
PART 1 GENERAL**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for bollards as required for the complete performance of the work, as shown on the Drawings and as herein specified.
- B. This Section Includes: The work specified in this Section includes, but shall not be limited to, the following:
1. Retractable bollards.

1.3 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
- B. American Concrete Institute (ACI):
1. ACI 305R, "Hot Weather Concreting."
 2. ACI 306R, "Cold Weather Concreting."
 3. ACI 308, "Standard Practice for Curing Concrete."
 4. ACI 309R, "Guide for Consolidation of Concrete."
 5. ACI 318/318M, "Building Code Requirements for Structural Concrete."
- C. American Welding Society (AWS):
1. AWS A5.1, "Specification for Carbon Steel for Shielded Metal Arc Welding" (copyrighted by AWS, ANSI approved).
 2. AWS A5.5, "Specification for Low Alloy Steel Electrodes for Shielded Metal Arc Welding" (copyrighted by AWS, ANSI approved).
 3. AWS D1.1, "Structural Welding Code - Steel" (copyrighted by AWS, ANSI approved).
- D. ASTM (ASTM):
1. ASTM A 53/A 53M, "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless."
 2. ASTM A 108, "Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality."
 3. ASTM A 496, "Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement."
 4. ASTM A 497, "Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement."
 5. ASTM A 615/A 615M, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
 6. ASTM A 775/A 775M, "Standard Specification for Epoxy-Coated Reinforcing Steel Bars."
 7. ASTM C 33, "Standard Specification for Concrete Aggregates."
 8. ASTM C 150, "Standard Specification for Portland Cement."
 9. ASTM C 494, "Standard Specification for Chemical Admixtures for Concrete."
 10. ASTM C 1116/C 1116M, "Standard Specification for Fiber-Reinforced Concrete."
- E. National Association of Architectural Metal Manufacturers (NAAMM):
1. NAAMM MFM, "Metal Finishes Manual."
- F. South Coast Air Quality Management District (SCAQMD):
1. SCAQMD Rule #1168, "Adhesive and Sealant Applications," including most recent amendments.

1.4 QUALITY ASSURANCE

- A. The work of this section shall be performed by a company which specializes in the type of electric retractable bollards work required for this Project, with a minimum of 5 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.
1. Work shall be performed in compliance with Owner's insurance underwriters' requirements and UL approvals and testing for materials, assemblies and procedures.

- B. Manufacturer shall specialize in manufacturing the type of electric retractable bollards specified in this section, with a minimum of 5 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty.
- C. Qualifications:
1. Installer Qualifications: Installer shall be a firm that has a minimum of five years of successful installation experience with projects utilizing bollards similar in type and scope to that required for this Project, and shall be approved by the manufacturer. The Installer shall have had at least completed 20 high security project installations in the past three years.
 - a. If work is to be done by a manufacturer-authorized installer; that authorized installer shall be one that has been trained and certified by the manufacturer.
 2. Welder Qualifications: Manufacturer will use welding processes and welding operators in accordance with AWS standard qualification procedures.
- D. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
- E. Manufacturer's Certified Representative: At the start of the installation, periodically as work progresses, and after completion, furnish the services of the manufacturer's certified representative at the job site as necessary to advise on every phase of the work.
- F. Pre-Installation Conference: Approved installer is to conduct a pre-installation conference. Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the General Contractor, the Installer, manufacturer's certified representative, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect.
- G. Single Source Responsibility: Obtain retractable and fixed bollards and other required accessories from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work and without affecting the performance characteristics of the work.
- H. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
 1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.5 ACTION SUBMITTALS

- A. Submit the following according to Conditions of the Construction Contract and Division 1 Specification Sections.
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications.
- C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data including, but not limited to, assembly and foundation.
- D. Quality Control Submittals:
1. Design Data: For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by the professional engineer who was responsible for their preparation.
- E. LEED Submittals: Submittals that are required to comply with requirements for LEED certification include, but shall not be limited to, the following:
1. Recycled Content Materials: Provide product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 2. Low-Emitting Materials: Submit certification by the manufacturer confirming that products (i.e., adhesives, sealants, paints, coatings, etc.) are within the volatile organic compound (VOC) limits set by specific agencies or other requirements as outlined in LEED Green Building Rating System. VOC limits shall be clearly stated in the submittal.

- F. Contract Closeout Submittals:
 - 1. Warranty Data: Submit manufacturer's warranty documents as specified.
 - 2. Installation Certification: Submit letter of certification from the manufacturer, signed by the Contractor and the Installer, stating that the work was completed in compliance with the Contract Documents and that the installation resulted in the work being installed to comply with the performance characteristics specified.
- G. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.
- H. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using format in Article 3 of General Conditions.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with General Conditions and Division 1 Section "Product Requirements".
- B. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
 - 1. Manufacturer's recommended measures shall be taken to prevent damage to the materials during shipment. Measures shall be of sufficient structural integrity to enable the assembly to be lifted and transported by overhead crane or forklift.
- C. Upon receipt at the job site, materials shall be checked to ensure that no damage occurred during shipping or handling.
- D. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.7 WARRANTY

- A. Comply with General Conditions and Division 1 Section "Product Requirements".
- B. Special Warranty: The Contractor shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of one year. The special warranty shall be countersigned by the Installer.
 - 1. Manufacturer will furnish a one year parts-only warranty.
 - 2. Manufacturer's first year warranty will be valid only if:
 - a. Proper installation guidelines are followed and documented.
 - b. Maintenance documents (records) must be submitted to SecureUSA Service Department upon completion of each quarterly interval (as specified in OEM manual).
 - c. Vehicle strikes shall be reported to ensure continued coverage on remaining unaffected equipment.
 - d. Repair/replacements must be conducted under direction of SecureUSA support personnel if site personnel are self-performing the work.
- C. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.8 SYSTEM DESCRIPTION

- A. General:
 - 1. Electric retractable bollard series shall be a stand-alone bollard installed as group across a roadway. The bollard design shall use a high strength steel pipe within an underground case with reinforcing that is cast-in-place in a standard foundation.
 - 2. The EB series bollards are ASTM-M30 (K4), ASTM-M40 (K8), and ASTM-M50 (K12) impact certified electric and retractable bollards.
 - a. 3608-12 ASTM-M50 (K12) EB/MB foundation depth:
 - 1) 62" (1574mm).

3. Bollards shall be installed at specified spacing in order to maintain the given crash ratings. The installation of bollards, as single units, shall make it easier to handle the installation process and shall also provide maximum design flexibility. The center to center spacing for each bollard model is as follows:
 - a. 3608-12 - 36" (914mm) in a three bollard array.
 4. Bollard shall be available as a stainless steel composite construction.
- B. The EB series bollards are designed to prevent unauthorized vehicular intrusion into facilities.
1. The EB and MB series bollards are designed and built to stop and immobilize:
 - a. EB-3608-12 - A 15,000 pound vehicle traveling at 50 MPH (6,804 Kg @ 80 KPH), ASTM M50 (DOS K12) energy level.
 2. Bollards shall provide security by providing an obstacle to non-armored or non-tracked vehicles. The bollard system shall be designed to stop and disable a vehicle attacking from either direction and within the weight and velocity characteristics as defined above.
- 1.9 PROJECT CONDITIONS**
- A. Field Measurements: Have field measurements taken prior to fabrication of the work and preparation of shop drawings, to ensure correct product is ordered. Show recorded measurements on final shop drawings. Notify the Owner and the Architect, in writing, of any dimensions found which are not within specified dimensions and tolerances in the Contract Documents, prior to proceeding with the fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 PRODUCTS

2.1 UNAUTHORIZED MATERIALS

- A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the Owner.

2.2 ACCEPTABLE MANUFACTURERS

- A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.
- B. Manufacturer shall be accredited with U.S. Department of Homeland Security Safety Act designation.
- C. Basis of Design: Product specified is "SU-EB/RB Electric/Manual Retractable Bollard" as manufactured by SecureUSA, Inc.; 4250 Keith Bridge Road; Cumming, Georgia 30041 USA; phone 1-888-222-4559; fax 1-770-889-7939; web site www.SecureUSA.net. Items specified are to establish a standard of quality for design, function, materials, and appearance. No substitute will be allowed.
 1. Product shall be certified to meet or exceed ASTM (or D.O.S.) impact ratings.
- D. Substitutions: Comply with General Conditions using form in Division 1 Section "Substitution Request Form".

2.3 MATERIALS

- A. LEED Requirements:
1. Recycled Content Materials: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent of the cost of materials used for the Project. See LEED Green Building Rating System.
 2. Low-Emitting Materials: Use adhesives, sealants, paints, coatings, etc., that comply with the specified limits for VOC content when calculated according to SCAQMD Rule #1168. See LEED Green Building Rating System for VOC content limits.
- B. Materials: Components, material, and procedures shall conform to the following specifications and codes:
1. Steel Pipes: ASTM A 500 Grade C.
 2. Welding Electrodes: AWS A5.1 or AWS A5.5 E-7-XX.
 3. Welding: Quality assurance and personnel according to AWS D1.1. Certify each welder has satisfactory passed the AWS qualifications.
 4. Concrete:
 - a. Concrete shall conform to ACI 318/318M unless noted otherwise. Concrete shall be normal weight, 3000 psi (27.58 MPa) at 28 days with maximum water/cement material ratio of 0.50. Maximum slump for concrete shall be 5 inches (127 mm) at point of placement.

- b. Unless noted, cement shall conform to ASTM C 150, Type I or Type II. Aggregates shall be normal weight conforming to ASTM C 33. Maximum size of aggregate shall be 1.5 inches (38 mm).
 - c. Concrete shall be air-entrained in accordance with ACI 318/318M, Table 4.2.1.
 - d. Concrete shall include, but shall not be limited to, a corrosion inhibitor complying with ASTM C 494, Type C at dosage of 1.5 times the minimum recommended by the manufacturer.
 5. Reinforcing Steel:
 - a. Epoxy-coated reinforcing steel shall comply with ASTM A 775/A 775M.
 - b. Welded deformed wire fabric (WDWF) shall conform to ASTM A 496 and ASTM A 497, Grade 80.
 - C. Bollards: Bollard shall be a below-grade assembly comprising a heavy steel rectangular weldment with a cylindrical bollard pipe assembly that shall present an obstacle to approaching vehicles. Upon impact, forces shall be first absorbed by the cylindrical pipe assembly and the rectangular weldment and then transmitted to the foundation of the unit.
 1. Bollard Height: Height of the bollard shall be 36 inches (914 mm), as indicated on the drawings, as measured from the top of the road (foundation) to the top of the bollard assembly with a decorative sleeve installed.
 2. Bollard diameter dimensions:
 - a. ASTM-M50 (K12) = 8in (203mm).
 - D. System Electrical:
 1. Standard power requirements shall be:
 - a. 208/240 volts AC, single-phase, 50/60 hertz, 50-60 amperes based on options selected.
 - b. 208– 230 volts AC, three-phase, 50/60 hertz, 40-45 amperes based on options selected.
 - c. 460/480 volts AC, three-phase, 50/60 hertz, 20-25 amperes based on options selected.
 - E. System Electrical Panel:
 1. The bollards shall be powered and controlled from an Electrical Power Unit (EPU). The EPU shall contain the following equipment:
 - a. Vehicular bollard system PLC. The PLC shall monitor and control all of the vehicular bollard system functions.
 - b. Bollard drive controls. The intelligent drive controllers shall provide for faster movements with automatic slowdown at the end of the movement to reduce mechanical wear and provide a quieter operation and longer bollard life.
 - c. Electrical power distribution and protection along with the systems power supply.
 2. The EPU shall be mounted within 50 feet of the bollard system.
 3. The EPU shall comply with UL-certification requirements.
 4. Field device connections shall be run to interposing terminal strips.
 5. EPU size:
 - a. Four to Five Bollards: 48 inches (1067 mm) high by 36 inches (914 mm) wide by 10 inches (254 mm) deep (based on options).
 6. Bollard heater shall be 120 volt in the case.
 7. EPU heaters shall be 120 volt.
 8. Safety loops shall have safety loop detectors included in the EPU for connecting entry and exit safety loops.
 - F. Operator's Stations: Standard operator panels shall be available as pushbuttons systems with indicator lamps or touch-screen panels with optional system diagnostic tools.
 - G. Main Operator Panel: An operator's control station shall be used to control the bollard's operation. This panel shall have the following functions, but shall be able to be customized to meet the requirements of the specific sequence of operation:
 1. Enable key (key lockable) main switch to enable operation of the pushbutton on the panel.
 2. Sub-panel enable (key lockable) switch to enable operation of the sub-panel.
 3. Open/close road lighted pushbutton to initiate the open or close road sequence and display the status of the system.
 4. Emergency operate (EO) lighted pushbutton with a protective cover to close the road with the highest possible bollard speed. The EO function requires a reset activated by an EO reset lighted pushbutton located on the panel. The EO shall bypass all safety interlocks.
 5. Automatic/manual operation selector switch to permit the operator to turn off automatic bollard controls and operate the bollards manually with the open and close road buttons.
 6. Reset button to reset bollards after a system fault.

- H. Sub-Operator Panel:
1. A control station shall also be able to be supplied to control the bollard operation.
 2. This panel shall be similar in function to the master control station.
 - a. Enable key (key lockable) to enable operation of the pushbutton on the panel.
 - b. Open/close road pushbuttons and status indicating lights to initiate the open or close road sequence and display the status of the system.
 - c. Emergency operate (EO) lighted pushbutton with a protective cover to close the road with the highest possible bollard speed. The EO function shall be reset from the master control station. The EO shall bypass all safety interlocks.
- I. Touch-Screen Operator Control Panels:
1. Touch-screen control panels shall be available for the main and sub-operators control panels.
 2. Touch-screen panel layout shall be customizable utilizing full monochrome or color screens and shall be easy to zoom in from total overview through to individual bollard settings and diagnostics as needed.
 3. Provide rugged industrial strength screens. Units shall have multiple customizable interfaces (Ethernet, USB, Serial, etc.).
 4. Provide logging of events and alarms for reporting.
 5. Programs and data shall be saved to compact flash removable memory cards, easy to use, read on any PC, instant backup, and data security.
 6. Simple two-wire cable shall connect the touch-screens to the electrical panels.
 7. Shall be password-protected with multiple users and security levels.
 8. Provide proven standard layouts and functionality.
- J. Accessories:
1. Safety logs wire, integrated with safety loop detectors in the EPU.
 2. Bollard status indicators.

2.4 BOLLARD OPERATION

- A. The vehicular bollard system shall be manually controlled from the operator control stations, or automatically controlled from a remotely located security control system with local interfaces such as card readers, RFID systems, Remote switches etc.
- B. The vehicular bollard system shall provide integrated control of the traffic lights, gate arm, and safety loops as part of the standard control system.
- * 1. Normal Cycle Time: 3 seconds to open and 3 seconds to close the road.
2. Emergency: 3 second emergency override.
3. Frequency: Design maximum of 300 cycles per hour during peak usage.
4. Bollard Expected Life: 500,000+ cycles.
5. Power Loss: Normal operation of system during power outage with manual operator. Optional UPS system shall be available.
6. Maintenance Safety: Lockable bollard.
- C. Sequence of Operation:

GENERAL GUIDELINES:

1. Control Panel (CP) is installed in the building security room, which has right to operate all of the bollards.
2. MANUAL mode definition: The roadway opens by manually pressing OPEN button on active control panel and the roadway closes by pressing CLOSE button on the active control panel manually.
3. AUTO mode definition: The roadway will automatically open by a valid card reader swipe or a presence loop activated, and the roadway closes when a pulse-to-close signal is sent by the loop.

AUTO MODE:

1. Normal State: Bollard Is In The Secure Position (Bollard Raised) Traffic Light Is Red.
2. The Mode Switch Is Placed To AUTO On the Enabled CP.
3. A Car Approaches And The Driver Swipes the Card Reader To Initiate A Pulse To Open Sequence.
4. Bollards Lower. After Bollards Reach Full Down Position Traffic Light Turns Green.
5. Car Travels Across The Attack Side Safety Loop, Once Past The Loop the Traffic Light Turns Red.
6. Car Crosses Bollards Then Safe Side Safety Loop.
7. Once Car Passes Safe Side Loop And Loops Are Clear, After A 2-second Delay.
8. Bollards Raise To Full Up Position.
9. System Has Returned To Normal State of AUTO Mode.

MANUAL MODE:

1. Normal State: Bollards Are In The Secure Position (Bollards Up, Traffic Light Red).
2. The Mode Switch Is Placed To MANUAL On CP.
3. Security Personnel Manually Pushes The OPEN Button.
4. Bollards Lower, After Bollards Reach Full Down Position.
5. Traffic Light Turns Green.
6. Car Travels Across The Attack Side Safety Loop, The Bollards, And Then the Protected Side Safety Loop. If Safety Loops Are Clear.
7. Security Personnel Manually Pushes The CLOSE Button.
8. Traffic Light Turns Red.
9. Bollards Raise To Full Up Position.
10. System Has Returned To Normal State Of MANUAL Mode.

D. Integration and Interfaces:

1. The vehicular bollard system controls shall be designed to interface with standard security devices and systems.
2. The system shall provide outputs and inputs to interface to remote monitoring or control systems.
3. The control system shall be designed to easily integrate with auxiliary equipment such as high speed gates, sliding gates, garage doors, card readers, vehicle identification systems, RFID systems, and control loops to form a complete perimeter security system.

2.5 FABRICATION

- A. Manufactured parts shall be shop-welded and cleaned to specifications. Bollards or decorative sleeves shall be coated with standard colors unless optional colors are specified.
1. Steel Structure: The bollard shall be coated for corrosion protection in accordance with the manufacturer's written recommendations.
 2. Architectural Enhancement:
 - a. Optional aluminum decorative outer sleeves shall be powder coated. Stainless Steel sleeves shall be brush finish as standard, options are available.
 - b. Optional stainless steel composite bollards shall be available possessing the strength of carbon steel and the appearance of stainless steel.

2.6 FINISHES

- A. General: Comply with NAAMM MFM for recommendations relative to applying and designating finishes.
1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of reviewed samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of reviewed samples and they are assembled or installed to minimize contrast.
- B. Iron and Steel Finishes:
1. Powder Coat-Applied Finish: Manufacturer's standard powder coat-applied finish consisting of a topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
 - a. Color: Match the Architect's sample.
- C. Aluminum Finishes: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
1. Powder Coat-Applied Finish: Manufacturer's standard powder coat-applied finish consisting of a topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
- D. Stainless Steel Finishes: Finish designations prefixed by AISI conform to the system established by the American Iron and Steel Institute for designating finishes for stainless steel sheet. Remove or blend tool and die marks and stretch lines into finish. Grind and polish surfaces to produce uniform, directional-textured, polished finish indicated, free of cross scratches. Brush direction is circumferential.
1. Bright, Directional Polish: Match AISI No. 4 finish.
 2. Cleaning: When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION**3.1 EXAMINATION**

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 PREPARATION

- A. Indicate the location of the bollards.
- B. Indicate all underground utility locations, USC&G benchmarks, property monuments, and other underground structures.
- C. Traffic shall be controlled around the bollards during any work for safety purposes.
- D. Final grades and installation conditions shall be examined to verify compliance with manufacturer's written installation recommendations.

3.3 INSTALLATION

- A. General: Install retractable bollards in accordance with reviewed product data, final shop drawings, manufacturer's written instructions, and as indicated on the Drawings.
1. The bollards shall be cast-in-place.
 2. The trench excavation for the foundation shall be common for all bollards. Bollard spacing and foundation as indicated on drawings shall provide the strongest system.
 3. If the area that the bollards are being placed is not level, the bollard shall always stay vertical. The appearance factor shall be considered and all bollards shall be in line.
 4. Before the concrete pour, the bollards shall be checked for vertical and horizontal alignment.
- B. Corrosion: Occasionally a site is both wet and unfriendly, i.e., either highly acid or basic. Upon request the manufacturer will review specific job locations and make suitable recommendations where such protection is needed.
- C. Concrete:
1. General: The Contractor shall use materials and employ construction methods in order to comply with the Drawings. The Contractor shall inform the Architect in writing of any specific deviations and obtain the Architect's written acceptance for the specific deviation. The Contractor shall verify and shall be responsible for dimensions and conditions at the job site.
 2. Foundations:
 - a. Foundation concrete may be placed directly into neat excavations, provided the sides of the excavation are stable. Where caving occurs, provide shoring. Type and method of shoring shall be at the Contractor's option.
 - b. The excavation shall be kept dry at all times. Ground water, if encountered, shall be pumped from the excavation.
 - c. Design net soil bearing pressure shall be 3000 psf (0.144 MPa) at a depth of 12 inches (203 mm) below adjacent grade. Footing excavations will be verified by others. It shall be the responsibility of the Contractor to report adverse conditions.
 - d. Sub-grade shall be uniformly compacted to at least 95 percent of the standard proctor maximum dry density.
 3. Concrete:
 - a. Hot weather concrete placement shall comply with ACI 305R. Cold weather concrete placement shall comply with ACI 306R.
 - b. Concrete curing shall comply with ACI 308.
 - c. Concrete shall be consolidated and shall comply with ACI 309R.
 - d. Control joints shall be scored or saw-cut joints (1 inch [25 mm] deep filled with sealant) to match existing conditions and shall be placed at a maximum spacing of 12 feet (3658 mm) on-center. Concrete surfaces that are exposed shall comply with the requirements of authorities having jurisdiction.
 - e. Provide spacer bars, chairs, spreaders, blocks, etc., as required to positively hold the steel in place. Dowels shall be firmly wired in place before concrete is poured.

- f. Concrete shall be conveyed from the mixer to final deposit by methods that shall prevent separation or loss of materials. Troughs, buckets or the like may be used to convey concrete. In no case shall concrete be allowed to free drop more than 5 feet (1524 mm).
 - g. Concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement, embedded fixtures, and into corners of forms.
 - h. Where exterior wall face requires shoring and/or forming, the forms shall be substantial and sufficiently tight to prevent leakage.
 - i. Construction joints not indicated on the Drawings shall not be allowed. Where a construction joint is to be made, the surface of concrete shall be thoroughly cleaned and laitance and standing water removed.
 - j. The Contractor shall be responsible for the protection of adjacent areas against damage and shall repair or patch damaged areas to match existing improvements.
4. Reinforcing Steel: Conform to ACI 318/318M.

3.4 CLEANING

- A. The Contractor shall keep the construction area clean and at completion of work remove surplus materials, equipment, and debris and leave the premises in a clean condition acceptable to the Owner.

3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the bollards will be without damage at time of Substantial Completion.

END OF SECTION