items described within and visualize the state and values of the system in its entirety.
3. A battery-less design is preferred. In case that an internal battery is needed a minimum of 10 years no-maintenance requirement is a must.
4. The HMI will have the following integrated communication ports and other connections at minimum:

Ethernet RJ45, interface: IEEE 802.3

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Ethernet RJ45, interface: 10BASE-T/100BASE-TX

USB 2.0 port mini B USB

USB 2.0 port USB type A

5. The HMI must be UL marked and Comply with Underwriters Laboratories Inc., UL508, Industrial Control Equipment

6. The HMI software will have the following requirements at minimum:

Display of animated synoptic screens with different types of animation (e.g. pressing touch-sensitive zone, changing of color, filling, movement, rotation, size, visibility and value display).

Possibility of control and modification of numeric and alphanumeric variables.

Display of date and time.

Real-time and trending curves with log.

Multi-window with emerging menus management.

Pages can be called up by the user.

Application and log support in CF, SD format external application memory card or USB.

Management of sound messages and integration with images.

Availability of screens design and configuration software in a Windows environment.

Extension capabilities and migration utilities between terminals improvements

Built-in applications for alarms, event and messages management with dynamic capabilities and with no limitation in the number of alarms.

Built-in applications for login and control access

Resource files concept and facilities for Multilanguage migrations

Capability to customize the built-in applications in aspect and functionality

Dynamic screen capabilities: dynamic texts, graphs etc

HMI variables accessible to/from the Display and to/from the HMI controller

Remote Monitoring & Control using Webgate.

Program uploading & Downloading Using USB

All included, no extra cost for each function above

7. The HMI Alarms will be capable of the following:

Display alarms in Alarm Summaries or Alarm Banners

Display both diagnostic and variable alarms

Monitor bit and word addresses

Group alarms in Alarm Categories

Trigger alarms by Limit, Deviation by Percent, or Deviation by Fixed

View three types of Alarm Summary displays: Active, History, and Log

Acknowledge individually or as a group

Runtime language swapping for alarm messages

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Print and save alarm logs

8. The HMI Data logging will be capable of the following:

Analyze, audit, and track performance

Display logged data in a Trend Graph:

Historical Trend Graph

Real-Time Trend Graph

Plot Trend Graph

Toolchest Trend Graph item

Collect data at regular intervals or when a trigger is activated

Store data in DRAM, SRAM, USB storage, CF card, or network storage

Convert data logging files into .CSV files

Display logged data from multiple terminals

Open Non-Proprietary Design

The system program/logic shall be established, designed, coded, programmed, for the full benefit of the Westchester County DPW. The program and functionality of the system shall be owned by the Westchester County DPW and have the ability to be maintained by more than one qualified maintenance vendor.

Ways that the upgraded control system shall be open and non-proprietary include:

- All application programs shall be un-protected (not password protected or locked) so that any maintenance vendor may view the programs for troubleshooting and maintenance. However, if a password is required, through the standard programming procedure, the password shall be made readily available to the Westchester County DPW.
- Westchester County DPW shall own the application programs for its own use. Proprietary application software shall not be used or if it is used rights to maintain and modify the software as well as source code shall be given to Westchester County DPW and their representatives. This only includes application software and not off the shelf software such as HMI development or PLC development software.

Monitored Operations

All span operations shall be datalogged, recording both operating parameters and faults/errors. The sequence of operations describes what faults shall be listed. The following parameters at minimum shall be logged:

- Drive motor Kilowatts
- Drive motor RPM
- Span position
- Errors
- Faults
- Any other functions as determined by the engineer

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The kilowatt and position data shall be recorded at 10 samples per second, and all faults and errors shall have a time/date stamp at a minimum 1-second resolution. Additional parameters may be added during the shop test and bridge startup – these shall be included as part of this item.

Rotary Cam Limit Switch

Furnish and install a rotary cam limit switch for span position on the machinery platforms where indicated on the Plans. Each limit switch shall be a rotary, cam-operated limit switch in a NEMA 4X enclosure and shall be coupled to the operating machinery as shown on the drawings, which shall rotate the input shaft.

The switch contacts shall have a minimum AC inductive continuous current carrying rating of 15 A and a minimum DC resistive continuous current carrying rating of 15 A. They shall be UL and CSA listed.

The limit switches shall have circuits individually micro-adjustable and provisions for internal vernier adjustments. The number of contacts shall be as shown on the plans. The limit switch shall come with a 7:1 gear ratio. The limit switch shall allow for a + or - 1/4 degree contact operation repeatability. Each contact of the limit switch shall be SPDT precision-type, snap-action switches.

Provide Gemco 1980 series with contacts and gearboxes as shown on the plans, adjustable input couplings, NEMA 4X stainless steel enclosure or approved equal, and they shall be driven as shown on the plans furnished with the operating machinery.

The span position limit switch shall be provided with an internal absolute position encoder that shall provide absolute feedback for position control and high resolution incremental feedback for speed control. They shall be dual port Ethernet encoders including an embedded Ethernet/IP switch to connect additional E/IP capable product in series and/or support a Device Level Ring (DLR) for Ethernet media redundancy. They shall be designed for high performance and reliability in harsh industrial environments providing high resolution absolute positioning. They shall be provided with single-turn 16 bit resolution.

They shall feature:

- EtherNet/IP Interface
- Embedded switch
- Hardware/software IP address setting
- Single turn resolution up to 16 bits
- Protection class up to IP67
- Device Level Ring (DLR)
- Revolution divisor
- Solid shaft as per the mechanical drawings
- M12 Connectors
- Status indication LEDs
- RSLogix 5000 Add-On-Profile

The following parameters shall be Configurable:

- Counting direction
- Counts per revolution
- Preset value
- Velocity unit

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- IP address
- Counts of revolution

The encoders shall be AMCI RM25, Allen Bradley model 842E, Sick model AFM60 or Engineer approved equal.

Proximity Switches

Lever-less mechanical limit switches shall be provided for span and end machinery indication and interlocking. They shall be enclosed in a stainless steel housing rated NEMA 4X and 6P. They shall be provided with single pole, double throw contacts and sensing contacts rated for 10 amperes. The contacts shall be silver cadmium oxide, gold flashed, and shall have a temperature rating of -40 to 221 degrees F. They shall have a repeatability of 0.002", and a response time of 8ms. They shall be provided with six foot epoxy potted cordsets. They shall have a nominal sensing distance of 1/4", and shall be provided with a magnetic sensor that will provide for a 3/4" sensing distance. The lever-less limit switches shall be Model 81 GO switch with model AMP3 magnetic target as manufactured by Emerson GO or engineer approved equal by Allen-Bradley or Eaton.

Encoder Buffers

The encoder buffer shall accept 4-26 VDC signals and provide two independent and completely isolated line driver outputs of 5-26 VDC based on user defined voltage levels. It shall be provided with optically isolated inputs that accept quadrature or single channel inputs, with or without their complements, from differential line drivers, open collector, or from proximity probes. The encoder buffer shall also have the ability to repeat and amplify signals. Each output of the encoder buffer shall be user definable from 5 to 26 VDC. In addition to having short circuit protection, outputs shall be ESD protected according to MIL-STD-883. Each connector of the encoder buffer shall be equipped with two positions for +VCC and common, as well as two extra field accessible tie points. The encoder buffer shall be capable of driving the output signal up to 26 VDC, and will function with either output disconnected.

STANDARD OPERATING CHARACTERISTICS:

- Input Signal: 2 or 3 channel quadrature signal, sine or square wave, open collector, differential, or single ended line driver.
- Input Signal Current: 2.2 mA minimum, 3.5 mA typical
- Input Impedance: Optically isolated, 1 kOhm at 4V, 6.8 kOhms at 24V typical. Current limited.
- Frequency Range: 0 - 120 kHz
- Output Signal: Two independent, isolated line driver output sets (A/A, B/B)
- Supply Voltage: 5 - 26 VDC
- Output Current: 150 mA (maximum per channel)
- Wire Gauge Accepted: 26 -16 AWG
- Environmental range: 0°C to 50°C at 98% RH non-condensing

The encoder buffers shall be model RIM SS2 as manufactured by Dynapar or engineer approved equal.

Deceleration Check Speed Switches

The electronic speed switches shall be rotation monitoring systems with two adjustable set points designed to detect unwanted over speed, under speed or stoppage in motors. In the event of rotational failure, the relays can be used for equipment shutdown and to provide an alarm. The sensor receives a pulse output from a motor encoder buffer and measures this frequency signal to determine shaft speed, and compares this to the pre-adjusted set point. The relay output can then be used for equipment

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shutdown or to provide an alarm, assuring machine protection and process integrity. The sensor shall be fail-safe; any malfunction during operation will de-energize the control circuit.

The sensor shall be an LRB 2000 specifically ordered with no start delay loss of feedback as manufactured by Electro-Sensors or Engineer approved equal.

- Input Power 115 Vac, 60 Hz
- Sensor Input Signal Type NPN Open Collector, Amplitude 5 Vdc, Pull-Up 4.7 KOhms, max Frequency Range 0-666.67 Hz

Set Point Data

- Under or Over Speed Set Point Relays Two form C, SPDT isolated 5A 115V ac resistive
- Set Point Adjustment Rotary Switches: (1) tens and (1) ones digit

General Specifications

- Housing and Cover NEMA1, Approved to UL 508 and CSAC 22.2 #14-95 Standards
- Stand-Alone Mounting

Control Apparatus and Miscellaneous Equipment

Control apparatus shall conform to the applicable requirements of NEMA Publication No. ICS, latest revision, Industrial Control and Systems, rated as shown on the Plans or as required and to the following:

Multi-Functional Power Monitor: The Multi-Functional Power Monitor shall be rugged metal housing with standard switchboard dimensions and cutout per ANSI 39.1. It shall be 300 volts phase to neutral, 600 volts phase to phase, for 277/480 connection. Three (3) current inputs, 5A nominal current input, Continuous overload 10A maximum. Frequency range from 45-75 Hz and a operating temperature of -20C to +70C. All meter setup parameters and Max/Min data should be contained in Non-Volatile RAM. The monitor should measure true RMS and have 64 samples per cycle with 1-second-update time. It shall be provided with an ethernet port to send all parameters to the PLC. The Multi-Functional Power Monitor shall be Shark 200 as manufactured by Electro Industries/GaugeTech or equal as approved by the Engineer.

Circuit Breakers: All branch circuits from the power buses shall be protected by molded-case circuit breakers mounted on the control panels. All breakers shall have quick-make and quick-break contacts, and the mechanism shall be trip-free and trip indicating. All circuit breakers and motor circuit protectors shall be provided with at least two form C auxiliary contacts for PLC input and status indication. Frame sizes shall not be less than 100 amperes. The breakers shall be equipped with thermal-magnetic trips or adjustable, instantaneous, magnetic trip units, with trip rating as shown on the Plans or as required. Molded-case circuit breakers shall meet the requirements of the latest revision of NEMA Publication No. AB1. The service entrance circuit breakers are to be 600 volt rated, frame size as indicated on the plans and shall be provided with electronic trip unit with independently adjustable short time pick-up and time delay, set to trip as per the plans. Interrupting capacity shall be no less than 100,000 AIC. Circuit breakers shall be Westinghouse Series C, Type LD with LS trip unit, Type TA or Engineer approved equal manufactured by General Electric or Square D Company.

Motor Starters and Magnetic Contactors: The continuous current rating of contactors and starters shall be adequate for the connected loads, and no starters shall be smaller than NEMA Size 1 unless otherwise noted. All starters shall be full voltage types, 600 VAC, 60 Hertz, rated with 120 VAC operating coils. All contact

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poles shall be provided with arc chutes, and contactors rated 150 amperes and above shall be equipped with magnetic blowouts. Reversing contactors shall be electrically and magnetically interlocked.

Starters for the brakes shall be IEC devices rated 12 amperes minimum and provided with manual motor starters to provide for isolation and overcurrent protection sized for the motor FLA and auxiliary contacts for PLC interfacing and indication. They shall be Allen Bradley Bulletin 103S or equal by Square D or ABB.

Service Disconnect Switches: Unfused safety switches, for use as disconnects, shall be installed where shown on the plans. The switches shall be nonfusible, heavy-duty, 600 VAC safety switches in watertight and dust-tight NEMA 4X, stainless-steel enclosures. Each disconnect shall be furnished with two N.O. auxiliary contacts and phenolic nameplate to identify the switch. The rating shall be as required and/or shown on the plans.

Motor Disconnect Switches: Unfused safety switches for use as disconnects, where required, shall be installed within the range of view of its respective motor, brake, or span lock. The switches for the main motors and span lock motors shall be tag out lockable, non-fusible, heavy-duty, safety switches, rated as shown on the Plans, in waterproof, NEMA 4X, stainless steel enclosures. The span drive motor disconnect switches shall be provided with auxiliary contacts for disconnecting the motor disc brakes. Each disconnect shall be furnished with a N.O./N.C. auxiliary contact and phenolic nameplate to identify corresponding motor.

Brake motor disconnect switches: The disconnects shall be three pole manual motor starting switches rated 30 amperes. They shall be provided with a weatherproof housing and shall be engineer approved equal to the Square D class 2520 type KW2.

Control Relays: Auxiliary control relays shall be multi contact magnetic relays with contacts rated at 10 amperes, 600 volts, on a continuous basis. Relays known to meet the specified requirements are the Square D class 8501 type X or approved equal.

Phase Failure and Reversal Relay: This relay shall prevent energizing operating the span in the event of reversed phase sequence, loss of one phase, or low voltage. The phase failure and reversal relay shall be the Square D Class 8430 Type MPD or approved equal.

Selector Switches and Pushbuttons: Pushbuttons and control switches shall be heavy-duty, oil-tight, contact blocks operated by glove handle selector knobs, key switches and push-button operators as indicated on the Plans. Contacts shall be fine silver, capable of interrupting 6 amperes at 120 volts AC, and of continuously carrying 10 amperes. Switches and pushbuttons shall be Square D class 9001, type K, NEMA 4 or approved equal.

Indicating Lights: Indicating shall be heavy-duty, oil-tight pilot lights with one or two fields as required as per the plans. They shall be provided with LED lamps the color of the lamp lens and shall be rated at 120 VAC. Where group testing cannot be accomplished through the PLC the lights shall be provided with a push to test feature. All lenses shall be glass, with color and marking as shown on the Plans.

Terminal Blocks: Terminal blocks for conductors of Size No. 8 AWG and smaller shall be feed through terminal blocks with stud and nut type connection DIN rail mounted modular terminal blocks. Barriers shall be not less than 13mm high and 3mm thick and shall be spaced 16mm center-to-center. Straps, studs and nuts shall be of a material for use in highly corrosive atmospheres and shall be rated for 57 amperes for a terminated conductor. The blocks shall provide a withstand voltage rating of 800 volts per

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IEEE switchgear standards. The terminal blocks shall provide studs and nuts suitable for use with locking fork wire connectors. Corrosion resistant marking strips shall be provided for conductor identification. At least ten- percent spare terminals shall be provided. Terminal blocks shall be Phoenix Contact type RBO 5 or approved equal.

Terminal Connectors: Terminal connectors shall be seamless, heavy duty compression locking fork terminals manufactured from pure electrolytic copper tubing. Terminals shall be tin plated and provided with a double-thick tongue and insulation grip. Terminals and compression tools must be approved by the Engineer.

Wire Ferrules Connectors: For conductors not suitable for locking fork terminals, they shall be provided with seamless, heavy-duty insulated wire ferrules terminal lugs. Terminal lugs shall be installed per lug manufacturer recommendations using the proper tools approved by the manufacturer.

Power Distribution Blocks: Power distribution blocks for all conductors larger than No. 8 AWG, shall be fingersafe, fabricated from copper and approved equal to Ferraz Shawmut FSPDB series, sized as required. Finger-safe fully insulated block shall ensure that no one can touch live parts. They shall be provided with recessed termination screws and wire openings providing IP20 grade protection and qualify as "finger-safe" per IEC 529, integral DIN rail adaptors allowing for quick and easy installations on 35mm DIN rail, and captive termination screws. Provide end anchors for rigid end stops.

Nameplates: Nameplates shall be provided for all aforementioned devices and shall be made of laminated phenolic plastic with white front and back and black core and shall be not less than 2.3mm thick. The lettering shall be etched through the front layer to show black engraved letters on a white background. Lettering shall be not less than 6mm high, unless otherwise detailed on the Plans. Nameplates shall be securely fastened to the equipment with stainless steel screws.

Bridge Control Cabinets

Control panels enclosed in freestanding cabinets shall be furnished and installed in the operator house and machinery spaces where shown on the Plans. All circuit breakers, PLC racks, switches, contactors, relays, regulating equipment, and other apparatus for control of the span and its auxiliaries shall be mounted on these enclosed panels. The arrangement and line-up of the individual control cabinets shall be as shown on the Plans.

All equipment in each control cabinet shall be mounted on sheet-steel bases, and each device shall be front-connected, front-wired, and removable from the front. The equipment in all cabinets shall be arranged for ease of access and for safety and convenience of operation. Special care shall be taken to obtain a systematic and neat arrangement of the equipment. Each device shall be suitably named and plainly marked by a laminated nameplate mounted near the device on the panel. Each nameplate shall show an approved descriptive title for the apparatus, together with the device designation appearing on the schematic wiring diagrams.

Each indoor control cabinet shall be a NEMA 4X enclosure constructed of No. 12 gauge sheet-steel and shall be reinforced with steel angles or channels to provide a rigid, freestanding structure. Exterior control cabinets shall be NEMA 4X stainless steel. The control cabinets shall be provided with hinged doors on the front of each panel section. Door panels shall be gasketed and shall be provided with three-point, vault-type latches. Drive and control panels shall be provided with fan and filter ventilation. Provide NEMA 4X stainless steel drain fittings. All hardware shall be corrosion resistant.

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Thermostatically controlled strip heaters shall be provided in each cabinet to prevent build-up of excess moisture. Each panel shall be provided with suitable interior light fixtures and a duplex receptacle.

Each control panel enclosure shall be as shown on the plans. If the final cabinet dimensions, as established by the manufacturer, should necessitate rearrangement or modification of the equipment in order to fit in the available space, such rearrangement or modifications shall be made and at no extra cost. The final arrangement of all equipment in the operator house shall be subject to the approval of the Engineer.

The indoor control panel enclosures and all metal reinforcing shall be painted inside with two coats and outside with three coats, consisting of one coat of primer followed by one coat of gray enamel on the inside surfaces and two coats of gray enamel outside. The finish coat shall be ANSI 61 light gray enamel.

All contactors, relays, and other devices shall be of required current carrying and interrupting capacity. All apparatus shall be of substantial construction and shall conform to the requirements of NEMA Standards Publications ICS 1 and 2, 2000, for industrial control devices.

All wire shall be flame-retardant, ethylene-propylene insulated, switchboard wire, Type SIS. Conductors shall be stranded copper not smaller than No. 14 American Wire Gauge.

For each assembled control panel, all outgoing wire, No. 8 AWG or smaller, shall be connected to terminal blocks installed at the sides of the cabinet. The control panels shall also provide sufficient extra terminals to allow connection of all wires coming from limit switches and other devices that go on to the bridge control console and other locations as required, even though these wires do not connect to apparatus on the control panels. Spare terminals totaling at least 10 percent of those actually used shall be provided. Each terminal shall be identified per wire number shown on the Contractor's schematic wiring diagrams.

All panel wiring shall be arranged systematically so that circuits can be readily traced. The wiring shall be installed in a network of troughs consisting of horizontal and vertical sections securely bolted to the panels. The troughs shall be fabricated from heavy duty Noryl plastic shaped into a channel cross-section. After installation of the wiring, an insulated, flanged cover shall be snapped over the open side of each trough section.

Motor Control Center (MCC)

The Motor Control Centers (MCC's) shall include, but not be limited to, all parts, materials and associated appurtenances described below, such as MCC enclosures, covers, wireways, mounting hardware, motor control and protection devices.

The MCC's shall be constructed to meet or exceed the requirements within NEMA ICS-2 and UL845 for motor control centers. The MCC's shall be designed, manufactured, and tested in facilities registered to ISO 9001 quality standards. The MCC enclosures shall be NEMA/EEMAC Type 12 rated.

The Motor Control Center(s) shall be 600 Volt class suitable for operation on a three-phase, 60 Hz system. The system operating voltage and number of wires shall be as indicated on the Plans.

Each MCC shall consist of one or more vertical sections of heavy gauge steel bolted together to form a rigid, free-standing assembly, and mounted on top of a 2inch concrete sill or pad, as shown on the Plans. The entire assembly shall be constructed and packaged to withstand all stresses included in transit and during installation. MCC shall be delivered in individually wrapped factory fabricated fiberboard type containers, with lifting angles mounted on each supporting structure. MCC shall be handled with care to prevent internal component damage, and denting or scoring of enclosure finish. The Contractor shall not install damaged MCC.

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Structures shall be totally enclosed dead-front, free-standing assemblies. They shall be no more than 90inch high and 20inch deep. Structures shall contain a horizontal wireway at the top, isolated from the horizontal bus and shall be readily accessible through a hinged cover. Adequate space for conduit and wiring to enter the top or bottom shall be provided without structural interference.

Structures shall be capable of being bolted together to form a single assembly. The total width of one section shall be 20inch. Widths of 25inch, 30inch, and 35inch can be used for larger devices. Where required, 40inch wide section shall be provided for the Power Panel (MCC-PP), as shown on the Plans.

Each section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused space shall be covered by hinged blank doors and equipped to accept future units. Vertical bus openings shall be covered by manual bus shutters.

A vertical wireway with minimum of 35 inches square of cross-sectional area shall be adjacent to each vertical unit and shall be covered by a hinged door. Wireways shall contain steel rod cable supports.

All full voltage starter units shall be of the drawout type. Drawout provisions shall include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Drawout units shall have a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend into the bus compartment. Interior of all units shall be painted white for increased visibility. Units shall be equipped with side-mounted, positive latch pull-apart type control terminal blocks rated 600 volts. Knockouts shall be provided for the addition of future terminal blocks. All control wire to be 14 AWG SIS type.

All drawout units shall be secured by a fastening device located at the front of the unit. Each unit compartment shall be provided with an individual front door.

An operating mechanism shall be mounted on the primary disconnect of each starter unit. It shall be mechanically interlocked with the unit door to prevent access unless the disconnect is in the OFF position. A defeater shall be provided to bypass this interlock. With the door open, an interlock shall be provided to prevent inadvertent closing of the disconnect. A second interlock shall be provided to prevent removal or reinsertion of the unit while in the ON position. Padlocking facilities shall be provided to positively lock the disconnect in the OFF position with from one (1) to three (3) padlocks with the door open or closed. In addition, means shall be provided to padlock the unit in a partially withdrawn position with the stabs free of the vertical bus.

Each structure, except the MCC-PP section where required, shall contain a main horizontal copper tin-plated bus, with minimum ampacity of 600 amperes as shown on the drawings. The horizontal bus shall be rated at 150 degrees F temperature rise over a 104 degree F ambient in compliance with UL standards. Vertical bus feeding unit compartments shall be copper and shall be securely bolted to the horizontal main bus. All joints shall be front-accessible for ease of maintenance. The vertical bus section containing the Main Breaker (CB-MCC) shall be fully rated 600 amperes. Other bus vertical sections shall be rated 300 amperes. The MCC-PP section where required, shall have independent bus/wire work fed from the designated breaker (CB-PP), as shown on the Plans.

The vertical bus shall be completely isolated and insulated. It shall effectively isolate the vertical buses to prevent any fault-generated gases to pass from one phase to another. The vertical bus shall include a shutter mechanism to provide complete isolation of the vertical bus when a unit is removed.

Buses shall be braced for minimum 42,000 amperes rms symmetrical.

A copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the MCC.

Each structure shall contain tin plated vertical ground bus rated 300 amperes. The vertical ground bus shall be directly connected to the horizontal ground bus via a tin-plated copper connector. Units shall connect to the vertical bus via a tin-plated copper stab.

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All combination starters shall utilize a unit disconnect. Magnetic starters shall be equipped with double-break silver alloy contacts. Each starter shall have minimum one (1) NO auxiliary contact or as indicated on the plans. All coils to be color-coded through size 5 and permanently marked with voltage, frequency and part number.

The disconnect shall include an electrical interlock for disconnection of externally powered control circuits. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.

Minimum starter and contactor size shall be NEMA Size 0.

Motor starters and contactors shall be Cutler-Hammer Freedom Series, Square D type S series, or Engineer approved equal.

Motor starters and contactors shall be designed to accommodate two (2) auxiliary contact blocks, each capable of a combination of up to four (4) normally closed or four (4) normally open auxiliary contacts. Contacts to be color-coded; black designating NC and silver designating NO. Contacts to be rated ten (10) amperes continuous, 7200 VA make, 720 VA break for 120 through 600V AC, and 69 VA make and break for 125 through 300V DC. Provide a minimum of one (1) spare NO contact and one (1) spare NC contact in addition to any auxiliary contacts required.

Provide a mechanical interlock on reversing or multispeed contactors of the lever-type mechanism (with electrical contacts included) to prevent closing of one contactor when the other is closed.

Each unit door shall have an engraved acrylic nameplate, white with black lettering. A master nameplate shall be provided on each MCC lineup.

Wiring diagrams shall be provided at a centralized location in the MCC. Each modular unit shall also be supplied with wiring diagrams and product data. The diagram shall show the exact devices inside the unit and shall not be a generic diagram.

The entire MCC shall go through a quality inspection before shipment. This inspection will include:

- Physical Inspection of: structure, electrical conductors, including bussing, general wiring, and units.
- General electrical tests including power circuit phasing, control circuit wiring, instrument transformers, ground fault system, device electrical operation.
- AC dielectric tests of power circuits and control circuits.
- Markings/Labels verification, including instructional type, Underwriters Laboratory (UL), and inspector's stamps.
- The manufacturer shall use integral quality control checks throughout the manufacturing process to ensure that the MCC meets operating specifications.
- MCC shall be Cutler-Hammer Freedom & Advantage series, Square D Model 6 series, Allen-Bradley or Engineer approved equal.

Receptacles

All receptacles will be 20-ampere, 125-volt, three-wire, ground-fault-interrupting type, polarized, duplex, convenience outlets. Each receptacle will be a heat-resistant melamine body, flush or surface mounted in an outlet box, and will be provided with a waterproof cover plate. Provide in-use covers where applicable as provided by the NEC. Receptacles will be specification grade and manufactured by Hubbell, Arrow Hart or Leviton, or approved equal.

Raceways

Except for multi conductor, jacketed cables, all wiring shall be installed in conduit or stainless steel wireway as shown in the Plans.

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All conduits shall be standard weight, threaded, rigid steel conduit conforming to the requirements of ANSI Standard C80.1. All conduits shall be hot-dip galvanized, inside and out, to meet the requirements of the above standard for protective coating. Conduit couplings and fittings shall be made of malleable iron or steel, hot-dip galvanized.

All conduits installed not in earth or encased in concrete shall be plastic coated as hereinafter specified. Conduit fittings, including couplings, unions, elbows, expansion and deflection fittings, and other items, shall also be plastic coated. Conduits and fittings, which are to be plastic coated, shall be provided with a factory-applied polyvinyl chloride (PVC) coating in the following manner. The exterior of the galvanized rigid steel conduit or fitting shall be coated with an epoxy acrylic, heat-polymerizing adhesive not to exceed 0.1mm. A PVC plastic coating, 0.8mm to 1mm thick shall be bonded to the outside metal surface the full length of the pipe, except for the threads. The plastic coating shall have an 85+Shore A Durometer rating and conform to NEMA RNI-1998 (Type A), ASTM D746, and Federal Specifications LP406b, Method 2051, Amendment 1 or 25 September, 1952. A two-part red urethane, chemically cured coat shall be applied to the interior of all conduit and fittings. This internal coating shall be at the nominal 2-mil thickness and shall be sufficiently flexible to permit field bending without cracking or flaking. The Plasti-bond, PVC coated, hot-dip galvanized steel conduit shall be UL labeled and listed.

All hollow conduit and fittings, which serve as part of the raceway, shall be coated with the same exterior PVC coating and red interior urethane coating. The plastic exterior coating and the red interior urethane coating shall be factory applied by the same manufacturer who produces the hot-dip galvanized conduit. PVC coated conduit shall be installed in accordance with the manufacturer's installation manual.

Unions to connect sections of conduit that cannot be joined to each other or to boxes in the regular manner shall be of malleable iron or steel, hot-dip galvanized, PVC coated.

Conduits shall not be less than ¾ inch in diameter. The interior surfaces shall have a smooth finish and be free of burrs or projections, which might cause injury to the cables. All conduits shall be free from blisters, cracks, or injurious defects and shall be reamed at each end after being threaded. Sections shall be connected to each other with screw couplings made up so that the ends of both conduits will butt squarely against each other inside of the coupling. Conduits shall be installed to be continuous and watertight between boxes and equipment. Conduits shall be protected at all times from the entrance of water or other foreign matter by being well-plugged overnight or when the work is temporarily suspended.

Conduit bends and offsets shall be made by cold bending using approved methods and equipment. The use of a pipe tee or vise for bending conduit will not be permitted. Conduit, which has been crushed or in any way deformed, shall be discarded. All bends shall be long sweep, free from kinks, and of such easy curvatures as to permit the drawing of conductors without injury. Conduit runs shall be made with as few couplings as standard lengths will permit, and the total angle of all bends between any two boxes or cabinets shall not exceed 90 degrees, unless otherwise approved by the Engineer. The radius of curvature of pipe bends shall not be less than eight times the inside diameter of said conduit. Long running threads will not be permitted. Pull boxes shall be used whenever necessary to facilitate the installation of the wire.

Except for installation where specifically permitted by the Engineer, condulets or conduit bodies shall not be used for pulling conductors or for making turns in conduit runs or for branching conductors. Condulets or conduit bodies, where permitted, shall consist of malleable iron castings with gasketed covers of the same material and fastened with brass cover screws. The bodies shall be hot-dip galvanized, and PVC coated when used with PVC coated conduit.

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Where conduits pass through the floors or walls of the houses, they shall be provided with PVC pipe sleeves for free passage of the conduits. After the conduits are installed, the openings shall be caulked with an elastic compound and escutcheon plates provided on the interior walls, ceilings, and floors.

Conduits and wireway shall be securely clamped and supported at intervals not exceeding five feet in length.

Conduit and wireway runs exposed on the steel structure shall be securely clamped to the steelwork. The conduit clamps, in general, shall consist of U-bolts attached to structural steel supports bolted to the members. The wireway clamps, in general, shall consist of manufacturer recommended stainless steel bracket hangers attached to structural steel supports bolted to the members. The wireway cover shall be on the top or on the side of the wireway and be clear of opening obstructions. The minimum thickness of the structural supports shall be 3/8 inch. Supports shall be arranged so that conduits and wireway rest on top of the support and conduit U-bolts rest on top of the conduits. The use of J-bolts to fasten structural supports or to clamp conduits will not be permitted.

All U-bolts and bracket hangers shall be provided with medium-series lock washers and hexagonal nuts. The bolts, nuts, and washers shall be of stainless steel conforming to the requirements of the Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes, ASTM Designation A276, Type 316.

Where conduits and wireways are to be mounted exposed on non-steel surfaces, they shall be securely clamped to the surface using bent plate pipe supports with back spacers held by not less than two bolts. The stock size for the bent steel plate supports shall be 6mm thick by 51mm wide. Back plates shall be of 10mm thick steel. Supports and spacers shall be hot-dip galvanized. Bolts shall be not less than 1/2" in diameter and shall be of stainless steel conforming to the requirements specified for U-bolts.

At any point where a conduit crosses an expansion joint longitudinally or where movement between adjacent sections of conduit can be expected, conduit expansion fittings shall be installed. The fittings shall be bronze expansion fittings and shall be provided with flexible bonding jumpers to maintain the electrical continuity across the joints. The fittings shall permit a total conduit movement of 203mm and shall be Engineer approved equal to the O.Z./Gedney Type EX, Spring City Type EF, or the Crouse-Hinds Type XJ.

At any point where a conduit crosses a joint laterally or where an offsetting type movement between adjacent sections of conduit can be expected, expansion and deflection fittings shall be installed. The fittings shall permit a movement of 3/4" from the normal in any direction. The fittings shall be the O.Z./Gedney Type DX, Spring City Type EDF, Adalet Type STX, or Engineer approved equal.

Flexible conduits for the connections between the rigid conduit system, all motors, and limit switches shall be made with sections of PVC coated, flexible, metallic, liquid tight conduit. Each section shall not exceed 18" without prior approval of the Engineer.

All conduit embedded in concrete, insofar as possible, shall be completely encased by concrete of not less than 3 inches, measured in any direction, and shall be securely held in place during pouring and construction operations. A group of conduits terminating together shall be held in place by a template.

All conduit, wireway, and fittings shall be carefully examined before being installed, and all pieces having defects shall be set aside and removed from the site. All conduit bends shall be made with standard size conduit elbows. Conduit shall be assembled hand tight and then using strap wrenches tightened two more turns. Wrench marks or chuck marks shall be touched up with the appropriate touch-

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up compound. All cuttings and threading shall be performed as recommended by the conduit manufacturer. All conduit, enclosures, and fittings shall be mechanically joined together to form a continuous electrical conductor to provide effective electrical continuity.

Ends of abandoned conduits, spare conduits/wireway, and empty conduits/wireway and stubs shall be capped during and after construction, and care shall be taken to ensure that no moisture or other matter is in or enters the conduits.

All conduits shall be pitched not less than 1" in ten feet (except by special permission). Where conduits cannot be drained to pull boxes, a drain "T" with drain fitting shall be installed at the low point and drained to a dry well of broken stone. Drain fittings shall be of stainless steel and shall be capable of passing 1 oz of water per minute.

The ends of all conduits projecting into boxes and equipment enclosures shall be provided with bronze insulated grounding bushings. The insulated portion shall be of molded phenolic compound, and each fitting shall have a screw type combination lug for bonding. Insulated bushings shall be the O.Z./Gedney Type RBLG, Spring City Type GB, or Engineer approved equal manufactured by Appleton. All bushings in any box or enclosure shall be bonded together with No. 8 AWG bare copper wire. Where conduit hubs are provided use locking nuts with grounding terminals.

All conduits and wireway shall be carefully cleaned both before and after installation. Upon completion of the conduit and box installation, the Contractor shall clear each conduit by snaking with a steel band, to which shall be attached an approved tube cleaner equipped with a mandrel of a diameter not less than 85 of the nominal inside diameter of the conduit and with a wire brush of the same diameter as the conduit, and shall then draw in the cables.

Both ends of each conduit or wireway run shall be provided with a brass tag having the same number stamped thereon in accordance with the conduit diagrams, and these tags shall be securely fastened to the conduit ends with No. 20 AWG brass wire.

Separate conduits or wireways shall be furnished and installed to carry the circuit wiring to all span driving motors.

All wireways shall be 16 gauge 304 stainless steel bodies with covers and oil-resistant gasket and adhesive. The flanges shall be 10-gauge stainless steel. Wireway fittings, nipples, and elbows shall be 304 stainless steel. A solid oil-resistant gasket shall be positioned between flanges when sections and fittings are bolted together.

Wireways shall not be less than 6" x 6". The seams shall be continuously welded and ground smooth. There shall be no holes or knockouts. The edges on all sections and fittings shall be smooth and rounded to prevent damage to cable and conductor insulation.

The wire way covers shall have heavy butt hinges and external screw clamps to assure complete seal between covers, gaskets, and bodies.

When wireway enters an enclosure, a box connector shall be used on the inside of the enclosure to ensure a tight and stable seal. Closure plates shall seal the end of wireway sections or runs.

At any point where a wireway crosses a joint, where an offsetting type movement between adjacent sections of conduit can be expected, or where movement between adjacent sections of conduit can be

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expected flexible wireway fittings shall be installed. The fittings shall be the wireway manufacturer's recommended fitting.

All conduits projecting into boxes and equipment enclosures shall be provided with water tight, weather proof, insulated throat conduit hubs. The conduit hubs shall be approved equal to Meyers Watertight Rigid Conduit Hubs except for PVC coated conduit which shall be provided with PVC hubs of the same manufacture as the conduits.

Boxes

All surface mounted pull, junction, and terminal boxes shall be of type 316 stainless steel, and shall be provided with full length hinged gasketed, covers held with stainless steel fast operating clamps to provide NEMA 4X watertight construction. They shall be Engineer approved equal to the Hoffman bulletin A4S or equivalent by Weigman or Hammond.

Flush Mounted Boxes

All flush mounted pull, junction, and terminal boxes will be 316L stainless steel, and will be provided with gasketed, covers. Enclosure will have the following construction: body will be manufactured from 14gauge Type 316 stainless steel. Mounting flange manufactured from 10 gauge Type 316L stainless steel. Screw cover and hinged door manufactured from 12 gauge Type 316L stainless steel. Seams will be continuously welded and ground smooth. Type 316L stainless steel lift-off hinges will be used with hinged door. Enclosure will have Stainless steel quarter-turn latches used with hinged door. Enclosure will also feature a grounding stud on body and a bonding provision on cover or door. The boxes will be as manufactured by Hoffman Enclosures, Saginaw Enclosures, or the Hammond Manufacturing, or approved equal.

Flush Mounted Boxes (sidewalk or roadway)

All flush mounted pull, junction, and terminal boxes will be cast-iron, hot-dip galvanized inside and out, and will be provided with gasketed flat covers to provide NEMA-4X watertight construction, and AASHTO H-20 live load rated for full deliberate traffic. Covers shall be slip resistant. The boxes will be O.Z. Gedney Type YF, Spring City Type HP, Appleton Type WHF, except with stainless steel cover screws, or equal as approved by the Engineer.

Interior and exterior boxes shall be provided with external mounting lugs and shall be fastened in position with stainless steel through bolts. Conduit entries shall be means of galvanized malleable iron hubs. PVC coated conduit shall use PVC coated hubs. No box shall be drilled for more conduits or cables than actually enter it. Exterior boxes shall be provided with drain fittings of the same type as specified for conduit drains.

All boxes shall be sized in accordance with the requirements of the National Electrical Code and the dimensions as shown on the Plans.

Terminal boxes shall be of sufficient size to provide ample room for the terminal blocks and interior wiring and for the installation of conduit terminations and multi conductor cable fittings. Interior mounting backpanels with tapped holes shall be provided for mounting the terminal blocks.

Hardware and Supports

Supports for conduits, wireways, cables, boxes, cabinets, disconnect switches, small limit switches, and other separately mounted items of electrical equipment shall be fabricated from structural steel not less

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than 3/8" thick. Clip angles and other supporting members, which are fabricated from structural steel plates and shapes and bolted to the structural members, shall be included with the structural steel. All other supporting members shall be included under the electrical work.

Structural steel brackets, boxes, and other equipment mounted on concrete surfaces shall be provided with a full neoprene gasket not less than 1/8 inch thick between the equipment and the surface of the concrete.

Expansion anchors for fastening equipment or brackets to concrete surfaces shall be wedge type anchor bolts, which shall be locked in place by an expansion wedge as the nut is tightened. All parts of the expansion anchors shall be of Type 303 stainless steel. Holes for the anchors shall be drilled to the size and depth recommended by the manufacturer using carbide tipped masonry drills.

Mounting bolts, nuts, washers, and other detail parts used for fastening boxes, disconnect switches, small limit switches, conduit clamps, cable supports, brackets, and other electrical equipment shall be of stainless steel conforming to the requirements of ASTM Designation A276, Type 316. Bolt heads and nuts shall be hexagonal and shall be provided with medium-series lock washers. Bolts smaller than 1/2" in diameter shall not be used, except as may be necessary to fit the mounting holes in small limit switches, boxes, and similar standard devices.

Usage of beam clamps for supporting conduits, boxes, or other equipment shall not be acceptable without prior approval of the Engineer.

Preformed metal framing channels, such as Kindorf, Unistrut, Superstrut, etc., where permitted by the engineer, will be of stainless steel.

Wiring and Cables

Except where otherwise noted, wiring in conduits shall be single-conductor.

All wires and their insulation and covering shall be of a nationally recognized brand, acceptable to the Engineer, and shall have marks always used on the particular brand for identifying it.

All wiring and cables shall conform to the requirements of NEMA Publication No. WC70-2000. Before wire and cable orders are placed with any manufacturer, the Contractor shall submit for approval typical published test data for the type of insulation proposed, showing that it meets the requirements of NEMA Publication No. WC7. All materials used to fabricate insulated wiring and cables shall be certified to be from stock not more than 1 year old.

All conductors shall be of stranded copper large enough to carry safely the maximum currents required without injurious heating or serious voltage drop. Conductors shall not be smaller than No. 12 AWG, except as approved for control panel and console wiring or for lighting fixtures. All conductors shall be soft-annealed copper wire conforming to the requirements of NEMA Publication No. WC70. All conductors shall have Class B concentric stranding, except for conductors in flexible cables.

The insulation shall be a chemically cross-linked, polyethylene compound conforming to the requirements of Part 3.7 of NEMA Publication No. WC70. The thickness of insulation shall be that required for 600 volts rated circuit voltage listed under Column A of Table 3-1. Insulation type shall be Type XHHW-2.

Equipment ground conductors shall be bare, stranded, coated copper conforming to the requirements of NEMA Publication No. WC70, Part 2.

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Single conductor wiring, including the insulating material, shall be tested to demonstrate that it meets specified requirements. The testing shall be done as stipulated in NEMA Publication No. WC70, Part 6. Wiring and cables shall not be shipped from the plant of the manufacturer until certified test reports on the cable properties have been approved by the Engineer.

The conductor sizes and number of wires shown on the Plans are the minimum permissible. The Contractor shall provide wiring and cables of sufficient size and number as may be required for the installation in accordance with the wiring diagrams on his approved working drawings. In each conduit and multi conductor cable containing ten or more conductors, at least one spare wire shall be provided for every ten conductors actually used.

Wiring shall not be installed in any conduit before all joints are made up tightly and the conduits rigidly secured in place. The drawing of cables into conduits shall be done without injury to the wires or their insulation or covering. No lubricant of any kind shall be used for the pulling of wires, unless specifically authorized by the Engineer. Sufficient slack shall be left in all cables to permit proper connections in boxes, cabinets, and enclosures.

Both ends of every single length of conductor shall be permanently and clearly tagged in accordance with the same numbers or designations appearing on the approved wiring diagrams. Wire tags for marking the conductors shall be heavy duty, heat shrink, waterproof, permanently marked, and resistant to ultraviolet light deterioration. Numbers and letters shall be black or blue on a white background. The Contractor shall submit the proposed wire marking system and a sample of the wire markers to be installed to the Engineer for approval. Each conductor, except for control and instrument conductors, shall be color coded with colored insulation. Color coding for 120/208 volt conductors shall be black for phase A or 1, red for phase B or 2, blue for phase C or 3, white for neutral, and green for equipment ground. Color coding for three phase 480 volt conductors shall be brown for phase A or 1, purple for phase B or 2, yellow for phase C or 3, gray for neutral, and green for equipment ground. Each conductor shall be marked at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection and shall include each branch circuit or feeder and control wire.

Conductors inside terminal boxes, the control console, and control panels shall be neatly formed into cables and laced with approved cable ties, with the individual conductors leaving the cable at their respective terminal points. These conductors shall be looped to allow not less than three inches of free conductor when disconnected. The formed cables shall be held securely away from the terminals and from contact with the enclosure by means of approved insulating supports.

All outgoing wires, No. 8 AWG or smaller, in the control console and control panels and in terminal boxes shall be connected to stud and nut style terminal blocks. Terminals shall be suitable for use with solderless, locking fork, wire connectors. Connectors which extend beyond the ends of terminal block barriers, shall be furnished with an insulating sleeve covering the metal part of the connector. Taping of extended terminals will not be permitted.

Each terminal of all terminal blocks shall be permanently marked to show the same number or designation as appears on the wire connected thereto.

Splicing of wires will not be permitted. Wherever it becomes necessary to joint or branch conductors, terminal blocks shall be used, and wires shall be clearly tagged.

Multi conductor cables supported on the steelwork shall be secured thereto by bent plate cable clamps spaced not more than 3 ft on centers. The cable clamps shall be fabricated from stainless steel plates bent

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to suit the cables' outside diameters. In general, the clamps shall be fastened to structural brackets bolted to the steelwork.

Where multi conductor cables enter the control console or any cabinets or boxes, they shall be provided with watertight cable terminators. Each cable terminator shall provide a watertight seal by compressing a tapered neoprene-sealing ring around the outer jacket of the cable. Cable terminator parts shall be made of bronze and shall be approved equal to the Series SF-327OB Watertight Cable Entrance Seals as made by O.Z./Gedney.

The Contractor shall take insulation resistance readings on all circuits installed, with electronic equipment disconnected, and furnish to the Engineer a complete record of the results obtained. These circuits shall include connected motors when tested. Conductors rated 600 volts, or more, shall be one hundred (100) megohms, or more. Defective circuits shall be replaced at the Contractor's expense.

Flexible cable for specified connections shall be rubber-insulated, multiple-conductor portable cords conforming to the requirements of NEMA Pub. No. WC3, Part 7.7 or NEMA Pub. No. WC8, Part 7.4 for hard service. Each cable shall be provided with a heavy-duty neoprene jacket conforming to the requirements NEMA Pub. No. WC3, Part 7.7.5.1 or NEMA Pub. No. WC8, Part 7.4.5.1. Flexible cables shall conform to the National Electrical Code, Article 400 for hard service. Flexible cables shall be provided with strain relief fittings and basket weave cable grips at each end. Strain relief fittings shall be malleable iron, liquid tight strain relief fittings. The cable grips shall be stainless steel, heavy long, closed wire mesh, single weave with a double eye support. All mounting hardware shall be stainless steel.

Submarine Cables are covered under a separate specification.

Pier Protection and Swing Span Navigation Lights

Navigation lights shall be provided in accordance with the rules and regulations of the United States Coast Guard as shown on the Plans.

For all navigation lights, the doors and lenses shall be gasketed, and each entire unit shall be completely weatherproof and vandal resistant. Fittings shall be non-corroding, and the sockets shall be of porcelain mounted on shock absorbers. The housings for all units shall be cast-bronze, and an LED 120-volt lamp with brass base shall be installed in each socket.

The swing span lights shall be controlled by the fully open limit switches so that the green lights shall show when span is fully opened, and the red lights shall show at all other times.

All navigation lights shall be equipped with bronze junction boxes.

The housing shall be of cast bronze and shall be suitable for marine environment. Construction shall be rain-tight and fully gasketed. The light assembly shall be designed for heavy duty, long life service. Design shall provide ready access for lamp service.

The lens shall be heat-resistant fresnel glass. Lens sections shall be 180 degrees red over 180 degrees green. Inside lens diameter shall measure approximately 7 inches. Outside lens diameter shall measure approximately 8 inches.

Base shall be cast of the same material as the fixture head. Light assembly shall mount via four 1/2" diameter bolts through the base, provided by installer to suit installation. A junction box shall be provided at the base of the unit. A cast junction box with gasketed access cover shall be provided. Junction box

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shall be of the same material as the fixture assembly and shall match the navigation light base footprint. Orientation of junction box shall be capable of rotation in 90 degree increments.

The pier protection lights shall be model PL as manufactured by B&B Roadway or approved equal by Tidewater or Fed Transit. The Swing span lights shall be model SS as manufactured by B&B Roadway or approved equal by Tidewater or Fed Transit.

The navigation light system shall be controlled by photoelectric control device. The photoelectric control unit shall be a completely self-contained, weatherproof device rated 1,800 VA at 120 volts and shall be provided with a time-delay feature and a deluxe, encapsulated lightning arrestor for protection against surges and lightning. The unit shall provide turn-on of the pier navigation lighting system at 10.74-lux nominal. The unit shall be suitable for operation within a temperature range of -50 degrees Celsius to 70 degrees Celsius and shall have a fail-safe feature so that the lighting load remains energized in the event of component failure. The unit shall be suitable for installation in a twist lock receptacle with adapter for mounting on PVC-coated rigid metal conduit. Locate the photoelectric controller on the machinery house, as approved by the Engineer.

A three-position selector switch shall be provided on the control console for operating the rest pier navigation lights. In the "Auto" position, the lights shall be controlled by the photoelectric control device. The "On" position shall override the photocell and turn the lights on. The lights can be turned to the off position for safety during maintenance.

Traffic Gates

The gates shall be explicitly designed for traffic control on movable bridges as described in AASHTO's current Standard Specifications for Movable Highway Bridges, HOV and reversible lanes and similar applications. They shall be provided with both roadway and sidewalk/pedestrian arms.

The operating mechanism and main control components shall be contained in a weatherproof housing. The housing shall be constructed of .188" (4.8mm) carbon steel, hot dip galvanized after fabrication. Exterior surfaces shall be painted aluminum. All fasteners shall be corrosion resistant. Arm shaft openings shall incorporate O-ring seals.

Front and rear access doors shall be mounted on full cross bronze straps. Hinges shall be of the slip-off type and shall have stainless steel pins. Door latches, two per door, shall use a vise action to compress a neoprene bulb-type gasket to seal the door openings. All maintenance and repairs shall be conducted and all interior components shall be accessible from the sidewalk side of the housing only.

The gate shall be fixed to the foundation using four 3/4" (20mm) diameter minimum anchor bolts. The gate housing base shall provide four 1.00" (25mm) holes on a 20 1/4" (514mm) square pattern.

The traffic gate arm shall be 4" (102mm) square, 6005-T5 aluminum extruded tubing. Stainless steel truss cables and a damping type bumper rod shall be furnished with longer arms at the discretion of the manufacturer. Front and rear arm surfaces shall be covered with alternating red and white high intensity reflective sheeting. Stripes shall be 16" (152mm) wide, and vertical according to MUTCD. Remaining exposed surfaces shall be painted white.

The gate shall be provided with a sidewalk arm. The arms shall be of fiberglass, sized by the manufacturer. Front and rear arm surfaces shall be covered with alternating red and white high intensity reflective sheeting. Stripes shall be 16" (152mm) wide, and vertical according to MUTCD. Remaining exposed surfaces shall be painted white.

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The warning lights shall be used as a traffic signaling light to mark and draw attention to the traffic gate. The housing shall be of high impact plastic. Assembly shall be double-faced. Light assembly shall be mounted to warning gate arm using an aluminum adapter plate. Lenses shall be red fresnel plastic, approximately 4" diameter. Lamp shall be 12V 100,000 hour LED lamp.

The arm base shall be designed with a shear pin mechanism to minimize damage to the gate and vehicle in the event of a collision. In the event of an impact, the shear pin shall break, allowing the arm to swing approximately 75 to 80 degrees. At the full open position, a spring-loaded latch shall engage, preventing the arm from swinging back into traffic. Arm shall be easily reset by manually releasing the latch, rotating the arm back into position and replacing the shear pin.

A pair of carbon steel channels, hot dip galvanized, painted aluminum, shall be rigidly affixed to the ends of the main arm shaft. The channels and a steel crossmember shall provide a sturdy mount for the arm, arm base assembly and counterweights. They shall be shortened as required so that the channels do not extend past the curbline.

At the rear end of the side arm channels, hot dip galvanized counterweights shall be mounted to balance the arm. Counterweights shall be sectional and shall permit at least 10% adjustment.

The main arm shaft shall be of 2" (51mm) diameter AISI 4150 with a minimum tensile strength of 140,000 psi. The shaft shall be mounted in heavy duty relubricable ball bearings.

The warning arm shall pivot in the vertical plane via a mechanical 4-bar linkage. The linkage shall utilize cranks keyed to the main arm shaft and transmission shaft and an adjustable connecting rod between a pair of self-aligning spherical rod ends. The connecting rod shall be of 1" (25mm) diameter AISI 4150. The linkage shall be driven by a fully enclosed, double reduction, worm gear speed reducer. Gear ratio used shall produce an operation time of 11 seconds. The velocity of the arm shall follow a sinusoidal pattern to provide smooth operation. The arm shall begin and end its full motion path with zero velocity and accelerate smoothly to maximum velocity at mid-travel.

The motor shall be 1 hp, 480 VAC, three phase, 60 hz. The motor shall be a C-face design and shall be mounted directly to the transmission. The motor shall be instantly reversing, and overload protected.

The motor shall be equipped with a solenoid-release, automatic brake. The brake shall have a manual release lever to permit manual operation of the gate during emergencies or setup.

A handcrank shall be provided with each gate to facilitate manual operation of the gate.

The gate limit switch assembly shall be a self-contained unit. The assembly shall provide 8 independent SPDT control switches. Switches shall be rated for 15 amps at 480 VAC. Switches shall be controlled by individually adjustable cams. The limit switch assembly design shall permit adjustment of all cams with the gate in any position. The limit switch assembly shall have a removable cover to help prevent accidental contact with switch terminals. Shaft, cams, bushings and housing pieces shall be of non-ferrous corrosion resistant materials.

A manual disconnect switch shall be provided, pre-wired at the factory to break the main motor leads, to protect personnel during service. A handcrank safety switch shall be provided to prevent powered actuation of the gate during manual operation. Door safety switches shall be installed and set at the factory to break the control circuit when either access door is opened. Door safety switches shall have a

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pull-to-override feature for test operation and shall automatically reset when doors are closed. Control components and terminal blocks shall be mounted inside an electrical enclosure mounted facing the rear side access opening. Pressure-type, modular terminal blocks shall be fully labeled and clearly coded to the control system vendor wiring diagrams. All control wiring shall be clearly coded to wiring diagrams and shall terminate at the terminal block. Connections to screw-type terminals shall have lugs. Conductors shall be type XHHW #14 AWG stranded, minimum.

Each traffic gate shall have a pedestrian gate arm. The pedestrian gate arm length shall be determined in the field. The pedestrian gate arm shall operate with the traffic gate arm.

The traffic gates shall be Model VW-4, as manufactured by B&B Roadway, or engineer approved equal.

Warning Gongs

A warning gong shall be attached to each of the oncoming traffic gate housings.

The housing shall be of heavy duty, cast aluminum construction. Gong assembly shall be equipped with an aluminum mounting adapter for mounting to the top of warning gate housing. Mounting shall be designed to enclose all wiring. A hinged and gasketed rear door shall provide service access. A cast aluminum guard above the shell shall provide weather protection. Gong shall produce a sound level of 90db at 10 feet. Gong shall operate on 120V power at a current draw of .45 FLA. The gong shell shall be spun silicon bronze.

The warning gong shall be approved equal to the B&B Roadway G12.

Barrier Gates

The barrier shall be designed for use as a penetration resistance barrier. The gates shall be explicitly designed for traffic control on movable bridges as described in AASHTO's current Standard Specifications for Movable Highway Bridges, HOV and reversible lanes and similar applications.

The barrier beam shall be fabricated from 12" square, .375" thick structural steel tube, hot dip galvanized after fabrication. Height to the top of the beam shall be as shown on the drawings. Traffic side of beam shall have 6" diameter wing type heavy dock bumpers sloped at 45 degrees down and away from the pintle and covered with engineering grade reflective sheeting. Beam face between bumpers shall also be covered with reflective sheeting to produce an alternating pattern of red and white stripes.

Nominal length of the beam shall be measured from the pivot to the far end of the beam.

Enclosed within an integral housing, near the far end, shall be a tractor unit which shall drive the barrier. The tractor unit shall consist of wheels, wheel drive mechanism, motor, brake, and gear reducer coupled directly to the motor. Design shall permit manual operation during emergency conditions and for convenience during installation.

Motor horsepower shall be determined by the manufacturer to suit the installation, but shall not be less than 2 HP.

Wheels shall have a minimum capacity of 120% of the load at the wheels. Wheel tread shall be of urethane elastomer or similar material to provide traction. Wheel shaft shall be AISI 4150 with a minimum tensile strength of 140,000 psi. The shaft shall be mounted in heavy duty relubricated ball bearings.

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The warning lights shall be used as a traffic signaling light to mark and draw attention to the traffic gate. The housing shall be of high impact plastic. Assembly shall be double- faced. Light assembly shall be mounted to warning gate arm using an aluminum adapter plate. Lenses shall be red fresnel plastic, approximately 4" diameter. Lamp shall be 12V 100,000 hour LED lamp.

The barrier shall be fixed at the pivot to a suitable foundation. Anchor bolt size and pattern shall be determined based on installation details and requirements.

The barrier shall be equipped with passive endlocks at the far end of the barrier. The endlocks shall engage with the opposing barrier.

Access panels or doors shall be located to permit servicing of all equipment. Access openings shall be designed to provide a weather resistant enclosure for equipment. All fasteners shall be corrosion resistant.

The pivot shaft shall turn on self-lubricating bronze radial and thrust bearings.

The barrier limit switch assembly shall be a self-contained unit. The assembly shall provide 8 independent SPDT control switches. Switches shall be rated for 15 amps at 460 VC. Switches shall be controlled by individually adjustable cams. The limit switch assembly shall permit adjustment of all cams with the barrier in any position. The limit switch assembly shall have a removable cover to help prevent accidental contact with switch terminals. Shaft, cams, bushings and housing pieces shall be of non-ferrous corrosion resistant materials.

A manual disconnect switch shall be provided, pre-wired at the factory to break the main motor leads, to protect personnel during service. A handcrank safety switch shall be provided to prevent powered actuation of the gate during manual operation. Door safety switches shall be installed and set at the factory to break the control circuit when either access door is opened. Door safety switches shall have a pull-to- override feature for test operation and shall automatically reset when doors are closed. Control components and terminal blocks shall be mounted inside an electrical enclosure mounted facing the rear side access opening. Pressure-type, modular terminal blocks shall be fully labeled and clearly coded to the control system vendor wiring diagrams. All control wiring shall be clearly coded to wiring diagrams and shall terminate at the terminal block. Connections to screw-type terminals shall have lugs. Conductors shall be type XHHW #14 AWG stranded, minimum.

The barrier gates shall be Model HR-7, as manufactured by B&B Roadway, or engineer approved equal.

Flasher

The flasher shall be moisture and corrosion resistant and shall be capable of dissipating heat sufficient for continuous duty. The flasher shall have two alternately flashing circuits, and one steady burn circuit. Each flashing circuit shall flash .50 seconds on and .50 seconds off. The input voltage shall be 120VAC. A 120V/12V transformer shall provide 12V for the flasher and the arm lights. The flasher shall operate properly for input voltages within 10% of nominal. The output circuits shall be rated at 10 amps at 12VAC each (10 amps total load). A voltage drop of up to .5 volts to the output terminals shall be acceptable. It shall have a built-in, internal overload protection with auto-reset. Terminals shall be clearly labeled and shall be compression type screw terminals.

CCTV System

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The Closed Circuit Television System (CCTV) shall consist of ten (10) PTZ, capable closed-circuit television cameras, power supplies, fiber optic/ethernet switches, ethernet/fiber optic switch power supplies, camera power supplies, multimode fiber, camera processors and DVR, and monitors. In addition, two identical cameras shall be provided as spares for the system. The cameras shall be monitored at the Control House by two 42", color, general purpose monitors, mounted as shown on the Plans. The intent is to provide a dedicated view of each camera on quad screens on the monitors and capability of accessing the CCTV via web-based client from a remote location. Initial system will be setup to show far side camera views on monitor 1 and the near side camera views to monitor 2. All apparatus and equipment comprising the CCTV system, including camera, lens, housings, controls, monitors, and rack mounting equipment and all associated appurtenances required to provide a complete functioning system, shall be manufactured or furnished by a single qualified system vendor.

The system shall be capable of two (2) week minimum recording duration.

The CCTV system vendor shall have a demonstrable competence in providing complete functioning systems. Such competence shall be demonstrated by identifying a minimum of three outdoor/indoor functioning CCTV systems in the past 5 years.

The CCTV system vendor shall assume complete system responsibility for the integrated functioning of all components to provide a satisfactory assembled system operating in accordance with specified requirements. The CCTV system vendor shall be responsible for the detailed design of the total system to ensure compatibility of equipment and suitability for the intended system functioning. The vendor shall provide supervisory assistance in the installation of equipment to ensure maximum reliability and ease of maintenance. The vendor shall provide on-call warranty service for a period of 1 year upon final acceptance of the bridge.

The CCTV system will be capable of remote viewing and operation through the CCTV system software remote client. The systems will have industry standard level of security and system encryption such that no unauthorized access is allowed.

All equipment shall be compatible with Genetec Omnicast Surveillance Suite software.

Contractor shall provide a minimum of 1 license for the Genetec Omnicast Surveillance suite software for the local CCTV equipment.

Cameras:

Cameras will be IP type and will be all 316 stainless steel construction, rated for outdoor applications, NEMA 4X rated, 30x optical zoom, 24VAC rated, and be furnished with a blower, sun shield, and heater added options. In addition, two identical cameras will be provided as spares for the system. Camera will be able to operate between -40 Deg C and 60 Deg C. All camera mounting hardware will be furnished with the camera and produced by the same manufacturer as the camera. The camera will be able to pan, tilt, zoom through the use of the same manufacture joystick control accessories. Cameras will be supplied with on board SDs with the highest possible memory allowed by the model camera. Each camera will be approved equal to Stainless Steel Spectra Enhanced Series IP PTZ dome camera with the environmental package.

Camera PTZ Controller:

The CCTV system will be provided with the camera manufacturer recommended PTZ controller station.

DVR:

Digital Video Recorder/processor will be capable of supporting 128 IP cameras and 64 Analog Cameras. The DVR will be supplied with 4TB of internal storage. All necessary software will be provided to establish a complete system.

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DVR will be approved equal to the Pelco DSSRV2.

Power Supplies:

Power to the cameras will be provided through local outdoor rated 4 output – 120VAC to 24VAC, 20A rated power supplies as shown on plans. Contractor will submit for review and approval final location of power supplies.

Power supplies will be approved equal to Pelco WCS4-20 4 output power supply.

The CCTV system will also consist of video monitors and CCTV Communication Equipment Cabinet.

- a) Video Monitors - The cameras will be monitored at the Control House by two 42", color LED, full-high definition, 1920x1080 resolution minimum, video surveillance monitors. Monitors will be with the CCTV cameras and mounted using manufacturer recommended ceiling mount and as shown on the Plans. Monitor at a minimum will have 1 VGA, 1 BNC, and 4 HDMI inputs.

- b) CCTV Communication Equipment Cabinet

- a. CCTV racks will be provided as required to mount all necessary CCTV equipment in the Control House including but not limited to: video signal receivers, camera processors, DVR/HVR, UPS, and cooling fans.
- b. CCTV Rack will be a UL Listed pivoting rack such that the mounted rack units can be swiveled out 90 Degrees and access to the rear connectors can be granted. Rack will accommodate 40 spaces minimum and be constructed of 16-gauge steel.

UPS:

Rack mounted UPS will be provided and will be capable of providing power instantaneously to the CCTV system upon power failure. UPS will be capable of powering CCTV equipment for a minimum of 1 hour.

CCTV Racks:

CCTV racks will be provided as required to mount all necessary CCTV equipment including but not limited to: NVR, UPS, and cooling fans.

Cable:

Video signal cable will fiber and industrial ethernet CAT6 cable.

Fiber optic cable will be 12 strand outdoor heavy duty rated jacket 62.5/125 multimode fiber.

Programming:

All equipment programming will be recorded and included in the operating manual.

Fiber Optic Cable

The cable shall be OM5 type single mode fiber optic cable. It shall be 24 strand and LC connectors shall be used for all terminations.

Roadway Lights

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The decorative post top lantern shall be an architectural luminaire that consists of luminaire housing, a prismatic optic and a decorative cover. The optical assembly shall be a type 3 acrylic refractor to precisely distribute light with excellent visual comfort and reduced glare. The programmable LED driver shall include 0-10V dimming. The driver life shall be rated to at least 100,000 hours.

The luminaire housing and decorative cover shall have a spike finial and be made of low copper cast aluminum and finished with corrosion resistant super durable powder coat green paint. Multi-stage pre-treating and painting process shall yield a finish that achieves a scribe creepage rating of 8 (per ASTM D1654) after over 5,000 hours exposure to salt fog chamber (operated per ASTM B117). The luminaire shall include an integral slipfitter that accepts a tenon.

The luminaire shall be type JFE Jefferson Gen 3 LED Post Top by Holophane, JFE3 P10 30K AL3, with P10 performance package, 3000K, 70 CRI and type 3 acrylic refractor. Green 4" tapered poles shall be mounted as shown in the plans.

Service Lighting

Service light fixtures shall be ceiling or wall mount RAB Vaporproof Fixtures, die cast aluminum, with all brass hardware and clear heat resistant glass globes. The fixture shall be supplied with a junction box and mounting lugs. One piece die cast aluminum guards shall be threaded for secure fit. Fixture shall be UL listed for use with 90 degree Celsius supply wiring for use in wet locations. Fixture shall have a high temperature silicone internal gasket. The porcelain socket shall have 150 degree Celsius 8" long leads included. An adapter plate shall be included with ceiling fixtures.

Marine Radio

1. The marine radio telephone for installation in the control house will be a limited coast station for monitoring and communicating with marine traffic. It will be designed to transmit on Channel 13 (156.650 MHZ) and monitor Channel 16 (156.800 MHZ). It will have a normal power output of 1 watt and maximum power of 10 watts.
2. The unit will be coupled to a stainless steel or fiberglass whip antenna of 1.0 meter in length. Coax type surge suppressors will be installed where the antenna leads enter the Control House.
3. The marine will be furnished complete with all appurtenances required for proper operation, including power supply, external speaker, hand-held microphone, outdoor antenna, interconnecting cables, brackets, plugs, connectors, adapters, and other equipment. The unit must comply with FCC rules and regulations.

Spare Parts

Supply spare parts in accordance with AASHTO requirements and Contract Plans. The spare parts supplied for each bridge shall include, but not be limited to, the following:

- Six fuses of each kind and size installed.
- 4 limit switch or proximity switch of each type specified. In addition, a full set of contacts and contact fingers for each type of limit switch
- A set of contacts and contact fingers for each unit or fractional unit of five or less of each kind or size installed, including contactors and starters. For units that do not incorporate replaceable contacts, furnish a complete unit with coil.
- One coil for every five or less of each size relay, contactor, and motor starter installed.

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- One complete relay timer, time delay relay, contactor, and starter for each unit or fractional unit of five or less of each kind and size installed.
- Two intelligent overload relays of each size installed.
- One spare Auxiliary motor
- For the motor brakes:
 - 1 spare thruster complete with heater and motor.
 - 1 limit switches for hand-release mechanism.
 - 1 limit switches - brake released.
 - 1 limit switches - brake set.
- For the traffic gates:
 - 1 complete roadway gate arm with lights prewired
 - 1 complete pedestrian arm
 - 1 rotary cam limit switch
 - 4 arm lamp assemblies
- For the navigation lights:
 - 1 each color and type lens.
 - 2 each color and type LED lamp.
 - 6 lens gaskets.
- For the PLC system:
 - 1 each of every type PLC input card and PLC output card.
 - In addition, a quantity of 4 discrete input cards and 4 relay contact output cards.
 - 1 PLC chassis power supply module.
 - One control switch contact unit of each type installed.
 - 1 fully programmed HMI unit
- For each drive provided:
 - 3 incoming line fuses
 - 3 control power fuses

Arrange the spare parts in uniform size cartons of substantial construction, with typed and clearly varnished labels to indicate their contents and store them where directed by the Engineer. Provide large spare parts with moisture-proof wrapping. Provide a directory of permanent type, describing the parts. In the directory state the name of each part, the manufacturer's number thereof, and the rating of the device for which the part is a spare. Mark the spare parts to correspond with their respective item numbers as indicated on the elementary wiring diagram.

Voltage and Arc Flash Warning Labels

Furnish and install warning labels to identify the equipment or panel operating voltage and arc flash warnings. The arc flash warning will be in accordance with NEC 110.16., National Fire Protection Association (NFPA) 70E 'Standard for Electrical Safety in the Workplace' and the Institute for Electrical and Electronic Engineers (IEEE) 1584 'IEEE Guide for Performing Arc Flash Hazard Calculations.' The approved labels will be printed on weather resistant vinyl labels and installed on the equipment.

CONSTRUCTION DETAILS

General

The cost of removal of existing items, as shown on plans, or if items are replaced as called out in this specification, shall be included in the bid price of this item.

Grounding

Bridge steel work on each side of the navigation channels shall be solidly bonded and grounded to 25mm copper plated steel ground rods installed using No. 2/0 AWG bare, stranded, tinned copper cable.

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The resistance to ground shall be no higher than 5 ohms. Provide exothermic welds, molded fusion, type as required, as manufactured by Cadweld, Thermoweld, Metalweld, or Engineer approved equal.

Bond together and solidly connect to a ground bus in the machinery and/or electrical rooms grounding conductors in submarine cable, navigation lighting units, all metal framing, cases, and enclosures of the electrical equipment, such as motors, control console, control cabinets, conduits, submarine cable armor (stripped of its jacket prior to clamping), and all other metal parts in the proximity of current carrying conductors or equipment. Extend a No. 2/0 AWG bridge-grounding conductor connected to this ground bus to the service disconnect via submarine cable.

Ground new utility service neutral conductors in accordance with local utility grounding requirements.

Exothermically weld together the utility service neutral conductor, the bridge grounding conductor and two No. 2/0 AWG grounding electrode conductors.

Ground the submarine cable armor where applicable. The armor wires' individual jackets must be stripped before the submarine cables are clamped in order to provide an adequate connection to the conduit system.

Provide grounding system terminals that are solderless lugs and that are secured by means of hexagonal-head, copper plated, steel machine bolts with lock washers or lock nuts. Ground system conductors shall be continuous unspliced connections between terminal lugs. Remove paint, rust, and scale over the contact area. Make up all connections as tightly as possible, and spot paint any bare metal or paint undercoat remaining exposed to restore the surface with the same coating and number of coats as applied to the adjacent metal.

Provide equipment ground conductors composed of seven-strand, soft-drawn, bare, tinned copper wire conforming to ASTM B33 and not smaller than No. 10 AWG.

Painting

The requirements for painting structural steel also apply to painting electrical equipment, unless otherwise specified.

Shop Painting

Electrical equipment such as conduits, boxes, supports, and other devices which have a galvanized finish and equipment such as motors, brakes, control console, and control panel frames and enclosures which normally are given a factory finish need not be shop painted. Give all other electrical equipment one shop coat.

Field Painting

Electrical equipment, which is normally given a factory painted finish suitable to the Engineer, need not be field painted. Give all other electrical equipment, such as conduits, boxes, device enclosures, supporting clips and brackets, and other devices, two field coats of paint as specified under the requirements for painting structural steel. Before applying the two field coats, clean galvanized surfaces free of all grease, oil, dirt, and foreign material and etch with copper sulfate solution, after which the solution shall be applied. In lieu of etching and a coat of shop paint, the Contractor may use galvanizing primer as a first coat for galvanized surfaces. Apply a final field coat on electrical equipment in the operator house the color and type of paint to match the house interior.

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Motor Testing

Main Span Drive and Auxiliary Motors

1. Prior to shipment, Span Drive motors will be factory tested according to all routine motor manufacturer tests plus any tests required to be performed such that all applicable fields of the IEEE STD 112 Form Annex C and any additional information as required by this specification can be filled with appropriate data. A complete speed-torque-current curve will be developed for each motor ranging from 0% speed to 100% speed. All critical curve points will be indicated including but not limited to, locked rotor torque, pull up torque, breakdown torque, and full load torque. Motor will be subjected to a complete full load heat run/winding temperature rise test for stator and rotor and will be performed in accordance to NEMA MG-1 and IEEE STD 112.
2. Once the Main span drive motor has completed the above testing, the motor will be coupled to the actual Flux vector drive which is to be used with the motor after final installation. All necessary equipment including but not limited to dynamic braking resistors, encoder, and cabling will be provided for testing. Motor-drive system will progress through the following load testing and will be performed in the “Heavy Duty Mode” of the drive:
 - a. 150% FLT for 30 seconds at 0% speed
 - b. 100% FLT for 30 seconds at 0% speed
 - c. 100% FLT for 30 seconds at 25% speed
 - d. 50% FLT for 30 seconds at 25% speed
 - e. 0% FLT for 30 seconds at 25% speed
 - f. 100% FLT for 30 seconds at 50% speed
 - g. 50% FLT for 30 seconds at 50% speed
 - h. 0% FLT for 30 seconds at 50% speed
 - i. 100% FLT for 30 seconds at 75% speed
 - j. 50% FLT for 30 seconds at 75% speed
 - k. 0% FLT for 30 seconds at 75% speed
 - l. 100% FLT for 30 seconds at 100% speed
 - m. 50% FLT for 30 seconds at 100% speed
 - n. 0% FLT for 30 seconds at 100% speed

Similar motor testing shall be testing for overhauling.

3. Input voltage to the drive, input current to the drive, input line frequency to the drive, three phase motor current, motor voltage frequency, three phase motor voltage, motor torque, and motor speed will be tabulated for each step of the above test and submitted for review and approval.
4. Contractor will coordinate all the testing requirements with the motor manufacturer and will include the cost of all the above testing in the bid price.

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5. All the above testing will be performed in the presence of Westchester County DPW authorized representative and test results will be submitted for review and approval prior to shipment of equipment from the factory.

CCTV

All brackets, housings, anchors, inserts, recessed ceiling mountings etc., for the CCTV monitors and Communication Enclosure Cabinet will be installed and connected in accordance with manufacturer's recommendations.

All CCTV wiring will be installed in separate conduits. The Contractor will provide the appropriate conductors/fibers for the cameras in the submarine cables.

To prevent electrolytic action and corrosion due to the mating of dissimilar metals, a 7/16-inch-thick neoprene gasket will be furnished and installed between the camera mounting brackets and steel as required elsewhere.

The following views will be required to be displayed on the two 42" monitors in order to aid the operator in operating the bridge, the contractor will provide all cabling and programming required to place these views on the screens:

Up River

Down River

Near Gates

Far Warning/Barrier Gates

Near traffic signals

Far Traffic signals

Parking plaza

Fiber Optic Cable

Cable shall be run from the far side submarine cable cabinet to the County Administration Building. The remainder of the cable shall be coiled in an underground pull box for future use and connection by the County. The pull box size shall be governed by the fiber optic cable listed permitted curve.

Service Lighting

Provide service lighting at the three (3) locations shown in the plans. Extend the lighting power from the nearest existing unit.

Marine Radio

The marine radio will be located as shown in the Contract Plans.

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PLC Programming and Sequence of Operation

The following is a general sequence of operation based on the general requirements of AASHTO. During the shop drawing submittal process the operating sequence shall be further refined with input from the Engineer and the County.

Step 1: Turn bridge control power on, which enables desk controls. Turn oncoming traffic signals from green, through yellow, to red.

Step 2: Energize the gate flashers and gongs. Lower the traffic gates. If a gate takes longer than 30 seconds to lower, the operation shall stop and an alarm shall be sent to the HMI. If a gate is lowered but does not provide lowered indication the traffic gates bypass shall permit operations to continue. The operation of the bypass switch shall cause an alarm to be sent to the HMI.

Step 3: Close the barrier gates. If a gate takes longer than 30 seconds to close, the operation shall stop and an alarm shall be sent to the HMI. If a gate is closed but does not provide closed indication the barrier gates bypass shall permit operations to continue. The operation of the bypass switch shall cause an alarm to be sent to the HMI.

Step 4: Confirm that with all gates closed the barrier gate latched limit switches are engaged. The barrier gate bypass shall permit the operation to continue. The operation of the bypass switch shall cause an alarm to be sent to the HMI.

Step 5: Withdraw the span locks. If a lock takes longer than 30 seconds to withdraw, the operation shall stop and an alarm shall be sent to the HMI. If the span lock motor operating current exceeds a preset value, to be field determined, an alarm shall be sent to the HMI, but operations shall continue. If the span lock withdrawn limit switches fail to register, the span lock bypass switch shall allow the operation to continue, and an alarm shall be sent to the HMI.

Step 6: If there is a static drive fault, or a circuit breaker is not closed, the operation shall stop, and an alarm shall be sent to the HMI. If any brake is hand released, the operation shall not continue, and an alarm shall be sent to the HMI. One brake hand release shall be permitted, and an alarm shall be sent to the HMI. Initiate span open by momentarily turning the selector switch to open. The drive shall smoothly ramp to 5% speed at 100% torque with the brakes still set. The system shall verify that the motor shaft is not turning. If the motor shaft turns, the operation shall stop, and an alarm shall be sent to the HMI. If the shaft is not turning, the brakes shall release, and the drive shall ramp the motor to 100% speed. If after 10 seconds the brakes do not release, the operation shall cease and an alarm shall be sent to the HMI.

Step 7: Once the span reaches the nearly open position (to be field determined) the drive shall ramp down to and remain at 10% speed until the span reaches fully open. The drive output torque shall be limited to 80%, the brakes shall set and then the drives shall shut down. An independent electronic speed switch shall verify deceleration and shall emergency stop the span if deceleration does not occur. Should deceleration failure occur, an alarm shall be sent to the HMI. If the time to open the span exceeds 120 seconds, the operation shall stop and an alarm shall be sent to the HMI.

Step 8: Allow navigation traffic to clear.

Step 9: Initiate span close by momentarily turning the selector switch to close. The drive shall smoothly ramp to 5% speed at 100% torque with the brakes still set. The system shall verify that the motor shaft is not turning. If the motor shaft turns the operation shall stop and an alarm shall be sent to the HMI. If the

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shaft is not turning, the brakes shall release and the drive shall ramp the motors to 100% speed. If after 10 seconds the brakes do not release, the operation shall cease and an alarm shall be sent to the HMI.

Step 10: Once the span reaches the nearly closed position (to be field determined) the drive shall ramp down to and remain at 10% speed until the span closes. The drive output torque shall be limited to 80%, the brakes shall set and then the drives shall shut down. An independent electronic speed switch shall verify deceleration and shall emergency stop the span if deceleration does not occur. Should deceleration failure occur, an alarm shall be sent to the HMI. If the time to close the span exceeds 120 seconds, the operation shall stop, and an alarm shall be sent to the HMI.

Step 11: Drive the span locks. If a lock takes longer than 30 seconds to drive, the operation shall stop, and an alarm shall be sent to the HMI. If the span locks driven limit switches fail to register, the span locks bypass switch shall allow the operation to continue and an alarm shall be sent to the HMI.

Step 12: Open the barrier gates. If the barrier gates are open, but the proper indications are not given, the barrier gate bypass switch shall allow the traffic gates to raise and alarm shall be sent to the HMI. If a gate takes longer than 30 seconds to open the operation shall stop and an alarm shall be sent to the HMI.

Step 13: Raise the traffic gates. If a gate takes longer than 30 seconds to raise the operation shall stop and an alarm shall be sent to the HMI. Both the barrier and traffic gate flashers and the traffic gate gongs de-energize.

Step 14: Turn traffic signals to green. Turn bridge control power off and desk controls are disabled.

In general, any drive fault, any bypass switch, any overtime fault, or any manual operation interlock fault shall send a fault to the HMI, which shall display a message unique to that fault. The vendor shall submit a complete list of proposed fault messages for review and comment and additional messages shall be added as required at no additional costs to the County. These messages shall be recorded in order with the time and date of the fault. Many operations can be bypassed; only one bypass switch can be enabled at any time, if more than one is enabled, the operation shall stop.

HMI Screens:

The control system vendor shall develop the screens for the HMI. At minimum, there shall be:

- a screen that shows the status of the complete bridge
- a screen for gates showing status and all alarms and faults
- a screen for span drives and motors showing status and all alarms and faults
- a screen showing a schematic layout of the bridge electrical machinery with icons that change colors based on status
- a screen showing the PLC and communications architecture showing any communications faults
- screens for alarms and alarm history
- screens showing the recorded parameters for the last five bridge operations
- screens showing the status of all PLC I/O

Additional screens may be added during shop drawing review and shop and field testing, and shall be provided at no additional cost to the County.

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CCTV System

The Contractor shall arrange the monitors to provide optimum viewing of screens considering the operator and size of the operator's room. The Contractor's plan for monitor mounting must be approved by the Engineer before furnishing or installing any of the CCTV equipment. The Contractor shall provide any additional framing required to mount the monitors above the control console in the operator's room.

The Contractor shall ensure video signal integrity against loss or attenuation and provide clean roll-free switching. Provide amplifiers or ground loop correctors, as required, at no additional cost to the County.

Video signal cable shall be splice-free, 75 ohm coaxial, 95 percent copper braid shield, copper center conductor, 100 percent sweep tested from 5-300 MHZ, Type RG-59/U. No splices are permitted, except connections inside terminal cabinets for cameras mounted off of the swing span.

Manufacturer's Field Start-Up Service

Included with the furnishing of the major items of electrical equipment by the manufacturer is the furnishing of all necessary field supervisory start-up time by the manufacturer's Service Engineering Department to facilitate proper adjustment of the drive equipment so as to achieve satisfactory functioning of the drives.

The manufacturer's field service engineering personnel are required to be experienced in the adjustment and functioning of the particular control equipment furnished by the manufacturer. The personnel are required to be capable of locating and correcting faults or defects and of obtaining from the manufacturer, without delay, new parts or replacements for apparatus that, in the opinion of the Engineer, does not perform satisfactorily.

Bridge Operator

Provide persons to supervise the operation of the bridges and to train personnel for a period of 30 consecutive working days after the construction of the permanent control system has been completed, fine-tuned, field tested, and utilized for span operations. Instructors include, but not be limited to, representatives from manufacturers of the major equipment and a Control Engineer.

Provide operators who are skilled persons competent to operate the bridge and who are completely familiar with the operating equipment of the bridge and its auxiliaries, such as bridge security, the communications system, and fire alarm system. The operators are required to be able to make any adjustments required to the electrical and mechanical equipment.

During the 30-day period specified above, the operator(s) is required to be in attendance at the bridge for the normal working period of 8 hours per day.

Included in the 30-day training and instruction period, provide on-site training of electricians, maintenance workers, and other personnel as indicated by the County on subjects such as troubleshooting, repair of electronic motor controls, drive circuit logic, maintenance and adjustment of all electrical equipment, software, PLC hardware, and other items required for full bridge operation and maintenance. Devote three 8-hour sessions to hardware and maintenance related topics. In addition, devote three 8-hour sessions to software requirements. Offer instruction pertaining to hardware and maintenance on two separate occasions to allow bridge personnel to coordinate the course with their normal activities. Devote one 8-hour session to training on the fire, security, and communications systems and equipment. Furnish all necessary instruction sheets, student training aids, books, paper, and booklets to supplement training. Submit to the State, a minimum of 2 weeks prior to training session, an outline of topics to be covered and training material for review. It is the Contractor's responsibility to coordinate with the State the

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location where training sessions will be held. Supplying of visual aid equipment and other miscellaneous items required for training shall be the responsibility of the Contractor.

The Contractor shall make the instruction booklet that was specified above, "Operation and Maintenance Manual, Volume 1, Operation of Electrical Equipment", available for use during the training period.

Training of the designated bridge operational personnel shall commence three (3) weeks prior to the official bridge opening date. This will allow training of personnel without interruption of normal traffic flow.

Arc Flash Calculation And Labeling

The Contractor will provide a complete arc flash risk assessment of the electrical system, based upon the equipment selected by the Contractor, performed in accordance with the National Fire Protection Association (NFPA) 70E 'Standard for Electrical Safety in the Workplace' and the Institute for Electrical and Electronic Engineers (IEEE) 1584 'IEEE Guide for Performing Arc Flash Hazard Calculations.' The panels will include all electrical distribution panels operating at a voltage greater than 50V powered downstream from the 150KVA Transformer in the service building. The Contractor will submit the report and proposed Arc Flash Warning Labels for review and comment. The approved labels will be printed on weather resistant vinyl labels and installed on the equipment. The assessment will include details on all time current curves of the equipment chosen.

METHOD OF MEASUREMENT

The work will not be measured for payment.

Basis of Payment

The lump sum price bid for "Electrical and Control System Work" includes the cost of all labor, materials, operation and maintenance manuals, training, and equipment necessary for a complete installation, ready for operation as well as the removal and lawful disposal of the existing equipment being replaced/removed.

Submit to the Engineer a detailed breakdown of the Contractor's costs under this item within 30 days of award of the contract. This breakdown will be evaluated by the Engineer and utilized as the basis for monthly progress payments for work satisfactorily completed. A minimum of ten-percent of the bid will be retained by the State until final acceptance of the bridge electrical system, the Contractor and Control System Vendor have completed all items on their punchlists, and all aspects of bridge operation, operator and maintenance personnel testing, training, and control are complete. An additional five-percent will be retained until final approval of the operation and maintenance manuals is granted by the Engineer.

Pay Item

Pay Unit

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SUMMARY OF QUESTIONS

Question #	RFI #	Contractor	Question	Response
082	009	Kiewit	Addendum No. 1 C-1 Project Labor Agreement Article 19 outlines the Workers' Compensation ADR. Please confirm that participation in the Workers' Compensation ADR Agreement is not mandatory and that traditional Workers' Compensation insurance coverage will be acceptable.	Participation in the Workers' Compensation ADR Agreement is not mandatory and traditional Workers' Compensation insurance coverage is acceptable.
143	016	GCCOM	Please reference drawings S-35 and S-36, repairs state they should be done on West Girders. Are we to assume that we are not repairing the East Girders or should the work be mirrored?	The repairs detailed on S-35 and S-36 are also applicable to the East Girder. Drawings have been revised and included in Addendum #5.
144	017	RCC	The temporary fender system shown on sheet 129 does not align with the existing piers and might be considered a navigation channel restriction. Please confirm the Fender system shown on sheet 129 is in the correct location or if it should be shifted to the left/North.	The temporary bridge drawings are conceptual. The Contractor is responsible for the final design and installation of the temporary bridge, in conformance with the project specifications and USCG Bridge Permit. The horizontal and vertical clearance of the temporary bridge shall match or exceed those of the permanent bridge.
145	017	RCC	The Northeast section of the temporary abutment foundation (in the plan view) impacts the existing bulkhead. Please provide details on the existing bulkhead so the contractor knows what is located below grade in this area. Is there any existing sheeting in this area? Have you considered shifting the abutment north to avoid any existing bulkhead impacts and if so how will that impact the approach roadway?	The temporary bridge drawings are conceptual. Details of the bulkhead and any existing sheeting are not available.
146	017	RCC	Deck/Overlay Over Counterweight. --> Dwg S-83 suggests the overlay over the Deck Over Counterweight to be removed 581.02 and Replaced 557.32000018. Addendun #4 - RFI question #53 was answered suggesting the "entire overlay" on the deck over counterweight is under 584.310908 - which is in conflict of S-83. Additionally, the Callout on Dwg S-68 has the approach slab (just north of deck over counterweight) remaining in place. Can you please clarify the scope of work in this area and the intent of these two bid items?	Overlay on approach slab shall be replaced under Item 584.310908. Overlay on deck-over-counterweight shall be replaced with lightweight concrete and paid for under item 557.32000018. Response to Question 053 has been revised. S-66, S-68 and G-04 have been revised.
147	017	RCC	On Drawing S-22 lateral bracing is called out as "WT5x19.5 (TYP.)" but on sheet S-09 lateral bracing is called out at "WT7x54.5 (TYP.)" Please advise which is correct.	See response to Question 136 in Addendum No. 5