May 22, 2026

Design Percent Completion: 100%

Statement of Work

REPAIR INSTALLATION BOUNDARY FENCE, 7211

VANCE AIR FORCE BASE, OKLAHOMA

FACILITY PROJECT ID 1024596, WORK TASK #: 18429975

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PART 1 GENERAL

1.01. PROJECT DESCRIPTION

A. The work covered under this Statement of Work shall consist of repairing a section of the Installation's boundary fence and any incidental work necessary to provide a complete and usable finished product.

1.02. INSTRUCTIONS TO BIDDERS

A. As part of the bid package the Contractor shall submit a completed copy of *APPENDIX B – BID FORM*, along with all required documentation as stated in Sam.gov.

B. Owner reserves the right to reject any bid which does not completely satisfy the Statement of Work.

1.03. LOCATION OF WORK

A. Location of work to be accomplished under this statement of work is at Vance Air Force Base (AFB). Vance AFB is located three miles south of the City of Enid, Oklahoma. The portion of Facility 7211, the Perimeter Fence, to be replaced, is located on the south end of the Installation.

1.04. SCOPE OF WORK

A. The Contractor shall furnish all supervision, labor, equipment, consumable materials, supplies, tools, and other items to complete the construction as listed in the Scope of Work. All quotes shall include all shipping charges for completion of the project. The contractor will coordinate all work with *ASRC Federal* Construction Management prior to execution. The list of items below are to be considered the general Scope of Work for the project.

B. The Contractor shall field verify location of work, dimensions, and existing site conditions prior to commencing work. The Contractor shall contact ASRC Construction Management for any discrepancies with the Scope of Work.

C. This project requires repair and restoration of the installation boundary fence to establish a continuous security barrier. All work shall match the existing configuration and comply with Unified Facilities Criteria (UFC) 4-022-03 standards, with the exception of the fabric height, which must match the existing 6-foot height to maintain visual and structural uniformity. Additional details are described below:

1. SITE PREPARATION:

    a. Clear vegetation, debris, and obstructions along the designated fence line to allow for repair operations.

    b. Maintain a clear zone of at least 20 feet on either side of the fence line per UFC standards.

2. DEMOLITION:

    a. Remove damaged chain-link fence and gates, to include bent posts, post-footings, broken barbed wire/outriggers, tension wire, top rails, braces and any other appurtenance needed to clear the area.

    b. Carefully remove and dispose of existing fence grounding systems in accordance with safety protocols.

    c. Remove damaged concrete mow strip.

    d. Dispose of all unserviceable materials outside of the installation in accordance with local, state, and federal environmental regulations.

3. PORTLAND CEMENT CONCRETE:

    a. Mow Strip:

        1. Refer to *APPENDIX C – SPECIFICATIONS, DIVISION 03 30 00 CAST-IN-PLACE CONCRETE*.

            a. Strength: Concrete must meet a minimum 28-day compressive strength of 4500 PSI.

    b. Post Footing:

        1. Refer to *APPENDIX C – SPECIFICATIONS, DIVISION 32 31 13.53 HIGH SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES.*

        2. Curing: A minimum of 7 day curing period is required before applying tension to cables and fabric.

4. ELECTRICAL GROUNDING:

    1. Refer to *APPENDIX C – SPECIFICATIONS, DIVISION 32 31 13.53 HIGH SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES.*

    2. Installation: Install a new, continuous grounding system along the entire 4,000 LF fence line.

    3. Ground Rods: Drive copper-clad steel ground rods (minimum 5/8-inch diameter, 8-foot length) into the earth at intervals not to exceed 150 feet, and at all corners, gate posts, and gate openings.

    4. Connections: Bond the fence fabric, tension wires, and gate posts to the ground rods using exothermic welds or heavy-duty mechanical connectors.

    5. Testing: The contractor must test the ground resistance to ensure it does not exceed 25 Ohms (or installation-specific standard) and submit testing logs to the COR.

5. FENCES & GATES:

    a. Refer to *APPENDIX C – SPECIFICATIONS*, *DIVISION 32 31 13.53 HIGH SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES* and *APPENDIX D – RECORD DRAWINGS*.

    b. Furnish and chain-link fence, and two (2) double swing chain-link gates:

        1. Fence length: 4,000 feet

        2. Gate dimensions: 6-foot-wide x 20-feet long

    c. Includes 9-gauge chain link fabric, tension wire, 3-strand barbed wire, tension wire, galvanized metal posts, top rail, braces, and any other necessary appurtenances to provide a complete and usable fence system.

        1. Fabric must be stretched with a minimum height of 6 feet.

        2. Tension wire: Install on top and bottom of the chain link fabric.

        3. Corrosion Protection: Apply a zinc-rich compound to all field welds or areas where galvanized coating was damaged during installation.

4. Ground Clearance: The bottom of the fence fabric must remain within 2 inches of firm ground or a concrete curb to prevent unauthorized tunneling or passage.

6. SITE CLEANUP:

   a. Grade the disturbed earth, re-seed if necessary, and remove all construction equipment and temporary fencing.

D. The Contractor shall always maintain clean areas free of clutter and debris during construction. After the work is completed, clean site to preconstruction conditions, or better.

E. Protection of Government Property

Take special care to protect Government property. Return areas damaged as a result of construction under this contract to their original condition. In addition to FAR 52.236-9, Protection of existing vegetation, structures, equipment, utilities, and improvements, perform the following:

1. Remove or alter existing work or facilities in such a manner as to prevent injury or damage to any portion of the existing work or facilities to remain.
2. Repair or replace portions of existing work altered during construction operations to match existing or adjoining work, as approved by ASRC Construction Management. At the completion of operations, existing work must be in a condition equal or better than that which existed before any new work started.

F. Construction Fence (Temporary Fence)

The Contractor shall provide construction fencing around the job site.

1. Provide 4-foot-high heavy duty plastic safety fence (orange fence).

G. Foreign Object Debris (FOD) Control on the Airfield

FOD Management shall be compliant with FAA Advisory Circular No. 150/5210-24, or latest applicable version.

1. Contractor shall maintain an inventory of tools, equipment, and other items on Contractor's vehicles to comply with the flight and safety ground procedures. Contractor shall check inventory daily, before and after work, to ensure that no tools, equipment, or any other items remain on the area at the end of the workday.

2. Contractor shall monitor, clean, and prevent FOD from propagating on the work area every day. The Contractor shall use a sweeper truck and/or any other means necessary to control and prevent FOD.

H. Erosion Control

1. The Contractor shall provide 3-foot high rolled erosion control filter fabric (snow fence) on steel posts.

1.05. CHANGES

A. No oral statement by any person other than the Contracting Officer as provided in the Federal Acquisition Regulation (FAR) will in any manner or degree modify or otherwise affect the terms of this contract.

1.06. WARRANTY

A. The Contractor shall provide a standard 1-year Warranty for all labor and material from date of the base's acceptance of completion in accordance with Federal Acquisition Regulation (FAR) clause 52.246-21. For warranted items furnish the Manufacturer's original warranty accompanied by a copy of the supplier's receipt showing place of purchase, telephone number of supplier, address, delivery order if applicable and ticket number.

1.07. SCHEDULE OF WORK

A. The Contractor shall be responsible for establishing a schedule to meet construction time.

B. The Contractor shall submit a schedule of all project work in advance to ASRC Construction Management indicating all work activities including required interruptions of utilities, facilities activities, or traffic flow.

C. The Contractor shall complete work on this contract such that interferences to necessary activities within and adjacent to the construction site are minimized and all Government property and personnel are always protected from incidental damage.

D. The Contractor shall coordinate work of all trades to prevent any conflicts. The Contractor shall resolve any conflicts of components before proceeding with construction.

E. The Contractor shall submit a Schedule of Values to ASRC Construction Management for approval. Schedule of Values to be provided on AIA G702 or similar.

1.08. WORK RESTRICTIONS

A. EXISTING UNDERGROUND UTILITIES

Any underground utilities within the work areas will initially be located and identified with paint markings on the surface by Vance AFB personnel. The Contractor shall maintain all utility markings, after base personnel have located them, for the duration of the contract. The Contractor shall obtain an approved Air Force Form 103, BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST before beginning any underground work. ***The Contractor shall notify ASRC Construction Management at least two weeks in advance of desired commencement of work.*** The Contractor is responsible for repairing any utilities damaged during construction.

B. WORK HOURS, ACCESS, AND PASSES

All Contractor employees, including subcontractors, subcontractors' employees, suppliers, and suppliers' employees are required to comply with the Installation Security Requirements regarding personnel, vehicle, and equipment security passes and access to the jobsite. Nothing in the contract is to be construed in any way to limit the authority of the Commanding Officer to prescribe new, or to enforce existing security regulations governing the admission or exclusion of persons and the conduct of persons while on VAFB, including but not limited to, the rights of search of all persons or vehicles on the Installation.

1. Access to Buildings / Occupied Buildings: The Contractor may work in or around existing occupied buildings. The Contractor is responsible, via the ASRC Construction Management, to obtain access to building and facilities and arrange for them to be opened and closed. Do not enter the building(s) without prior approval of the ASRC Construction Management. Keep the existing buildings and their contents secure at all times. Provide temporary closures as required to maintain security.

2. Passes: Contractor employees and representatives performing work under this contract are required to be either United States citizens or documented legal residents (status verified by prime contractor) and have a Real ID driver’s license. All Contractor employees must obtain the required passes. Failure to obtain security and base access passes must not be a cause for contract performance time extension. The Contractor is required to immediately turn in all terminated employee's passes to the issuing office.

3. Contractor Vehicles: All vehicles must display a valid state license plate and safety inspection sticker, if applicable, and must be maintained in good condition. The company name must be displayed in a clearly visible manner and size on each Contractor vehicle used in the course of work. Registration, proof of insurance and driver's licenses are required to obtain a station vehicle pass.

4. Work Hours: Normal working hours are from 7:30 a.m. to 4:30 p.m., Monday through Friday. Night, Weekend (Saturday and Sunday) and Federal Holiday work will be subject to approval by the ASRC Construction Management. *The Contractor must provide a written request of their intention to work outside of normal working hours to ASRC Construction Management at least 48 hours in advance of the specified time.*

    a. The Contractor shall perform all work during normal working hours except as otherwise approved to accommodate agreed upon "shutdowns" and other required "after hours" work. At no time will any facility have their services or utilities disrupted during normal working hours without prior approval from the ASRC Construction Management.

5. Contractor employees must conduct themselves in a proper, efficient, courteous, and businesslike manner. Remove from the site any individual whose continued employment is deemed by the ASRC Construction Management to be contrary to the public interest or inconsistent with the best interests of National Security.

1.09. CONTRACTOR'S REPRESENTATIVE

A. Superintendent: A representative of the Contractor shall directly supervise accomplishment of this work. The representative will be responsible for coordinating all phases of work with the ASRC Construction Management. The representative shall always be on the job site when work is being performed and shall have authority to execute no cost field changes on behalf of the Contractor if agreed to by all parties involved.

    1. Qualifications: Must have a minimum of 5 years of experience as a Superintendent on previous projects of similar size and complexity. Provide a Superintendent Resume for the proposed on-site Project Superintendent describing experience with references and qualifications to ASRC Construction Management for approval. ASRC Construction Management reserves the right to interview the proposed on-site Project Superintendent at any time in order to verify the submitted qualifications.

B. Quality Control (QC): A representative of the Contractor responsible for all quality control of the job site and will be held responsible by the ASRC Construction Management for the removal and installation of all products in accordance with the statement of work. The representative shall be competent and familiar with all phases of work under their authority.

1. Qualifications: Must have a minimum of 5 years combined experience as a Superintendent, Inspector, QC manager, Project manager, or Construction Manager on similar size and type construction contracts which included major trades included in this statement of work. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance.

C. A single representative of the Contractor for supervising the project, ensuring quality control (QC) and site safety is permitted provided that the representative is competent and familiar with all phases of work under their authority, and it is qualified to perform these duties.

D. Contractor Personnel: Provide ASRC Construction Management the name(s) of the supervisory person(s) authorized to act for the Contractor. Provide, and update as required, a list of the key personnel for the Contractor and Subcontractors including addresses and telephone numbers (main and cell) for use in the event of an emergency.

1.10. PROVIDED SERVICES AND UTILITIES

A. All reasonable required amounts of electric power will be made available to the Contractor at the discretion of ASRC Construction Management from the nearest suitable and available connection.

B. All reasonable required amounts of water will be made available to the Contractor at the discretion of ASRC Construction Management.

C. The Contractor shall be required to provide their own latrines that are staked down to prevent being turned over.

1.11. INSPECTION

A. The work shall be conducted in accordance with the Statement of Work and is subject to the inspection of the ASRC Construction Management and Government Representative to ensure strict compliance with the terms of the statement of work.

1.12. EXCESS MATERIALS (EXCLUDING HAZARDOUS MATERIALS OR WASTE)

A. All waste materials resulting from execution of work shall become the property of the Contractor. The Contractor shall haul all non-hazardous waste off Vance AFB and dispose of it in a legal manner.

B. The Contractor shall be required to control all foreign objects debris (FOD) from exiting the job site at all times.

C. At no time shall the Contractor dispose of any recyclable materials in the landfill. All recyclable material shall be taken to an approved recycling center at no cost to the government.

D. The Contractor shall submit tonnage of waste and recycled material to ASRC Construction Management at project completion.

1.13. SPECIAL MATERIALS

A. Prohibited Material: The manufacturer of materials to be used shall certify the products do not contain mercury, toluene, chlorinated solvents, hydrolysable chlorine derivatives, ethylene base glycol ethers and their acetates, nor any carcinogen, as defined in 29 CFR 1910.1200. Materials used shall not contain lead and hexavalent chromium compounds.

B. At no time shall class 1 Ozone Depleting Chemical (ODC's) be specified and shall not be used unless otherwise allowed by ASRC Construction Management.

1.14. MATERIALS

A. All materials must meet the Buy American Act.

B. Material Submittals:

1. Copies of all materials and shop drawings are to be submitted to ASRC Construction Management and must be approved prior to purchasing any items.

2. All hazardous chemicals used on the project are required to have Safety Data Sheets (SDS) approved by the Vance Environmental Office prior to transport to the installation.

3. All hazardous waste generated by the project shall become the property of Vance AFB for legal disposal.

4. The Contractor shall use the Short-Term Hazardous Material Inventory and Usage Report Form to get Hazardous Materials authorized for use inside the fence.

C. List of Materials

1. Refer to Section 1.04 Scope of Work, within this Statement of Work.

2. Refer to *APPENDIX C – RECORD DRAWINGS*.

D. Material Delivery: The Contractor shall have all materials delivered during normal working hours and will have a representative present to receive shipments. The Contractor shall ensure all delivery vehicles have sufficient project information and are prepared to undergo inspection upon entering the Installation. This includes name and address of the project site, name of prime contractor and a point of contact for delivery. Material will be delivered to a location for staging as approved by ASRC Construction Management.

PART 2 EXECUTION

2.01. SITE SAFETY REQUIREMENTS

A. All work shall be done in compliance with the safety standards as defined in DAFMAN 91-203, Air Force Occupational Safety, Fire, and Health Standards.

B. The Contractor shall comply with all applicable standards and provisions of the Occupational Safety and Health Act (OSHA) (29 CFR OSHA 1926).

C. The Contractor shall take all necessary and prudent safety precautions to ensure safety of the workforce and other exposed personnel.

D. The Contractor shall coordinate all requests for entry to the airfield or Air Force control/restricted areas through ASRC Construction Management.

2.02. INSTALLATION

A. Project Duration:

1. The total period of performance is 135 calendar days as described below.

    a. Non-Performance Period: The Contractor shall have up to 45 calendar days of nonperformance for mobilization and material lead time. If material lead time exceeds this number of days, the nonperformance period may be extended with coordination of the ASRC Construction Management and approval by Contracting Officer.

    b. Performance Period: All work shall be completed within 90 calendar days after obtaining a Notice to Proceed from the Contracting Officer.

B. Installation shall include all items listed in this statement of work, and any incidental work necessary to provide a complete and usable finished product.

C. Contractor shall remove equipment and material from the site upon completion of work as directed by ASRC Construction Management.

PART 3 SITE INFORMATION

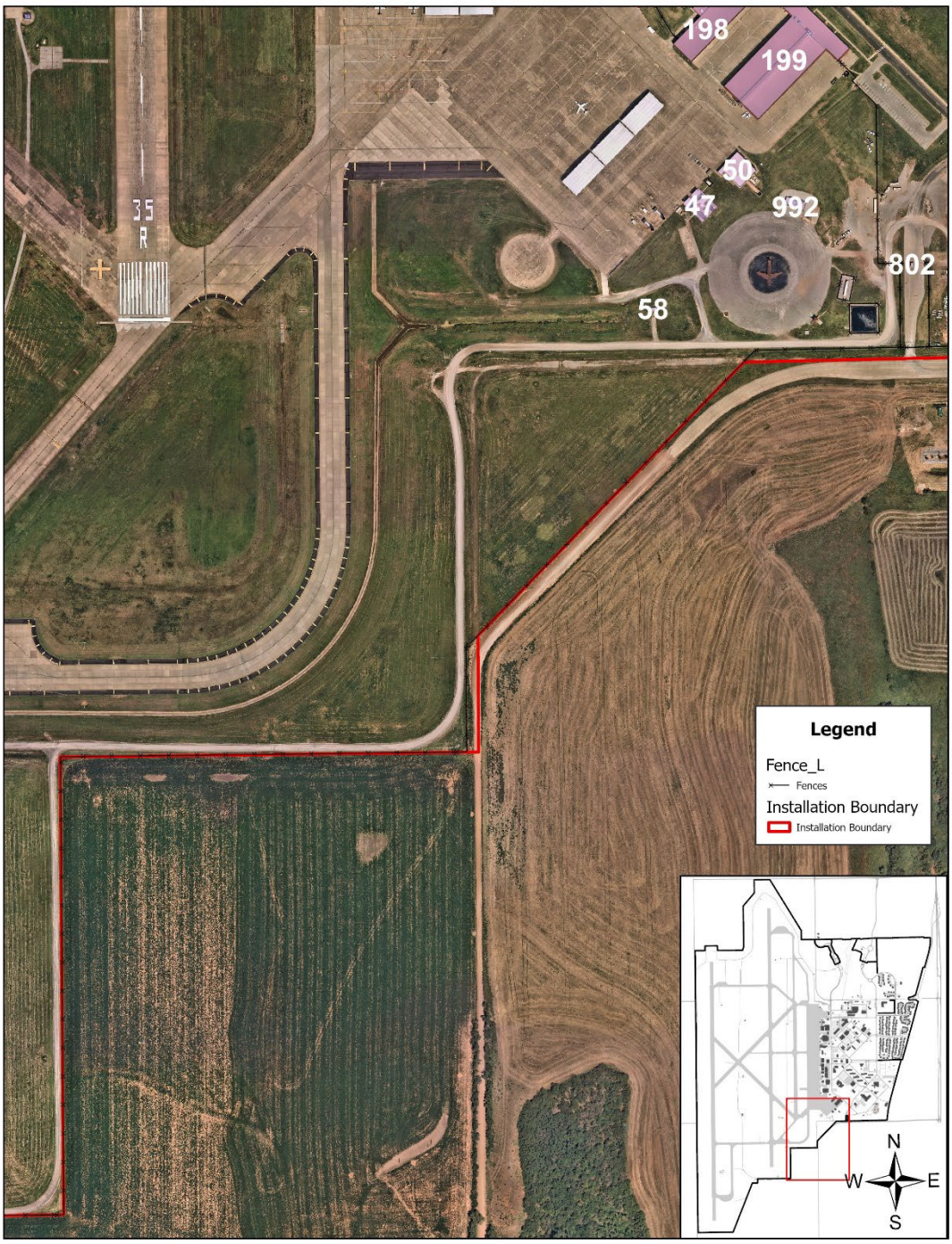


Figure 1: Project Location

PART 4 APPENDICES

4.01. APPENDIX A – SITE PHOTOS

4.02. APPENDIX B – BID FORM

4.03. APPENDIX C – SPECIFICATIONS

A. DIVISION 03 30 00 CAST-IN-PLACE CONCRETE

B. DIVISION 32 31 13.53 HIGH SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES

4.04. APPENDIX D – RECORD DRAWINGS

A. C-503 FENCE DETAILS

B. PD-1522 FENCE DETAILS & NOTES

C. PD-1522 FENCE DETAILS

4.05. APPENDIX E – SCHEDULE E

END OF STATEMENT OF WORK

APPENDIX A – SITE PHOTOS

APPENDIX A – SITE PHOTOS

Figure 2: South East Fence

Figure 3: South East Fence

Figure 4: South East Fence

Figure 5: South East Fence

Figure 6: South East Fence

Figure 7: South East Fence

Figure 8: South East Fence

Figure 9: South East Fence

Figure 10: South East Fence

Figure 11: South East Fence

APPENDIX B- BID FORM

400 Young Road
Vance AFB, OK 73705
580.213.7174

APPENDIX B - BID FORM

Fac. Proj. ID: 1024596, WT#18429975
Proj. Name: Repair Installation Boundary Fence, 7211

ITEM	DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL
Base Bid					
1	Demolition	LS	1		$ -
2	P.C.C. Mowstrip - Complete-In-Place	CY	133		$ -
3	Chain Link Fence - Includes Tension Wire, 3-Strand Barbed Wire, Top Rail, Bracing, Posts, Grounding and Other Necessary Appurtenances for a Complete-In-Place Fence.	LF	4,000		$ -
4	Chain Link Double Swing Gates - Includes Bracing, Tension Wire, 3-Strand Barbed Wire, Posts, Grounding, Padlocks and Other Necessary Appurtenances for a Complete-In-Place Gate System.	EA	2		$ -
5	Erosion Control - Silt Fence	LS	1		$ -
6	Construction Fence (Orange Fence)	LS	1		$ -
7	Final Clean-Up	LS	1		$ -
8	**Total Cost Base Bid (Sum of lines 1 through 7)**				**$ -**

Contractor's Name _____ Date _____

Contractor's Signature _____

Address:

_____

_____

_____

Phone Number: _____

E-mail address: _____

APPENDIX C – SPECIFICATIONS

SECTION 03 30 00

CAST-IN-PLACE CONCRETE
02/19, CHG 1: 02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 213R	(2014; E2017) Guide for Structural Lightweight-Aggregate Concrete
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304.2R	(2017) Guide to Placing Concrete by Pumping Methods
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305.1	(2014) Specification for Hot Weather Concreting
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 308.1	(2011) Specification for Curing Concrete
ACI 347R	(2014; Errata 1 2017) Guide to Formwork for Concrete
ACI SP-2	(2007; Abstract: 10th Edition) ACI Manual of Concrete Inspection

ACI SP-15	(2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A184/A184M	(2019) Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A767/A767M	(2016) Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A775/A775M	(2017) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A820/A820M	(2016) Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
ASTM A884/A884M	(2019) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934/A934M	(2016) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A955/A955M	(2020c) Standard Specification for

	Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement
ASTM A970/A970M	(2018) Standard Specification for Headed Steel Bars for Concrete Reinforcement
ASTM A996/A996M	(2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1022/A1022M	(2016b) Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement
ASTM A1044/A1044M	(2016a) Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete
ASTM A1055/A1055M	(2016) Standard Specification for Zinc and Epoxy Dual Coated Steel Reinforcing Bars
ASTM A1060/A1060M	(2016b) Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2019a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2020) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2020) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C78/C78M	(2018) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM C138/C138M	(2017a) Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	(2020) Standard Test Method for Slump of

	Hydraulic-Cement Concrete
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C311/C311M	(2018) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C330/C330M	(2017a) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C552	(2017; E 2018) Standard Specification for Cellular Glass Thermal Insulation
ASTM C567/C567M	(2019) Determining Density of Structural Lightweight Concrete
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2020) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C595/C595M	(2020) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C803/C803M	(2018) Standard Test Method for Penetration Resistance of Hardened Concrete
ASTM C845/C845M	(2018) Standard Specification for Expansive Hydraulic Cement
ASTM C873/C873M	(2015) Standard Test Method for

	Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds
ASTM C900	(2015) Standard Test Method for Pullout Strength of Hardened Concrete
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1012/C1012M	(2018b) Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1074	(2011) Standard Practice for Estimating Concrete Strength by the Maturity Method
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1116/C1116M	(2010a; R 2015) Standard Specification for Fiber-Reinforced Concrete
ASTM C1157/C1157M	(2020) Standard Performance Specification for Hydraulic Cement
ASTM C1218/C1218M	(2020c) Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
ASTM C1240	(2020) Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	(2008; R 2015) Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1567	(2013) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C1778	(2016) Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2628	(1991; R 2016) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D2835	(1989; R 2017) Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D3042	(2017) Standard Test Method for Insoluble Residue in Carbonate Aggregates
ASTM D5759	(2012; R 2020) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D6690	(2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM E329	(2020) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E1155	(2020) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers
ASTM E1643	(2018a) Standard Practice for Selection,

	Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM E1745	(2017) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
ASTM E1993/E1993M	(1998; R 2020) Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2018) Manual of Standard Practice
CRSI RB4.1	(2016) Supports for Reinforcement Used in Concrete

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001	(2015) Principles and Criteria for Forest Stewardship

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1	(2009) DOC Voluntary Product Standard PS 1-07, Structural Plywood

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS SS-S-200	(Rev E; Am 1; Notice 1) Sealant, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED NC	(2009) Leadership in Energy and Environmental Design(tm) New Construction Rating System

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. When used, a code following the "G" classification identifies the office that will review the submittal for the

Government. Submit the following:

SD-03 Product Data

Joint Sealants; (LEED NC)

Joint Filler; (LEED NC)

Cementitious Materials; (LEED NC)

Vapor Retarder

Concrete Curing Materials

Reinforcement; (LEED NC)

Admixtures

SD-06 Test Reports

Concrete Mix Design; G

Compressive Strength Tests; G

Air Content

Slump Tests

SD-07 Certificates

Reinforcing Bars

Safety Data Sheets

Field Testing Technician and Testing Agency

SD-08 Manufacturer's Instructions

Joint Sealants; (LEED NC)

Curing Compound

1.3 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301, ACI 304R and ASTM A934/A934M requirements and recommendations. Do not deliver concrete until vapor retarder, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

1.3.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

PART 2 PRODUCTS

2.1 FORMWORK MATERIALS

a. Form-facing material in contact with concrete must be plywood, tempered concrete-form-grade hardboard, metal, plastic, or treated paper that creates specified appearance and texture of concrete surface. Submit product information on proposed form-facing materials if different from that specified herein.

b. Design formwork, shores, reshores, and backshores to support loads transmitted to them and to comply with applicable building code requirements.

c. Design formwork and shoring for load redistribution resulting from stressing of post-tensioned reinforcement. Ensure that formwork allows movement resulting from application of prestressing force.

d. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.

e. Design formwork to accommodate waterstop materials in joints at locations indicated in Contract Documents.

f. Provide temporary openings in formwork if needed to facilitate cleaning and inspection.

g. Design formwork joints to inhibit leakage of mortar.

h. Do not use earth cuts as forms for vertical or sloping surfaces.

2.2 CONCRETE MATERIALS

2.2.1 Cementitious Materials

2.2.1.1 Portland Cement

a. Unless otherwise specified, provide cement that conforms to
. ASTM C150/C150M Type I and meets low alkali content requirements

2.2.2 Water

a. Water must comply with the requirements of ASTM C1602/C1602M.

b. Minimize the amount of water in the mix. Improve workability by

adjusting the grading of the aggregate and using admixture rather than by adding water.

c. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.

2.2.3 Aggregate

2.2.3.1 Normal-Weight Aggregate

a. Aggregates must conform to ASTM C33/C33M.

b. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.

2.2.3.2 Lightweight Aggregate

Lightweight aggregate in accordance with ASTM C330/C330M.

2.2.4 Admixtures

a. Chemical admixtures must conform to ASTM C494/C494M.

b. Air-entraining admixtures must conform to ASTM C260/C260M.

c. Chemical admixtures for use in producing flowing concrete must conform to ASTM C1017/C1017M.

d. Do not use calcium chloride admixtures.

e. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.

f. Protect stored admixtures against contamination, evaporation, or damage.

g. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete Curing Materials

Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

2.3.2 Nonshrink Grout

Nonshrink grout in accordance with ASTM C1107/C1107M.

2.3.3 Floor Finish Materials

2.3.3.1 Liquid Chemical Floor Hardeners and Sealers

a. Hardener must be a colorless aqueous solution containing a blend of inorganic silicate or siliconate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufactures instructions for placement of liquid chemical floor hardener.

b. Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content. Submit manufactures instructions for placement of sealers.

2.3.4 Expansion/Contraction Joint Filler

ASTM D1751 Type I. Material must be 1/2 inch thick, unless otherwise indicated.

2.3.5 Joint Sealants

Submit manufacturer's product data, indicating VOC content.

2.3.5.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T.

2.3.5.2 Preformed Polychloroprene Elastomeric Type

ASTM D2628.

2.3.5.3 Lubricant for Preformed Compression Seals

ASTM D2835.

2.3.6 Vapor Retarder and Vapor Barrier

ASTM E1745 Class Apolyethylene sheeting, minimum 10 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.4 CONCRETE MIX DESIGN

2.4.1 Properties and Requirements

a. Use materials and material combinations listed in this section and the contract documents.

b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.

c. Selected target slump must meet the requirements this section, the contract documents, and must not exceed 4-in (Plus or minus 1-in). Concrete must not show visible signs of segregation.

d. The target slump must be enforced for the duration of the project. Determine the slump by ASTM C143/C143M. Slump tolerances must meet the requirements of ACI 117.

e. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

f. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must be in accordance with the requirements of the paragraph titled DURABILITY.

g. Measure air content at the point of delivery in accordance with ASTM C173/C173M or ASTM C231/C231M.

h. Concrete for slabs to receive a hard-troweled finish must not contain an air-entraining admixture or have a total air content greater than 3 percent.

i. Concrete properties and requirements:

Minimum compressive strength: 3,500 psi at 28 days.

Exposure Class: F1.

2.4.2 Durability

2.4.2.1 Alkali-Aggregate Reaction

Do not use any aggregate susceptible to alkali-carbonate reaction (ACR). Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction (ASR):

a. For each aggregate used in concrete, the expansion result determined in accordance with ASTM C1293 must not exceed 0.04 percent at one year.

2.4.2.2 Freezing and Thawing Resistance

a. Provide concrete meeting the following requirements based on exposure class assigned to members for freezing-and-thawing exposure in Contract Documents:

Exposure class	Maximum *w/cm**	Minimum *f'c*, psi	Air content	Additional Requirements
F0	N/A	2500	N/A	
F1	0.45	3500	Depends on aggregate size	N/A
F2	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by
F3	0.40	5000	Depends on aggregate size	See limits on maximum cementitious material by
F3 plain concrete	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by

*The maximum *w/cm* limits do not apply to lightweight concrete.

b. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must meet the requirements of the following table:

Nominal maximum aggregate size, in.	Total air content, percent*^	
	Exposure Class F2 and F3	Exposure Class F1
3/8	7.5	6.0
1/2	7.0	5.5
3/4	6.0	5.0
1	6.0	4.5
1-1/2	5.5	4.5
2	5.0	4.0
3	5.5	3.5

*Tolerance on air content as delivered must be plus/minus 1.5 percent.
^For f'c greater than 5000 psi, reducing air content by 1.0 percentage point is acceptable.

c. Submit documentation verifying compliance with specified requirements.

d. For sections of the structure that are assigned Exposure Class F3, submit certification on cement composition verifying that concrete mixture meets the requirements of the following table:

Cementitious material	**Maximum percent of total cementitious material by mass***
Fly ash or other pozzolans conforming to ASTM C618	25
Slag cement conforming to ASTM C989/C989M	50
Silica fume conforming to ASTM C1240	10
Total of fly ash or other pozzolans, slag cement, and silica	50^
Total of fly ash or other pozzolans and silica fume	35^

*Total cementitious material also includes ASTM C150/C150M, ASTM C595/C595M, ASTM C845/C845M, and ASTM C1157/C1157M cement. The maximum percentages above must include:
i. Fly ash or other pozzolans present in ASTM C1157/C1157M or ASTM C595/C595M Type IP blended cement.
ii. Slag cement present in ASTM C1157/C1157M or ASTM C595/C595M Type IS blended cement.
iii. Silica fume conforming to ASTM C1240 present in ASTM C1157/C1157M or ASTM C595/C595M Type IP blended cement.
^Fly ash or other pozzolans and silica fume must constitute no more than 25 percent and 10 percent, respectively, of the total mass of the cementitious materials.

2.4.3 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C94/C94M.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C94/C94M:

a. Type and brand cement

b. Cement and supplementary cementitious materials content in 94-pound bags per cubic yard of concrete

c. Maximum size of aggregate

d. Amount and brand name of admixtures

e. Total water content expressed by water cementitious material ratio

2.5 REINFORCEMENT

a. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.

b. When handling and storing coated reinforcement, use equipment and methods that do not damage the coating. If stored outdoors for more than 2 months, cover coated reinforcement with opaque protective material.

c. Submit manufacturer's certified test report for reinforcement.

d. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Placing drawings must indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.

e. Submit request with locations and details of splices not indicated in Contract Documents.

f. Submit request to place column dowels without using templates.

g. Submit request for field cutting, including location and type of bar to be cut and reason field cutting is required.

2.5.1 Reinforcing Bars

a. Reinforcing bars must be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain. ASTM A615/A615M with the bars marked S, Grade 60; or ASTM A996/A996M with the bars marked R, Grade 60, or marked A, Grade 60.

b Submit mill certificates for reinforcing bars.

2.5.2 Reinforcing Bar Supports

a. Provide reinforcement support types within structure as required by Contract Documents. Reinforcement supports must conform to CRSI RB4.1. Submit description of reinforcement supports and materials for fastening coated reinforcement if not in conformance with CRSI RB4.1.

2.5.3 Dowels for Load Transfer in Floors

Provide greased dowels for load transfer in floors of the type, design, weight, and dimensions indicated. Provide dowel bars that are plain-billet steel conforming to ASTM A615/A615M, Grade 40. Provide dowel pipe that is steel conforming to ASTM A53/A53M.

2.5.4 Welding

a. Provide weldable reinforcing bars that conform to ASTM A706/A706M and ASTM A615/A615M and Supplement S1, Grade 60, except that the maximum carbon content must be 0.55 percent.

b. Comply with AWS D1.4/D1.4M unless otherwise specified. Do not tack weld reinforcing bars.

c. Welded assemblies of steel reinforcement produced under factory conditions, such as welded wire reinforcement, bar mats, and deformed bar anchors, are allowed.

d. After completing welds on zinc-coated (galvanized), epoxy-coated, or zinc and epoxy dual-coated reinforcement, coat welds and repair coating damage as previously specified.

PART 3 EXECUTION

3.1 EXAMINATION

a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.

b. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.

c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

3.2.1 General

a. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

b. Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

3.2.2 Subgrade Under Slabs on Ground

a. Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

b. Previously constructed subgrade or fill must be cleaned of foreign materials

c. Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

d. Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation

indicated.

3.2.3 Edge Forms and Screed Strips for Slabs

a. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment.

b. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

3.2.4 Reinforcement and Other Embedded Items

a. Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.

3.3 FORMS

a. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade.

b. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch. Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces.

c. Provide formwork with clean-out openings to permit inspection and removal of debris.

d. Inspect formwork and remove foreign material before concrete is placed.

e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.

f. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in formwork after concrete has reached initial setting. Brace formwork to resist lateral deflection and lateral instability.

g. Fasten form wedges in place after final adjustment of forms and before concrete placement.

h. Provide anchoring and bracing to control upward and lateral movement of formwork system.

i. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.

j. Provide runways for moving equipment. Support runways directly on formwork or structural members. Do not support runways on reinforcement. Loading applied by runways must not exceed capacity of formwork or structural members.

k. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.

l. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

3.3.1 Coating

a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.

b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement.

c. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

3.3.2 Reuse

a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.

b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.

c. Remove leaked mortar from formwork joints before reuse.

3.3.3 Forms for Standard Rough Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

3.3.4 Forms for Standard Smooth Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view.

3.3.5 Tolerances for Form Construction

a. Construct formwork so concrete surfaces conform to tolerances in ACI 117.

b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within ACI 117 tolerances.

c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

3.3.6 Removal of Forms and Supports

a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.

b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.

c. Do not damage concrete during removal of vertical formwork for columns, walls, and sides of beams. Perform needed repair and finishing operations required on vertical surfaces. If forms are removed before end of specified curing period, provide curing and protection.

d. Leave formwork and shoring in place to support construction loads and weight of concrete in beams, slabs, and other structural members until in-place required strength of concrete is reached.

e. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

3.4 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

a. Unless otherwise specified, placing reinforcement and miscellaneous materials must be in accordance to ACI 301. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.

b. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

3.4.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

3.4.2 Vapor Retarder and Vapor Barrier

a. Install in accordance with ASTM E1643. Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches and tape.

b. Remove torn, punctured, or damaged vapor retarder and vapor barrier material and provide with new vapor retarder and vapor barrier prior to placing concrete. Concrete placement must not damage vapor retarder and vapor barrier material

3.4.3 Reinforcement Supports

Provide reinforcement support in accordance with CRSI RB4.1 and ACI 301 Section 3 requirements. Supports for coated or galvanized bars must also be coated with electrically compatible material for a distance of at least 2 inches beyond the point of contact with the bars.

3.4.4 Splicing

As indicated in the Contract Documents. For splices not indicated follow ACI 301. Do not splice at points of maximum stress. Overlap welded wire reinforcement the spacing of the cross wires, plus 2 inches. AWS D1.4/D1.4M. Approve welded splices prior to use. Repair the cut ends of hot-dipped galvanized reinforcement steel to completely coat exposed steel, ASTM A780/A780M.

3.4.5 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.4.6 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.4.7 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

a. Provide fabrication tolerances that are in accordance with ACI 117.

b. Provide hooks and bends that are in accordance with the Contract Documents.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

a. Bar lengths, depths, and bends beyond specified fabrication tolerances

b. Bends or kinks not indicated on drawings or approved shop drawings

c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

3.4.8 Placing Reinforcement

Place reinforcement in accordance with ACI 301.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

For slabs other than on grade, supports for which any portion is less than 1 inch from concrete surfaces that are exposed to view or to be painted must be of precast concrete units, plastic-coated steel, or stainless steel protected bar supports. Precast concrete units must be wedge shaped, not larger than 3-1/2 by 3-1/2 inches, and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 301 and CRSI 10MSP. Do not use supports to support runways for concrete conveying equipment and similar construction loads.

b. Equip supports on ground and similar surfaces with sand-plates.

c. Support welded wire reinforcement as required for reinforcing bars.

d. Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.

e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.

f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents.

3.4.9 Spacing of Reinforcing Bars

a. Spacing must be as indicated in the Contract Documents.

b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

3.4.10 Concrete Protection for Reinforcement

Additional concrete protection must be in accordance with the Contract Documents.

3.4.11 Welding

Welding must be in accordance with AWS D1.4/D1.4M.

3.5 PLACING CONCRETE

Place concrete in accordance with ACI 301 Section 5.

3.5.1 Cold Weather

Cold weather concrete must meet the requirements of ACI 306.1 unless otherwise specified. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

3.5.2 Hot Weather

Hot weather concrete must meet the requirements of ACI 301unless otherwise specified.]Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and

prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.5.3 Bonding

Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

a. At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

b. At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated and covered with a cement grout coating.

c. Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

3.6 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with ACI 301 and ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Where straightedge measurements are specified, Contractor must provide straightedge.

3.6.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

3.6.1.1 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with ACI 301 Section 5 for a broomed finish.

3.7 JOINTS

3.7.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

3.7.1.1 Maximum Allowable Construction Joint Spacing

a. In walls at not more than 60 feet in any horizontal direction.

b. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet.

3.7.1.2 Construction Joints for Constructability Purposes

a. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.

b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.

c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

3.7.2 Isolation Joints in Slabs on Ground

a. Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

b. Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not

less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

3.7.3 Contraction Joints in Slabs on Ground

a. Provide joints to form panels as indicated.

b. Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.

c. Sawcut contraction joints into slab on ground in accordance with ACI 301 Section 5.

e. Sawcutting will be limited to within 12 hours after set and at 1/4 slab depth.

3.7.4 Sealing Joints in Slabs on Ground

a. Contraction and control joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

b. Sealed groove must be left ready to receive filling material that is provided as part of finish floor covering work.

3.8 CURING AND PROTECTION

Curing and protection in accordance with ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

3.8.1 Curing Periods

ACI 301 Section 5, except 10 days for retaining walls, pavement or

chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

3.8.2 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

3.8.3 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any 1 hour nor 80 degrees F in any 24-hour period.

3.8.4 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.8.5 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.9 FIELD QUALITY CONTROL

3.9.1 Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

3.9.2 Testing

3.9.2.1 Slump Tests

ASTM C143/C143M. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

3.9.2.2 Compressive Strength Tests

ASTM C39/C39M. Make six 6 inch by 12 inch test cylinders for each set of tests in accordance with ASTM C31/C31M, ASTM C172/C172M and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days,and hold two cylinder in reserve. Take samples for strength tests of each mix design ofconcrete placed each day not less than once a day, nor less than once for each 100 cubic yards of concrete for the first 500 cubic yards, then every 500 cubic yards thereafter, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of this section, the Contract Document, and ACI 301. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.9.2.3 Air Content

ASTM C173/C173M or ASTM C231/C231M for normal weight concrete . Test air-entrained concrete for air content at the same frequency as specified for slump tests.

3.9.2.4 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may

accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

3.10 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Contracting Officer for approval before any corrective work is accomplished.

3.10.1 Crack Repair

Prior to final acceptance, all cracks in excess of 0.02 inches wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Contracting Officer for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

3.10.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 1/4 inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 1/4 inch thick must be removed and replaced or mitigated in a manner acceptable to

the Contracting Officer.

3.10.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

SECTION 32 31 13.53

HIGH-SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES
02/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A116	(2011) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A121	(2013) Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A240/A240M	(2020) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A392	(2011a; R 2017) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A478	(1997; R 2019) Standard Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire
ASTM A491	(2011; R 2017) Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A666	(2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A702	(2013) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought

ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A824	(2011; R 2017) Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM A1023/A1023M	(2019) Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM F567	(2014a) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2014) Standard Specification for Fence Fittings
ASTM F668	(2017) Standard Specification for Poly(Vinyl Chloride) (PVC) and other Organic Polymer-Coated Steel Chain-Link Fence Fabric
ASTM F844	(2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F883	(2013) Padlocks
ASTM F900	(2011; R 2017) Standard Specification for Industrial and Commercial Swing Gates
ASTM F1043	(2018) Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083	(2018) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures
ASTM F1145	(2017) Standard Specifications for Turnbuckles, Swaged, Welded, Forged
ASTM F1184	(2016) Industrial and Commercial Horizontal Slide Gates
ASTM F1910	(1998; R 2018) Standard Specification for Long Barbed Tape Obstacles
ASTM F1911	(2005; R 2019) Standard Practice for Installation of Barbed Tape

ASTM F2408	(2016) Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets
ASTM F2589	(2016) Standard Specification for Ornamental Fences Employing Steel Tubular Pickets
ASTM F2814	(2009; R 2015) Standard Guide for Design and Construction of Ornamental Steel Picket Fence Systems for Security Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fabric

Posts

Post Caps

Chain Link Braces

Line Posts

Sleeves

Top Rail

Tension Wire

Barbed Wire

Barbed Wire Supporting Arms

Barbed Tape

Latches

Hinges

Stops

Keepers

Turnstiles

Padlocks

Wire Ties

Swing Gates

Fence Fabric Reinforcement

SD-07 Certificates

Chain Link Fence

Fabric

Barbed Wire

Gate Hardware and Accessories

Concrete

SD-10 Operation and Maintenance Data

Operating and maintenance instructions

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials elevated off of the ground to protect against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 COMPONENTS

2.1.1 Chain Link Fence Fabric

2.1.1.1 General

Provide ASTM A392, Class 2, zinc-coated steel wire with minimum coating weight of 2.0 ounces of zinc per square foot of coated surface.

2.1.2 Posts

2.1.2.1 Metal Posts for Chain Link Fence

Provide posts conforming to ASTM F1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II, roll-formed steel sections, meeting the strength and coating requirements of ASTM F1043 and ASTM A702. Group III, ASTM F1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. [Provide either Group IA steel pipe posts, Group IC, Group II, roll-formed steel sections, or Group III steel H-sections and be zinc coated (Type A) and polyvinyl chloride coated conforming to the requirements of ASTM F1043.] Provide sizes as shown on the drawings. Use line posts and terminal (corner, gate, and pull) posts of the same designation throughout the fence. Provide gate post for the gate type specified subject to the limitation specified in ASTM F900 and/or ASTM F1184.

2.1.2.2 Accessories

a. Provide accessories conforming to ASTM F626. Coat ferrous accessories with zinc or aluminum coating.chloride-coated, minimum thickness of 0.006 inch, maximum thickness of 0.015 inch. Match color coating of fittings to color coating of the fabric.

b. Provide truss rods (with turnbuckles or other means of adjustment)for each terminal post.

c. Provide barbed wire supporting arms of the single 45 degree outward angle 3-strand arm type and of the design required for the post furnished. Secure arms by top tension wire, top rail, or as recommended by the Manufacturer.

d. Furnish post caps in accordance with manufacturer's standard accessories.

e. Provide 9 gauge steel tie wire for attaching fabric to rails, braces, and posts and match the coating of the fence fabric. Provide miscellaneous hardware coatings which conform to ASTM A153/A153M unless modified.

2.1.3 Chain Link Braces and Rails

ASTM F1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Provide Group IC steel pipe, zinc-coated, that meets the strength and coating requirements of ASTM F1043.

2.1.4 Chain Link Gates

2.1.4.1 Gate Assembly

Provide gate assembly conforming to ASTM F900 and/or ASTM F1184 of the type and swing shown. Provide gate frames conforming to strength and coating requirements of ASTM F1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2.

2.1.4.2 Gate Leaves

For gate leaves, more than 8 feet wide, provide either intermediate members and diagonal truss rods or tubular members as necessary to provide rigid construction, free from sag or twist. For gate leaves less than 8 feet wide, provide truss rods or intermediate braces. Provide intermediate braces on all gate frames with an electro-mechanical lock. Attach fabric to the gate frame by method standard with the manufacturer. Welding is not an acceptable method for attaching fabric to gate frames.

2.1.4.3 Gate Hardware and Accessories

Submit manufacturer's catalog data. Furnish and install latches, hinges, stops, keepers, rollers, and other hardware items as required for the operation of the gate. All items are required to match the material characteristics of the fence system being installed. Arrange latches for padlocking so that the padlock will be accessible from both sides of the gate. Provide stops for holding the gates in the open position. For high security applications, extend each end member of gate frames sufficiently

above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

2.1.5 Ornamental Fence Gates

2.1.5.1 Swing Gates

Submit manufacturer's catalog data. Fabricate swing gates by welding 2 sq in tubular steel ends and rails. Use pickets that match the adjacent fence construction. Reinforce gates to ensure assembly sags no more than 1% of the gate leaf width or 2 in, whichever is less. Size gate posts to accommodate the weight and width of each gate leaf. Mount gates to posts with weldable steel plates or blocks, pressed steel, or malleable iron hinges. Hot-dip galvanize all hinges with a minimum zinc weight of 1.20 oz/sq ft. Secure all tamper points by welding or peening the threads. Use swing gate latches and drop bar guides manufactured of pressed steel, hot-dipped galvanized with a minimum zinc weight of 1.20 oz/sq ft. Finish all gate hardware in the same color/coating as the fence system.

2.1.6 Padlocks

Provide padlocks conforming to ASTM F883.

2.2 MATERIALS

2.2.1 Wire

2.2.1.1 Wire Ties

Submit samples as specified. Provide wire ties constructed of the same material as the fencing fabric.

2.2.1.2 Barbed Wire

Provide barbed wire conforming to ASTM A121 zinc-coated, Type Z, Class 3, or aluminum-coated, Type A, with 12.5 gauge wire with 14 gauge, round, 4-point barbs spaced no more than 5 inches apart.

2.2.1.3 Tension Wire

Provide Type I or Type II tension wire, Class 4 coating, in accordance with ASTM A824.

2.2.2 Concrete

ASTM C94/C94M, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Use grout consisting of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.3 FENCE FABRIC REINFORCEMENT

Provide galvanized structural wire rope as indicated and in accordance with ASTM A1023/A1023M, 3/4 inch nominal diameter of strand, 19 wire strand, regular lay, extra improved plow steel (EIPS), independent wire rope core (IWRC) and with a minimum breaking strength of 40,800 pound-force.

Galvanize cable, Class A, in accordance with ASTM A1023/A1023M.

2.3.1 Wire Rope Accessories

All structural steel members used in cable anchoring system shall be hot-dipped galvanized. Clamps, U-bolts, and associated hardware shall be hot-dipped galvanized in accordance with ASTM A153/A153M.

2.3.2 Turnbuckles

Turnbuckles shall be 1-1/4 inches x 12 inches x inches Type I, Grade 1 galvanized, in accordance with ASTM F1145.

2.3.3 Rope Clamps

Rope clamps shall be hot-dipped galvanized in accordance with ASTM A153/A153M.

2.3.4 Threaded Rods, U-Bolts, and Bolts

All threaded rods, U-bolts shall conform to ASTM A307 and installed with ASTM F844 and ASTM A563 nuts. The entire bolt assembly shall be galvanized.

]PART 3 EXECUTION

3.1 PREPARATION

Perform complete installation conforming to ASTM F567.

3.1.1 Line and Grade

Install fence to the lines and grades indicated. Clear the area on either side of the fence line to the extent indicated. Space line posts equidistant at intervals not exceeding 10 feet. Set terminal (corner, gate, and pull) posts whenever abrupt changes in vertical and horizontal alignment are encountered. Provide continuous fabric between terminal posts; however, ensure runs between terminal posts do not exceed 500 feet. Repair any damage to galvanized surfaces, including welding, with paint containing zinc dust in accordance with ASTM A780/A780M.

3.1.2 Excavation

Excavate holes to depths indicated. Clear all post holes of loose material and spread waste material where directed. Eliminate ground surface irregularities along the fence line to the extent necessary to maintain a 2 inch clearance between the bottom of the fabric and finish grade.

3.2 INSTALLATION

3.2.1 Installation Drawings

Submit complete Fence Installation Drawings for review and approval by the Contracting Officer prior to shipment. Submit drawing details that include, but are not limited to the following information: Fence Installation Drawings, Location of gate, corner, end, and pull posts, Gate Assembly, Turnstiles, and Gate Hardware and Accessories. Install fence system per approved drawings.

3.2.2 Security Fencing

Install new security fencing, remove existing security fencing, and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer.

3.2.3 Posts

3.2.3.1 Earth and Bedrock

a. Set posts plumb and in alignment. Except where solid rock is encountered, set posts in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, set posts to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, set posts to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case terminate depth of penetration. Grout all portions of posts set in rock.

b. Set portions of posts not set in rock in concrete from the rock to ground level. Set posts in holes not less than the diameter shown on the drawings. Make diameters of holes in solid rock at least 1 inch greater than the largest cross section of the post. Thoroughly consolidate concrete and grout around each post, free of voids and finished to form a dome. Allow concrete and grout to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Set driven posts to a minimum depth of 3 feet and protect with drive caps when setting.

c. Test fence post rigidity by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground. Ensure post movement measured at the point where the force is applied is less than or equal to 3/4 inch from the relaxed position. Test every tenth post for rigidity. When a post fails this test, make further tests on the next four posts on either side of the failed post. Remove, replace, and retest all failed parts at the Contractor's expense.

3.2.3.2 Concrete Slabs and Walls

When installed in concrete slabs or walls, set posts in zinc-coated sleeves, to a minimum depth of 12 inches. Fill sleeve joint with lead, nonshrink grout, or other approved material. Set posts for support of removable fence sections in sleeves that provide a tight sliding joint and hold posts aligned and plumb without use of lead or setting material.

3.2.4 Rails

Bolt bottom rail to double rail ends and securely fasten double rail ends to the posts. Peen bolts to prevent easy removal. Install bottom rail before chain link fabric. [Provide 3/8" diameter eye hook anchored into concrete footing at midpoint.]

3.2.5 Fabric

a. Set fabric height at 6 feet.

b. Install chain link fabric on the side of the post indicated. Attach fabric to terminal posts with stretcher bars and tension bands. Space bands at approximately 15 inch intervals. Install fabric and pull taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fasten fabric to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately [24][12] inch intervals.

c. Cut fabric by untwisting and removing pickets. Accomplish splicing by weaving a single picket into the ends of the rolls to be joined. Install the bottom of the fabric 2 plus or minus 1/2 inch above the ground.

d. After the fabric installation is complete, exercise the fabric by applying a 50 pound push-pull force at the center of the fabric between posts; use a 30 pound pull at the center of the panel to ensure fabric deflection of not more than 2.5 inches when pulling fabric from the post side of the fence. Every second fence panel is required to meet this requirement. Resecure and retest all failed panels at the Contractor's expense.

3.2.6 Supporting Arms

Install barbed wire supporting arms and barbed wire as indicated on the drawings and as recommended by the manufacturer. Anchor supporting arms [to the posts in a manner to prevent easy removal with hand tools. Pull barbed wire taut and attach to the arms with clips or other means that will prevent easy removal.

3.2.7 Gate Installation

a. Install gates at the locations shown. Mount gates to swing as indicated. Install latches, stops, and keepers as required. Install Slide gates as recommended by the manufacturer.

b. Attach padlocks to gates or gate posts with chains. Weld or otherwise secure hinge pins, and hardware assembly to prevent removal.

c. Submit 1 electronic copy of operating and maintenance instructions. Outline the step-by-step procedures required for system startup, operation, and shutdown. Include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Include in the maintenance instructions routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. Also include the general gate layout, equipment layout and simplified wiring and control diagrams of the system as installed.

3.2.8 Grounding

a. Ground fencing as indicated on drawings and as specified by manufacturer.

b. Ground fences crossed by overhead powerlines in excess of 600 volts and ground all electrical equipment attached to the fence, as applicable.

c. Ground fences on each side of all gates, at each corner, at the closest approach to each building located within 50 feet of the fence, and where the fence alignment changes more than 15 degrees. Ensure grounding locations are located no more than 650 feet apart. Bond each gate panel with a flexible bond strap to its gate post. Ground fences crossed by powerlines of 600 volts or more at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing.

d. Provide ground conductor consisting of No. 8 AWG solid copper wire. Use grounding electrodes that measures 3/4 inch by 10 foot long and are a copper-clad steel rod. Drive electrodes into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, bury electrodes a minimum of 12 inches deep and radially from the fence. Install the top of the electrode to be less than 2 feet or more than 8 feet from the fence. Clamp ground conductor to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. Measure total resistance of the fence to ground and ensure it is not greater than 25 ohms.

3.2.9 Cable Reinforcement Installation

Comply with the contract drawings.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Cleanup

Remove waste fencing materials and other debris from the work site each workday.

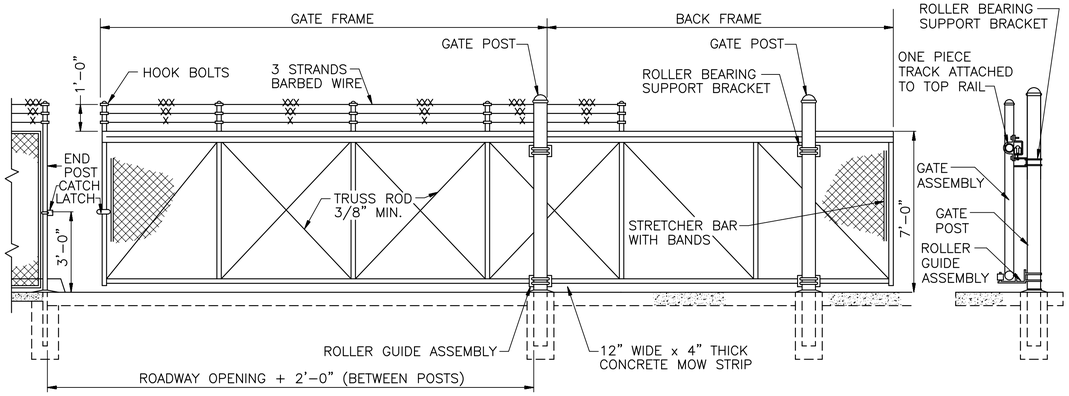
-- End of Section --

APPENDIX D – RECORD DRAWINGS

POST & FRAMEWORK SCHEDULE

	LINE POST	CORNER, ANCHOR OR STRETCHER POST	GATE POST (FOR INDICATED LEAF WIDTH) 6'& LESS	GATE POST OVER 6'– 12'	GATE POST OVER 12'	TOP RAIL OR POST BRACE RAIL	GATE FRAMES 6'& LESS	GATE FRAMES OVER 6'– 10'	GATE FRAMES OVER 10'–18'
SHAPE	○	○	○	○	○	○	○	○	○
NOMENCLATURE	2" PIPE	2 1/2" PIPE	2 1/2" PIPE	3 1/2" PIPE	6" PIPE	1 1/4" PIPE	1 1/4" PIPE	1 1/2" PIPE	1 1/2" PIPE
DIMENSIONS	2.38" OD 2.07" ID 0.154" THK	2.88" OD 2.47" ID 0.203" THK	2.88" OD 2.47" ID 0.203" THK	4.00" OD 3.55" ID 0.226" THK	6.63" OD 6.07" ID 0.280" THK	1.66" OD 1.38" ID 0.140" THK	1.66" OD 1.38" ID 0.140" THK	1.90" OD 1.61" ID 0.145" THK	1.90" OD 1.61" ID 0.145" THK
CRITICAL AXIS SEC. MODULUS	0.561 IN.^{3}	1.06 IN.^{3}	1.06 IN.^{3}	2.39 IN.^{3}	8.50 IN.^{3}	0.235 IN.^{3}	0.235 IN.^{3}	0.326 IN.^{3}	0.326 IN.^{3}
WEIGHT	3.65 LBS/LIN.FT.	5.79 LBS/LIN.FT.	5.79 LBS/LIN.FT.	9.11 LBS/LIN.FT.	18.97 LBS/LIN.FT.	2.27 LBS/LIN.FT.	2.27 LBS/LIN.FT.	2.72 LBS/LIN.FT.	2.72 LBS/LIN.FT.
LENGTH FOR GIVEN FENCE FABRIC HEIGHT 4'	6'–3"		6'–9"		6'–9"				
LENGTH FOR GIVEN FENCE FABRIC HEIGHT 5'	7'–6"		7'–10"		7'–10"				
LENGTH FOR GIVEN FENCE FABRIC HEIGHT 6'	8'–6"		9'–3"		9'–3"				
LENGTH FOR GIVEN FENCE FABRIC HEIGHT 8'	11'–0"		11'–6"		11'–6"				
EMBEDMENT FOR GIVEN FENCE FABRIC HEIGHT 4'	24"		30"		30"				
EMBEDMENT FOR GIVEN FENCE FABRIC HEIGHT 5'	27"		33"		33"				
EMBEDMENT FOR GIVEN FENCE FABRIC HEIGHT 6'	30"		36"		36"				
EMBEDMENT FOR GIVEN FENCE FABRIC HEIGHT 8'	33"		39"		39"				
FOOTING DIM. IN EARTH	10" DIA.	16" DIA.	16" DIA.	16" DIA.	24" DIA.				
FOOTING DIM. IN ROCK	5" DIA. 9" DEEP	5" DIA. 9" DEEP	5" DIA. 12" DEEP	6" DIA. 16" DEEP	9" DIA. 24" DEEP				

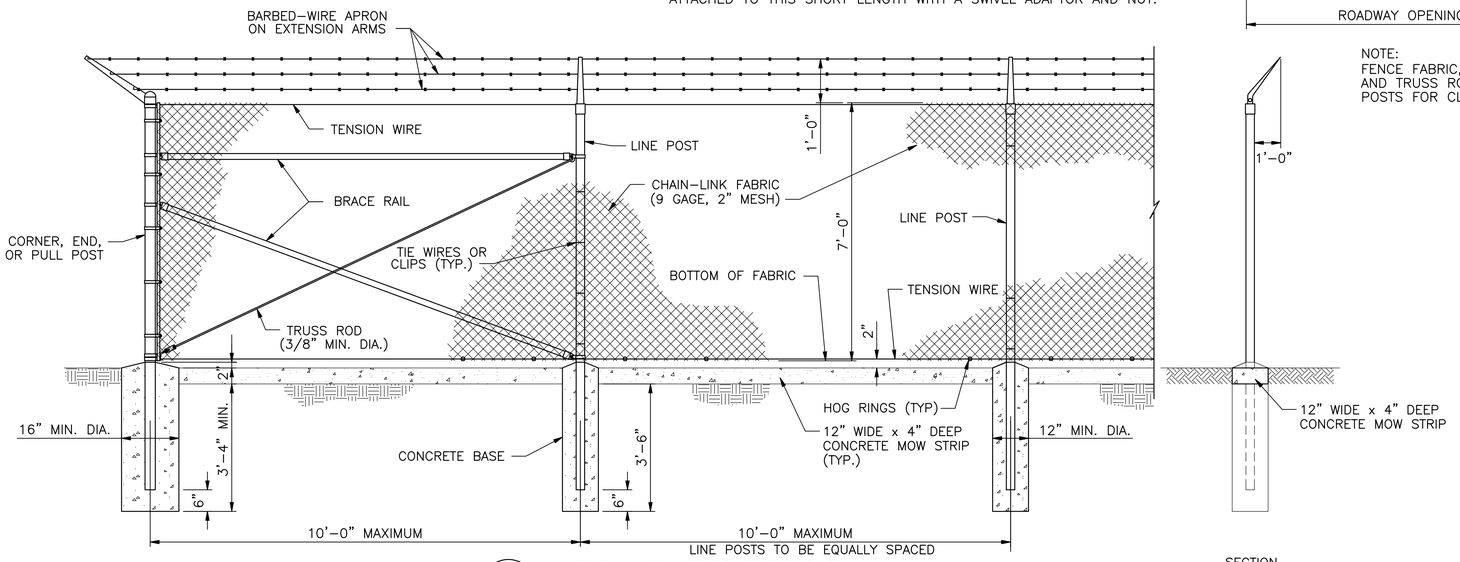
NOTES:
1. BOTTOM EDGES TO BE TWISTED AND BARBED.
2. HEIGHT (H) OF SECURITY FENCE TO BE 8'–0" WITH 3 STRANDS OF 4 POINT BARBED WIRE SECURELY ATTACHED TO SINGLE EXTENSION ARMS ALONG TOP OF FENCE. TOP STRAND TO BE 1'–0" ABOVE CHAIN LINK FABRIC.
3. SINGLE EXTENSION ARMS SHALL POINT OUTWARD AT A 45 ANGLE.
4. PROVIDE SLOPED CONCRETE BASE.
5. DETAIL TYPICAL AT BOTH SIDES OF CORNER AND STRETCHER POST.
6. TRUSS ROD SHALL BE ATTACHED TO BRACE CLAMP AT UPPER CORNER. AT LOWER CORNER, A SHORT LENGTH OF TRUSS ROD WITH THREADED END SHALL BE CLAMPED TO POST. LOWER END OF TRUSS ROD SHALL BE ATTACHED TO THIS SHORT LENGTH WITH A SWIVEL ADAPTOR AND NUT.



NOTE:
FENCE FABRIC, BARBED WIRE, BRACES AND TRUSS RODS NOT SHOWN AT GATE POSTS FOR CLARITY.

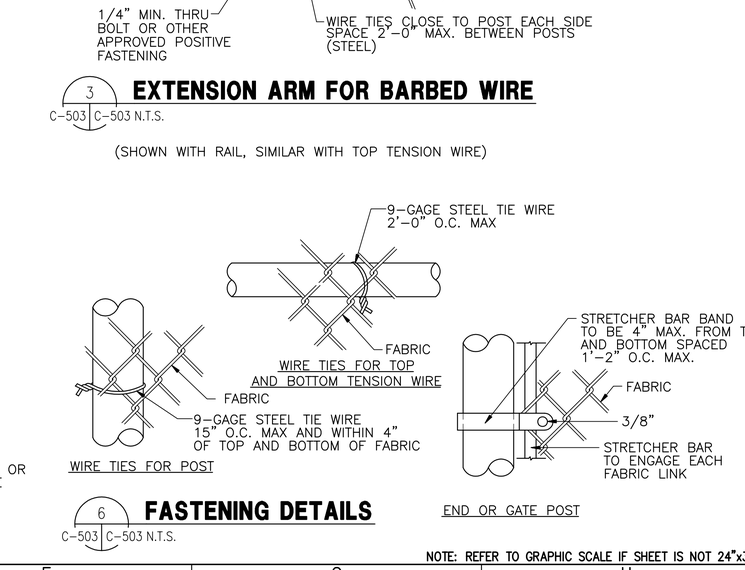
CANTILEVER GATE DETAIL AND SECTION

2 | C-503 | C-503



CHAIN LINK FENCE DETAIL

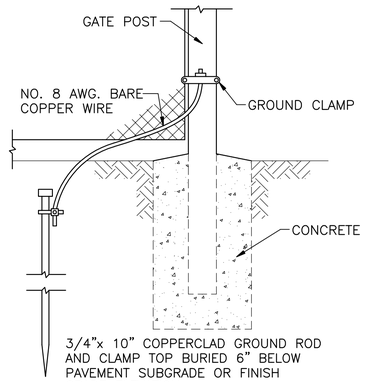
1 | C-003,C-105,C-117, C-118,C-119–C-401, C-402,C-403 | C-503 N.T.S.



EXTENSION ARM FOR BARBED WIRE

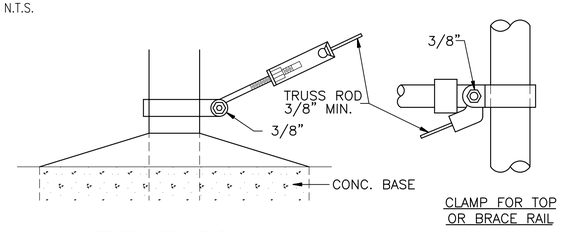
3 | C-503 | C-503 N.T.S.

(SHOWN WITH RAIL, SIMILAR WITH TOP TENSION WIRE)

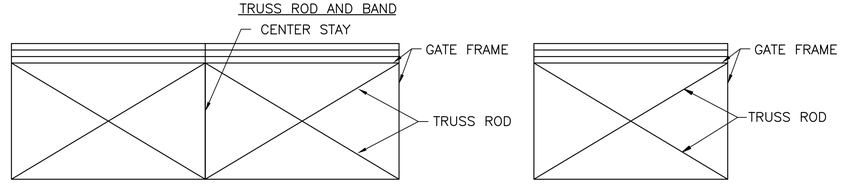


FENCE GROUNDING

4 | C-503 | C-503 N.T.S.

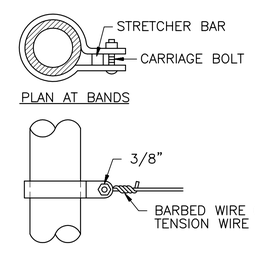


CLAMP FOR TOP OR BRACE RAIL



GATE FRAME CONSTRUCTION DETAILS

5 | C-503 | C-503 N.T.S.



FASTENING DETAILS

6 | C-503 | C-503 N.T.S.

U.S. ARMY CORPS OF ENGINEERS TULSA DISTRICT

Symbol	Description	Date	Appr.
1	REVISED AS–BUILT	5/5/08	

Drawn by: K. HANES | Contract Date:
Dwg. Code: AF 730–839–01 | File Name: VA06FPC–503.DWG
Plot Date: 10/25/2006
Plot Scale: 1=1
Designed by: J. DOUGHERTY
Reviewed by: K. SULLIVAN
Submitted by: P. CARROLL, President/CEO
Contract No.: W912BV–06–C–2013
Modification No.: P00023

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

C.H. GUERNSEY & COMPANY
Civil and Land Development Engineers
5555 North Grand Boulevard
Oklahoma City, Oklahoma 73112
405-416-8000 www.chguernsey.com

FORCE PROTECTION ENHANCEMENTS
VANCE AFB, OKLAHOMA
FY06 PN: XTLF063303

FENCE DETAILS

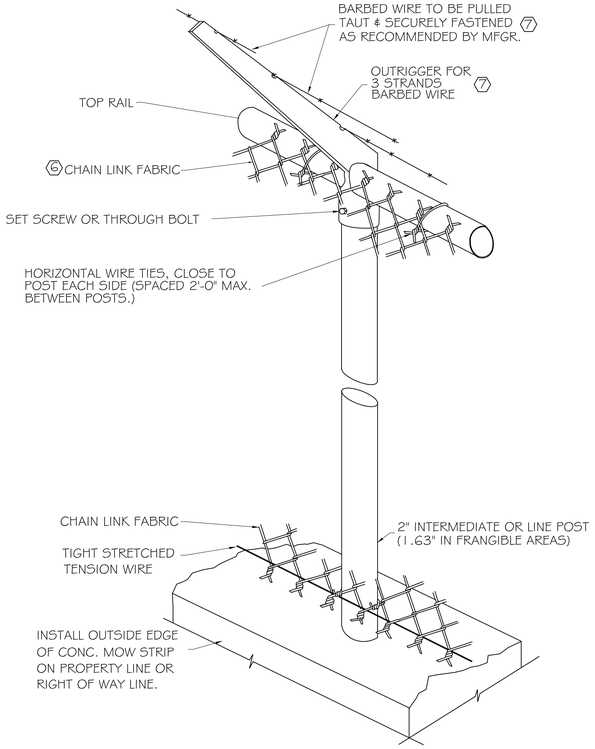
Sheet Reference Number: C–503
Sheet 068 of 232

NOTE: REFER TO GRAPHIC SCALE IF SHEET IS NOT 24"x36"

DRAWING OF WORK AS–BUILT

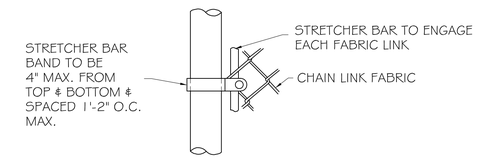
VA06FP

M:\7770\015\VA06FPC–503.dwg 10/25/2006 10:02:22 AM CDT



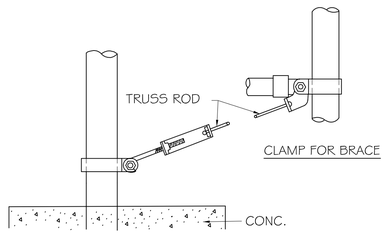
A/3 DETAIL OF NEW FENCE AT LINE POST (TYP).

NO SCALE



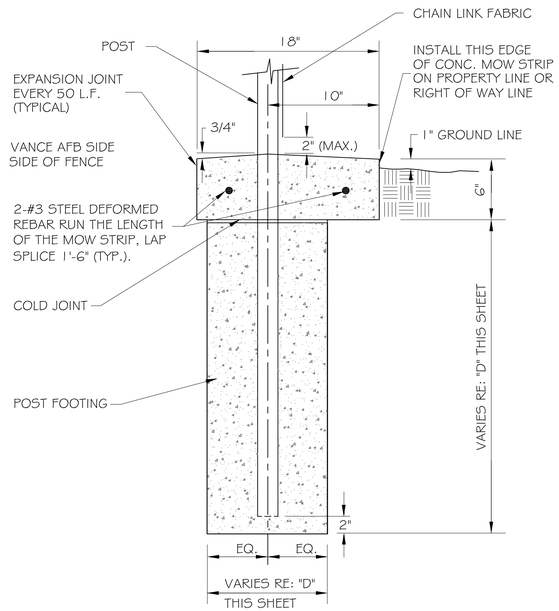
B/3 DETAIL END OR GATE POST

NO SCALE



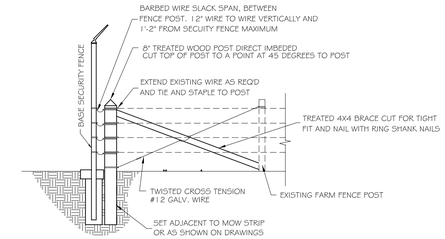
C/3 TRUSS ROD & BAND

NO SCALE



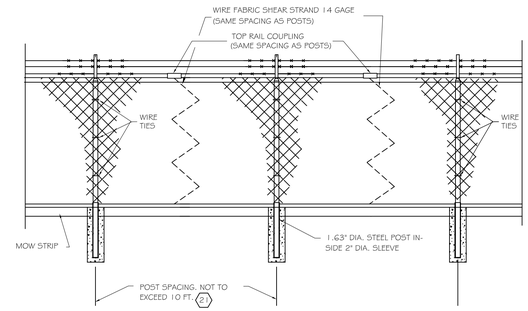
E/3 DETAIL OF NEW FENCE MOW STRIP (TYP).

NO SCALE



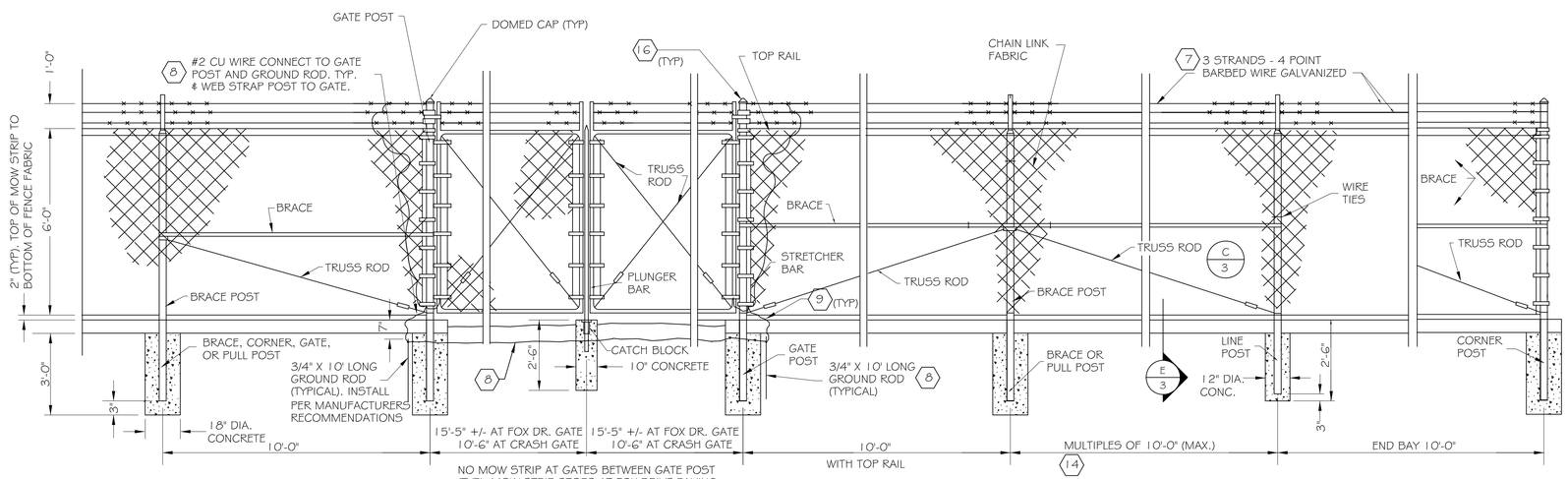
F/3 REPLACEMENT CORNER POST

NO SCALE



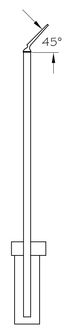
G/3 FRANGIBLE FENCE SECTION (TYP.)

NO SCALE



D/3 CHAIN LINK FABRIC FENCE

NO SCALE



SECTION

LEGEND

(N) GENERAL NOTE, N = NOTE NUMBER, SHEET # 2

"F" SECTION DESIGNATION

"3" LOCATION SHEET WHERE SECTION IS DRAWN

"F" DETAIL DESIGNATION

"3" LOCATION SHEET WHERE DETAIL IS DRAWN

REVISIONS	DATE	DESCRIPTION	DATE	APPROVED

UNITED STATES AIR FORCE — AIR EDUCATION AND TRAINING COMMAND

VANCE AIR FORCE BASE — ENID, OKLAHOMA

XTLF 08-1009 C/R

ATFP CONSTRUCT PERIMETER FENCE

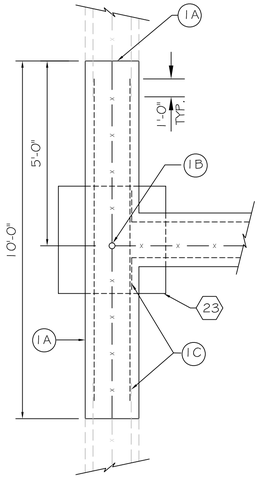
FENCE DETAILS

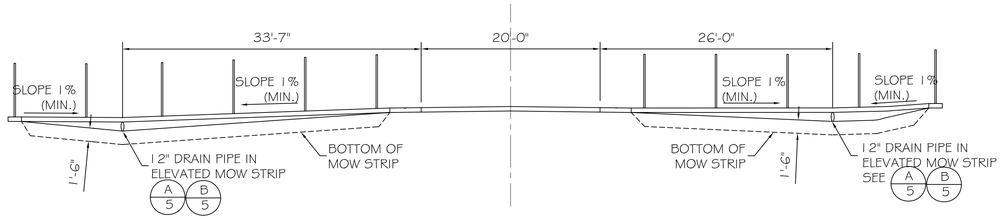
CSC Vance AFB

Computer Since Corporation
140 Channel st., Suite 205
Vance AFB, Ok 73705-5621
(580) 213-7772

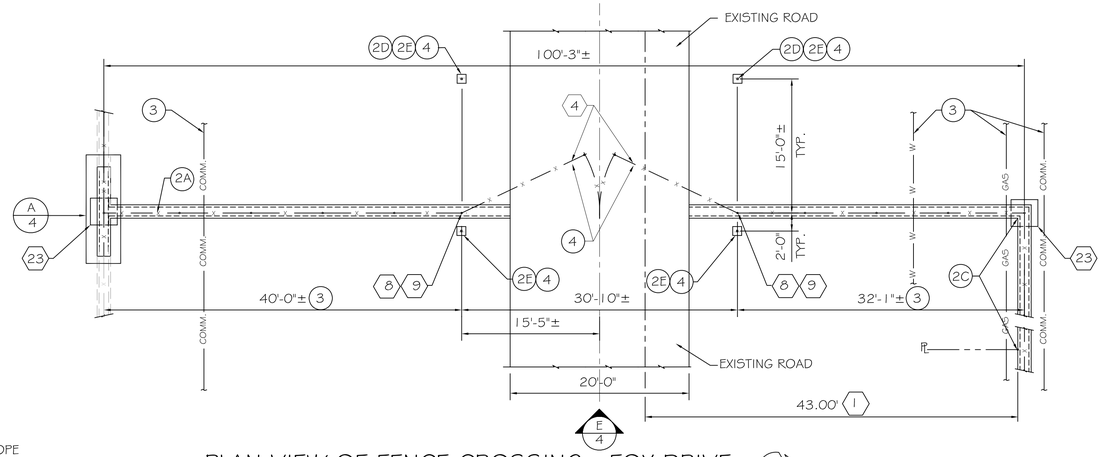
DESIGNED	CHECKED BY	SCALE	DRAWING NUMBER
JS		NOTED	PD-1522
DRAWN BY	DATE	PROJ. NUMBER	SHEET 3 OF 6 C2
MWF/RLM		XTLF 08-1009 C/R	

12-12-06





E/4 ELEVATION VIEW OF FENCE CROSSING - FOX DRIVE
1/8"= 1'-0"

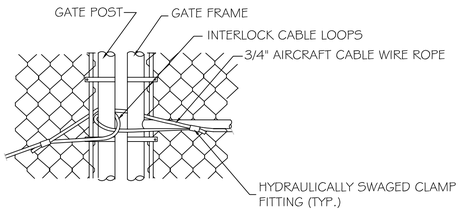


A/4 TIE INTO EXISTING FENCE AT MFH
1/2"= 1'-0"

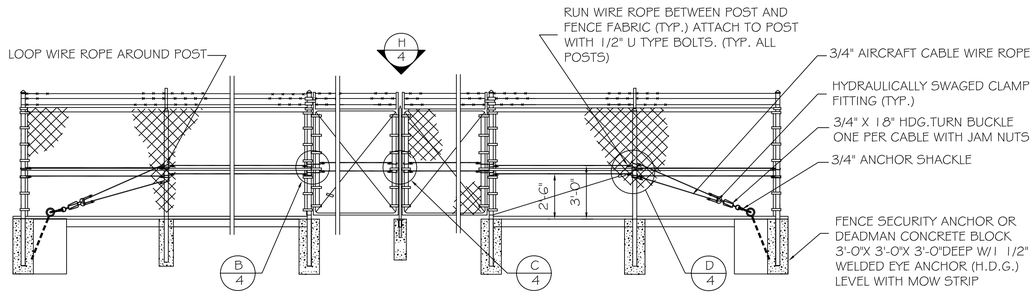
F/4 PLAN VIEW OF FENCE CROSSING - FOX DRIVE
1/8"= 1'-0"

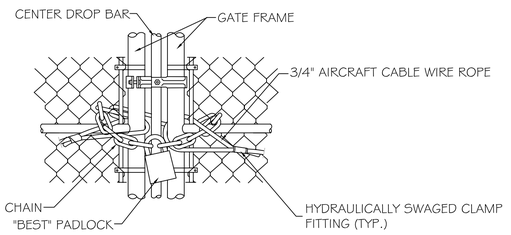
N

FOR FENCE DETAILS RE: SHEET "C2"



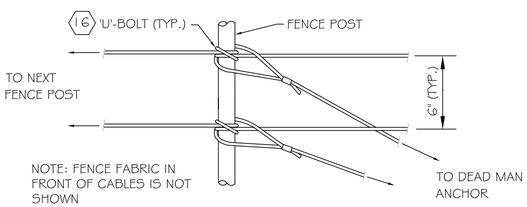
B/4 WIRE ROPE INTERWOVEN AT GATE POST
NTS



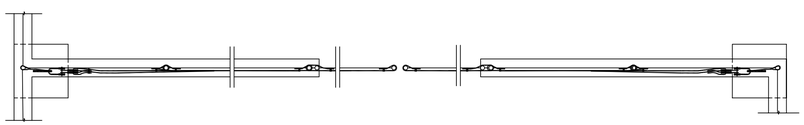


C/4 CHAIN AND WIRE ROPE LOCKING SYSTEM FOR SWING GATES
NTS

G/4 ELEVATION VIEW OF TYPICAL REINFORCEMENT OF CHAIN-LINK FENCE AND GATE
1/4"= 1'-0"



D/4 WIRE ROPE ATTACHMENT TO ANCHOR AT FENCE
NTS



H/4 PLAN VIEW OF TYPICAL REINFORCEMENT OF CHAIN-LINK FENCE AND GATE
1/4"= 1'-0"

FOR FENCE DETAILS RE: SHEET "C2"

DETAIL NOTES: ◯

1. DETAIL, FENCE TIE INTO MFH FENCE:
   A. CUT AND REMOVE EXISTING MOW STRIP, FORM AND PLACE NEW MOW STRIP TYING IN TO THE EXISTING MOW STRIP.
   B. REPLACE THE EXISTING FENCE POST WITH A CORNER POST, WITH ALL HARDWARE. RE-TENSION EXISTING FENCE FABRIC.
   C. TIE EXISTING REBAR TO NEW REBAR, OR DRILL, EPOXY DOWEL INTO EXISTING MOW STRIP, AND INSTALL TWO 1" BY 18" STEEL BARS AT EACH CUT.
2. DETAIL, GATE ACROSS FOX DRIVE:
   A. INSTALL GATE APPROXIMATELY NINE FEET WEST OF PROPERTY LINE TO ALIGN WITH AN EXISTING POST IN MFH FENCE.
   B. GATE AND FENCE WITH MOW STRIP, TO THE NORTH AND SOUTH, SHALL BE INSTALLED TO ALIGN WITH THE MFH FENCE POST APPROXIMATELY NINE FEET WEST OF THE PROPERTY CORNER.
   C. INSTALL A MONUMENT AT THE PROPERTY CORNER, AND PIN THE FENCE CORNER.
   D. TRAFFIC REFLECTOR SIGN IN LINE WITH AND 15 FEET FROM THE GATE POST, WITH A MECHANICAL LATCH TO HOLD THE GATE IN THE OPEN POSITION.
   E. TRAFFIC REFLECTOR SIGN AND POST, POSITION TO PROVIDE TRAFFIC SAFETY FOR GATE POST.
3. CONTRACTOR TO VERIFY UTILITY LOCATIONS AND DEPTH.
4. STOP, AND WARNING SIGNS PROVIDED AND INSTALLED BY CONTRACTOR, SEE SPECIFICATIONS 02821 'FENCE AND GATES', SECTION 2.9.G AND 3.4.N.

GENERAL NOTES: ⬡

FOR ALL GENERAL NOTES REFER TO SHEET "C1".

LEGEND

GAS	GAS LINE
W	WATER LINE
COMM.	COMMUNICATIONS LINE, COPPER OR FIBER
	SECTION LINE
℄	PORPERTY LINE
H.D.G.	HOT DIP GALVANIZE AFTER FABRICATION
(N)	GENERAL NOTE, N = NOTE NUMBER, SHEET # 2
(N)	DETAIL NOTE, N = NOTE NUMBER, SHOWN ON SAME SHEET OR DETAIL

F/3 "F" SECTION DESIGNATION
"3" LOCATION SHEET WHERE SECTION IS DRAWN

F/3 "F" DETAIL DESIGNATION
"3" LOCATION SHEET WHERE DETAIL IS DRAWN

REVISIONS	DATE	DESCRIPTION	DATE	APPROVED

UNITED STATES AIR FORCE — AIR EDUCATION AND TRAINING COMMAND
VANCE AIR FORCE BASE — ENID, OKLAHOMA
XTLF 08-1009 C/R

ATFP CONSTRUCT PERIMETER FENCE

FENCE CROSSING DETAILS AND NOTES

CSC Vance AFB
Computer Since Corporation
140 Channel st., Suite 205
Vance AFB, Ok 73705-5621
(580) 213-7772

DESIGNED	CHECKED BY	SCALE	DRAWING NUMBER
JS		NOTED	PD-1522
DRAWN BY	DATE	PROJ NUMBER	SHEET 4 OF 6
MWF/RLM		XTLF 08-1009 C/R	C3

12-12-06

APPENDIX E – SCHEDULE E

Schedule E

Project Title: Repair Installation Boundary Fence. F7211 **DATE: 22-May-26**

											To Be Completed by ASRC/CEEC					
	Item or Description of Item	Product Data	Shop Drawings	Samples	O&M	MFG REC	COC	WTY	SDS	MISC	Date Received.	Date Approved	Date Disapproved	Date Resubmitted	Date Approved	Date Disapproved
1	Project Schedule															
2	Schedule of Values															
3	Warranties															
4	O&M Manuals															
5	Hazmat/SDS															
6	Inventory of Installed Property															
7	As-Builts															
8	1.04.C.3 P.C. Concrete															
9	1.04.C.4. Grounding Rod & Wire															
10	1.04.C.5.b.1 Chainlink Fence															
11	1.04.C.5.b.2 Chainlink Swing Gates															

COC = Certificate of Compliance MFG REC = Manufacturer's Recommendations
MSDS = Material Safety Data Sheet WTY = Warranty Data