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US Army Corps of Engineers
TransAtlantic Afghanistan District

Design-Build
Northern Electrical Interconnect
Camp Shaheen ANSF

Balkh Province
Afghanistan

Design Criteria and Specifications

10 July 2015

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.1 DEFINITIONS

The following is a list of abbreviations with corresponding definitions for the electrical terminology used in this contract:

V (Volt)	-	Unit of voltage
kV (kilovolt)	-	1,000 volts
W (Watt)	-	Unit of active power
kW (kilowatt)	-	1,000 watts
MW (Megawatt)	-	1,000 kW
Wh (watt-hour)	-	Unit of Energy
kWh (kilowatt-hour)	-	1,000 Wh
MWh (Megawatt-hour)	-	1,000 kWh
VA (Volt-ampere)	-	Unit of apparent power
kVA (kilovolt-ampere)	-	1,000 VA
MVA (Megavolt-ampere)	-	1,000 kVA
VAr (volt-ampere reactive)	-	Unit of reactive power
MVAr(megavolt-ampere reactive)	-	1000 VAr
XFMR (transformer)	-	Ratings as indicated
Transmission System	-	110 kV or 220 kV
Medium Voltage Distribution (MV)	-	20 kV
Low Voltage Distribution (LV)	-	400/230 V
Load Factor	-	Ratio of average power demand to maximum power demand
Electrical Losses	-	Difference between energy delivered and energy sent out
Grid Substation	-	Substation with primary voltage of 110 kV or 220 kV
Distribution Substation	-	Substation with secondary voltage of 400/230 V
NEI	-	Northern Electrical Interconnect

1.2 WORK COVERED BY CONTRACT DOCUMENTS

1.2.1 Project Description

This Design-Build (D/B) contract will expand the high voltage power system at Naiabad Substation in Balkh Province and transmit that power to a new substation, Camp Shaheen Substation, in Balkh Province. This new substation shall distribute power to two Afghan National Security Forces (ANSF) Bases. This new power system will provide electricity to ANSF Bases currently operating on generator power. The objective of this project is to provide a cost effective, reliable transmission and distribution system of electric power. The project consists of a Base Bid as described herein.

1.2.2 Scope of Work

1.2.2.1 Base Bid – Electrification of Camp Shaheen ANSF Bases

a. Design includes expanding Naiabad Substation to transmit power to a new

substation, Camp Shaheen Substation, in Mazari Sharif Province. This new substation shall distribute two 20 kV double circuits to the ANSF 209th Corps Garrison at Camp Shaheen and ANSF facilities at the Dashti Shadian Area. Termination of the 20 kV circuits is located at the existing power plants inside each ANSF Base. A load study shall be performed (load demand) to determine design requirements (equipment capacity and sizing) at the substation and each ANSF base.

Naiabad Substation shall be designed to install a new line bay utilizing the existing space within the footprint of the substation yard. The design shall not utilize the substation's existing electrical spare or future capabilities including available bays and switchgear. Design shall include all necessary equipment and control modifications, additions, and reconfigurations necessary for a complete and usable system. Equipment installed shall be compatible with the existing equipment.

Design a single circuit aerial 220 kV electrical transmission system from Naiabad Substation to the new Camp Shaheen Substation. Design the 220 kV distribution system structures to support two 220 kV transmission circuits. Design shall also include an Optical Fiber Composite Overhead Ground Wire OPGW) for communications and lightning protection.

Camp Shaheen Substation shall have one 220 kV line bay, a 20 kV yard with indoor switchgear, connection to two 220 kV/20 kV power transformer rated no less than 25 MVA each, one 20 kV line bay capable of expansion to 34 MVA, and line dead-end structures for connection to six 20 kV distribution system lines. Six 20 kV distribution dead-end structures shall be built but only four will be utilized for this design. The substation shall be sized to allow expansion to one additional 220 kV line bays, a 20 kV yard with four additional 20 kV line bays, and one 220 kV/20 kV power transformer rated no less than 25 MVA. The substation shall be designed utilizing a main and transfer configuration.

Design two double circuit aerial 20 kV electrical distribution circuits from Camp Shaheen Substation to distribute one double circuit to the ANSF 209th Garrison at Camp Shaheen and the other double circuit to the ANSF facilities at Dashti Sahdian. The facilities to be powered at Dashti Shadian are the ANCOP Centre Site and the ANCOP Expansion Site. Design the 20 kV distribution system structures to support two 20 kV distribution circuits. Each circuit shall distribute and terminate power to each power plant at the ANSF Bases. The 209th Garrison at Camp Shaheen and Dashti Shadeen are divided into two power plants and both power plants shall be powered from the same double circuit from the new Camp Shaheen Substation. Design shall also include an overhead ground wire for lightning protection.

Conceptual distribution and termination plans at the ANSF bases have been provided in Appendix D for information only. Conceptual plans do not reflect installation of a double circuit and are only provided to assist in determining requirements. Conceptual designs are not for construction and all information shall be verified after award. Structures within the ANSF Bases have been coordinated with the ANSF Base Commanders and shall be located as shown. Deviations from these locations shall be approved by the Contracting Officer.

The double circuit 20 kV distribution system shall terminate into the existing 20 kV switchgears located at each ANSF 209th Garrison power plant at Camp Shaheen. The switchgear, controls, relays, protection scheme and all

other associated equipment shall be expanded and reconfigured to accept both circuits to form a complete and usable system. Design shall also have provisions to ensure when the power plant is operating on generator power back feeding into the electrical grid does not occur. Transferring power from utility to generator power shall be manual.

The other double circuit 20 kV distribution system shall terminate into the existing 380 V switchboards located at the ANSF facilities at the Dashti Shadian area power plants. Design shall include the installation of a 2.5 MVA, 20 kV/ 380 V step-down transformer. The switchgear, controls, relays, protection scheme and all other associated equipment shall be expanded and reconfigured to accept both circuits to form a complete and usable system. Design shall also have provisions to ensure when the power plant is operating on generator power back feeding into the electrical grid does not occur. Transferring power from utility to generator power shall be manual.

Substation designs shall include all necessary functions including grading, drainage, landscaping, lighting, switchyard, roads, fences, grounding, structural foundations, dead-end towers, bus work, lightning and surge protection, instrument transformers, transformers, breakers, disconnects, and telecommunication systems for voice, data and security utilizing the OPGW unless noted otherwise above. Substations shall also include force protection measures, parking areas, emergency generators, fuel storage and other incidental systems to provide a complete and functional substation.

Substation designs shall include a control building utilizing the OPGW (Optical Fiber Composite Overhead Ground Wire) for SCADA/EMS (System Control and Data Acquisition/Emergency Management System). The control building shall include DABS industry standard bus, transformers, breakers, and line protection. It shall also be sized and equipped with panels to allow expansion as indicated for substation line bays. Control building shall include one room for the relay panel and the AC/DC equipment, a switchgear room, a battery room, a Heating, Ventilating, and Air Conditioning (HVAC) system, a storage room, a workshop, an office, a kitchen and a Wash Closet/Bathroom. Designs shall include interior and exterior utility services such as electric, telecommunication, water supply, wastewater and other incidental systems to provide a complete and functional building.

The DOR (Designer Of Record) design shall provide a radial and network load flow and stability analysis to determine necessary reactive power support. It shall include reactive power support equipment such as switchable network reactors and capacitors including all necessary control and protection.

An OPGW shall be designed on the transmission system and shall be suitable for communication systems such as SCADA/EMS, protective relay, and voice/data circuits. The right-of-way shall be obtained in accordance with section 01 11 05 paragraph RIGHT-OF-WAY (ROW) AND LAND AQCUSITION.

b. Provide all costs connected with the mobilization and demobilization of the Contractor's plant and equipment required for construction of the base bid. These items will be paid for at the contract lump sum prices for these items as listed in the Bidding Schedule.

c. Construct the expansion to Naiabad Substation per contractor’s design.

d. Construct the 220 kV electrical transmission system per the contractor’s design.

e. Construct Camp Shaheen Substation per contractor's design.

f. Construct the 20 kV electrical distribution system from Camp Shaheen substation to the ANSF 209th Garrison at Camp Shaheen per the contractor's design. Work shall only include the distribution system from the substation to the perimeter of the ANSF base.

g. Construct the 20 kV electrical distribution system from Camp Shaheen substation to Dashti Shadeen per the contractor's design. Work shall only include the distribution system from the substation to the perimeter of the ANSF base.

h. Construct the terminations into the ANSF 209th Garrison at Camp Shaheen power plants per the contractor's design. Work includes the 20 kV distribution system from the perimeter of the ANSF base to the power plants and all work associated with connecting the distribution system to the existing power plants.

i. Construct the terminations into the ANSF facilities at Dashti Shadian power plants per the contractor's design. Work includes the 20 kV distribution system from the perimeter of the ANSF base to the power plants and all work associated with connecting the distribution system to the existing power plants.

j. Demining for Base Bid work shall be as specified in Section 01 11 05 DESIGN REQUIREMENTS.

k. Security for Base Bid work shall be as specified in Section 01 35 53 SECURITY.

1.3 CONTRACT DRAWINGS

The following drawings in the listed appendices accompany this contract and are a part thereof for reference only as stated in paragraph 1.6.4 REFERENCE DOCUMENTS:

APPENDIX A – PROJECT AREA MAP

APPENDIX B – TRANSMISSION AND DISTRIBUTION SYSTEMS PLANS AND PROFILES

APPENDIX C – STRUCTURE STAKING COORDINATES

APPENDIX D – CONCEPTUAL DISTRIBUTION AND TERMINATION PLANS AT ANSF BASES

APPENDIX E – CONCEPTUAL ELECTRICAL SINGLE LINE DIAGRAMS AND SUBSTATION LAYOUT

APPENDIX F – OPGW DESIGN DATA

APPENDIX G - PREPARATORY LAND ACQUISITION CONSULTANCY SERVICES

1.4 GOALS AND OBJECTIVES

The goal of this project is to connect ANSF Bases to the existing electrical power system throughout Afghanistan. A focus on quality shall be maintained

throughout the project development and construction. The objectives are to deliver the project on time and in a safe manner, which meets the specific needs of the user.

1.4.1 Electrical Equipment Durability

Materials and equipment shall be chosen for their durability to withstand the extreme environments of Afghanistan. The overall design will conserve manmade resources whenever possible.

1.4.2 Alternate Construction Methods

Alternate methods and materials, which represent value-for-the-money, will be considered for all aspects of the project. The intent of this design-build proposal is to present the overall design parameters with some definition of the systems to be used. Assemble the best value-priced construction systems for this project that meet or exceed the design criteria set forth herein.

1.4.3 Reference Documents

There may be references (outside design resource documents) included in this contract that are not specifically referred to in the criteria requirements (i.e. List of References). Such references are intended only as support documents for design to the designer, unless referred to specifically in the criteria sections. These references are not intended to add additional scope to the project. If conflicts arise between this request for proposal and these references, the requirements stated in this contract shall govern.

1.5 OPERATION AND MAINTENANCE REQUIREMENTS/TRAINING

1.5.1 Operation and Maintenance Manuals

The intent of the O&M Manuals is to promote and maximize the efficiency, economy, safety, and effectiveness of the life cycle operation, maintenance, and repair of the transmission system and substations including all interconnection equipment. The contractor shall provide operation and maintenance manuals as required by Section 01 78 23 of this contract.

1.5.2 Training

The Contractor shall provide adequate operational and maintenance training appropriate for the design for all systems furnished under this contract including transformers, SF-6 circuit breakers, controls, vacuum circuit breakers, relaying system protection, line maintenance, power grid operation, etc. The training will be for the operating and maintenance personnel. This training will be provided in accordance with the requirements set for in this contract. Provide 24 hours of training for 20 personnel per substation, for each substation to educate the on-site personnel on the proper operation and maintenance of the substation. Assume that the individuals to be trained have entry level knowledge of electrical fundamentals, and are proficient in Dari or Pashto (not English). The trainings shall be conducted using these languages. The training shall be video recorded and three copies shall be submitted for review and approval by the government.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01 11 05

DESIGN REQUIREMENTS

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PART 1 DESIGN OBJECTIVES

1.1. GENERAL

1.1.1. The objective of this solicitation is to connect the Afghan National Security Force (ANSF) 209th Corps Garrison at Camp Shaheen and ANSF facilities at the Dashti Shadian Area to the existing electrical transmission system in Afghanistan as described in Section 01 11 00. The system shall operate in a reliable and stable manner within voltage tolerances over the full range of loading conditions.

1.1.2. All transmission and distribution line, substation drawings and power plant drawings in the Appendices including elevations, details, site plans, structures, and substation configurations are indicative of the conceptual design required for project completion. The Designer of Record (DOR) shall use these concept design documents as a starting point in their development of the completed design. Site plans are prescriptive (including dimensions) and shall be followed by the Design-Build (D/B) Contractor to comply with the functional needs outlined and specified within the documents provided. Final design development is the responsibility of the DOR. Refer to drawings located in Appendix B of this contract for terrain descriptions and Plan and Profiles. These drawings represent the routing and terrain along the preliminary transmission and distribution line corridor. Proposed alignment and tower locations shown are approximate. The contractor shall use the alignment and tower locations shown when practical, however the Contractor may alter the transmission and distribution line routing to enhance design, comply with codes, incorporate options, include betterments, or support constructability. Actual locations shall be determined during the design phase. Appendix D provides the distribution alignment within the perimeter walls of the 209th Garrison at Camp Shaheen and the facilities at the Dashti Shadian Area. The distribution alignment and structure locations shall be located as shown on plans in Appendix D. The locations shall be coordinated with the base commander and may move with approval of the Contracting Officer. The distribution line alignments proposed in Appendix B shall connect to the distribution alignment shown in Appendix D and at the utility connection points shown in the drawings in Appendix D. The contractor shall coordinate with any local airports and determine in the line will affect air traffic and relocate the line as necessary.

1.1.3. There shall be construction fencing around the contractor’s lay down yard, staging area, or other areas used for the contractor’s activities and those areas shall be part of this project from the beginning of the Contractor’s activity on the site until the final work is accepted by the government unless otherwise directed by the Contracting Officer. All areas were the Contracting Officer has provided approval for construction activities to begin or where approval has been given for use as a lay down, staging or other construction use area will be under the control and security of the D/B contractor to execute the work of the project.

1.2. APPLICABLE CRITERIA

1.2.1. Applicable design and construction criteria is specifically indicated, but not limited to that mentioned in this Section. Criteria shall be taken from the most current references as of the date of issue of the contract, unless otherwise noted. Referenced standards and specifications are minimum acceptable criteria. Administrative, contractual, and procedural features of the contract shall be as described in other sections of the contract.

1.2.2. Design and construction shall comply with the requirements contained in this contract. The design and technical criteria contained and cited in this contract establish minimum standards for design and construction quality. The Designers of Record shall use British Standards (BS) and International Electrotechnical Commission (IEC) standards to fully develop the technical specifications and construction drawings. When other standards and codes exist that are national or relate to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified can be submitted for approval by the Contracting Officer.

1.3. DESIGN REQUIREMENTS

1.3.1. Requirements stated and illustrated in this contract are intended as minimums. The transmission and distribution system and substation plans, details and diagrams are to be adhered to in so far as the general concepts show. Innovative, creative, or cost-saving proposals which meet or exceed these requirements are encouraged and will be considered during the design submittal reviews.

1.3.2. The drawings provided establish project requirements and spatial relationships of equipment that have been reviewed for user function and preliminary code compliance. Site and substation layout plans and transmission and distribution line routing may change with Government approval to enhance design, comply with codes, incorporate options, include betterments, or support constructability.

1.4 RIGHT-OF-WAY (ROW) AND LAND ACQUISITION

1.4.1 The Contractor shall design the transmission and distribution lines to follow the National road within the associated right-of-way, to the greatest extent possible. Submit the proposed transmission and distribution line routing (right-of-way minimum width shall be 25m for the transmission line and 15m for the distribution line) to the Government within the time specified below. Verification of property ownership, appraisals and documentation shall be prepared by a Land Acquisition Specialist as specified below and in 01 33 05 paragraph 2.4.3. The Government of Afghanistan (GIROA) will obtain the necessary real estate. Allow for a minimum of 150 calendar days for the Government of Afghanistan to obtain the real estate.

Schedule of ROW & Land Acquisition Submittals

Interim (60%)	Final (100%)
ROW Submittal 1,2	ROW Submittal 1,2

Base Bid	45	90

(1) Calendar days after receipt of Initial NTP.
(2) The 60% submittal shall include proposed routing plan and obstacles.
(3) The 100% submittal shall include final routing plan, obstacles and land acquisition information as described in paragraph below.

1.4.2 The Contracting Officer will not issue the Construction Notice to proceed for the Base Bid until the land and ROW issues are resolved for that portion of work.

1.4.3 Scope for Preparatory Land Acquisition Specialist (Consultancy Services): The scope of verification will be the areas falling under the transmission and distribution system corridor and substation areas. The contractor shall assist GIROA to acquire the land by performing the following tasks; survey the route of the line, identify/authenticate the land owners affected by construction, obtain existing land ownership documentation, identify the compensation cost that the land owner desires and the appraised value and submit the real estate ownership information, identified land compensation costs, and coordinates of the area to be used. The land acquisition specialist shall be furnished with the transmission and distribution line routing and substation layout drawings. Land shall be identified for the rightful owner and appraised value. Similarly structures/building shall be identified for the rightful owner and its appraised value. Land/ properties that are in the footprint of the transmission and distribution system corridor and are within the substation perimeter belonging to Government of the Islamic Republic of Afghanistan (GIRoA) shall be identified for relevant authorities' action. The activities include preparation of sketches identifying properties, appraisal values and any other documentation that will support the specialist work and aid the GIRoA in acquiring the properties so that the transmission and distribution system can be built. Relevant polices, handbooks, and guidelines of Asian Development Bank (ADB) shall be adhered to in preparation of the documentation. Specialist shall add to the documentation if the specialist believes through investigative work that particular areas or structures have to be acquired through involuntary means. In addition the consultant will review the site/route surveys for the project to determine the most cost effective design, wherever possible, seeking to avoid involuntary resettlement and land acquisition and furnish recommendation.

1.4.4 Potential consultants who can provide Preparatory Land Acquisition Services are provided in the Appendices. They are provided for information only and are not limited to the Consultants listed.

PART 2 TECHNICAL REQUIREMENTS - GENERAL

2.1. GENERAL REQUIREMENTS

2.1.1. Existing System Coordination

The transmission and distribution system being constructed shall be

coordinated with the existing national transmission and distribution system. It shall operate seamlessly (functionally and electrically) as part of the existing completed national transmission and distribution system. The transmission and distribution system design should minimize maintenance and warehousing expenses by selecting products, equipment, and technical specifications being utilized on other portions of the national transmission and distribution system.

2.1.2. Mobilization/Demobilization

Sixty percent of the lump sum price for mobilization and demobilization will be paid to the Contractor upon completion of his mobilization at the work site. The remaining forty percent will be included in the final payment for work under this contract.

In the event the Contracting Officer considers that the amount in these items (sixty percent) which represents mobilization does not bear a reasonable relation to the cost of the work in this contract, the Contracting Officer may require the Contractor to furnish cost data to justify this portion of the bid price. Failure to justify such price to the satisfaction of the Contracting Officer will result in the payment of actual mobilization costs, as determined by the Contracting Officer, at the completion of mobilization. The payment of the remainder of this item will be included in the final payment under the contract. The determination of the Contracting Officer in these circumstances is not subject to appeal.

2.2. SYSTEM CHARACTERISTICS AND CLIMATIC CONDITIONS

All equipment shall be designed for efficient operation under Afghanistan's climatic conditions, which can be very harsh with snow and ice in winter and hot and dusty conditions in the summer. The following system characteristics and climatic conditions data are provided for guidance in designing the equipment. Additional information regarding geographic conditions is included in the plan and profile drawings included in Appendix B of this contract. The Contractor is responsible for verifying existing conditions prior to the commencement of the design.

HV Transmission System

Parameter	**220 kV System**
Nominal voltage (Un)	220 kV
Highest system voltage (Umax)	245 kV
Design voltage Um	245 kV
Standard frequency	50 Hz
Rated short time current:	25 kA/1 sec
System configuration	3 Ø, 3 wire
Earthing	Solidly earthed

Parameter	**220 kV System**
Insulation coordination	IEC 60071-1
Rated impulse withstand (peak) 0-1,500 m a.m.s.l.	950 kV
Rated impulse withstand (peak) 1,501-2,500 m a.m.s.l.	1,050 kV
Rated 1 min power frequency withstand kV rms), 0-1,500 m a.m.s.l.	395 kV
Rated 1 min power frequency withstand (kV rms), 1,501-2,500 m a.m.s.l.	460 kV
Minimum phase-to-earth air clearance	
Minimum phase-to-earth air clearance	2,100 mm
Creepage distance outdoor	25 mm/kV
Vector group of feeding transformers	YNd5 and YNdll

MV Distribution System

Parameter	**20 kV System**
Nominal voltage Un	20 kV
Highest system voltage Umax	24 kV
Design voltage Urn	24 kV
Standard frequency	50 Hz
Rated short time current:	12.5 kA/1 sec
System configuration	3 Ø, 3 wire
Earthing	Solidly earthed
Insulation co-ordination	IEC 60071-1,-2
Rated impulse withstand (peak)	150 kV
Rated 1 min power frequency withstand (rms)	50 kV
Minimum phase-to-earth air clearance	320 mm
Creepage distance outdoor	25 mm/kV
Vector group of feeding	Yzn5 up to 160 kVA

Parameter	**20 kV System**
transformers	and Dyn5 above 160 kVA

LV Distribution System

Parameter	**LV System**
Nominal voltage Un	400/230 V
Design voltage Um	0.6/1 kV
Voltage variation	±7.5%
Standard frequency	50 Hz
Rated short time current:	12.5 kAl1 sec
System configuration	3 Ø, 4 wire or 1 Ø, 2 or 3 wire, plus protective earth TN-S
Earthing	Solidly earthed, TN-S

Climate and Geographic Conditions

Altitude	300 to 500 meters a.m.s.l.
Dry Period	June to November
Rainy Period	December to May
Annual Rainfall	327mm
Air Temperatures:	
Average	+12.6°C
Maximum	+45.0°C
Minimum	-15.0°C
Air Humidity:	
Average humidity summer	35%
Average humidity winter	75%
Thermal Resistivity, Soil:	
Average	1.2°C m/W
Maximum	3.0°C m/W
Maximum Solar Radiation	1,200 W/m^2
Wind	
Maximum Wind Velocity	41 m/s (148 km/h)
Wind and Dust	Sand and dust storms in summer
Isokeraunic Level	23 Thunderstorm days/year

2.3. NOT USED

2.4. SITE REGULATIONS AND SAFETY

2.4.1. The Contracting Officer and the Contractor shall establish Site regulations according to the General Conditions of Contract.

2.4.2. Work in existing substations shall be carried out while the station is in service, and only short interruptions for temporary connections and arrangement of safety barriers are permitted. The

Contractor shall arrange for all temporary connections and safety, which shall be approved by the Contracting Officer.

2.5. NOTICES AND PERMITS

The Contractor shall give the requisite notice to Government Inspectors as may be required in the case of excavations, trenching and (in particular) blasting operations and pay for all permits required prior to and during the execution of the Contract including those required for all temporary works.

For use of explosives obtain written approval from the appropriate GIRoA local officials and the local Coalition Forces (CF) commander, for transportation and use of explosives during construction. Maintain a daily log of explosives in inventory and daily usage by quantity. This log shall be available at the explosives storage location and subject to review by the PPO or his representative. Notify Coalition Forces (CF) in advance of any demolition/ rock excavation work that will occur within 2 kilometers of any CF positions or encampments. Notify the PPO in advance if demolition or rock breaking will deny CF vehicles access to the route for more than 8 hours.

2.6. VERIFICATION OF DIMENSIONS

Before work is commenced on any structural element required to be fabricated or provided under this Contract, the Contractor shall verify by measurement on site, the relevant dimensions of all work previously completed.

2.7. CONSTRUCTION SITE MAINTENANCE

Throughout the progress of the Works the Contractor shall keep the site and all working areas in a tidy and workmanlike condition, and free from rubbish and waste materials. Equipment and construction materials which (temporarily) are not required for use by the Contractor shall be dispersed about the site in an orderly fashion and shall be properly and securely stored. The Contractor shall not remove any construction plant, materials, etc. from the Site without the consent of the Contracting Officer.

2.8. REINSTATEMENT

Reinstatement of any areas, including existing amenities and structures, affected by the Contractor's establishment, temporary works, access routes, spoil disposal areas and the like, shall include restoring such areas to at least the condition, degree of safety, drainage and stability as existed before the Contractor entered the Site. Restoration shall include clearing and removing all rubbish and waste, breaking up and removing all concrete slabs and hard standings and re-grading the ground to match adjacent slopes, replacing topsoil to a depth equal to that originally in place, fertilizing and establishing an approved grass cover.

2.9. NOT USED

2.10. DABS PERSONNEL TRAINING

2.10.1. Operation and Maintenance Training

2.10.1.1. The Contractor shall provide operational and maintenance training to DABS personnel (maximum 10 per substation/connection) for all systems furnished under this contract including sectionalizing equipment, line maintenance, power grid operation, etc. The training will be for the operating and maintenance personnel. This training will be provided in accordance with the requirements set forth in the procurement and shall be provided in accordance with Paragraph 1.5.2 of Section 01 11 00 of this contract.

2.11. TEST AND INSPECTION

2.11.1. Test and Inspection shall be carried out according to the requirements given in the General Conditions of the Contract.

2.11.2. A program of the tests in the factory and at the Site is to be mutually agreed upon between the Contractor and the Contracting Officer. The tests applied at works shall comprise those type and routine tests described in the British Standard recommendations, but the type tests may not be required if the Contractor can satisfactorily show that such tests have been made on essentially similar equipment. The Contractor shall supply all necessary test equipment and furnish certificates, records and curves for all routine and site tests.

2.11.3. On completion of erection and before commissioning, the equipment shall be fully tested to a schedule of tests previously agreed with the Contracting Officer, to demonstrate its suitability for commercial use. The tests shall include, but not be limited to:

2.11.3.1. Insulation resistance

2.11.3.2. Operation and load checks.

2.11.4. All apparatus shall have at least the data specified in the Technical Specifications. The data shall be verified in reports of type tests performed by an independent authority in accordance with the British Standards. All type tests shall be performed in a country outside the country of origin of the apparatus.

2.11.5. Such type tests shall have been performed less than 5 years previously. Such reports shall be submitted for the approval of the Contracting Officer on request.

2.11.6. The Contractor shall submit for approval a detailed program of quality control and inspection and testing procedures and methods proposed. The contractor shall also retain full responsibility for the quality control, inspections and tests. All instruments and equipment necessary for testing shall be provided by the Contractor. The test reports shall be submitted to the Contracting Officer for review and approval in three copies.

2.12. SITE COMMISSIONING AND TESTS

2.12.1. Commissioning is the process to verify to the Government that systems, equipment, mechanical, electrical, controls and special systems function together properly to meet performance requirements and design intent, and as described in the Contract Documents. The Contractor shall be responsible for executing and performing the commissioning process. The Contractor shall furnish labor and materials sufficient to meet all requirements of commissioning under this contract.

2.12.2. A Commissioning Firm shall perform commissioning duties. The firm shall be a tier-one Sub-Contractor and shall be financially and corporately independent of all other Sub-Contractors. The Commissioning Firm shall report to and be paid by the prime Contractor. The Commissioning Firm shall be an entity specializing in the commissioning of transmission and distribution systems, electrical substations, and building systems of similar scope and complexity to those of this project. They shall be certified by an internationally recognized commissioning group such as AABC Commissioning Group (ACG), NEBB or equivalent as approved by the Contracting Officer.

2.12.3. The Commissioning Agent shall develop a commissioning plan for approval. The Commissioning Plan is a tool through which the commissioning process is described and incorporates the Government, Contractor and Commissioning Specialist roles relative to the commissioning process. Commissioning team members are all contractors, subcontractors, design professionals, government representatives (USACE and using agency) whose participation is of benefit in the delivery of a fully functioning project. The plan shall describe the communication, authority and responsibility of commissioning team members.

2.12.4. The Preliminary Commissioning Plan shall include the following:

2.12.4.1. The purpose of commissioning

2.12.4.2. Detail the commissioning process

2.12.4.3. Commissioning team member's responsibilities

2.12.4.4. Schedule of commissioning activities

2.12.4.5. Documentation requirements

2.12.4.6. Communication & reporting protocols

2.12.4.7. Systems to be commissioning

2.12.5. The Final Commissioning Plan shall include:

2.12.5.1. All items in the Preliminary Commissioning Plan updated to reflect any changes.

2.12.5.2. Detailed Pre-functional Construction and Functional Performance Test Checklist Procedures. The detailed functional performance test procedures shall explain,

step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the sequences of operation, and other contract documents.

2.12.5.3. Guidelines for acceptance of each piece of equipment or system. Expected results for each test shall be included.

2.12.6. At sites the supplied equipment shall be completely tested by the Contractor. All tests shall be carried out by experienced test engineers. Special requirements for the site tests are specified in the different clauses of the Technical Specification.

2.12.7. Testing shall in principle be done during normal working hours. Test involving equipment in operation may be done after working hours if necessary.

2.12.8. The Contractor shall record the test results in an approved form in such a manner that the test reports can be used as the basis for future maintenance tests. No tests in the agreed program shall be waived but on the Contracting Officer's written instruction.

2.12.9. All test equipment must be supplied as needed by the Contractor and must be certified and calibrated by a recognized European or American agency with a current test certificate.

2.12.10. All 220 kV, 110 kV and 20 kV protection setting calculations, including any amendments and changes to the existing protection settings at existing substations shall be supplied by the Contractor Designer of Record. The DOR will be responsible for the relay protection design and any changes to their system will be required to be approved by the DOR. Any changes to the existing substations shall be documented by the DOR. The protection settings shall be modeled with PSS/E (Power System Simulator for Engineers©) or similar software and the protection model source file shall be supplied in electronic form on CD, together with a hard copy of the protection setting calculations.

2.13. PACKING AND TRANSPORT MARKING

2.13.1. All parts of the Plant and Equipment shall be well packed and protected against loss or damage during the transport by sea and over land and whilst in storage under adverse climatic conditions. All packing shall be performed in such a way that the equipment will not be damaged by overturning of the packages. Dimensions of packages, crates, etc., shall be suitable for road transport. Instruction for handling shall be clearly marked on all parts, packages and crates.

2.13.2. All parts, packages and crates shall be adequately marked in order to enable identification. Each item contained in a package shall be clearly identified on the packing list by its description and part number and assembly drawing reference, and each item shall be marked or labeled to correspond with the packing list. The marking system to be used shall be as instructed by the Contracting Officer.

2.13.3. The cost of all equipment needed for the temporary fixing and supporting of the various parts of the Plant and the various packages to crane hooks, etc., during handling, transport and storage and the cost of load distribution beams, etc., where they form part of the packing or crates, shall be included in the Bid Price.

2.13.4. The Contractor shall be entirely responsible for all packing and any loss or damage of equipment. Damaged goods shall be replaced with new or repaired at the discretion of the COR at the Contractor's expense. Any costs associated with the delay to the project milestones in the project schedule shall be borne by the Contractor.

2.13.5. Any transshipment of materials and equipment through countries adjacent to Afghanistan shall be the Contractor's responsibility. Any costs associated with transshipment of materials and equipment shall be deemed to be included in the Contract Price.

2.13.6. Identification, reinforcement or upgrading of roads/bridges for access to the site and for transport of equipment and materials shall be the responsibility of the Contractor. Any costs associated with identification, reinforcement and upgrading of roads and bridges shall be deemed to be included in the Contract Price.

2.14. CORROSION PROTECTION AND PAINTING

2.14.1. General

2.14.1.1. All parts of the Plant shall be protected against corrosion under service conditions. The protection shall also prevent corrosion during transport, storage and erection. Due to the potential of high humidity at the Site, the protection shall be carried out at the Contractor's workshop.

2.14.1.2. Damage to the protection during transport, erection, etc., and erection joints, shall be repaired to the same quality as specified for the object.

2.14.2. Galvanizing

2.14.2.1. All ferrous parts that are exposed shall be galvanized. Galvanizing shall be applied by the "hot dip" process and shall consist of a continuous coating to minimum weights (indicated in g/m^2) as follows: Rolled steel exposed to the atmosphere only – 600; Rolled steel under the ground surface - 1,500; Cast iron and malleable iron – 600; Bolts, nuts and washers – 375.

2.14.2.2. The zinc coating shall meet the requirements according to BS 729, ASTM, A123, A153, A239 and A385.

2.14.2.3. All steel shall be fully fabricated before galvanizing, no machine or shop work, boring, punching, etc., will be allowed after galvanizing.

2.14.3. Structural Steel and Cast Iron

2.14.3.1. Structural steel shall be made by the open-hearth basic oxygen or electrical furnace process.

2.14.3.2. In order to reduce the risk for material confusions, only two strength classes may be used.

2.14.3.3. Steel shall comply with the requirements of ASTM A 143 and embrittlement tests shall be made in accordance with that specification.

2.14.3.4. If the Contractor intends to use more than one quality of steel, they will be required to take every precaution to the satisfaction of the Contracting Officer, against any possible intermixing of different qualities during transport, storing, handling manufacture and installation.

2.14.3.5. Cast iron shall have a tensile strength of at least 140 N/mm^2. It shall be made from the best grey pig and scrap iron, and shall be close-grained, tough and uniform in character.

2.14.3.6. Malleable iron shall be of the black heart type with a tensile strength of not less than 330 N/mm^2.

2.14.4. Copper, Aluminum Alloys and Clad Steel

2.14.4.1. Copper and aluminum stranded conductor material shall meet the requirements of British Standards.

2.14.4.2. The specification of proposed aluminum alloys shall be submitted for approval.

2.14.4.3. The preferred aluminum-clad steel to be supplied is Alumoweld or substantially equivalent.

2.14.4.4. The preferred copper-clad steel to be supplied is Copperweld or substantially equivalent.

2.15. MARKING

A legible mark of origin shall be applied on all castings and forgings, particularly on conductor and overhead ground wire hardware, and on insulators and associated hardware. Insulators shall, in addition, be marked with the mechanical or electromechanical failing load or a corresponding code number. Each separate member of the structure shall be marked indicating structure type, number and the piece corresponding to the shop drawings. These marks shall be embossed into the steel before galvanizing, or concrete as part of the casting, in such a manner as to be plainly visible after manufacture.

2.16. MAINTENANCE TOOLS AND APPLIANCES

2.16.1. The Contractor shall include and supply all tools and appliances that are required for the normal operation and maintenance of the equipment being supplied under the Contract. All tools and appliances shall be subject to the inspections and/or the tests on the functions specified in the Contracting Officer Requirements and guaranteed in the accepted drawings.

2.16.2. Instruction manuals of tools and appliances shall be submitted for approval in the same manner as the installation operation and maintenance manuals and when finally approved, one original and three copies shall be prepared and forwarded to the Contracting Officer.

2.16.3. Each tool and appliance shall be clearly marked with its size and/or purpose and shall be packed in the appropriate box with three (3) sets of an operation and maintenance instruction book. All name plates, duty labels and instruction plates on tools and appliances shall be marked in English.

2.17. TRAINING OF OPERATION AND MAINTENANCE STAFF

The Contractor shall provide training for the Contracting Officer's operation and maintenance staff. The training shall be carried out at each Site in conjunction with scheme commissioning, and shall be provided in accordance with Paragraph 1.5.2 of Section 01 11 00 of this contract.

2.18. AUXILIARY ELECTRICAL SUPPLY

The Contractor shall be entirely responsible for providing auxiliary electricity supplies needed on site for construction and commissioning.

2.19. TEMPORARY SITE INSTALLATION

2.19.1. The Contractor shall be entirely responsible for providing all temporary site installations of every kind that may be required for carrying out the works including the facilities concerning office, living accommodation, fenced storage areas, lockable sheds, installations for supply of industrial water, power and compressed air, etc. The Contractor shall plan all temporary site installations required for the works to the approval of the Contracting Officer.

2.19.2. All costs for the construction and/or supervision and the removal or handing over to the Contracting Officer of all temporary site installations shall be deemed to have been included in the schedules.

2.19.3. The Contractor shall construct a temporary 1.8 meter high chain link fence around trailers, materials and other construction activities. The fence shall include plastic strip inserts, colored green or brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be

placed or stored outside the fenced area unless approved in writing by the Contracting Officer.

2.19.4. The Contractor shall erect suitable temporary fences, lighting, and necessary structures to safeguard the site, materials and plant against damage or theft and for the protection of the general public and shall adequately maintain the same throughout the course of the contract.

2.20. RUNNING COST

2.20.1. The Contractor shall be entirely responsible for the running and maintenance costs throughout the period when the site works are being carried out, including all temporary site installation works.

2.20.2. The costs for running and maintaining the temporary site installations together with other running costs necessary for the satisfactory execution of the work shall be deemed to have been included in the schedules.

2.21. LANDMINES AND UNEXPLODED ORDINANCE

2.21.1. The entire corridor along the transmission and distribution line called Right-Of-Way (ROW) (25m for transmission and 15m wide for distribution) shall be surface swept. Areas for construction activities shall be swept and demined as described herein.

2.21.2. The Contractor shall hire/use clearance/removal services from UN Mine Action Center for Afghanistan (UNMACA http://www.macca.org.af/macca/) accredited entities. Clearance shall be accomplished to the Contractor designed foundation depths. For sub-surface construction activities performed on this site, the minimum clearance depth will be 1 meter. Clearance by definition is an investigation and clearance of all sub-surface metallic anomalies on the site. Search for, identify and clear all mines and unexploded ordnance (UXO) from the construction areas for sub surface construction activities. Clearance/removal shall only be undertaken in accordance with International Mine Action Standards (IMAS), Afghanistan Mine Action Standards (AMAS), and applicable U.S. Army Corps of Engineer (USACE) Ordnance & Explosives (OE) safety standards. These standards can be found at http://www.mineactionstandards.org. When mines and/or UXO's are identified, place them in a location in accordance with IMAS/AMAS/USACE until destruction of the items can take place. Construction shall not commence in any area that has not been cleared.

2.21.3. Submit a standard UXO/Demining safety work plan to the UXO/Demining COR for review prior to commencement of all UXO clearance/demining activities on the project. After the UXO/ Demining clearance has been performed, provide the UXO/Demining COR a clearance certificate for review and approval prior to the commencement of any construction activities. Provide a copy of the clearance certificate to the UNMACA for entry into their country wide database. A final signed copy of the UNMACA certificate shall be submitted to the UXO/Demining COR.

2.21.4. It is the responsibility of the Contractor to be aware of the risk of encountering UXO/mines and to take all actions necessary to assure a safe work area to perform the requirements of this contract. The Contractor assumes the risk of any and all personal injury, property damage or other liability arising out of or resulting from any Contractor action taken hereunder. The Contractor may not handle, work with, move, transport, render safe, or disarm any UXO/mine, unless they have appropriate accreditations under the IMAS/AMAS from the UNMACA.

2.21.5. Coordinate with the Contracting Officer for the government UXO/Demining point of contact.

2.21.6. If during construction, the contractor becomes aware of or encounters UXO/mines or potential UXO/mines, the contractor shall immediately notify the COR, mitigate any delays to scheduled or unscheduled contract work, and clear/remove the UXO/mines.

2.21.7. For previous UXO/mine information, and a copy of the clearance certification the following points of contact from the UN Mine Action Center of Afghanistan are provided:

Mine Action Coordination Center of Afghanistan
Website: http://www.macca.org.af/
Email: flora.sutherland@macca.org.af
Address:
Phone: +93 (0) 700 295 207
Fax: +92-51 211 450

Mr. Mohammed Sediq Rashid, Head of Operations
Email: sediq.rashid@macca.org.af <mailto:Sediq@macca.org.af>
Phone: +93 (0) 700 295 207

Mr. Rafiullah Alkozai, Communications Office
Email: rafiullah.alkozai@macca.org.af
Phone: +93 (0) 707 306 803

2.22. COMPLIANCE WITH MOSS

2.22.1. The Contractor shall follow the UN Guideline's for Minimum Operating Security Standards (MOSS) and shall familiarize all field staff in the same.

2.22.2. One senior project officer shall be designated Project MOSS Coordinator and shall be responsible for ensuring all site personnel are familiar with and follow AFRM's MOSS procedures. The Project MOSS Coordinator shall also maintain regular liaison with the appropriate local UN security counterparts, including United Nations Mine Action Centre, Afghanistan (UNMACA). The Project MOSS Coordinator shall be familiar with the UN Field Security Handbook; UN Security Awareness Handbook; UN Country Security Plan; UN Country Security Structure; Country Travel Clearance Procedures; Country Security Standard Operating and Emergency Procedures; Country Security Notices, Local Sub-Office Security Procedures and Medevac Procedures (as appropriate).

2.22.3. The Contractors Field Offices shall be equipped with a satellite telephone and VHF and HF (Codan) communications facilities and shall maintain regular reporting schedules to AFRM. Project field transport vehicles shall be equipped with VHF and HF (Codan) communications and shall maintain regular reporting schedules to the Project Field Office. Necessary international staff and key national staff shall be issued with handheld VHF radios. All communications equipment (including charged batteries) shall be regularly checked for proper operations and regular radio checks shall be conducted. Coordinate intended frequencies with the local FOBs after award.

2.22.4. All project staff shall be provided with full country and security briefing prior to deployment in Afghanistan and shall have training in personal security, hostage survival, office/residential security, use of communications equipment, basic first aid and mine awareness.

2.23. LOCAL CONSTRUCTION MATERIALS

2.23.1. The Contractor is encouraged to use local construction materials wherever possible provided the quality is of adequate standard and does not prejudice the safe and reliable operation of the Works. This may include, but not be limited to, such items as doors, windows, drainage and water/waste water piping, roofing materials, etc. Construction material procurement shall be in compliance with the Trade Agreement Act and Balance of Payment Program Clause 252.225-7045.

2.23.2. Subject to the approval of the Contracting Officer, stone masonry may replace concrete in nonstructural locations.

2.24. SCRAP METAL

2.24.1. Scrap metal shall be the property of the Host Government. The scrap metal on site shall be moved to an area away from the site perimeter as directed by the Contracting Officer’s Representative and left for the Host Government to remove and/or salvage.

PART 3 TECHNICAL REQUIREMENTS - TRANSMISSION AND DISTRIBUTION LINE EQUIPMENT

3.1. HIGH VOLTAGE TRANSMISSION LINE AND MEDIUM VOLTAGE DISTRIBUTION LINE

3.1.1. Summary of Scope of Work

3.1.1.1. The High Voltage transmission line and the Medium Voltage (MV) distribution line works covers the construction of new lines, involving transmission and distribution.

3.1.1.2. The line route consists mostly of a flat desert terrain, with some mild hills. Elevations range from 300 m to 500 m.

3.1.1.3. The transmission lines (220 kV) shall be designed with one overrunning Optical Ground Wire (OPGW) ground wire

and three simplex overhead phase conductors per circuit and the distribution lines (20 kV) shall be designed with one overrunning Overhead Ground Wire (OGW) and three simplex overhead phase conductors per circuit.

3.1.1.4. Phase conductors shall be Aluminum Conductor Steel Reinforced (ACSR), in accordance with Para 3.2.2.1.

3.1.1.5. The OPGW and OGW ground wire shall be provided in accordance with Para 3.2.2.2.

3.1.1.6. Phase conductors and the ground wires shall be dead-ended on terminal structures beyond the perimeter walls of substations. At the substations short approach spans of low mechanical tension to the substation gantry shall be supplied and installed.

3.1.1.7. The transmission and distribution line work comprises design, manufacture, testing at works, delivery at site, erection, testing on site, commissioning of all materials and works to provide a complete and functional system.

3.1.1.8. All components and accessories necessary for the safe and efficient operation of the plant, in accordance with codes and standards, shall be included in the supply.

3.1.1.9. The sites will normally be approached from the existing main and secondary roads. However, it is the responsibility of the Contractor to identify and construct access roads to sites and ensure the adequacy of the existing or temporary access roads.

3.1.1.10. All access roads will be considered temporary construction roads, of which the Contractor is in charge, and no additional payment will be made for these roads. All access roads may be removed after the completion of construction and the land returned to the condition in which it was found as mandated by the Contracting Officer.

3.1.2. Electrical Design

In addition to the requirements of Paragraph 2.2, the electrical characteristics of the High Voltage (HV) system shall be as stated below. See Paragraph 4.10 for additional voltages and characteristics.

Description	**For Simplex Conductor**
Nominal System Voltage	220kV

Nominal Rating	150 MW
Nominal current (single phase)	525 A
Nominal transmission capacity (per circuit)	200 MVA
Maximum shielding angle to outer phase conductor	300
Minimum creepage distance	4,654 mm
Number of conductors per phase	1
Phase Conductor spacing (center to center)	IAW Para 3.1.4.2.

3.1.3. Mechanical Design

3.1.3.1. Structures

The structures shall be of the self-supporting type (no guyed structures) and meet the requirements of this specification. Structures shall have a reliability level 1 as specified in BS 50341. Contractor shall choose the most economical structure option for design and construction, however, wood structures are prohibited.

3.1.3.2. Structure Types

The normal structure types to be designed, manufactured and supplied are to match the specified design requirements. If lattice towers are used, they shall accept leg extension up to 3 m in steps of 1 m.

3.1.3.3. Proven Structure Designs

In order to save time for design and testing of the structures, the Contractor may propose an existing proven structure design, if it is equal to, or exceeds the design loading and clearances required by this Specification.

3.1.3.4. Design Data-Assumptions and Determinations

Wind Loads

The maximum design wind velocity used for this project is 41 m/s. This corresponds to a dynamic wind pressure of 1,000 N/m^2. Reduction factors on the wind pressure, for increasing span length, shall be based on IEC 60826 - Design criteria of overhead transmission lines.

The coefficient of dynamic wind pressure shall be considered for all structures/conductors/ground wires according to IEC 60826. The dynamic wind pressure coefficient for the line conductor is 1.0. The dynamic wind

pressure coefficient for the Insulator set is 1.2.

Design Spans

The term "basic span" shall mean the horizontal distance between centers of adjacent supports on level ground from which the height of standard supports is derived with the specified conductor clearances to ground in still air at maximum temperature.

The term "wind span" shall mean half the sum of adjacent horizontal span length supported on any one structure.

The term "weight span" shall mean the length of conductor, the weight of which is supported at any structure at minimum temperature in still air. At a suspension position, the minimum weight of conductor supported shall not be less than 25% of the total weight of conductor in the two adjacent spans (measured at the time of minimum sag or coldest design temperature).

Design Loading Assumptions

The structures shall be designed to withstand the following load combinations as a minimum:

1) High wind at 90 degree angle to the line:

   Maximum wind speed at a conductor temperature of +10°C

2) High wind at 45 degree angle to the line:

   Maximum wind speed at a conductor temperature of +10°C

3) Exceptional conditions:

   Broken wire condition and longitudinal overload condition at +10°C final tension in accordance with IEC 60826

4) Construction and maintenance loads:

   Loading conditions according to the document specified above.

5) Combined Ice and Wind Loads:

   Medium altitudes - 15 mm radial ice thickness, 200 Pa wind, -5°C (Hard Rime Ice)

   Ice density, based on the different expected ice types, and related considerations shall be as per IEC 60826.

Design Loading Requirements

The structure/line loading shall be as determined from all the relevant requirements BS 50341 and this specification. This includes factors on wind and the structures, security loads, component strength including insulators and fittings and for the loading combination requirements above.

As per clause 6.2.1 of IEC 60826, The Contractor shall account for the increased wind speeds due to funneling and sloping ground, affecting the line and structure loading.

Phase Conductors, OGW, OPGW

The following design limitations shall apply to the phase conductors, OGW and OPGW:

Conductors:

- Temperature +5° C, still air, initial tension not exceeding 25% of the UTS
- Temperature +25° C, still air, final tension not exceeding 20% of the UTS
- Final sags under maximum temperature to be calculated at +75° C

OGW/OPGW:

In accordance with manufacturer's instructions but not exceeding the following:

- Temperature +5° C, still air, initial tension not exceeding 20% of the UTS.
- Temperature +25° C, still air, final tension not exceeding 20% of the UTS
- Temperature +20° C, still air, final sag not exceeding 75% of initial conductor sag at the same temperature
- Final sags under maximum temperature to be calculated at, +55° C.

Loading Diagrams, Application Charts and Sag and Tension Charts

Using the loads, load factors and design limitations, loading diagrams and application charts for each structure type, as well as sag and tension and clipping charts for the conductor, and overhead ground wire, shall be provided by the Contractor for acceptance by the Contracting Officer.

3.1.4. Clearances

3.1.4.1. Phase Conductor Clearances

Minimum clearances of conductors shall meet requirements of BS 50341 and be maintained at a maximum conductor temperature of +75 °C in still air and final sag, i.e. pole spotting temperature. The clearances shall be observed within the overhead line area and up to 5 meters outside the outer phase and 0.5 meters shall be added to the clearance values to allow for survey and drawing errors. Minimum clearances shall be kept after final settling of conductors, i.e. including 5 years creep. Ground wire sag shall not be larger than the conductor sag under any circumstances.

Transmission and distribution line routing shall avoid running conductors over the residences/structures. In unavoidable situations, the identified structure will be purchased by GIRoA and be demolished/removed by the Contractor.

Set back of the distribution line from the road shall be a minimum of 5m. Set back of the transmission line from the road shall be a minimum of 10m, except at road crossings. Exceptions will be considered on a case by case basis by the Government.

Road crossing. Use tension towers 15 degree on either side of road when crossing the road.

3.1.4.2. Phase Conductor Spacing

To avoid phase clashing in spans, diagonal conductor-to-conductor spacings are to be checked to ensure minimum spacing as derived from the following formula is met:

$$\sqrt{x^2 + \left(1.2y^2\right)} \geq 0.4 \times \sqrt{f + l} + 0.007 \times U$$

where:

x = projected horizontal distance in meters between conductors at mid-span

y = projected vertical distance in meters between the conductors at mid-span

f = final conductor sag at +75° C in m

1 = length of insulator set in m

U = highest voltage in kV.

3.1.5. Crossing Of Obstacles

3.1.5.1. The Contractor shall make all necessary temporary provisions and take all necessary precautions, including the erection of guard structures, as required where the line crosses roads, bodies of water, telecommunication lines, power lines or other obstacles to maintain the load of the public and to avoid damage. The contractor shall notify the Contracting Officer and the owner of any such obstacle within a reasonable time before the Contractor intends to make the crossing. Power lines will normally be taken out of service and earthed, and during the time required by the Contractor to complete the crossing.

3.1.5.2. Before making the crossing, the Contractor shall obtain the Contracting Officer's approval of the precautionary arrangements and installation methods intended for use, and the time required for the work.

3.1.5.3. When permanent reconstruction of obstacles as indicated in the structure list has to be performed, the Contractor shall act as outlined above.

3.1.5.4. No additional payment will be made for temporary or permanent provisions according to above.

3.1.6. Structure Locations

All survey and structure spotting shall be performed by the Contractor and be approved by the Contracting Officer. The line survey team shall include as a minimum surveyors, a transmission/distribution line design engineer, a MEW representative appointed by the Manager of the MEW Regional Office and a representative appointed by the local Village Head. It shall be the Contractor's responsibility to coordinate the members of the survey team including the MEW and local village representatives. The cost shall be included in the Contractor's price. The line shall be provided with a tension structure for sectionalizing the line every 4 to 6 km, dead ended in both line directions. The Contractor shall where practicable minimize the line length and the overall number of structures.

3.2. MATERIAL SPECIFICATIONS - PHASE CONDUCTORS AND INSULATORS

3.2.1. Standards

Conductors and insulators shall conform to the latest revision of the standards listed below, which shall be verified by a type certificate issued by the manufacturer.

IEC 60060 High voltage test techniques

IEC 60071-1 Insulation co-ordination

IEC 60120 Dimensions of ball and socket couplings of string insulator units

IEC 60305 Insulators for overhead lines with a nominal voltage above 1000 V - Ceramic or glass insulator units for A.C. systems - Characteristics of insulator units of the cap and pin type

IEC 60372 Locking devices for ball and socket couplings of string insulator units - Dimensions and tests

IEC 60383 Insulators for overhead lines with a nominal voltage above 1000 V

IEC 60437 Radio interference test on high-voltage insulators

IEC 60797 Residual strength of string insulator units of glass Of ceramic material for overhead lines after mechanical damage of the dielectric

IEC 60888 Zinc-coated steel wires for stranded conductors

IEC 60889 Hard-drawn aluminum wire for overhead line conductors

IEC 61089 Round wire concentric lay overhead electrical stranded conductors

3.2.2. Phase Conductor and Ground Wire

3.2.2.1. Conductor

The conductor shall be ACSR (aluminum conductor steel reinforced), in accordance with IEC 61089.

Manufacturing, testing and delivery of conductors shall be in accordance with IEC 60888, IEC 60889 and IEC 61089 as a minimum.

The conductor shall have the following physical properties or equivalent as a minimum. Conductors below shall be used for bidding purposes. Other size conductors may be utilized but requires justification by the Contractor and government approval.

<u>220 kV System</u>
Code name - Drake
Complete Cable Nominal Size – 400 mm2
Stranding Design – 26 Aluminum Wires and 7 Steel Wires
Wire Diameters – Aluminum 4.43 mm, Steel 3.45 mm
Nominal Outside Diameter of Complete Cable – 28.07 mm
Aluminum Nominal Sectional Area – 402.8 mm2
Steel Nominal Sectional Area – 65.8 mm2
Complete Cable Nominal Sectional Area – 468.6 mm2
Nominal Mass – 1622 kg/km
Rated strength - 140,119 N
Rated DC resistance at 25°C - 0.0745 Ω/km

<u>20 kV System</u>
Code name - Chickadee

Complete Cable Nominal Size – 211 mm2
Stranding Design – 18 Aluminum Wires and 1 Steel Wires
Wire Diameters – Aluminum 3.76 mm, Steel 3.76 mm
Nominal Outside Diameter of Complete Cable – 18.8 mm
Aluminum Nominal Sectional Area – 200 mm2
Steel Nominal Sectional Area – 11.10 mm2
Complete Cable Nominal Sectional Area – 211 mm2
Nominal Mass – 636.7 kg/km
Rated strength – 44.2 kN
Rated DC resistance at 25°C - 0.144 Ω/km

3.2.2.2. Optical Ground Wire (OPGW)

The Optical Ground Wire shall be an OPGW with 24 fibers, with a combination of stranded aluminum and aluminum coated steel, surrounding the optical fiber configuration. The core housing the fibers shall be stainless steel. Refer to OPGW Design Data in the Appendices of this contract for additional information.

The OPGW ground wire shall be of type concentric-lay-stranded aluminum alloy/steel with a nominal cross section as specified (depending upon the available fault current), or equivalent in accordance with the OPGW Design Data in the Appendices.

Preference will be given to the slotted core design, unless alternatives provide similar crush resistance and everyday tension characteristics.

Manufacturing, testing and delivery of conductors shall as a minimum be in accordance with ASTM B416.

Contractor shall select OPGW equivalent to the project design requirements and preferences above and shall be responsible for any OPGW communication repeater stations required between circuit stations. OPGW design and repeater station locations are subject to Contracting Officer’s acceptance and shall be designed and installed per manufacturer recommendations.

3.2.2.3. Overhead Ground Wire (OGW)

Overhead ground wire shall be selected based on project design requirements and the DOR’s design and calculations. Manufacturing, testing and delivery of conductors shall as a minimum be in accordance with ASTM B416.

3.2.2.4. Conductor Reels

Reels housing conductors shall be stored and transported in matched sets, i.e. approximately the same lengths of conductors shall be sorted and transported together to facilitate the handling.

The reels shall be of sufficient size and strength to

protect the conductor or overhead ground wire and suitable for tension stringing method. The flanges and the drum shall have such a design and smoothness that the conductor or the overhead ground wire is not damaged during winding and unwinding. Only one length of conductor shall be placed on each reel.

Plastic or equivalent material is to be provided between the conductors or overhead ground wire and the reel and lagging.

Fiberboard lagging is acceptable provided it is placed between the flanges of the reel; otherwise, wood lagging is required.

The reels shall be plainly marked with a metal tag. Included in the marking shall be the factory reel number, destination and description, the actual length; the net, tare and gross weights; the contract number and arrows showing the direction in which the reel should be rolled and in which direction the outer end of the conductor points.

For bidding purposes, it may be assumed that conductor supply will be on properly lagged non-returnable wooden drums. Conductor reels and lagging shall be approved by the Contracting Officer before delivery.

3.2.3. Insulators

3.2.3.1. General

String insulator units shall be of cap and pin type and shall be according to IEC 60305. The insulating part shall be of brown-glazed porcelain or toughened glass and be designed to withstand alternating current (AC).

The cap shall be of malleable cast iron, spheroidal graphite cast iron, or forged steel. The graphite in malleable cast iron shall only appear in the form of temper carbon, and the graphite in spheroidal graphite cast iron shall only be present in spheroidal form. The socket coupling shall be according to IEC 60120 and have an internal height according to IEC 60372.

The pin shall be of forged steel. In tensile tests, the pins shall exhibit ductile fractures characterized by a considerable contraction of area. The pin coupling shall be according to IEC 60120.

Cap and pin shall be hot-dip galvanized. The pin shall be protected by a zinc-collar sleeve.

Split-pins shall be of copper alloy or stainless steel and be in accordance with IEC 60372. W-clips are not acceptable.

Insulating part, cap, and pin shall be concentrically assembled using Portland cement or aluminous cement.

All materials, whether fully specified herein or not, shall be supplied by internationally recognized manufacturers who have been in the business for a minimum of 10 years, and comply in all respects with these Specifications.

The materials shall be free from folds, cracks and other exterior and interior defects that can affect its strength, ductility, durability or ability to function.

All materials shall be inspected and tested in full to prove compliance with the requirements of these Specifications and to the satisfaction of the Contracting Officer. The testing shall be carried out according to the relevant standards approved by the Contracting Officer.

Assembly shall be performed in such a way that the mechanical properties cannot be affected and to ensure that the insulating part is not subject to any mechanical stress due to pressure exerted by the bottom edge of the cap.

Free surface of insulating parts shall be cleaned from cement and other impurities.

Each insulator unit shall be marked with the name or trade mark of the manufacturer and the year of manufacture according to IEC 60383 and means to ensure the system of traceability for each of the component parts. In addition, each insulator unit shall be marked with the specified electromechanical or mechanical failing load in conformity with IEC 60383, or the first part of the designation according to IEC 60305.

3.2.3.2. Testing

The contractor shall carry out the type, sample and routine tests as prescribed below.

Certificate from type tests shall be performed by an internationally known, independent testing laboratory. Said test certificate together with certificates from Routine and Sample Tests from the latest delivery shall be submitted.

<u>Type Tests</u>

Submit type test reports for the tests specified below on similar insulators supplied under previous contracts. The type tests shall not be older than five years.

a) Verification of the dimension

Number of insulator units to be tested: 10 units

The test shall be performed according to IEC 60383-1.

b) Electro-mechanical or mechanical failing load test

Number of insulator units to be tested: 10 units

The test shall be performed according to IEC 60383-1.

c) Thermal-mechanical performance test

Number of insulator units to be tested: 10 units

The test shall be performed according to IEC 60383-1.

d) Dry lightning impulse withstand voltage test

Number of insulator units to be tested: 1 short string (5 units)

The test shall be performed according to IEC 60383-1.

e) Wet Power-frequency withstand voltage test

Number of insulator units to be tested: 1 short string (5 units)

The test shall be performed according to IEC 60383-1.

f) Residual strength test

Number of insulator units to be tested: 25 units

The test shall be performed according to IEC 60797.

Sample Tests

The Contractor shall keep the Contracting Officer informed about the progress of the manufacture of materials and works, so that the inspection and testing can be performed in the presence of the Contracting Officer's representative.

Before every inspection and test supervised by the Contracting Officer, the Contractor shall assure the Contracting Officer that the work is in all respects ready for inspection and testing, according to this Specification.

Full and complete testing of all components shall be carried out to the satisfaction of the Contracting Officer.

The tests listed below shall be carried out on each production lot of insulators at the expense of the manufacturer, and these insulators and split-pins shall be added by the Contractor, free of charge, to the number specified in the tender documents. The insulators which

have been subjected to sample tests shall not be included in the delivery lot. The sample tests are to be performed on the sample E1, E2 or E3 as indicated in the table, the size of these samples shall be determined according to IEC 60383-1.

Lot size (N)	Sample size		
	E1	E2	E3
N<300	Subject to agreement		
300<N<2000	4	3	4
2000<N<5000	8	4	8
5000<N<10000	12	6	12

a) Verification of the dimensions

Number of insulator units to be tested: The units of sample E1 and E2

The test shall be performed according to IEC 60383-1.

b) Verification of axial and radial run out

Number of insulator units to be tested: The units of sample E1 and E2

The test shall be performed in accordance with IEC 60383-1.

c) Verification of the locking system

Number of insulator units to be tested: The units of sample E2

The test shall be performed in accordance with IEC 60383-1.

d) Temperature cycle test

Number of insulator units to be tested: The units of sample EI and E2

The test shall be performed in accordance with IEC 6083-1.

e) Electro-mechanical failing load test

Number of insulator units to be tested: The units of sample E1

The test shall be performed in accordance with IEC

60383-1.

f) Residual strength test

Number of insulator units to be tested: The units of sample E3

The test shall be performed in accordance with IEC 60797.

g) Puncture withstand test

Number of insulator units to be tested: The units of sample E2

The test shall be performed in accordance with IEC 60383-1.

h) Porosity test

Number of insulator units to be tested: The units of sample E1

The test shall be performed in accordance with IEC 60383-1.

i) Galvanizing test

Number of insulator units to be tested: The units of sample E2

The test shall be performed in accordance with IEC 60383-1.

Routine Test

The manufacturer shall carry out, at his expense, the routine tests specified in IEC 60383. The routine tensile load shall be 50% of the electromechanical failing load.

a) Routine visual inspection

Number of insulator units to be tested: All

The test shall be performed in accordance with IEC 60383-1.

b) Routine mechanical test

Number of insulator units to be tested: All

The test shall be performed in accordance with IEC 60383-1.

c) Routine electrical test

Number of insulator units to be tested: All

The test shall be performed in accordance with IEC 60383-1.

3.2.4. Packing

3.2.4.1. Insulator units shall be packed in crates and each crate shall contain six insulator units. The crates shall be packed on a pallet and each pallet shall contain 20 crates.

3.2.4.2. The packing shall afford adequate protection for the insulators during ordinary handling and shipping.

3.2.4.3. The Contractor shall make sure that split-pins operate properly and that they are placed in the locking position. Each crate shall be marked with the type designation used by the Manufacturer.

3.3. DESIGN REQUIREMENTS – INSULATOR SETS AND FITTINGS

3.3.1. Suspension and Tension Insulator Sets

3.3.1.1. Assemblies for Transmission and distribution Line Conductors

The following suspension and tension insulator sets and assemblies shall be used in accordance with this contract:

- Suspension insulator sets
- Tension insulator sets

3.3.1.2. Assemblies for Overhead Ground Wires

The tension assembly shall be attached to the structure comprising an adjustable device for trimming the wire tension.

The overhead ground wire shall be connected to each structure by means of a jumper connected to the overhead ground wire with a parallel clamp, and to the pole with an earthing clamp.

3.3.1.3. Drawings

The following drawings shall be submitted with the design:

- Drawings of suspension clamps, specifying material and ultimate strength values.
- Drawings of tension clamps, specifying material and ultimate strength values.
- Drawings of joints, specifying material and ultimate

strength values.

- Drawings of repair sleeve, specifying material and ultimate strength values.

- Drawings of vibration dampers, specifying material.

3.3.2. Hardware

3.3.2.1. General

Clamps and fittings shall be of a design approved for the conductor according to the relevant clause.

All hardware shall at least provide the same ultimate strength as the chosen insulator.

The earthed end of suspension and tension insulator sets shall be mechanically attached to the transmission and distribution system structure and this mechanical attachment shall also provide electrical continuity.

The connecting attachments, including bolts, nuts and washers, shall be included in the insulator assemblies.

The earthed end of tension sets assemblies for the overhead ground wire shall be attached to the transmission and distribution system structure by means of articulated connectors. The tension set shall comprise a device for adjusting the conductor tension. All materials, whether fully specified herein or not, shall be of first class quality and shall conform to the best modern practice and comply in all respects with these specifications.

All materials shall be free from folds, cracks and other exterior and interior defects which can affect its strength, ductility, durability of ability to function.

All materials shall be inspected and tested in full to prove compliance with the requirements of the Specifications and to the satisfaction of the Contracting Officer.

The testing shall be carried out according to the relevant standards approved by the Contracting Officer.

3.3.2.2. Splices

<u>Splices for Conductors</u>

The splices shall be of the compression type and shall consist of two parts, one of galvanized steel for the steel core, and one of aluminum alloy for the aluminum part of the conductor.

All splices shall develop at least 95% of the ultimate

strength of the conductor, according to BS 3288 part 2.

The resistance of all splices shall not be more than 50% of the resistance of the conductor itself on the same length as the splice.

The splices shall be filled with grease after compression to protect the conductor against corrosion.

Splices in jumpers shall consist of at least two parallel groove clamps.

3.3.2.3. Repair Sleeves

The repair sleeves shall be of the compression type for conductors and preformed armor rods for overhead ground wires. The compression repair sleeve shall preferably be two-piece type of aluminum alloy.

When properly applied such repair sleeves shall achieve 95% of the ultimate strength of the conductor, when less than one fourth of the aluminum wires of the outer layer is damaged, according to BS 3288 part 2.

The resistance of the repair sleeves shall not be more than 50% of the resistance of the conductor itself on the same length as the repair sleeve.

The repair sleeves shall be filled with grease after compression to protect the conductor against corrosion.

Repairs on overhead ground wires shall be made with preformed aluminum-clad steel armor rods.

3.3.2.4. Tension Clamps

Conductor

The tension clamp shall be of the compression, wedged or bolted type and be as light as possible. The part that will be in contact with the conductor shall be of aluminum.

The tension clamp shall be connected to the live end of the tension insulator set to ensure adequate flexibility.

When installed, the tension clamp shall develop a holding force of at least 95% of the ultimate strength of the conductor without causing slipping off, or damage to the conductor or any part thereof, according to BS 3282 Part 2.

Bolts shall be used as clamping devices only and not as current carrying parts. All bolts, nuts and washers shall be of high strength galvanized steel.

Tension clamp of the compression type shall consist of two parts, one aluminum compression body for the aluminum part

of the conductor, together with an integral lug for connection of the jumper terminal, and one compression eye of galvanized steel for the steel core. The current carrying capacity shall be equal to or better than that of the conductor. The compression type of tension clamp shall be filled with grease after installation to protect the conductor against corrosion.

Tension clamps of the wedged or bolted type shall allow the conductor to run continuously through the clamp. No cutting off of the conductor inside the clamp will be permitted.

Ground Wire - OPGW and OGW

Manufacturer's guidelines for OGW and OPGW tension clamping arrangements shall be followed, subject to meeting the requirements of the following:

The tension clamp shall be of the compression type and be as light as possible. The part that will be in contact with the conductor shall be of aluminum.

The tension clamp shall be connected to the live end of the tension set to ensure adequate flexibility.

When installed, the tension clamp shall develop a holding force of at least 95% of the ultimate strength of the ground wire without causing slipping off, or damage to the conductor or any part thereof, according to BS 3282 Part 2.

Tension clamps of the compression type shall be as per manufacturer's requirements.

The current carrying capacity of any tension clamps shall be equal to or better than that of the ground wire. The compression type of tension clamp shall be filled with grease after installation, in accordance with the manufacturer's requirements, to protect the ground wire against corrosion.

3.3.2.5. Jumpers

The jumper for tension poles with tension clamps of compressed type shall consist of one un-spliced jumper conductor with one jumper terminal of the compressed type in each end. The jumper terminal shall consist of an aluminum body together with an integral lug for connection purpose. The jumper terminals shall be filled with grease after compression to protect the conductor against corrosion. The resistance over the compressed tension clamp and the jumper terminal shall be less than 50% of the resistance of the conductor itself on the same length as the tension clamp and the jumper terminal.

The jumper for tension poles with tension clamps of wedged

or bolted type shall consist of a jumper conductor from both tension clamps spliced together with two parallel groove clamps. The resistance over the parallel groove clamps shall be less than 50% of the resistance of the conductor itself on the same length as the parallel groove clamps.

Bolts shall be used as clamping devices only and not as current carrying parts. All bolts, nuts and washers shall be of high strength galvanized steel.

3.3.2.6. Suspension Clamps

The suspension clamp shall be light and free to pivot in the vertical plane. The pivoting centre shall be close to the conductor axis. The conductor groove shall be bell-mouthed at both ends. The groove shall be free of burrs and edges. It shall be tailored to suit the conductor for a turning angle of at least 25°.

Clamping pressure on the conductor shall not be applied near the ends of the supporting groove of the clamp where conductor bending stresses are high. Clamping bolts shall be provided with locking devices.

The clamp design shall be such as permitting the installation of an additional device for the suspension of counter weights where required.

Armor rods shall be installed for the protection of the conductor.

OGW and OPGW suspension clamping arrangements shall comply with manufacturer's requirements, subject to meeting the above specification.

3.3.2.7. Armor Rods

Armor rods of the factory-formed type shall be installed on all conductors in the suspension clamps.

Armor rods shall be of aluminum alloy for use on the phase conductors, and of aluminum clad steel for use on the overhead ground wires.

3.3.2.8. Vibration Dampers

Conductors and overhead ground wires shall be provided with vibration dampers of the Stockbridge type.

The damper clamp shall be of aluminum alloy. The conductor groove shall be smooth and free from irregularities. The damper clamp shall have sufficient grip to maintain the damper position on the conductor without damaging the conductor or causing premature fatigue damage on the conductor under the clamp. The dampers shall be designed

for live line installation.

Additional dampers shall be installed at all angle and terminal structures, on all major crossing spans and on such other spans where conductor vibrations are likely to occur.

The Contractor shall present damper application data provided by the damper manufacturer. The exact quantities of dampers required will be based on the application data.

Test reports showing the dynamic characteristics and the damping efficiency shall be submitted with the final design.

3.3.2.9. Jumper Counter-Weight

To reduce the swing and keep the clearance distances from the jumper to the structure jumper counter-weights shall be used on the conductor.

The jumper counter-weight shall be made of hot dip galvanized cast iron and have an appropriate weight. The conductor-groove shall fit the conductor properly.

3.3.2.10. Counter-Weight for Suspension Sets

Counter-weights shall be attached by a U-bolt, acting on the conductor groove clamp at the pivot point.

The counter-weight shall be free to swing within 45 degrees from the vertical plane.

3.4. MATERIAL SPECIFICATIONS - STRUCTURES

All steel structural members shall be factory made hot rolled steel and entirely galvanized by the hot dip process.

3.4.1. Material

3.4.1.1. Material

Steel used in structures shall be Mild steel and/or high strength steel. The quality of steel to be used shall correspond to DIN, BS or ASTM standards, whichever is applicable.

Refer to Paragraph 3.4.3 for structure bolt references.

All material shall be tested at the steel mill in accordance with the applicable specification and standards under which they are manufactured. The Contractor shall supply the Contracting Officer with all certified mill tests if requested. Tests shall be conducted in accordance with DIN Regulations or their equivalent. The tests to be conducted shall include, but are not limited to, uniformity

of galvanizing coating, mechanical and chemical properties of all steel and additional embrittlement tests on high strength steel.

Concrete shall meet the requirements of paragraph 3.7.

3.4.1.2. Design Stresses

The unit stresses in members and connections for the structural design calculation, based on the design loading and design unbalanced loading (broken wire conditions) multiplied by load factor shall not exceed the yield stresses according to DIN, BS or ASTM standards, whichever is applicable. Connections shall be designed for the same member forces and according to the above-mentioned standards. All material properties shall be modified by the applicable partial material factor as given in BS 50341. No damage or permanent distortion of any members, bolts, connections of fittings or elongation of bolt holes shall be permitted for these design conditions.

The following slenderness ratios (L/R) of members shall not be exceeded, where "L" is the buckling length of member, and "R" is the corresponding radius of gyration of the members:

Tower legs, main compression members in crossarms and ground wire peak - L/R<150

Other compression members carrying calculated stresses - KL/R<200

Redundant members - KL/R<250

For calculation of the buckling resistance of compression members reference is made to the "Guide for Design of Steel Transmission Towers" (ASCE-Manual No. 52) and to the ANSI/ASCE-Standard 10-90: "Design of Latticed Steel Transmission Structures". For calculation of required strength of transmission and distribution poles, refer to "Design of Transmission Poles" (ASCE-Manual No. 48).

Other accepted calculation methods may be applied according to the Standards specified or otherwise accepted by the Contracting Officer. In this case the calculated buckling resistance may not exceed the values given in ASCE standards.

Structures shall be designed so that all members will withstand normal and broken wire conditions with load factors.

The total loading for the structure shall include the dead weight of the structure plus transverse wind load on the structure plus the simultaneous application of loading as specified. Wind loads on tower leg extension shall be taken

into consideration.

Terminal structures shall be designed to face the direction of the incoming line, and shall withstand the load of all conductors and ground wire.

The Contractor shall submit the stress analysis calculation for structure members of all structure types and for each of the specified load conditions. An explanation shall be submitted along with the computer calculation.

3.4.1.3. Full Scale Structure Load Tests

Full scale structure load tests of assembled structures shall be carried out in accordance with IEC 60652. The following requirements shall be fulfilled in the load tests of the structure:

The members in a test structure shall be of the same grade and quality of fabrication as those to be supplied for the structures under the contract. The Contractor shall furnish certified test reports of the heats from which the material was rolled and a record showing the heat from which each member was obtained.

Test structures shall not be specially fitted other than with such fittings as are required on similar structures to be erected in the field.

Test structures shall be erected on a foundation structure which shall be of adequate strength and stiffness to safely withstand the structure reactions under test loading, without noticeable distortion or displacement.

Structures shall be connected to the anchorage in the same manner as to the normal stub angle at site.

In preparing for the tests, the Contractor shall supply the Contracting Officer with a test program, together with diagrams indicating the proposed methods of applying the various loads and measuring of deflections.

The Contractor shall calibrate dynamometers and gauges before testing the structure.

The test loads shall be those obtained from the design loads multiplied by the specified load factor. Any combination of the test loads shall be applied to prove the capability of the structure to withstand all required loading.

Each structure shall withstand the test loads for at least five minutes without failure or permanent distortion of any member, fitting, bolt or part and without elongation of bolt holes. There shall be no adjustment of loads during the five minute period. Should it become necessary to

adjust the loading, the five-minute period shall re-start after the adjustment is completed.

All test loads shall be removed completely before the loads for the next tests are applied. Test loads corresponding to conductor and ground wire loading shall be applied to the attachments provided for these loads while test loads equivalent to wind load on the structure shall be applied in locations accepted by the Contracting Officer. Friction losses in rigging shall be taken into account in the application of the test loads.

Any conspicuous yielding or any failure under any of the test loading shall be considered as defect, in which case the Contractor shall modify the design and shall repeat at his own expense, the test case in which the defect developed.

After all defects, having developed during the regular tests, have been corrected and after the structure satisfactorily carries design loads multiplied by load factors, the structure shall then be tested to destruction.

Test samples shall be cut from members that fail in destruction tests and standard tensile tests shall be performed at Contractor’s expense. The results of the tests on these samples shall be used to correct the assembled structure test results for comparison with design.

The Contractor shall submit full reports of all structure physical load tests including clear photographs of the test set-ups and nature of all failures, certified calibration reports, detailed diagrams showing the manner in which test loads were applied and deflection records.

The prices bid for structure tests shall include the cost of supplying, erecting, testing and dismantling of structures, together with all rigging, accessories, dynamometers, gauges, and personnel necessary for the conduct of the tests.

Only one structure (with maximum height extensions) shall be tested. No member of such structure shall be used further in the execution of the Contract.

The structure shall be assembled with all step bolts/ladders in place. The Contracting Officer's Representative will test all climbing provisions for strict adherence to the specification and suitability, by climbing every structure completely.

Any modifications found advisable during this test shall be incorporated into the structure design, without any extra cost. Notwithstanding prior acceptance given for structure drawings, design and location of all climbing provisions

will be considered accepted only after Contracting Officer's confirmation, in writing, of their suitability, after successfully climbing the test structures.

3.4.1.4. Acceptance of Already Existing Test Reports

If Paragraph 3.1.3.3 is applicable in lieu of the above testing, certified results of a previous test may be acceptable, provided that the test results were adequately documented and test parameters were equal to or more demanding than the tests specified herein and that the structures tested were of the types tendered and specified for testing.

3.4.2. Construction

3.4.2.1. The structures shall be of standard construction and shall be designed to reduce the number of different parts to a minimum, thus facilitating transport and erection. No member shall be of angles with dimensions less than 50 x 50 x 5 mm. The minimum thickness for legs and compression members in crossarms and in ground wire peaks shall be 6 mm. Gusset plates shall not be less than 6 mm thick.

3.4.2.2. Stub angles shall be at least 2 mm thicker than the attached steel leg angle and shall be fitted with cleats. The stub angle shall be galvanized also below the top of the concrete.

3.4.2.3. The maximum width of the steel leg angle shall not exceed 16 times the thickness. Cold formed steel angles, flat bars and rods shall not be used for structure members.

3.4.2.4. The diameter of bolt holes for all types of structures shall not be more than 1.5 mm larger than the nominal diameter up to 16 mm diameter bolts. For bolts above 16 mm, the bolt hole shall be 2.00 mm larger than the nominal diameter.

3.4.2.5. All members of the structures shall be connected by bolts. Connections of members shall be designed to avoid eccentricity as much as possible.

3.4.3. Nuts and Bolts

3.4.3.1. Bolts shall have vandalproof heads and nuts, with metric thread (coarse) and shall conform to DIN 267 and DIN 555. In lieu of vandalproof nuts and bolts, structural members may be tack welded.

3.4.3.2. In general, bolts for the connection of structure members shall not be less than 16 mm in diameter.

3.4.3.3. The minimum grade for bolts shall be 5.6 according to

DIN 267.

3.4.3.4. All nuts shall be secured by use of helical spring lock washers conforming to DIN 127 in connection with flat washers conforming to DIN 126.

3.4.3.5. All nuts and bolts shall be hot dip galvanized. Threads before galvanizing shall be a coarse thread. There shall be no excess of galvanizing at the root of the thread and nuts shall turn easily on the completed bolts without excessive looseness. Nut threads shall be tapped after galvanizing so as to produce a finger-free fit on the galvanizing. Bolts will be rejected if they are considered by the Engineer to have an excessively loose or tight fit.

3.4.3.6. The length of bolts and the length of thread shall be such that bearing is upon the shank and not upon the threads. After tightening, the bolts shall project out of the nut a minimum of three threads.

3.4.4. Anti-climbing Devices, Step Bolts and Bird Guards

3.4.4.1. Each structure shall be fitted with an anti-climbing device to prevent unauthorized persons from climbing the structure.

3.4.4.2. The anti-climbing device shall be fixed at a height of approximately 3 meters above the foundation. It shall provide suitable lockable gates adjacent to the step bolt legs.

3.4.4.3. The bolts shall be provided on each structure and one tower leg only. They shall begin directly above the anti-climbing device and continue to the structure top. They shall be spaced at a distance of 333 mm from center to center, distributed strictly alternating on the outer sides of the leg angle. The spacing distance of all step bolts shall be equal on the entire structure. Spacing tolerances according to VDE 0210/12.85 shall be accepted.

3.4.4.4. All step bolts shall be at least 24 mm in diameter, with a free tread width of 20 cm. For protection against slipping a lateral limit of min. 20 mm above top of step shall be provided. The tread side of the step bolts shall be uniform for all structures. The fastening side may accommodate different sizes, to take advantage of holes provided for structural bolts. Step bolts shall be rated at least for a concentrated load of 1.500 N, acting vertically at the most unfavorable position. If applied in place of a structural bolt, its loading shall be considered in addition to the step loading.

3.4.4.5. Structure members positioned above insulator strings

shall be fitted with stainless steel needle strips, effectively preventing birds from sitting in these locations. The strips shall extend sufficiently, horizontally beyond the protected location and be applied to all surfaces a bird can sit on. Where needles are projecting from the crossarm contour towards live parts, the structure clearance diagram shall consider the height of the needles.

3.4.5. Conductor and Ground Wire Attachments

3.4.5.1. Conductor and ground wire attachments shall be considered as part of the respective basic structures and shall be supplied as integral parts of them.

3.4.5.2. All conductor suspension points shall provide 3 brackets for installation of suspension hinges suitable for the attachment of double and single insulator strings associated with suspension conductor support assemblies. Both, individual hinges and suspension point assemblies shall be orientated in line direction, allowing the insulator strings to swing in crossarm direction.

3.4.5.3. Tension structures shall have brackets suitable for the attachment of tension hinges for double insulator strings associated with dead-end conductor assemblies.

3.4.5.4. The spacing of all double strings shall satisfy the requirements as specified under this Article below. Insulators of double strings shall be kept parallel at all line angles.

3.4.5.5. The ground wire shall be connected to the suspension structure peak by one hinge orientated in line direction, allowing the suspension assembly to swing in crossarm direction. Connection to tension structures shall be provided by tension assemblies, to be fixed to the structure peak.

3.4.5.6. For direct connection of overhead ground wire shunts to the structures, 2 sets of two holes, each, shall be provided on every ground wire peak.

3.4.6. Structure Grounding and Earth-Clamping Bolts

3.4.6.1. Each structure shall be provided as described, elsewhere with basic grounding and with additional grounding on structure locations with high soil resistivity. The ground electrodes may be either rods or pipes, although rods are generally more economical. Sections of the line will have to be placed in very aggressive soil and the Contractor shall propose measures to prevent the structure grounding from becoming corroded, subject to the approval of the Contracting Officer.

3.4.6.2. The Contractor shall submit for approval the proposed types of ground electrodes and ground connections. For the connection of the copper conductor with the copperweld rod and for underground connections the exothermic weld process shall be used.

3.4.6.3. For connecting additional grounding devices, sets of two holes each, are to be provided in all four stub angles to take two 16mm bolts.

3.4.6.4. As a service earthing point, one earthing bolt M 16, DIN 48088 part 2, to be delivered with spring washer, flat washer and nut shall be installed on the crossarm steelworks, near to the base side of every insulator string in an easily accessible location, subject to the Contracting Officer's approval. This earthing point will be required for system earthing during line repair and maintenance work. The earth clamping bolt shall be designed to withstand the specified short circuit current for a period of 1 second.

3.4.7. Workmanship

3.4.7.1. All work shall be equal to the best modern practice in the manufacture and fabrication of materials covered by this Specification.

3.4.7.2. The Contractor shall be responsible for the correct fitting of all parts. The Contractor shall replace, free of cost, any defective material discovered during erection, and pay all costs of field corrections for such replacement.

3.4.7.3. All parts of the structure shall be neatly finished and free from kinks, twists or bends. The fabrication shall be in strict accordance with the shop drawings prepared by the Contractor and approved by the Contracting Officer.

3.4.7.4. Structural material shall be straight and cleaned of all rust and dirt before being laid out or worked in any manner.

3.4.7.5. Shearing and cutting shall be performed carefully. Manually guided cutting torches shall not be used.

3.4.7.6. All bolt holes in steel members shall be punched, sub-punched, reamed or drilled before galvanizing. Holes shall be drilled, not punched, if the thickness of the metal exceeds the diameter of the hole, and in all crossarm members exposed to permanent tension. All holes shall be cylindrical and perpendicular to the member, clean cut with sharp tools and without torn or ragged edges.

3.4.7.7. Plugging, welding, or slotting of miss-punched, miss-

reamed or miss-drilled holes will not be permitted. The holes shall be located accurately so that when the members are in position the holes will be lined up before being bolted.

3.4.8. Marking and Identification Plates

3.4.8.1. The plates required for each structure are:

Danger signs - one

Structure number plate - one

Circuit number plates – one per electric circuit

Phase plates - one set of three per electric circuit

3.4.8.2. Danger plates shall feature red symbols on a white background. They shall comprise a skull with crossed bones, as well as lightning arrows conforming to DIN 40006. The text "DANGER" and line voltage shall be boldly written in a maximum of two languages to be coordinated with the local electrical authority and contracting officer.

3.4.8.3. Structure number plates shall show the structure number in black letters, on a white background. The height of the letters shall not be less than 150 mm.

3.4.8.4. Circuit number plates shall show the circuit abbreviation and number in black letters, on a white background.

3.4.8.5. Termination gantries shall be equipped with circuit plates showing the circuit names in full length.

3.4.8.6. Phase plates shall show the English letters "R", "Y", and "B", in black color, on red, yellow and blue background respectively.

3.4.8.7. The danger signs and the structure number plate shall be installed on the structure base at approximately 1.5 m height. The number plate shall face the normal structure access. Fitting positions for all structures shall be submitted for Contracting Officer's approval.

3.4.8.8. The circuit designation, as well as the phase identification plates shall be installed under each circuit and shall be placed on the step bolt legs, directly above the anti climbing device. They shall be positioned to reflect the phase allocation on the structure and to be easily identifiable from ground level.

3.4.8.9. Furthermore, on each tension and every tenth

suspension structure an airborne observation number plate shall be provided. The structure number shall be cut from sheet metal, with a minimum letter height of 700 mm. The plate background shall be black. The plates shall be installed, either on the top crossarm or on the ground wire peak, in a position that is easily recognizable from the air. It shall be ensured that legibility of the cut-out number is not impaired by structure steelworks, placed behind the plate. Orientation of all plates on the line shall be uniform.

3.4.8.10. All plates shall be of corrosion resistant aluminum with embossed letters and painted, or of enameled iron. If enameled iron is used, great care has to be taken to ensure that the surface is completely enameled (including edges) and not damaged during transport and installation. In this case special washers of an approved material have to be provided for securing bolts and nuts without damaging the enamel.

3.4.8.11. On all plates, the colors shall be free from fading. Lettering and size of the plates shall be to the Contracting Officer's approval.

3.4.9. Marking Packing and Handling

3.4.9.1. Each separate member of the structure shall be marked indicating structure type and number and the piece corresponding to the shop drawings. The marking for members that are used for more than one type of structure shall have all structure type designations.

3.4.9.2. These marks shall be embossed into the steel before galvanizing in such manner as to be plainly visible after galvanizing.

3.4.9.3. The marking shall be in the same relative location on all members, using different marks for different members, and the same marks for identical parts. Where high strength steel is used for any structure member, all of these members shall have distinguishing marks stamped on them adjacent to the identification number before galvanizing.

3.4.9.4. Structure members shall be assembled for shipment in bundles of the same size and weight containing pieces of the same or similar identifications mark and length. All bolts, nuts, washers, step bolts and minor fittings shall be shipped in wooden cases of suitable size and weight, with pieces properly separated according to size and type.

3.4.9.5. To ensure uninterrupted erection, the Contractor shall supply a five (5) percent excess of bolts, nuts,

washers, step bolts, and minor fittings.

3.4.9.6. It is the Contractor's responsibility to ensure that the packing and handling is made in such a way that neither the steel nor the galvanizing shall be damaged in transit. Transporting vehicles shall be clean and free from foreign material that could in any way injure the steel or zinc coating.

3.4.9.7. A legible mark of origin shall be applied on all castings and forgings, particularly on conductor and overhead ground wire hardware, and on insulators and associated hardware. Insulators shall, in addition, be marked with the mechanical or electromechanical failing load or a corresponding code number. Each separate member of the structure shall be marked indicating structure type, number and the piece corresponding to the shop drawings. These marks shall be embossed into the steel before galvanizing, or concrete as part of the casting, in such a manner as to be plainly visible after manufacture.

3.4.10. Content of Drawings

Five sets of drawings shall be submitted for the Contracting Officer review. These drawings shall show the following data and information for structures listed above and as shown on the conceptual design drawings:

a) An outline drawing of the structure showing all basic design dimensions;

b) Electrical clearances;

c) Specified loading conditions;

d) Wind loads on the structure at each point of application;

e) Stress diagrams or computer data so that the client can readily check the strength of the structure from the loading conditions specified;

f) A detail of the conductor, overhead ground wire and foundation attachments where not specified by the Engineer, including design calculations;

g) All shop drawings of structure and structure members and legs shall show the item assembled in place, clearly indicating all dimensions, the size, number and lengths of bolts required in each connection;

h) A bill of materials shall be prepared in tabulation form, listing all materials required for fabrication and assembly of the structure. The list shall show the number of items required and the total weight of each part.

3.5. MATERIAL SPECIFICATIONS – CROSSARMS AND HARDWARE

Crossarms for structures shall be fabricated from hot rolled steel angle sections. All crossarms, braces and related steelwork shall be factory made and entirely galvanized by the hot dip process.

3.5.1. Construction

The minimum thickness for crossarms, braces and ground wire peaks shall be 6 mm. The diameter of bolt holes for all types of structures shall not be more than 1.5 mm larger than the nominal diameter of the bolt. All members of the structures shall be connected by bolts. Connections of members shall be designed to avoid eccentricity as much as possible.

3.6. MATERIAL SPECIFICATIONS – FOUNDATIONS

3.6.1. General

3.6.1.1. Foundations shall be designed for all the specified structure types for good and poor soil, both in dry and fully submerged conditions, and for rock.

3.6.1.2. The responsibility for proving the adequacy of the foundation type at each structure site shall rest with the Contractor. The necessary soil surveys including field or laboratory tests shall, therefore be undertaken by the Contractor according to these Specifications.

3.6.1.3. Parallel to these soil investigations, the Contractor shall also take water tests (analysis) in waterlogged locations to ensure the application of the correct cement type. The results of these tests shall be documented by the Contractor and submitted to the Contracting Officer.

3.6.1.4. Pile foundations or special foundation designs may be required in difficult locations or in especially poor soil.

3.6.1.5. The Contractor is required to design for each type of structure, suitable foundations, including pile foundations, if required, for each kind of soil encountered.

3.6.1.6. Structure foundation designs for each structure type shall indicate geometry and volume of excavation, and concrete, and shall be submitted. All foundations shall be below the frost penetration depth.

3.6.1.7. The Contractor shall be free to propose alternative types of foundations to those specified in the technical specifications, provided that these comply with all requirements specified. However, only the types specified above shall be included in the bid.

3.6.2. Design Data

3.6.2.1. The foundations shall be designed to resist uplift, overturning and vertical and horizontal pressure. Foundations shall also be able to withstand the stresses, which may be imposed upon them under erection and stringing operations.

3.6.2.2. Loads derived from the structure design calculations shall be increased by 10% for application in the foundation design. Where unstable soil conditions exist, as well as lack of sufficient soil data, an increased load factor can cover uncertainties in the design.

3.6.2.3. Soil properties shall be determined from the original design information, and confirmed by site specific testing.

3.6.3. Calculations

3.6.3.1. Submittals

a) The Contractor shall submit for all foundations detailed calculations showing that the ultimate earth bearing capacity is not exceeded by the maximum pressure due to loads, acting on the structure, multiplied with the corresponding load factor, and due to the dead weight of the structure and foundation. Total and differential settlement calculations shall also be submitted based on normal maximum loading conditions.

b) The design shall further prove that the uplift forces on the foundation do not exceed the weight of the fictive anchor body in the soil, assumed to be in the shape of an inverted pyramid starting 25 cm above the toe of the pile.

c) The Contractor shall also submit the Contracting Officer calculations and drawings showing the bearing capacity and stresses at each critical section of the concrete and the steel reinforcement.

3.6.4. Protection of Structure Foundations

3.6.4.1. At locations where earth moving (e.g. land slides, erosion, etc.) is likely to occur, the structure foundations shall be protected against this effect by means of backfilling and of layers of stabilizing material soil to prevent erosion.

3.6.4.2. Any approved stabilizing layer has to be well compacted and should have a thickness of not less than 50 cm. The protected area should reach at least 5.0 m beyond the edge of the foundations.

3.6.4.3. The structure locations where such protection is

needed shall be finally decided upon by the Contracting Officer at site. Appropriate alternative solutions may be finally decided upon by the Contracting Officer at site. Appropriate alternative solutions may be indicated by the Contractor.

3.7. CONCRETE WORKS FOR TRANSMISSION AND DISTRIBUTION SYSTEM COMPONENTS

3.7.1. General

3.7.1.1. In general, and except where otherwise specified, the Contractor shall supply all labor, materials and equipment required for the concrete work and all tests thereon and shall: Mix, transport, place, compact, finish and cure all concrete; Erect and dismantle all forms and form work; Fix all steel reinforcement; and Embed, as required, all items, whether supplied and erected directly or by other Contractors, in accordance with these specifications and drawings.

3.7.1.2. All concrete work shall be carried out in accordance with DIN 1045, latest issue. No concreting shall commence in any portion of the work until the preparations and the concrete mix design have been accepted and permission has been granted by the Contracting Officer.

3.7.1.3. The required minimum concrete class is a B 25 as per DIN 1045. The mix design of the concrete has to be approved, and its suitability proven in trial mixes at site. In case of use of ready mixed concrete, trial mixes may be waived if an earlier proven mix design is used for the Work.

3.7.1.4. Methods of testing shall be included in the offered price.

3.7.2. Cement

3.7.2.1. Cement for concrete shall be of ordinary Portland cement conforming to the BS standard BS12 or equivalent standard and shall be accepted by the Contracting Officer. It shall be delivered to the site in bulk cement containers or in sealed bags clearly marked with the maker's name and shall be carefully stored in a waterproof shed with a raised floor or in a silo of accepted design. Each consignment of cement shall be stored apart from earlier consignments and the cement shall be used in the order in which it is delivered.

3.7.2.2. Weathered or congealed cement, or cement more than six months old after production, shall not be permitted to be used unless otherwise approved by the Engineer after the quality test.

3.7.3. Aggregates

3.7.3.1. All aggregates to be used for the Works shall comply with the requirements of BS 882 in all respects and shall be subject to the tests specified in BS 812 or equivalent. The Contractor shall furnish to the Contracting Officer samples of both the proposed fine and the coarse aggregates, together with such full details as the Contracting Officer may require. No aggregates may be used in the Works until they have been approved by the Contracting Officer.

3.7.3.2. During the Work the Contracting Officer shall order such tests he may consider necessary on the aggregates. Any aggregates found to have unsuitable characteristics shall not be used in the Work and shall be removed from the Site.

3.7.3.3. The various fractions of fine and coarse aggregates shall be stored separately and in such a manner as to avoid the admixture of dirt in the concrete. Aggregates shall be handled in such a way that separation is avoided.

3.7.4. Grading of Aggregates

3.7.4.1. The grading of the fine and coarse aggregates shall be mixed in the proportions decided for each class of concrete, the grading of the combined aggregate shall be suitable for making dense concrete of appropriate workability, containing the proportions of cement and water prescribed.

3.7.4.2. The proportions of fine and coarse aggregates and the maximum size of the coarse aggregate to be used in each class of concrete shall be accepted by the Contracting Officer.

3.7.4.3. The Contractor shall be responsible for mixing the aggregates in the proportions accepted by the Contracting Officer for each class of concrete and each section of the Work. Submit samples of the concrete material to the Contracting Officer prior to starting any concrete work, and have test cubes made and tested from the aggregates and the cement which he intends to use for the Work. Concrete works must not begin until such samples and tests are to the Contracting Officer’s satisfaction. Concrete to be cast under water is to have sufficient quantities of fine materials. Its grading curve is to be in the middle of curves A and B of DIN 1045.

Aggregates are for all groups being subject to the Contracting Officer’s acceptance.

3.7.5. Water

The water to be used for mixing and curing of concrete shall at all times be kept clean and free from deleterious matters such as oil, acid, alkali, silt, etc.

3.7.6. Admixtures

Subject to the acceptance of the Contracting Officer, the Contractor may use an admixture, listed below, if required to improve the quality of concrete or mortar such as workability and finish and water tightness. Usage shall only be in accordance with the Manufacturer's instructions.

3.7.6.1. Water-reducing and set-retarding agent to ASTM C494

3.7.6.2. Plasticizer

3.7.7. Delivery and Storage

3.7.7.1. All accepted cement shall be properly protected, delivered and stored in dry weather-proof sheds or covers. Cement shall be delivered in quantities sufficient to ensure continuity of the work, and to enable all the necessary tests to be carried out before it is used, but should not be stored for more than 6 weeks. The Contractor shall ensure that each consignment is accompanied by a certificate from the manufacturer certifying that the cement in that consignment is in accordance with the Specification.

3.7.7.2. Tests after Delivery

Each consignment of cement may, after delivery to the site and at the discretion of the Contracting Officer, be subjected to the whole of the tests and analyses required by the Specification. The Contractor shall arrange for these tests to be carried out at his own expense.

3.7.7.3. Rejection of Cement

The Contracting Officer may reject any cement as a result of any tests thereof, notwithstanding the manufacturer’s certificate. The Contracting Officer may also reject cement which has deteriorated owing to inadequate protection or other causes or in any other case where the cement is not to his satisfaction. The Contractor must remove all rejected cement from the site without delay and expenses for the Contracting Officer.

3.7.8. Concrete Mixing

3.7.8.1. The Contractor will be required to proportion the materials by weight at all times.

All concrete shall be machine mixed. The type of mixer shall be approved by the Contracting Officer. The slump of the concrete shall be between 25 mm and 50 mm or as

determined by the designer of record corresponding to a stiff, plastic consistency. Air content shall be a minimum of 3% or as required by designer of record.

Next to the operator where the concrete is mixed, the quantities of aggregates, cement, water and additives, if any, in kg per m^3 of compacted concrete shall be displayed legibly.

In hot weather conditions various means should be employed to lower the temperature of concrete as:

- using cold water; the use of ice is to be limited to chill the mixing water, but no ice is to be used during batching
- avoiding the use of the hot cement
- insulating water supply lines and tanks
- cooling coarse aggregate
- shading and/or cooling mixer drums
- watering sub-grade adequately, formwork and reinforcement
- avoiding concreting around midday
- the temperature of fresh concrete must in no case exceed +35 °C.

3.7.9. Ready-mixed Concrete

Ready-mixed concrete may be used in the Works, provided that adequate control is maintained of the supply, mixing and placing of the concrete.

3.7.10. Steel Reinforcement

3.7.10.1. The steel reinforcement shall consist of hot rolled deformed bars conforming to the requirements of BS 4449, Grade 4601425 or equivalent. The specific number, type and location of ridges of the deformed bars shall be accepted by the Contracting Officer.

3.7.10.2. The number, placing and fixing of bars shall be in accordance with the drawings and accepted bar bending schedules, or otherwise, as directed by the Contracting Officer.

3.7.10.3. All placed and fixed reinforcement shall be free from loose mill scale, loose rust, oil, grease or other deleterious material and shall be approved by the Contracting Officer before commencing any concreting.

3.7.11. Formwork

3.7.11.1. The Contractor shall be entirely responsible for the design and construction of the formwork to be used for concreting. The formwork shall be rigidly constructed to represent the shape of the concrete as detailed on the Drawings.

3.7.11.2. External wall surfaces of concrete buildings shall be formed by vertical boards of even and acceptable appearance. Such formwork shall be supplied by the Contractor at his own costs.

3.7.11.3. All formwork for internal surfaces of concrete buildings shall consist of plywood or steel elements also to be supplied by the Contractor at his own cost.

3.7.11.4. No concrete shall be placed until the Contracting Officer has examined and approved the formwork.

3.7.12. Placing and Compacting

3.7.12.1. Concrete shall be transported from the mixer to the place of casting in such a manner that a separation of the aggregates does not occur. During transport and depositing, mixed concrete shall be protected from contamination by rain, spray, dust and dirt etc., and every precaution shall be taken to void the segregation of the constituent materials.

3.7.12.2. Concreting of any unit or section shall be carried out in one continuous operation, and no interruption allowed except with the Contracting Officer's approval.

3.7.12.3. Concrete shall not be dropped from more than 1 m height; for heights exceeding 1m, funnels down to the toe of the pile shall be used.

3.7.12.4. During placing of concrete under water, special precautions have to be taken to ensure continuity of concrete flow to guarantee minimum contact of concrete with the surrounding water.

3.7.12.5. The concrete shall be placed in its final position as soon as possible and in no case more than half an hour after mixing. The method of placing shall be such as ensuring that the concrete in its final position shall be dense and homogeneous.

3.7.12.6. Compacting shall be carried out in a manner approved by the Contracting Officer, and vibrators and other compacting equipment shall be to the satisfaction of the Contracting Officer.

3.7.12.7. If concrete for the load bearing components is to be

placed under water, it shall have a slump of around 15 cm, equal to a spread of 45 to 50 cm (DIN), at the maximum. The water/cement ratio shall not exceed 0.45, and the cement content shall be at least 400 kg per m^3 finished concrete for the first mix. Afterwards, concreting may be continued with a minimum cement content of 350 kg per m^3 of finished concrete.

3.7.13. Surface Finish

3.7.13.1. Unless otherwise shown on the drawings, all permanently visible concrete surfaces shall have a regular finish of uniform texture free from holes, pins and formwork.

3.7.13.2. Should any section of the concrete present a rough, uneven, honeycombed discolored or imperfect appearance when the shuttering is removed, it shall be chiseled to such a depth and refilled and properly refaced with such class of concrete as the Contracting Officer may direct.

3.7.13.3. In the event of excessive porosity being discovered the defective area shall be chiseled and make well as specified above, all at Contractors cost. No plastering of such concrete areas will be permitted.

3.7.13.4. Concrete foundation edges above the ground level and 300 mm below the ground level shall be beveled by inserting 25 mm triangular lifts in the formwork.

3.7.13.5. Concrete foundation heads shall be designed and finished preventing the accumulation of water.

3.7.13.6. Concrete surfaces shall be wood float or steel trowel finished as specified on the Drawings or instructed by the Contracting Officer. All finishing works shall be carried out in accordance with the relevant specification of British Standard and to the satisfaction of the Contracting Officer.

3.7.13.7. All concrete foundations shall be treated with an asphaltic or equivalent coating in order to be acid-resistant. The surface to be covered must be perfectly clean. The coating shall be applied on the whole formed surface of the foundation with a layer at least 2 mm thick.

3.7.13.8. The required protective painting of foundations shall not be executed till the end of the curing period to obtain a completely dry surface. Painting shall be done according to the specifications of the supplier.

3.7.14. Curing

3.7.14.1. Cement-based repairs do usually require some initial

protection, because rapid drying out could halt the hydration of the cement and lead to shrinkage cracking, delamination and weakness.

3.7.14.2. Careful curing is essential by covering with absorbent material that is kept damp, preferably covered in turn by polythene or similar sheets, which are sealed at the edges. Shading from the sun may be necessary. Above all, alternate wetting and drying must be prevented because of the alternating stresses that it would cause.

3.7.14.3. If repairs are to be carried out during hot weather it is advisable to shade the work from direct sunlight in order to prevent drying out of cement-based repairs or over-rapid stiffening of resin-based materials.

3.7.14.4. Requirements for curing large volume repairs are similar to those for new construction. Although they are less critical in this respect than thin patches, curing is important to a durable result. Normal curing methods are usable except that sprayed-on curing membranes are suitable if a surface coating is to be applied later.

3.7.15. Fixing of Steel Structures

3.7.15.1. Where shown on the drawings or as directed by the Contracting Officer, steel items shall be embedded directly in correct positions in primary concrete. All brackets, anchor bolts and other steel items, for which recesses in concrete have been specified, shall be fixed by secondary concrete after careful alignment to correct positions.

3.7.16. Testing of Concrete

3.7.16.1. All testing of concrete shall be carried out in accordance with the requirements of BS 5328: Part 4 and BS 1881.

3.7.16.2. During the mixing of concrete for each section of the work and at such other times as directed by the Contracting Officer 3 sets of test cubes, size 15 cm x 15 cm x 15 cm, shall be taken, each set consisting of 6 cubes. From each set 3 cubes shall be tested after 7 days and the remaining 3 cubes after 28 days.

3.7.16.3. The compressive strength of the cubes shall not be less than 28 N/mm^2 after 28 days.

3.7.16.4. Consistency and bleeding test and such other preliminary tests as the Contracting Officer may direct, shall be taken as often as directed by the Contracting Officer. No concrete of any type or class shall be used in the Works before the preliminary

tests have shown specified compressive strength and workability.

3.7.16.5. All test cubes shall be well marked and cured as specified.

3.8. GROUNDING

3.8.1. General

3.8.1.1. Every structure shall be permanently and effectively grounded to achieve a low footing resistance.

3.8.1.2. At structure sites in urban areas often frequented by people, an additional protective earthing, i.e. measurements for smoothing out the ground potential during earth faults shall be carried out.

3.8.1.3. All cradle guard and buildings with metal sides or roofs, and other objects as decided by the Contracting Officer, which lie under or within falling the distance of the line, shall be earthed at two points in an approved manner. Details of the proposed method shall be included in the bid.

3.8.1.4. The Contractor shall carry out approved soil resistivity tests at each structure location to determine the number of rods or conductors required. The results of the soil resistivity tests shall be documented by the Contractor and submitted to the DOR for approval.

3.8.1.5. All underground connections shall be made using the exothermic welding process.

3.8.2. Structure Footing Resistance

3.8.2.1. The footing resistance of any structure shall be less than 10 ohms.

3.8.2.2. Individual structure earthing shall be made with earthing rods or when this is not possible, with a radiating earth conductor.

3.8.3. Earthing Rods

3.8.3.1. Earthing rods shall be solid, copper-clad steel rods with a minimum diameter of 20 mm and minimum length of 3 m and with provision for coupling together with a suitable clamp for connection of the ground wire. The copper coating shall have a minimum thickness of 0.3 mm. Below grade earthing connections shall be bonded using the exothermic weld process.

3.8.4. Radiating Earth Conductors

3.8.4.1. Conductors for connecting structures to earthing, for radiating earth grid and for continuous counterpoise shall be copper-clad steel, according to ASTM B 228. Wires of the chosen conductor shall be at least 16 mm^2.

3.8.4.2. The Contractor shall choose an appropriate conductor as above according to footing resistance and short circuit current.

3.8.4.3. All underground connections shall be made using the exothermic welding process.

3.8.5. Connections

3.8.5.1. The ground wire shall be directly connected to the structure with bolted connectors of an approved material suitable for use with the ground wire such that galvanic action, i.e. chemical reaction between copper and galvanized steel, is minimized.

3.8.5.2. Connections to the substations earthing grid shall be made by compressed clamps or bolted connectors of accepted design.

3.8.5.3. All underground connections shall be made using the exothermic welding process.

3.9. CONSTRUCTION SPECIFICATIONS

3.9.1. Line Route

3.9.1.1. General Information

The proposed transmission and distribution line route is located as shown on the Project Area Map in Appendix A. Refer to drawings located in Appendix B of this contract for terrain descriptions and plan and profiles for the proposed transmission and distribution line. Preliminary tower structure staking coordinates have been provided in Appendix C for pricing purposes only. Final staking coordinates and number of structures are the responsibility of the contractor. Appendix D provides plan and profile drawings for the distribution line within the ANSF bases. The number of structures and locations shall be used as the final staking coordinates, unless approved by the Contracting Officer’s Representative.

3.9.1.2. Clearing of the Line Route

The contractor shall perform clearing of the line route. The clearing will consist of the removal and disposal of trees and other vegetation, houses and huts, barns, cattle-sheds, etc., within a total width of 25 m, i.e. 12.5 m on each side of the center of the transmission line, and within a total width of 15 m, i.e. 7.5 m on each side of the center of the distribution line. All tall trees, which

after falling will be within 20 m of the transmission and distribution line center, shall be removed even if they are outside the 25 m cleared area. All trees which would cause flashover from a conductor deflected up to 23 m from the vertical shall be removed. In determining the flashover clearance and in estimation the mean height of the bush or forest due allowance shall be made for seasonal growth.

The Contractor shall make the necessary arrangements with property Owners so as to permit cutting or trimming of trees located both inside and outside the right-of-way, where such cutting or trimming is unavoidable. The Contracting Officer may extend assistance to the extent possible.

In addition, where trees outside the cleared area have such a height that they could fall within 2 meters of the conductors, they shall be cut or trimmed to such a height to avoid such a possibility.

Any cost arising from any removal of vegetation will not be paid for separately, it is deemed to be included in the Contract price.

3.9.1.3. Survey

Line Profile Survey

The topographical line survey shall be carried out along the approved line route. All site plans shall be geo-referenced using the WGS 1984 coordinate system, specifically the following: WGS 1984 UTM one 41 North. If the designer is not able to use the stated coordinate system the coordinate system used shall be correlated to the stated coordinate system. A table shall be provided within the site drawing set cross referencing the WGS84 system to that utilized.

The theodolites used and measuring techniques applied shall be state of the art, employing digital recording technique, to Contracting Officer's satisfaction. The survey shall be carried out to a minimum accuracy of 1 in 2,000 for distance, and 1 minute for angular measurements.

The Contractor shall prepare longitudinal profile drawings of the transmission and distribution line, in scales of 1:2,000 for the horizontal and 1: 200 for the vertical axis unless otherwise determined.

The profile plans shall contain the longitudinal ground profile along the OHL centerline, plus side profiles right and left under the outermost conductors, shown in different broken lines. They shall display the bottom conductor catenary, at 75°C, together with the ground or special clearance curves, as well as the minimum temperature catenary. Structure numbers, structure types, weight spans,

wind spans, equivalent spans, section length, continuous chainage, elevations, level differences, UTM coordinates, etc. shall be shown. Along the bottom of the profile plan, a strip plan of the line route, extending 30 m beyond either side of the centerline, shall be shown. The strip plan shall detail all relevant information regarding obstructions, services, vegetation, trees, terrain type, land use, land ownership boundaries together with the name of the land owner etc. The names of the MEW and local village representatives who participated in the survey shall be detailed on the strip plan. Horizontal and vertical coordinates of all features affecting the line construction shall be indicated on the profile plan. Crossings of existing overhead lines shall be documented with measured elevations and locations of their top and bottom conductors, at centerline and side profile limits, together with the air temperature at the time of measurement. All qualified crossings and approximations shall be covered by individual clearance calculations, to be shown on the profile plan. Structure center coordinates and all elevations shall be reduced to UTM (Universal Transverse Mercator) datum, and indicated on the profile plans.

The Contractor shall locate and indicate bench marks and reference points already existing in the project area. The Contracting Officer will render assistance to the Contractor in providing information about locations of the reference points. Where these do not exist, the Contractor shall provide such reference points in consultation with e.g. the Municipalities, etc.

The line route shall be marked in the field by timber survey pegs of sufficient length, with a cross section of minimum 50 mm x 50 mm, to be driven flush into the ground. The accurate centerline shall be shown on the pegs by a single nail, to be driven into the peg's top. Terminal and angle pegs shall be secured by a concrete foundation, to the Contracting Officer's approval. Straight line pegs shall be driven along the OHL centerline, at a minimum of 4 per km, and to either side of every line crossing. After acceptance of the structure distribution on the profile plans, structure center pegs shall be driven at site. After final acceptance of structure locations, which will be given by the Contracting Officer after detailed site inspection, insurance pegs shall be driven, approximately 30 m to either side of each structure center peg, in line direction. Different kinds of pegs shall be distinguishable by a paint marking system, to be submitted for the Contracting Officer's approval.

All pegs or other marks shall be preserved until their removal is authorized by the Contracting Officer.

The Contractor shall minimize the number of structure locations between line angle points, without exceeding the

structure /conductor design limits. The structure distribution shall be performed by means of a recognized computerized optimization program, to Contracting Officers approval.

Structure Site Survey

After acceptance of profile plans with structure distribution, the Contractor shall prepare diagonal cross sections of all structure locations, to determine leg/hillside extensions/reductions, foundation platform/protection requirements, and foundation setting levels. It shall be ensured that the foundation concrete caps will have a minimum height of 0.75 m above final ground level.

Angle and terminal structures shall be placed within survey accuracy limits (see above). Straight line structures shall be located and centered within 10 cm of the center line transversely, and within a 0.5% deviation of their back span length longitudinally, relative to their specified position on the profile plan.

Relocation of a structure exceeding the longitudinal deviation limit will be allowed only if accepted by the Contracting Officer and for purposes of improving soil conditions for foundation work or for avoiding houses. Such relocation shall in any case not exceed more than 10 m in either direction and will be allowed, provided ground clearance is not impaired and specific loading of the particular structure is not exceeded.

Structures in tangent positions shall be oriented with the transverse faces at right angles to the transmission and distribution line center line, and structures in angle positions shall be oriented with the transverse face at right angles to the bisector of the deviation angle. Structures with asymmetrical crossarms shall be offset from the theoretical centerline, so far as to even out the distance between conductors of either structure side to the theoretical centerline.

3.9.1.4. Access

The Contractor shall provide and maintain all access to the transmission and distribution line routes and the structure locations, as required for erection work.

The Contractor shall reinstate, as mandated by Local Authorities and the Contracting Officer, all access to the transmission and distribution line routes after construction.

All access provisions intended by the Contractor shall be submitted, prior to construction, for Contracting Officer's approval.

No separate payment will be made to the Contractor on account of maintaining or repairing these access roads.

The same applies to slight changes on the line routings such as they may be required in shifting the transmission and distribution line routes due to the requirements of local Authorities and the Contracting Officer.

3.9.2. Erection of Structures

3.9.2.1. Location Of Structures

Unless otherwise specified, straight line structures (suspension) shall be installed to have the crossarm at right angles to the line direction, and angle structures to have the crossarm bisecting the line deviation angle.

Tolerances of centers of structure locations shall be as follows:

- In-span length: 1.0 - 2.0 m
- In-height: 0.5 m
- Deviation from straight line between two adjacent structure centers - 0.25 m

3.9.2.2. Erection Works

General

The Contractor shall ascertain that all concrete foundations or rock anchor grouting are cured and that all backfill is compacted to its approved level before placing or erecting structure steel on the foundations. Concrete in structure foundations shall be allowed to set a minimum of 7 days before erection of the structure and a minimum of 28 days before conductor and ground wire installation on the structure.

The Contractor shall erect the types of structures specified at the locations indicated on the Contract Drawings.

Structures shall be assembled in accordance with the accepted drawings and erected by a suitable method which will not overstrain structural members or their foundations, subject to the Contracting Officer’s acceptance.

Handling and Storage

Steel and concrete shall be stored on wooden supports of sufficient height to avoid any ground contact or other contamination. Storage conditions shall be well ventilated, preventing the formation of wet storage stain from

accumulation of humidity and sand. It shall be clearly understood, that white rust formation will lead to rejection of the affected material.

All necessary measures shall be taken to prevent structural injury to members, or damage to galvanized coatings. Members shall not be dragged on the ground, or will the practice of throwing structure steel into piles on conveyances, or from conveyances onto the ground, and of skidding steel members over each other, be permitted. Lifting of structure steel shall not be done with steel slings, being in direct contact with galvanized surfaces. Instead, fabric belts, or other suitable protection shall be applied.

Damaged structure material shall be replaced by the contractor at their expense. Any delays because of damaged material, to the schedule must be remedied by the Contractor.

Small (less than 150mmX150mm) accidental damage to galvanized surfaces may be repaired by application of an approved repair paint. Larger areas of damage to or systematic defects of the galvanizing shall be repaired by hot-dip galvanizing, only.

The attempt to repair shall not bind the Contracting Officer to accept the repaired part when this is re-offered for inspection.

Acceptance by the Contracting Officer of any repaired galvanized steel does not absolve the Contractor from his responsibility of supplying galvanized steel to give satisfactory service in the prevailing corrosive atmosphere. The Contracting Officer reserves the right to reject any galvanized steel found rusty, damaged, bent or other-wise defective, before final acceptance.

Erection

During the erection, no tools shall be taken up to the structures, except structure wrenches and drift pins. Only such wrenches will be allowed, which do neither deform nor injure the galvanized coating of the bolts/nuts. Use of drift pins is limited to guiding the different structure members into position, without enlarging holes or distorting structure members.

Each bolt shall be securely tightened with adequate but non-excessive torque. Proper tightness shall be spot checked by the Contractor, to Contracting Officer's satisfaction, with an accurately calibrated torque wrench. The Contractor shall indicate the torque that shall be applied for each bolt size. All structure bolts shall be completely tightened, immediately after a structure is erected. After erection, structures shall be left in workmanlike condition, complete and safe in every respect.

In order to prevent pilfering, all bolts and nuts below a minimum height of 3 m above the foundation cap shall be secured by suitable means, to be proposed by the Contractor, for Contracting Officer's approval.

A reasonable amount of drifting will be allowed in assembly of structures. Any drifting used shall not distort the metal or enlarge the hole. Accidentally missing/mismatched holes may be drilled/reamed at site, only in exceptional cases, subject to Contracting Officer's prior acceptance and proper application of repair paint Reaming/drilling at site, for correction of mismatched/missing holes due to systematic shop errors, will not be tolerated. Members so affected shall either be hot-dip re-galvanized, after repair, or entirely replaced with correct material.

Earth clamping bolts and structure sign plates shall be installed according to the articles above.

Structures must be completely erected with all members in place and bolts securely tightened before any stringing of conductors or ground wires may be started. All structures shall be inspected by the Contracting Officer accompanied by the Contractor before the stringing operation. Prior to the erection of structures or parts of structures which have been completely assembled on the ground, the acceptance of the Contracting Officer is required.

After conductors and ground wire have been installed and sagged, all structures shall stand plumb, with a tolerance on vertical deviation not exceeding 3 mm/m.

3.9.3. Foundations

3.9.3.1. Excavation and Backfill

Except when stated below, structures shall be placed on natural, undisturbed virgin soil. All loose and disturbed materials shall be completely removed prior to concrete placement. Excavation pits shall be kept dry during installation of foundations. Whenever necessary or as required by the Contracting Officer, the Contractor shall re-excavate materials which have accumulated in previously prepared pits.

No additional payment will be made for blasting, sheet piling or water pumping. Excavated soil may be used as backfill if it is suitable for compacting. Rock and soil not suitable for compacting shall, at Contractor's own cost, be removed and replaced with a suitable backfill to the satisfaction of the Contracting Officer.

All filling material shall be free from cinders, ashes, refuse vegetation or organic material, boulders and other material, which in the opinion of the Contracting Officer is unsuitable.

Backfill shall be placed in lifts of approximately 150 mm thickness. Each layer shall be carefully compacted by means of a suitable plant.

Backfill shall be carried out to a minimum height of 20cm over the original ground surface to compensate for the future settlement of the filling.

All backfill of structure foundations shall be protected from being washed away by running water in an approved manner. At all structure positions, the surface of the ground shall be sloping from the structure foundation to provide drainage as required. No additional payment will be made for such work.

Erosion control, such as the installation of rip rap or ditches, may be required during construction. No additional payment will be made for such work.

3.9.3.2. Type and Size of Foundations

The Contractor shall be responsible, at his own cost of ascertaining that the foundations to be employed are suitable for the sub-soils encountered at each structure site. For this purpose and at his own cost the Contractor will be responsible for classifying the sub-soils at each structure site at an early stage of the Contract. The type and number of soil tests to be carried out in order to determine soil conditions shall be to the approval of the Contracting Officer. Generally, it may be assumed that tests are carried out at about one fifth of the structure sites.

Basically, the soil tests shall be carried out at structure sites located near streams and rivers or places where it is not likely that rock will be found. Structures near exposed rock shall normally not be tested. Soil tests from more than one fifth of the structure sites shall be carried out if necessary, in the opinion of the Contracting Officer, to determine soil classes.

The Contractor shall be responsible for any subsidence or failure due, in the opinion of the Contracting Officer, to insufficient care having been taken in his examination of ground conditions or in erection of the structures.

The results of the soil tests shall be submitted to the Contracting Officer in an approved manner together with proposals for each structure site for employment of a class of standard foundation as given under Specification of foundations or the need for a special or modified standard foundation design. The class of foundation proposed for each structure site shall be accepted by the Contracting Officer before erection of the structure.

A record shall be kept of each structure installed

including details of the strata of the ground throughout the depth of excavation, the presence or not of water during construction and liability to seasonal flooding, together with results of tests carried out and all other relevant information.

3.9.3.3. Earth and Rock Work

General

The Contractor is responsible for all necessary safety measures and shall be liable for any damage and accidents occurring while earth work is being dug out and carried away. Proper standing, including any necessary re-arrangement protection of slopes or cribbing, preparation of design calculations, etc., shall be deemed included in the contract price.

In the event of soil slides occurring during earth and rock work, all damage will be to the Contractor’s debit.

This also implies that no payment will be made for the additional moving of soil resulting from such damage.

Clearing and Grading

The sites of all structure base work shall be cleared and leveled so that on completion of the work the finished reinstated ground level shall normally be at least the same as prior to commencement of the work.

Backfilling

Refilling shall be carried out only after all works within the excavations have been inspected and accepted by the Contracting Officer. Unless otherwise directed all filling shall be approved selected material, and shall be deposited and compacted using approved material in layers not exceeding 150mm thick for hand compaction and 250 mm for mechanical compaction, loose depth.

During the placing of backfill the hole shall be kept free from water. All temporary timbering and all decomposable material shall be removed from the excavations prior to backfilling.

Settlement

The Contractor shall be responsible for making good all settlement of filling due to any cause whatever which may occur up to the completion of the maintenance period.

Surplus Material

All material that is surplus to the requirement of fill, and all debris and rubbish shall be removed and deposited

as directed by the Contracting Officer.

3.9.3.4. Rock Anchors

Drilling in Rock

All drilling operations shall be carried out by fully qualified personnel, using only approved methods and equipment. Flushing with water when drilling shall be employed whenever possible.

Drilling mud and lubricants on drill rods shall be used only where permitted by the Contracting Officer.

The drilling of holes in rock for anchors, drainage and grouting may be carried out by means of percussion rock drilling machines. The diameter of holes for anchors shall be 1.5 to 2 times the diameter of the steel bar.

When holes are completed, they shall be temporarily plugged until they are used for their purpose.

The drilling of drain holes in rock shall be carried out in the vicinity of holes where grouting is going on, and restrictions specified by the Contracting Officer in this respect shall be adhered to.

Anchors

Anchor bolts shall be used for anchoring concrete structures to rock. Strengthening of the rock may be effected by means of grouted-in bolts.

Anchors in rock shall be of a quality accepted by the Contracting Officer. They shall consist of deformed steel bars meeting the requirements of type "High Yield" according to BS 4449 and shall normally have a diameter of 25 mm. The bars shall be thoroughly cleaned before they are placed in position.

Anchors in rock shall be grouted-in either by the “Perfo” method, the SN method or other methods approved by the Contracting Officer. The “Perfo” method implies that the two halves of a perforated steel tube of the same length of the hole that are first to be filled with a stiff sand-cement mortar. They shall then be put together and inserted right to the bottom of the drill hole.

Immediately afterward the bar shall be driven into the tube by means of a pneumatic hammer so that the mortar, pressed through the perforations of the tube, completely fills the space between the bar and the rock.

According to the SN method, the holes shall firstly be filled with mortar through a hose inserted to the bottom of the hole and successively pulled out as the mortar fills

the hole. The bar is then driven into the hole by means of a pneumatic hammer. When specified on the drawings, the steel shall be of a weldable quality accepted by the Contracting Officer.

The holes shall be thoroughly cleaned with water and air immediately before they are filled with mortar.

The grout may either be cement grout or sand-cement mortar. The consistency and composition thereof shall be accepted by the Contracting Officer.

Where shown on the drawings or as directed by the Contracting Officer, the protruding ends of the bars shall be bent.

Where directed by the Contracting Officer, testing of the anchorages shall be carried out. The protruding ends of the bars shall then be given a sufficient length from the surface of the rock to allow the fixing of a hydraulic jack provided by the Contractor. The matrix of the jack shall be designed to ensure a satisfactory grip up to stresses 01300 N/mm^2 in the bar. It is envisaged that in case the number of failures is found to be five per cent or less, normally not more than five per cent of the total number of anchorages will be tested as prescribed above.

3.9.4. Installation of Insulators, Conductors, OGW and OPGW

3.9.4.1. Insulators

Insulators shall be handled with the utmost care in order to avoid chipping or cracking of the discs, and bending of the pins. Insulators shall remain in their shipping crates until required for assembly at the pole site.

Before assembly, all units shall be closely inspected. Bent pins will not be allowed. In order to minimize the risk of pin bending, no rope slings shall be used for lifting assembled units, but a suitable hook shall be applied to the insulator.

Damaged insulator units shall be replaced. Invisible disc cracks may be detected by sounding each unit with a light wood or hard-rubber club. The cracked ones shall immediately be destroyed in order to avoid unintentional re-use.

Before installation and immediately before hanging, the insulator shall be thoroughly cleaned, and all cotter pins shall be checked for correct positioning and freedom from defects.

Insulator strings may be climbed only without shoes, or with shoes with rubber soles.

All bolts, nuts and cotter pins shall be installed to facilitate easy inspection and live line maintenance work.

3.9.4.2. Conductor Joints and Tension Assemblies

Compression joints and tension clamps shall be installed according to good engineering practice. The Contractor shall submit detailed written instructions for the complete installation procedure for the acceptance of the Contracting Officer.

The person appointed by the Contractor to be responsible for the installation of the joints and tension assemblies shall punch his identification sign on each assembly. All installation of joints and clamps shall be made in the presence of the Contracting Officer and shall be punched with his identification sign.

Wherever possible, full use shall be made of maximum drum lengths of conductors and overhead ground wires in order to reduce the number of joints.

The number of joints and their location in the spans shall be accepted by the Contracting Officer.

No joints shall be made in spans which cross main roads, power lines or in the major river crossings, nor, whenever conductor drum lengths permit, in spans immediately adjacent thereto.

The distance between joints of the same conductor shall in no case be less than 100m. Joints shall in no case be installed closer than 20m to the center of suspension clamps or closer than 100m to tension clamps.

The Contractor shall keep a record of all joints and tension clamps indicating the location, type and date of each assembly.

3.9.4.3. Overhead Ground Wire and Optical Ground Wire Joints and Tension Assemblies

Ground wire joints and tension clamps shall also be made according to the requirements of the previous paragraph where applicable. The procedure to be followed shall be as recommended by the manufacturer, and will ensure the ground wire is not damaged, and provide reliable protection over the life of the cable.

3.9.4.4. Repair Sleeves

In case of damage to the conductor aluminum strand, an approved repair sleeve shall be installed provided the damage consists of not more than one fourth of the strands in the centre layer are broken, or dented deeper than one half of their diameter. When more than one fourth of the

strands are damaged, the damaged section of the conductor shall be cut out.

Repair sleeves shall be installed in the presence of the Contracting Officer.

3.9.4.5. Stringing Pulleys

Stringing pulleys shall have adequate strength and shall be of approved design. They shall be equipped with bail or roller bearings. The sheave diameter measure at the bottom of the groove shall not be less than 15 times the outside diameter of the conductor or overhead ground wire.

The groove shall be wide enough for the passage of compression joints. Stringing pulleys for the conductors and overhead ground wires shall have the sheave grooves lined with electrically conductive neoprene or equivalent.

Pulleys shall be inspected daily for proper operation. The use of defective pulleys will not be permitted.

3.9.4.6. Stringing

Conductors and overhead ground wires shall be pulled out and strung by an approved tension stringing method. Conductors shall, as a principle, never be allowed to touch ground.

The Contractor shall submit in writing, for the acceptance of the Contracting Officer, a complete and detailed description of the stringing equipment and the stringing and sagging procedure intended for use.

Unless otherwise accepted by the Contracting Officer, the tension stringing procedure shall be in strict conformity with the recommendations of the manufacturer of the stringing equipment. Only specially trained linesmen must be employed who are well acquainted with the handling and running of the particular equipment to be used.

Reliable means of instantaneous two-way communication must be available between the pulling and the braking crews, and between these crews and any observation posts that may be placed along the stringing section.

The stringing equipment shall be set up so as not to cause excessive vertical loads on the structures/crossarms. The distance to the nearest structure through which the cables are being strung shall be selected with due regard to the relative levels of the pulleys on the structure and the stringing equipment reasonable allowance should also be made for possible accidental over-tensioning of the cables. Stringing pulleys shall preferably be located at approximately the same levels as that which the conductors and overhead ground wires will occupy when installed.

At all times during stringing, the conductors and overhead ground wires shall be handled and protected so as not to be scratched, nicked, abraded, kinked or damaged in any way. If during stringing it should prove inevitable to lower the conductors to the ground, suitable non-metallic lagging shall be placed underneath.

Conductors, which have been subject to bird-caging during stringing, will not be accepted.

Stringing tensions shall never exceed corresponding sagging tensions.

Clamps for attaching the conductors and overhead ground wires to the hauling device shall be of approved design and shall prevent the relative movement of strand or layers of the conductors or overhead ground wires. Freely rotating ball bearing swivels shall be used for each cable to be strung.

If, for any reason, stringing operations in progress must be interrupted, the conductors and overhead ground wires may be left in the stringing pulleys, but their tension shall be reduced as far as possible. In all cases, however, the cables must be kept completely clear of the ground, by approximately 2 m, and sufficiently far from any obstacles which might cause abrasion of the cables, if touched by them.

If the interruption lasts for more than 40 hours or if stormy weather has prevailed, the cables shall be closely inspected for damage. Such inspection applies particularly to the suspension points where the cables have been resting in the pulleys' sheaves.

At all times during stringing, sagging and clamping operations, the conductors, overhead ground wires, reels and hauling equipment shall be effectively grounded.

Damage to the conductors or overhead ground wires shall be immediately reported to the Contracting Officer who will instruct the Contractor on how to proceed.

3.9.4.7. Sagging

The "equivalent span" method shall be used for the line conductors and ground wire, according to which the tension in any line section, i.e. between two tension structures, is that which would apply to a single span equal to the square root of the figure arrived at by dividing the sum of the cubes of the individual span lengths, in the section considered, by their sum.

The Contractor shall submit for the acceptance of the Contracting Officer sag and tension charts for use during erection, which shall be established with due regard to the

specific stringing and sagging methods to be employed so that remaining creep after clamping may be assessed and taken into account with reasonable accuracy.

Erection sagging charts or tables shall display sag in still air against span length for temperatures between 50°C and 65°C in increments of 5°C.

Sagging temperature shall be read from a certified thermometer, the bulb of which has been inserted in an approximately 50cm long piece of conductor with the inner layers removed. The thermometer so equipped shall be freely suspended in the air without any shielding and not less than 3m above ground. Temperature readings will be taken only after at least 20 minutes exposure.

After finishing stringing operations, the conductors and overhead ground wires shall be sagged according to agreed sagging procedure and relevant erection sagging chart or table.

All insulators shall hang vertically after the sagging operation. The contractor shall be responsible for determining the need for offset clipping. The contractor shall include an offset clipping report with the design submittals.

It is essential that prescribed hold periods before definite sagging are rigorously observed.

The Contractor shall check the sag of each conductor and overhead ground wire of a sagging section in at least one span of approximate ruling span length. The sags shall also be checked in all spans exceeding 500m and in spans on each side of angle structures and sharp breaks in profile. Intermediate spans shall be inspected for uniform sag.

Sag will be subject to checking by the Contracting Officer, and the Contractor shall furnish such assistance in equipment and personnel as may be required for this purpose.

Sagging sections shall be limited to such length as can be sagged satisfactorily.

Final sagging of conductors shall not be made earlier than 8 hours but not later than 48 hours after they have been taken up to approximate specific sag. All conductors of a sagging section shall be sagged at the same time.

Conductor tension shall be equalized between sagging sections so that the insulator strings will assume the proper position when successive sagging sections have been clamped in. The Contractor shall keep a record on approved schedules of the particulars of the sagging of conductors and overhead ground wires on each sagging section.

3.9.4.8. Clamping-in

After finishing sagging operations, the conductors and overhead ground wires shall be clamped-in according to agreed procedure. Tension clamps shall be installed and properly anchored prior to clamping-in at suspension strings. In order to make future adjustments possible, approximately one half of the available length adjustment of turn buckles shall remain after anchoring.

Clamping-in shall be affected within 48 hours after completion of sagging, unless otherwise agreed.

In transferring the conductors from the stringing pulley to the suspension clamps and during installation of the preformed armor rods, the conductors shall be carried by neoprene lined hooks with a saddle-shaped bearing surface long enough so as not to injure the conductors or any part thereof, or by equivalent means, as agreed with the Contracting Officer. The neoprene lining shall be electrically conductive.

Armor rods shall be installed in strict accordance with the manufacturer's instruction. They shall be centered within plus or minus 5cm. When installed, the difference between the ends of the rods shall not exceed 5mm.

All markings of the conductors, e.g. for the centering of clamps or armor rods, shall be made with tape or other means that do not affect the integrity of the conductors. Scratch marks or similar will not be permitted.

Tightening torque of clamp bolts shall be as recommended by the manufacturer.

Immediately after clamping-in, sag tolerances shall be plus or minus 1% of the specified sag, provided that all conductors in the span assume the same sag, and specified clearance to ground will be obtained.

Suspension insulators shall be plumbed longitudinally within plus or minus 30mm.

3.9.5. Vibration Dampers and Jumper Loops

3.9.5.1. Vibration Dampers

Vibration dampers shall be installed as specified after clamping-in. Dampers shall be located, installed and clamped, in accordance to the manufacturer's recommendations.

Stockbridge dampers shall hang plumb and in the same vertical line for each circuit after installation, with drain holes facing downwards. Before installation, all dampers shall be thoroughly cleaned and inspected for bent

spring wires, distorted clamps or other damage.

Spacers and spacer dampers shall be installed in every span, in the same relative positions to each other, on all phases.

3.9.5.2. Jumper Loops

Jumper loops shall connect all tension strings, between terminal fittings and shall be formed into a parabolic shape, as will afford the minimum clearances specified on the structure outline drawings. To maintain minimum clearances under loop swing, the Contractor may utilize jumper loop suspension insulators (dolly sets), however, with no extra cost to the Contracting Officer. Pipe-type jumper loops may be proposed, subject to Contracting Officer's acceptance.

When setting compression jumper terminals special care has to be taken to prevent any "basketing" of the conductor. After completion, the jumper loops shall present a smooth and uniform appearance without sharp bends.

At one terminal structure bottom crossarm jumper loops shall be transposed, to facilitate correct phase sequencing in the substations, This transposition shall be achieved with one normal and one extra large size jumper loop maintaining required minimum inter-phase clearance under all operating conditions.

3.9.6. Structure Earthing

All structures shall be permanently and effectively earthed,

The individual structure footing resistance shall be less than 10 Ω

Individual structure earthing shall be made with earthing rods or when this is not possible, with a radiating earth conductor. In addition, the first four spans outside substations shall be equipped with a continuous counterpoise, which shall also be connected to the substation earthing grid.

Earthing rods shall be driven to a depth per codes and standards.

When installed, the top of the earthing rod shall be 0.6 m (0.9 m in cultivated areas) below the ground level. Each earthing rod shall be connected to the pole, as specified by the manufacturer.

Each radiating earth conductor shall have a length as calculated by the DOR to reach the required resistance values. The earth conductors shall be buried and connected to the structure as above.

At each structure connection, a 2 m extra loop of the ground wire shall be buried.

Continuous counterpoise shall be buried and connected to the

steelworks and substation earthing grid as above.

3.9.7. Spare Parts and Tools

Spare parts and tools shall be provided for items and quantities as determined by the Government during the final design phase under the D/B contract.

PART 4 TECHNICAL REQUIREMENTS - SUBSTATION EQUIPMENT

4.1. 220 kV, 110kV AND 20kV PRIMARY EQUIPMENT

4.1.1. All 220 kV, 110 kV and 20 kV primary equipment shall be designed and manufactured in accordance with the latest edition of IEC and BS standards. This includes the following main applicable standards:

All 220 kV, 110 kV and 20 kV primary equipment and accessories shall be air insulated, installed outdoors and meet the requirements specified in Paragraph 4.10, Dimensioning Data.

During design the requirements presented in Part 4 shall be coordinated with the existing substation(s) to verify all components will operate correctly and are coordinated to provide a fully functional system. All components related to substation design have been included in Part 4 in case unforeseen components and equipment technical requirements are required for design. Technical requirements below also apply to the ANSF power plants as they may contain medium to high voltage equipment. Equipment selected shall be of similar specification to decrease maintenance requirements. Substation designs shall include DABS industry standard bus, transformers, breakers, line protection, and SCADA/EMS. It shall also be sized and equipped with panels to allow expansion as indicated for substation line bays.

4.1.2. 220 kV, 110 kV and 20 kV Circuit Breakers

4.1.2.1. The circuit breakers shall be rated in accordance with the following data:

Rated voltage	245 kV	123 kV
Rated normal current -	1,250A XFMR Bay	1,250A XFMR Bay
	1,600A Busbar Bay	1,600A Busbar Bay
	1,250A Line Bay	
Rated short-circuit breaking current -		
	40 kA	40 kA
Rated insulation level -	1050 kV	50 kV
Rated voltage	24 kV	

Rated normal current - 1,250A XFMR Bay

1,250A Busbar Bay

630 A line bay

Rated short-circuit breaking current -

25 kA

Rated insulation level - 170 kV

4.1.2.2. The 220 kV and 110 kV circuit breakers shall be of SF6 type. The 20 kV circuit breakers shall be indoor metal clad of vacuum or SF6 type.

4.1.2.3. Circuit breakers shall be equipped with motor-charged spring operated mechanism for 220 V DC or 110 V DC as required. The motorcharged spring-operated devices shall have a direct-on-line starter. It shall be possible to set the operating spring manually with a hand-crank. Motors shall be designed in accordance with valid BS publications and operate correctly between 85% and 110% of rated voltage. The motors shall be effectively protected. The motor circuits shall be controlled 2-pole (Phase) from the motor-protection and end-position contacts. An auxiliary relay for alarm shall be connected to the motor-voltage and have a closed contact for no voltage, tripped motor-protection and unloaded spring.

4.1.2.4. The operating mechanism shall be provided with an anti-pumping device.

4.1.2.5. The circuit breaker shall have 220 V DC or 110 V DC shunt coils for closing and duplicate tripping. The coil and relays in the closing circuits shall operate correctly between 85% and 110% of the rated voltage. For tripping circuits the limits are 70% and 110%.

4.1.2.6. The operating devices shall be equipped with a selector switch for local and remote control.

4.1.2.7. Manual closing for maintenance work shall be possible. Manual tripping (mechanical) shall be possible even in the absence of supply voltage for emergency situations, unless the breaker is locked out.

4.1.2.8. One set of auxiliary contacts necessary for control purposes shall be mechanically linked to the circuit breaker. All contacts shall be wired and connected to terminals in the cubicle.

4.1.2.9. A switch shall be provided for the operating voltage for each circuit breaker. The switch shall in the open position prevent all electrical operations of circuit

breakers. The switch shall have at least 10 contacts and be labeled “OPERATION”.

4.1.2.10. The mechanism shall be provided with an operation counter for at least 9999 CO-cycles.

4.1.2.11. The 20 kV circuit breakers shall be fitted with an auto-recloser relay, designed for automatic reclosing of the line in case of transient overcurrent or earth faults. The relays shall lockout further operation after two unsuccessful attempts at reclosing.

4.1.3. 220 kV and 110 kV Disconnectors/Earthing Switches and 20 kV Load Switch

4.1.3.1. The disconnectors and disconnector/earthing switches shall be rated in accordance with the parameters given in paragraph 4.1.2.1

4.1.3.2. The disconnectors shall be of center break or center rotating type with horizontal operation. All disconnectors shall provide the possibility for a manual operation with a hand crank.

4.1.3.3. Disconnectors with a manually operated earth switch shall be provided with a mechanical interlock between the disconnector and the earth switch to prevent closing of the earth switch when the disconnector is in the closed position.

4.1.3.4. The disconnector and the earth switch shall be possible to lock with padlock in open and closed position.

4.1.3.5. Motor operated disconnectors shall be designed to provide three-pole operation and shall operate on 220 V DC or 110 V DC as required. The motor shall be designed in accordance with valid BS publications and work correctly between 85% and 110% of rated voltage. The motor shall be effectively protected. Electric control shall always be two-pole to avoid malfunction in case of earth faults.

4.1.3.6. Motor operated disconnectors shall be designed for control and position indication from remote. The operating device shall be equipped with a selector switch for local and remote control.

4.1.3.7. A 20kV fuse switch shall be used for protection and switching of the local service transformers. The 20 kV switch disconnector in combination with fuses shall be designed for automatic tripping, three-pole operation, in the case that only one fuse trips. The facility for manual operation with a hand crank shall be provided. The handle shall be lockable with a padlock.

4.1.4. 20 kV Switchgear

4.1.4.1. The equipment shall comply with the requirements of the appropriate IEC or British standards and comprise a metal-enclosed, free-standing switchboard suitable for indoor application, dust and vermin proof and suitable for coordination with a 20 kV, 3-wire system.

4.1.4.2. Design of the switchgear shall allow good accessibility with maximum personnel safety during operation, inspection and maintenance. Also maximum segregation shall be afforded between cubicles and between high and low voltage sections within the cubicles.

4.1.4.3. Where required, the switchboard shall be complete with all necessary contacts, transducers etc. to provide full compatibility with the system SCADA.

4.1.4.4. The single line diagrams illustrate the equipment specified. The switchgear shall be suitable for the 20kV, 3-phase, 3-wire, 50Hz section, with the neutral solidly earthed at the 220 kV/20 kV or 110 kV/20 kV transformers. The source of 20 kV supply is the zone substation transformers at each substation. Provision shall be made for future extension of the switchboard at either end.

4.1.4.5. The three, phase busbars shall be installed in a conventional manner and shall be completely screened in a chamber running the length of the switchboard. Busbars shall be fully insulated along their entire length with high dielectric strength sleeving.

4.1.4.6. Inter-panel connections shall be via insulated barriers designed to preserve an effective seal between cubicles under the most severe arcing fault conditions.

4.1.4.7. The busbars shall have a current rating of 1,250 A and all components of the busbar system shall be able to withstand the stresses imposed by vibration, short circuits, thermal expansion or other causes.

4.1.4.8. The circuit breakers shall be of the vacuum or SF6 type as specified in Paragraph 4.1.2, carriage mounted for horizontal withdrawal. They shall be spring operated with a 230V AC single-phase motor for charging the springs. The springs shall also be able to be manually charged. The circuit breaker closing the tripping coils shall be 220 V DC or 110V DC as required. The operating mechanism shall be trip free. All circuit breakers shall be rated at 1,250 A or 630 A and shall be fully interchangeable between circuits.

4.1.4.9. A mechanical means shall be provided to show whether

the circuit breaker is open or closed.

4.1.4.10. Electrical/mechanical interlocks shall be provided to ensure that the circuit breaker may only be withdrawn when open and the circuit breaker may only be restored to the service position when open.

4.1.4.11. Auxiliary contacts, including 2-N/O and 2-N/C spares, shall be provided and wired out to terminal blocks, to be used for remote indications. Provision shall be made for operating the circuit breaker in the withdrawn position for test or maintenance purposes.

4.1.4.12. Each circuit breaker shall be equipped with a circuit breaker condition indicator that shall record the opening speed of the contacts, the gas pressure (if applicable) inside the poles and the wear of the breaker poles. At exceeded limits an alarm shall be given for remote indication.

4.1.4.13. The circuit cubicle shall be equipped with a door at the front that shall support the circuit breaker on its carriage when withdrawn into the maintenance position. The door shall have a window through which the circuit breaker condition indicator and mechanical open/closed indicator are viewed. The insertion or withdrawal of the circuit breaker from the service position shall be carried out with the door closed by means of a racking mechanism indicator operated by the racking mechanism and visible on the front panel of the racking mechanism.

4.1.4.14. The circuit cubicle shall be arranged so that the busbars and circuit connections are completely screened when the circuit breaker is withdrawn. Automatic shutters shall be operated by the circuit breaker truck to screen both the busbar and circuit fixed contacts when the circuit breaker is withdrawn. The shutters shall be clearly labeled "BUS BARS" and "CIRCUIT" and provided with means for padlocking in the closed position.

4.1.4.15. The high voltage cable termination compartment shall be equipped for the termination of the cable cores of the three phase circuit connections.

4.1.4.16. This surge arrester cubicle shall be equipped with three 24 kV surge arresters connected between each phase of the busbars and the earth bar.

4.1.4.17. A surge arrester shall be provided with a counter able to be read from the front panel of the cubicle.

4.1.4.18. Current transformers shall be mounted in the cable compartment and shall be of the insulated bar primary type unless otherwise approved. Secondary windings

shall be earthed at one point only and means shall be provided to short circuit these windings. All necessary terminals and rating plates shall be provided and characteristic curves shall be submitted for each current transformer.

4.1.4.19. Voltage transformers shall be single phase units, for three phase applications three single phase units shall be connected in star. Class 0.5 shall be provided for measuring applications and class 3P for protection.

4.1.4.20. An earth busbar shall be run internally through the length of the switchboard. All non-current carrying metalwork earth switches, surge arresters, CT and VT secondary circuits, etc shall be bonded to this earth busbar. A fixed/moving contact arrangement shall be provided for the positive earthing of the circuit breaker carriage.

4.1.4.21. Each circuit cubicle shall be provided with an integral fault making earthing switch for the safe and effective earthing of the 'circuit' connections. In addition, the surge arrester cubicle shall accommodate an equivalent earthing switch for the earthing of the busbars. The earthing switches shall be interlocked with their associated circuit breakers. The earthing switches shall be manually operated from the front of the switchgear panel.

4.1.5. 220 kV, 110 kV and 20 kV Current Transformers

4.1.5.1. The current transformers shall be rated in accordance with the following data:

Location	220 kV Line Bay, XFMR Bay (160 MVA) & Bus Coupler
Rated Voltage -	245 kV
Core 1 & 2	
Assignment -	200-500-800-1200/1A, Class PX, Vk=1500V,
	Rc ≤6 ohms, Ie ≤ 25mA
Core 3 & 4	
Assignment -	1200-2400/1 A, Class PX, Vk=1500 V,
	Rc ≤ 12 ohms, Ie ≤ 50mA
Core 5	
Assignment -	200-500-800-1200/1A, Class 0.2, 25 VA

Location 220kV XFMR Bay (16 MVA)

Rated Voltage - 245 kV

Core 1 & 2

Assignment - 10-20-40-80/1A, Class PX, Vk=1500 V,

Rc ≤6 ohms, Ie ≤ 25 mA

Core 3 & 4

Assignment - 10-20-40-80/1A, Class PX, Vk=1500 V,

Rc ≤ 12 ohms, Ie ≤ 50 mA

Core 5

Assignment - 10-20-40-80/1A, Class 0.2, 25 VA

Location 110kV AUTOXFMR Bay (160 MVA) & Bus Coupler

Rated Voltage - 123 kV

Core 1 & 2

Assignment - 200-500-800-1200/1A, Class PX, Vk=1500V,

Rc ≤6 ohms, Ie ≤ 25 mA

Core 3 & 4

Assignment - 1200-2400/1A, Class PX, Vk=1500V,

Rc ≤ 12 ohms, Ie ≤ 50 mA

Core 5

Assignment - 200-500-800-1200/1A, Class 0.2, 25 VA

Location 20 kV XFMR Bay (16 MVA) & Bus Sectionalizer

Rated Voltage - 24 kV

Core 1 & 2

Assignment - 100-200-400-800/1A, Class PX, Vk=1500 V,

Rc ≤6 ohms, Ie ≤ 25 mA

Core 3

Assignment - 100-200-400-800/1A, Class 0.2, 25 VA

Location 20 kV Line Bay

Rated Voltage - 24 kV

Core 1 & 2

Assignment - 100-200-400/1A, Class PX, Vk=1500 V,

Rc ≤6 ohms, Ie ≤ 25 mA

Core 3

Assignment - 100-200-400/1A, Class 0.2, 15 VA

4.1.5.2. Earthing of secondary windings shall be done through a disconnectable terminal inside the low-voltage cabinet. Unused cores shall be wired to terminals and short-circuited in the low-voltage cabinet.

4.1.5.3. A legible circuit-diagram plate showing the transformer connection and terminal markings, shall be permanently fixed inside the low-voltage cabinet. The separate main data for the different cores shall be shown on the plate.

4.1.6. 220 kV, 110 kV and 20 kV Voltage Transformers

4.1.6.1. The voltage transformers shall be rated in accordance with the following data:

	220 kV	110 kV
Voltage ratio	220 kV√3, 110V√3,110V√3	110 kV√3, 110V√3, 110V√3
Accuracy/Burden Secondary	0.2,100 VA	0.2, 100 VA
Accuracy/Burden Tertiary	3P, 100 VA	3P,100VA
Type	Capacitive	Capacitive

	20 kV
Voltage ratio	20kV√3, 110V√3, 110V√3
Accuracy/Burden Secondary	0.2,100 VA
Accuracy/Burden Tertiary	3P, 100 VA
Type	Inductive

4.1.6.2. Earthing of secondary windings shall be done through a disconnectable terminal inside the low-voltage cabinet. Each secondary winding shall be protected with individual MCB's or fuses. To prevent malfunction of relay protection, interlock system, etc. a supervision device for the MCB's or fuses shall be provided.

4.1.6.3. A legible circuit-diagram plate showing the transformer connection and terminal markings, shall be permanently fixed inside the low-voltage cabinet. The separate main data for the different cores shall be shown on the plate.

4.1.7. 220kV, 110kV and 20kV Lightning Arrestors

4.1.7.1. The lightning (surge) arrestors shall be rated in accordance with the following data:

System voltage	245 kV	123 kV	24 kV
Rated voltage (Ur IEC 60099-4)	198kV rms	123 kV rms	24kVnms
Energy Capability Class	Class 3	Class 3	Class 2
Nominal discharge current	10 kA peak	10 kA peak	10 kA peak

4.1.7.2. The surge arresters shall be of ZnO-type and heavy-duty station class. One common surge counter per three-phase group of arresters shall be provided.

4.1.8. Medium and High Voltage Terminals

4.1.8.1. Terminals shall normally be of module plate type. If the terminal is a direct extension of an internal conductor as for bushings or current transformers, pin type is accepted as an alternative.

4.1.8.2. Copper or copper alloy terminals shall be tinned to a thickness of minimum 50 µm. Copper alloys shall not be sensitive to season cracking. Aluminum or aluminum alloy terminals shall not be treated. Aluminum alloys sensitive to layer or inter crystalline corrosion shall not be used.

4.1.9. Shunt Reactors

4.1.9.1. Each substation shall be provided with shunt reactors for reactive support (reactor bay) to be sized when the load flow study is finalized. The reactors, where required, to account for line over-voltages in the transmission and distribution systems shall be three-phase reactors.

4.2. POWER TRANSFORMERS

4.2.1. Reference Standards

4.2.1.1. All transformers shall be designed and manufactured in accordance with the latest edition of IEC and British standards.

4.2.1.2. The list of applicable standards is as follows:

IEC 60076	Power Transformers
IEC 60137	Insulating bushings for alternating voltages above 1000 V
IEC 60214	Tap-changers
IEC 60296	Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear
IEC 60354	Loading guide for oil-immersed transformers
IEC 60529	Degrees of protection provided by enclosures
IEC 60542	Application guide for on-load tap-changers

4.2.2. General Design

4.2.2.1. Power transformers shall be 3 phase, oil immersed consisting of a complete independent unit with on-load tap changer (OLTC), outdoor bushings, surge arrestors, cooling equipment, auxiliaries and accessories. All transformers supplied shall be installed outdoors and shall be required to operate under the system characteristics and climatic conditions specified in Paragraph 2.2. Each transformer shall produce its full rated power at its designated substation after applying any derating factors due to climate and altitude. The transformers shall comply with IEC 60076.

4.2.2.2. The power transformers shall be located and rated in accordance with the following data:

Type	Autotransformer	Transformer
Rated power	160 MVA	25 MVA
Rated frequency	50 Hz	50 Hz
Rated voltage	220 ± 6 x 1.25 %/110kV	220 ±6 x 1.25 %/20 kV
Impedance voltage	10%	10%
Vector Group	YNaOd11	YNynOd11
Cooling	ODAF	ONAF

4.2.2.3. The transformers shall be capable of operating continuously at the specified output and at voltages at 10% higher than the rated voltages at any tap without undue heating, vibration, noise and other operating difficulties. All items, except for windings, shall be designed for continuous current of 120% of the rated current, without exceeding the temperature rises prescribed in the Standards.

4.2.3. Losses

4.2.3.1. The transformer losses shall be stated and guaranteed. The capitalized value of the guaranteed losses will be taken into account when comparing transformer data sheets. The transformers shall be designed to minimize losses and achieve efficient design.

4.2.3.2. The guaranteed losses are to be maximum values and shall not be exceeded. If the tested losses exceed the guaranteed losses but are within the tolerances allowed in IEC 60076 then losses in excess of the guarantees shall be capitalized at the evaluation rate and the amount deducted from the contract price. There will be no credit for losses under guarantee.

4.2.3.3. The values for losses stated by the Contractor shall be verified during the factory tests.

4.2.3.4. The Contracting Officer has the right to reject transformers that exceed the tolerances allowed by IEC 60076.

4.2.4. Cooling System

4.2.4.1. Transformers shall be capable of operating continuously at full load utilizing ONAF (or ODAF) type cooling. The manufacturer shall advise the maximum reduced rating output power with the cooling fans out-of-service.

4.2.4.2. The coolers shall be of the fin type, fully hot-dip galvanized, detachable and equipped with lifting eyes, vent holes with plugs, plugs for filling and draining and with shutoff valves to permit the removal of any cooler without draining the oil from the transformer tank. The coolers shall be removable during operation of the transformer. All radiator-isolating valves shall be fully oil tight and vacuum capable and shall be mounted to the transformer and radiator by bolted flanges.

4.2.4.3. Only transformers less than 10 MVA shall have radiators mounted directly to the transformer tank, all other transformers shall be mounted via a manifold. ODAF designs shall have main and standby oil circulating pumps.

4.2.5. Temperature Rise

4.2.5.1. In continuous service, at the specified ratings, the rise in temperature above the ambient air shall not exceed 60° C for the windings and 55° C for the top oil.

4.2.5.2. For cores and other parts the rise in temperature shall, in no case, reach a value that will damage the core itself, metallic parts or adjacent materials.

4.2.6. Short-Circuit Withstanding Capability

4.2.6.1. The transformer shall be designed and constructed to withstand, on any tapping, without damage:

(a) Thermal and mechanical effects of any short-circuit (three-phase short-circuits and solid line-to-ground short-circuits, etc.) that can appear at the terminal of any winding

(b) Transportation or impact forces of 3g or greater. See paragraph 4.2.16 for further information.

4.2.6.2. The radial short circuit strength of windings shall use the free buckling method of calculation.

4.2.7. Vibration and Noise Levels

Special attention shall be given in order to avoid undue vibrations and noise in the transformer in accordance with IEC 60076.

4.2.8. On-Load Tap Changer

4.2.8.1. General

On-load tap changers (OLTC) shall be designed for all 220/20 kV and 110/20 kV transformers and auxiliary power transformers. All 220/110 kV transformers shall be designed for de-energized tap changing (DETC).

OLTC for manual control and electrical remote control shall be provided. The OLTC shall comprise a tap selector with changeover switch and a rotary diverter switch of high-speed transition resistor type. The OLTC shall be in conformity with IEC 60214 and IEC 60542. Only designs that have been type tested in accordance with the relevant IEC or British standards will be accepted. Control voltage shall be 110 VDC.

The OLTC shall be mounted from the cover into the transformer tank at narrow sides of the transformer tank. The diverter switches and/or selector switches shall have oil compartments separate from the transformer oil as well as their own closed sub-sections in the oil conservator.

The tap changer head shall be equipped with a bleeding duct to be connected to Buchholz relay of main tank to avoid any gas collection underneath the tap changer head outside the diverter switch compartments. No piping or other equipment shall be arranged beyond the tap changer head to allow lifting of the diverter switches and/or selector switches without removing (dismantling) of any other equipment.

An oil-flow operated protection relay and a sudden-pressure operated protection relay shall be provided for internal failure protection. In addition a spring-loaded pressure relief device with trip contact shall be mounted directly onto the tap changer head.

The power of the transformers shall remain constant at all tap positions, and the OLTC shall be capable of successful tap changes for the maximum current to which the transformer can be loaded.

The permissible continuous through-current of each tap changer unit at rated switching capacity shall cover all cyclic loading duties as per IEC 60354 at highest current tap and at rated system operation voltage applied on the transformer terminals.

The OLTC shall withstand all kinds of through-fault currents for at least 3 (three) seconds without damage.

The motor drive, plus all auxiliary equipment for operation of the tap changer, shall be incorporated in a control cabinet made, protection class IP66, and shall be mounted onto the transformer tank in a convenient floor height.

The complete wiring shall be of highly flexible stranded copper and furnished with Slip-over ferrules at both ends. Wiring shall also have crimped termination. The minimum cross-section of the wiring other than for step-position transmitters shall be 2.5 mm2.

The AC supply of the motor drive cabinet shall occur via the control cabinet for cooling equipment or marshalling box and an appropriate MCB with trip contact shall be provided in the concerned cabinet for the outgoing auxiliary supply cable.

The cabinet shall be mounted on a narrow side of the transformer and the following main equipment shall be installed:

- Driving motor with complete motor protection equipment
- Operation counter
- Control switch or push buttons for local raise/lower operations (properly protected against unauthorized operation)

- Electrical limit switches
- Mechanical stops in end positions
- Step position indicator ("1" related to the position with the maximum high voltage)
- Local/remote switch
- Voltage supervisory relays for all phases of supply voltage and main circuits of control voltage
- MCB's for driving motor and each auxiliary supply circuit
- Hand lamp (controlled via door contact)
- One heater, thermostatically controlled
- Minimum one conventional position transmitter of the resistor type
- Additional end position contacts
- Spare plug socket LV, AC (BS) with MCB 10 A
- Terminal blocks with terminals of single insertion type with isolating facilities and test connectors and being universally suitable for connection of solid conductors from 0.5 mm^2 up to a cross-section of at least 10 mm^2 (Phoenix or equivalent), with ten percent spare terminals on each terminal block
- Crank handle for manual operation
- Padlock facilities for front door
- All equipment installed in the cabinet shall be designed for a cubicle inside temperature of at least 70°C
- A rigid pocket for storing the related paper drawings shall be securely fixed on the inner side of the door of this cabinet.

The motor drive shall meet the following requirements:

- Mechanical indication of step position at the motor drive cabinet
- Transmission of step positions of the transformers to the local control room
- Manual operation in the case of a failure in the electrical supply system

- Step-by-step operation with automatic stop after each step

- Automatic restart of tap changing operation in the case of a failure in the electrical supply system, interlocking to be provided against simultaneous raise/lower operation

- Blocking of end positions by means of limit switches

- Provisions to be made for parallel running and automatic operation controlled by a voltage regulating device and parallel control unit.

4.2.8.2. Parallel Operation and Voltage Regulation

The power transformers shall be able to be operated in parallel at a future date.

4.2.8.3. Performance Characteristics of Motors

The motor shall be capable of giving rated output without reduction in the expected life span when operated continuously under the following supply conditions:

a) Variation of supply voltage from rated motor voltage ±10%

Variation of frequency
±5%

Combined over or under excitation
±10 %

b) The motor shall be capable of starting and maintaining the load with the applicable method of starting without exceeding acceptable winding temperature when the supply voltage is in the range of 85 % of the rated supply voltage

c) The motor shall be suitable for full voltage direct on line starting

d) AC motors shall be of the three-phase type

e) The vibrations of motors shall be within the limits specified in applicable standards

f) Insulation shall be given fungicide treatment suitable for extremes of hot and cold climate.

4.2.9. Core

4.2.9.1. The flux density in the core shall not exceed 1.70 Tesla during normal operation at rated primary voltage on nominal tap and at rated frequency with no over-

fluxing occurring.

4.2.9.2. The core shall be made of high grade, un-aging, cold rolled grain oriented steel. Laminations shall have low losses and high permeability. Insulated packets of the core are to be connected so that no potential differences will exist between them. Flux distortion shall be minimized to reduce noise level.

4.2.9.3. The cores, framework, clamping arrangements, shall be capable of withstanding any shocks to which the equipment may be subjected during transport and operation.

4.2.9.4. Both the core and frames shall be earthed via a single point earthing design where each connection to either the frame or core is brought out through separate 2kV bushings complete with removable bolted shorting links that connect them to an earth stud on the transformer tank lid. All components shall be rated for the maximum possible circulating current should the core or frame becomes inadvertently earthed. The bushings located on the transformer lid shall be protected from inadvertent physical damage by a removable cover or similar.

4.2.10. Windings

4.2.10.1. The turns in coils shall be thoroughly treated in such a way as to develop the full mechanical and electrical strength of the transformer. Oil from radiators shall be directed into the bottom of each winding.

4.2.10.2. All windings 220 kV and above connected in star shall have graded insulation; and all windings rated less than 220 kV shall be fully insulated.

4.2.10.3. The transferred voltage from one winding to any other winding when open circuited shall not exceed the impulse test voltage of that winding. Where windings do not meet this criteria then surge arrestors located in their own separate compartment located outside the main tank shall be used to restrict such transferred voltages to the specified impulse levels.

4.2.10.4. All winding conductors and connections shall be manufactured from burr free profiled high conductivity copper or aluminum. All electrical connections within the windings shall be fully brazed or welded and capable of withstanding all shocks encountered in service, transport, earthquakes etc. All connections from windings shall be mechanically sound and fully supported.

4.2.10.5. All cylinders and wraps shall be made from pre-

compressed transformer board. All cylinder joints shall be fully scarfed with overlaps being made only on duct strips. Only fully molded caps and collars are acceptable; designs utilizing "Petal" collars or caps are not acceptable. When used, enamel covered wires shall have a minimum radial thickness of 0.05 mm and where crossovers or transpositions occur they shall be mechanically and electrically protected.

4.2.10.6. When used, enamel covered wires shall have a minimum radial thickness of 0.05mm and where crossovers or transpositions occur they shall be mechanically and electrically protected.

4.2.10.7. No electrical out-of-balance turns will be acceptable between phase windings. All duct strips and spacers shall be full contoured and shall be of a solid construction, strips and spacers stacked together are not acceptable. All paper covered conductors shall use thermally upgraded paper. All continuously transposed conductors shall be epoxy fully epoxy bonded to withstand all free buckling and short circuit forces.

4.2.11. Tank

The tank shall be constructed of high-grade steel plate, suitable reinforced to withstand handling and pressure during faulty condition without any destruction. The tank shall be provided with manholes, valves and de-aerating cocks as may be required for the prescribed maintenance of the transformer. The tank shall be provided with earthing terminals for a wire of 95 mm^2 at two opposite sides of the tank.

4.2.12. Corrosion Protection

The corrosion protection shall be carried out as specified in Section 2.13 in the General requirements.

4.2.13. Oil

4.2.13.1. All oil used during the manufacture of the transformer shall be free of all additives. Oil supplied for the filling of the transformer shall be new and shall contain at least 0.3 per cent by weight oxidation inhibitor of type diterbutyl paracresol (DBPC) according to IEC 60296.

4.2.13.2. The oil shall not contain PCB. If oil samples taken from the transformer on delivery contain 2 ppm or more PCB, the Contracting Officer shall have the right to refuse the delivery of the transformer.

4.2.13.3. Oil shall be provided by the manufacturer. Transformer shall either be shipped with oil or shipped separately by the manufacturer. If shipped separately the manufacturer, or their approved

technicians, shall be responsible for filling and dressing the transformer.

4.2.14. Bushings

4.2.14.1. Bushings shall be of type stated in IEC 60137 and of the porcelain type.

4.2.14.2. Connections from the windings to the bushings shall have the necessary flexibility. The bushings shall be installed so that they are easy to check and place, without removing the tank cover pipe work.

4.2.14.3. The star point of the winding shall be separately bought out through the tank lid by means of an outdoor bushing, located so that it cannot be associated with the main phase bushings. All bushings shall have permanent phase markings adjacent to the bushing flange.

4.2.15. Accessories

The following accessories shall be provided for the transformer:

- Oil temperature indicator for the top oil equipped with a maximum reading device individually insulated and a minimum of two separately adjustable contacts for alarm and tripping, with all immersed parts able to be removed without the need to interfere with the tank

- Winding temperature indicator shall be equipped with a maximum reading device individually insulated and a minimum of two separately adjustable contacts for alarm and tripping, with all immersed parts able to be removed without the need to interfere with the tank

- An aseismic Buchholtz relay for gas protection with a minimum of two non-mercury separate contacts for signal and tripping. A gas capture and test device shall be connected to the Buchholtz and located adjacent to the control cubicle

- Oil level indicator equipped with a minimum of two separately adjustable contacts for alarm and tripping

- Oil drying device, type Silica Gel breather

- Terminal box equipped with disconnect able terminals for signal cables to the auxiliary cubicle

- The on-load-circuit tap changer shall be provided with a mechanism for automatic operation. The operating mechanism shall be provided with a tap position indicator.

4.2.16. Impact and Shock Recorders

During transportation if a transformer experiences a mechanical

shock more than the suggested "g" levels specified by the manufacturer, the following damage may occur:

a) Windings/core may get displaced or distorted.

b) Due to active part movement, the insulation between the turns can be abraded causing a short circuit and damage to the windings later during operation.

c) Mechanical vibrations may cause the windings to lose their clamping pressure leading to collapse of the windings during electric faults.

d) The safe clearance between the tank and the active part may be compromised.

In order to protect the transformers from potential failures identified above, each transformer shall be equipped with a shock recorder data analysis tool to determine concealed damage. The shock recorder shall be waveform type and be compliant per DIN EN 13011 standards. The minimum battery life of the waveform recorder shall be 3 months to allow complete monitoring during the shipment duration. Upon delivery of the transformer to the project site, the impact recorder and the recorded data shall be sent to Government for review and analysis. The waveform recorders shall be shipped with instruction manuals and software to allow the Government to perform analysis. If the shock impact recorder indicates shocks amplitudes greater than manufacturer specified levels, additional tests on the transformer shall be performed to validate its integrity before the transformer is accepted. The additional tests shall be done in accordance with the transformer manufacturer's recommendations.

4.2.17. Routing and Type Tests

4.2.17.1. General

Full and complete testing of the transformer with accessories shall be carried out according to the relevant IEC Standards. The more important tests are listed below.

The Contractor shall give a complete description of the proposed test methods. The test methods and the performance of the test shall be subject to the approval of the Contracting Officer. All instruments and equipment necessary for the testing shall be provided by the Contractor.

4.2.17.2. Test Particulars

Testing shall include but not be limited to the following:

- When a transformer is to be subject to a temperature rise test, dielectric test including an impulse test shall be carried out as soon as practicable after this test, that is whilst the transformer is still

hot

- The no-load losses and the current of the transformer shall be measured at 90%, 100% and 110% of rated voltage before commencement of the dielectric test. The no-load losses and current measured after completion of the dielectric test shall be the values used in determining the performance of the transformer

- Impulse test shall be applied on all transformer terminals, including neutrals. Impulse test oscillography records shall be made

- Noise level measurements shall be carried out according to IEC 60076

- Bushings shall be fully tested according to IEC 60137

- Insulation power factor tests shall be performed with bushings in place.

4.2.17.3. Type Tests

The following type tests shall be carried out. The tests shall be according to IEC 60076, except where otherwise specified.

- Temperature rise test

- Zero sequence impedance

- Noise level

- Examination of harmonics

- Tests on bushings

4.2.17.4. Routine Tests

The following routine tests shall be carried out. The tests shall be according to IEC 60076, except where otherwise specified.

- Winding resistance measurements on all windings

- Ratio tests on the rated voltage connection

- Polarity tests

- No-load loss at 90%, 100% and 110% of rated voltage

- Exciting current at 90%, 100% and 110% of rated voltage

- Impedance and load loss at rated current

- Separate source withstand tests
- Induced voltage tests
- Impulse voltage withstand tests on all windings. Full wave and chopped wave
- Pressure tests on tank and coolers for oil tightness. If a temperature test is made, the pressure test shall be made while the transformer is still hot
- Operational tests of all devices and wiring
- Insulation tests on auxiliary devices and wiring
- Test on bushings.

4.2.18. Warranty

The transformers shall be warranted against defects in workmanship and material for twelve (12) months after start-up and twenty-four (24) months from manufacturer shipment date, whichever occurs last. Transformers shall be supplied with a parts and supplier list. List shall include all necessary replacement part information with a supplier list indicating where each part can be purchased and their purchase prices.

4.3. EARTHING SYSTEM

4.3.1. General

4.3.1.1. The station earthing system shall be designed according to IEEE 80 Guide to Safety in Substation Grounding. The earthing system shall consist of buried conductor loops around the substation building and the transformer foundation. The loops shall be connected to an earth bar inside the building. Connections to the earth bar shall be possible to disconnect. The connections shall be clearly labeled. To reach the desired earth resistance, additional grounding rods shall be installed and connected to the earth bar. Conductors shall be copper.

4.3.1.2. Connections shall be made by compressed clamps or by an approved welding process. Below grade earthing connections shall be bonded using the exothermic weld process. Connections to steel structures (riser connections) shall be made by compressed lugs with two holes in the contact pad. Risers or earth conductors shall not touch cables.

4.3.2. Earthing of Enclosures

An earthing conductor of a sufficient cross-sectional area shall be provided extending the whole length of the switchboards and control cabinets. All metal parts of the enclosure/cubicle shall be earthed

by risers from the conductor loop.

4.3.3. Earthing of Other Types of Equipment

4.3.3.1. Earth terminals of LV equipment shall be earthed by wire designed for the actual earth fault current.

4.3.3.2. Connection and marshalling cubicles, etc. for LV or control equipment shall be connected to the earthing system irrespective of whether they are mounted on otherwise grounded structures or not.

4.3.3.3. Cubicle doors, where electrical apparatuses or instruments are installed, shall be earthed by a flexible earthing card.

4.3.4. Temporary Earthing Devices

4.3.4.1. Two three-phase sets of temporary earthing devices with leads of sufficient length and short circuit capacity, one for each winding, shall be delivered for each transformer. One three-phase set of temporary earthing devices with leads of sufficient length and short circuit capacity shall be provided for the 20kV switchgear.

4.3.4.2. The design and test methods for temporary devices are subject to acceptance of the Contracting Officer. Both the phase conductor and the steel structure shall always have fixed contacts.

4.3.4.3. Earthing devices shall be designed for 1-second duration of the specified fault current. Earthing switches in connection with disconnectors shall be designed for the same fault current as the disconnectors.

4.3.5. Corrosion Risks

The Contractor shall be observant of the risks for corrosion of buried galvanized steel structures if connected to copper.

4.4. CABLES AND ACCESSORIES

4.4.1. Cable Racks

4.4.1.1. A sufficient number of fittings, rack-joints and angles shall be included in the supply. Low voltage and control cables respectively, shall be laid on separate cable racks. Cable racks and suspension fittings shall be dimensioned for a distributed load of at least 150 kg/m.

4.4.1.2. Cable racks, accessories and suspension fittings shall be hot dip galvanized after manufacturing or be made of aluminum. Accessories shall be designed so pulling

of cables can be done without damage. Diversion plates shall be used at junctions.

4.4.1.3. The cable racks shall be erected in a way so cables can be laid without threading. The distance between a horizontal rack and the wall shall exceed 50mm to allow cables to be pulled down between the rack and the wall. Sharp edges, screw-tips, etc., shall be removed from the rack before cable pulling. Expansion bolts used for suspension fittings shall have a diameter of at least 6mm.

4.4.1.4. The cable racks shall be connected to the station earth wire system. An earth wire laid along the rack shall be tied underneath to the rack at every second step.

4.5. MARKING OF EQUIPMENT

4.5.1. All main parts of the plant, including towers, gantries, busbars, apparatus, etc. shall be equipped with designation labels. All switchgear, distribution boards and control gear and units thereof, components mounted therein and wiring and cables, shall be labeled and marked according to IEC and BS. The purpose of the labeling and marking is to facilitate the identification of switchgear and control gear and parts thereof and their relation to the relevant technical documentation in order to facilitate a rational and simple manner of installation, operation, troubleshooting, maintenance and repair.

4.5.2. All apparatus in the outdoor switchgear shall be labeled. Labels shall normally be placed adjacent to the middle phase. The main transformers shall be labeled with phase designations on all primary, secondary and tertiary bushings.

4.5.3. Designation system for text on designation labels will be provided by the Contracting Officer. Text on warning labels shall be approved by the Contracting Officer. The text on operational and safety labels shall be in a maximum of two languages to be coordinated with the local electrical authority and approved by contracting officer.

4.5.4. Labels for outdoor use shall be of enameled sheet metal. Labels that are protected from solar radiation shall be made of fiberglass-reinforced polyester with embedded color layers. Labels shall be fixed by stainless steel screws or rivets. Enameled labels shall have stainless steel hole reinforcements.

4.5.5. Labels shall be white with red text and red frames. Phase designation labels shall be respectively colored red, yellow and blue for phases L1 (R)-L2(S)-L3(T). Sizes shall be chosen with regard to label location. Phase markings shall have the same height as designation labels at the same location, and shall be square.

4.5.6. Warning labels shall have a lightning bolt symbol in red at both ends. Warning labels shall be mounted on all dangerous parts of the installation. This means:

- A general warning label on low voltage distribution boards

- Special warnings shall be applied on all cubicles where back voltage can appear after switches are opened

- General warning labels outside all fences, gates or walls surrounding the Substations. These shall be applied every 50 m along fences and walls. Completion with labels stating prohibitions against entrance, photographing, etc., shall be done at the Contracting Officer's request

- Labeling, as is deemed necessary to prevent dangers arising from malfunction of equipment.

4.5.7. Inside the entrance doors to each building in the substation a large sign of poster type, of durable design, shall be set up. It shall show steps and methods to be taken and used in case of electrical accidents where persons are hurt, i.e. first aid principles and how to proceed.

4.5.8. Fire extinguishers shall be supplied and shall have a clearly readable sign applied to the wall above them, with notices about type and size.

4.5.9. In addition to the above, labeling and marking shall apply as follows:

- Each switchboard and control board shall have one label stating the make, the maker's identification data and rates, insulation voltage class and one label identifying the board in the plant.

- Each unit of switchgear or control gear (such as a cell, panel, cubicle or box as well as remote located switching and control devices) shall have a label identifying the unit and stating its purpose in the plant. The latter information is in more complicated cases suitably given in a mimic diagram.

- All apparatus or units of apparatus in the panels, cells, etc., shall have labels or markings identifying the apparatus or units thereof (normally the relevant apparatus designations used in the technical documents for the switchgear or control gear). In some cases this marking shall be completed with function marking in plain text. Apparatus labels shall be affixed by means of screw or reverts on the framework, so they remain in place when the apparatus is dismounted or changed.

- All terminals of apparatus or apparatus units shall be clearly marked. However, this marking may be omitted when the design and arrangement of the apparatus are such that a marking is obviously unnecessary.

- All electronic printed circuit boards shall have type marking. The electronic cubicles shall have item marking for each circuit board for identification of the circuit board in the schematic diagram.

- All instruments, indicating devices and control devices shall have identification marking in plain text or simple symbols or colors. Control devices shall in addition have marking of control positions in plain text, simple symbols or colors.

- Control cable terminals and, for small load circuits, also power terminals, shall be clearly marked for identification. The marking system shall be logically built up from letter and/or figures in one system consistently used within the switchgear or control gear.

- Internal wiring within switchgear, control gear or apparatus units shall have all wire ends marked, the marking to include as a minimum the same marking as has the terminal to which the wire end is connected. The marking shall be carried out with sleeves or similar. Tape is not permitted. Current and voltage circuits shall also have phase marking and, where necessary, polarity marking. Protective earth wires shall be marked with green-and-yellow.

- Cables connected to switchgear, control gear, external apparatus, etc., shall be marked with cable numbers according to the cable list and core number according to the external connection diagram. In addition, all cable cores shall have the same marking as the terminals to which cores are connected. Marking with glued tape is not permitted.

- The marking shall be indicated with ferrules. The ferrules shall be of white insulated material and be provided with a glossy finish preventing adhesion and dirt. They shall be clearly and durably marked in black and shall not be affected by damp or oil.

- Trenches with buried cables shall be marked with labels on walls where applicable or with labels on posts with one set up at each end of a road crossing, one set up for every paint of change of direction of a cable trench, and one set up for each twentieth (20) meter of a cable trench. The cables shall be provided with warning tapes along all the trenches.

- All labels shall be of plastic or metal indoors and of enameled metal outdoors, and shall have the text or symbol engraved. Text and symbols shall be of dark color and the surface shall be light. All labels shall be permanently fixed to the switchboard and apparatus. Glued labels and marking tape are not acceptable.

4.5.10. Some of the above required markings and labeling may, subject to the Contracting Officer's approval, be combined or omitted for uncomplicated parts of the equipment.

4.6. CONTROL, RELAY AND AUXILIARY POWER EQUIPMENT

4.6.1. Control, Relay and Auxiliary General

4.6.1.1. The control panel in the control building shall

include control and indication of all 220 kV, 110 kV and 20 kV circuit breakers and disconnectors. The control panel shall be integrated with the relay panel. The transformer control and protection and OLTC panels shall include control and indication of the power transformers. The control switches for the circuit breakers and disconnectors and indicating instruments shall be installed directly on the front of the control panel.

4.6.1.2. The panel front shall also include a mimic diagram, reflecting the actual layout of the complete 220 kV, 110 kV and 20 kV switchgear. Diagram shall represent all systems present in the switchgear. The mimic diagram shall have different colors for different voltages and symbols for the main apparatus.

4.6.2. Design Data

The following voltages shall be used:

- Auxiliary power 400/230 V AC, three-phase, 5 wire with system earthing TN-S
- General auxiliary voltage supply 110 V DC, 2-wire insulated system
- Tolerances are +10% - 15%, measured at the consuming objects.

4.6.3. Auxiliary Power Transformers

4.6.3.1. General

The auxiliary power transformers shall be 3 phase, oil immersed. The design shall comply with IEC 60076 and shall be rated in accordance with the following data:

Location	All Substations & Switching Station
Rated power	kVA, sized per design
Rated frequency	50Hz
Rated voltage	20 ± 2 x 2.5 %/0.4 kV
Impedance voltage	4%
Vector Group	Dyn11
Cooling	ONAN
Design fault levels, HV-winding	500 MVA

The auxiliary power transformers shall be of a suitable type for service under the specified ambient conditions.

The transformers shall be capable of withstanding continuous operation at the rated power and at a voltage 10% higher than the rated voltage without causing dangerously high temperatures or abnormal vibration.

Voltage regulators shall be provided with transformers.

They shall be fluid-immersed, step-type voltage regulators rated for outdoor environments. The voltage regulator must be self-contained and provide ±10% regulation in thirty-two (32) steps of approximately 5/8% each. Forced air (ONAF) ratings are not acceptable to achieve the voltage regulator nominal KVA rating. A control panel shall be provided for each voltage regulator for control and monitoring. Voltage regulators and controls shall be designed, manufactured, and tested in accordance with IEEE Std C57.15-2009 standard.

The transformers shall be designed with cable entry boxes for direct cable connection on the low voltage side and shall have outdoor bushings on the on the HV side. Oil or compound filled cable boxes are not permitted.

4.6.3.2. Oil

The oil shall contain at least 0.3 per cent by weight oxidation inhibitor of type diterbutyl paracresol (DBPC) according to IEC 60296. The oil shall not contain PCBs. If oil samples taken from the transformer on delivery contain 2 ppm or more of PCB, the Contracting Officer has the right to refuse the delivery of the transformer.

4.6.3.3. Accessories

The following accessories shall be provided for the transformer:

- Bushings for HV side
- Cable entrance boxes for LV side
- Marshalling box including terminal blocks for connection of external cables to the transformer accessories
- Oil temperature indicator
- Valves for filling and draining the oil
- Lifting devices such as eyes or hooks for lifting the complete transformer with oil and for lifting the coil and core assembly alone.

4.6.4. Auxiliary Power Equipment

4.6.4.1. Motors

Electrical motors shall fulfill the following requirements:

- Insulation Class F
- Enclosure Degree of Protection IP 54

- Cooling design IC 4.

They shall have protected drainage holes, and be capable of operating continuously under equal service conditions without exceeding the specified temperature rises.

All motors required to operate in damp or humid conditions or located outdoors shall be supplied with electrical heating equipment in order to protect the windings against moisture.

4.6.4.2. Low Voltage Boards

General

The requirements for boards are where applicable also valid for boxes for separately mounted apparatus. Boxes outdoors shall fulfill Degree of Protection IP 54 according to IEC 60529 and have thermostat-controlled heaters, ventilation and drainage.

All cables shall be connected to the boards with terminal blocks of approved type located near the cable entry. Cables with large cross-section areas are permitted to be connected directly to the apparatus.

All auxiliary circuits shall be connected to terminals with isolating arrangements having 4 mm banana plug sockets on both sides. All boards shall have 10% spare terminals for power circuits and 10% for auxiliary circuits. All transmission and distribution boards shall have 20% spare space for future extension.

The boards shall be complete with terminal block marking, full set of circuit breakers, switches and fuses as well as with other components required. The boards shall be designed for erection on wall without rear access. The operation devices for switches and control switches shall be operated from the front of the board without the doors being opened. The expanding gases developed in case of a short circuit shall be directed in a safe direction in order to prevent injury to persons being near the board.

AC Boards

Boards for 400 V AC shall be of metal-enclosed of panel type and vermin-proof designed, Degree of Protection shall be IP 43 according to IEC 60529.

The boards shall have Cu busbars for phases, neutral (N) and protective earth (PE). The neutral busbar shall also have full insulation against earth and be connected to earth with one link in the board only (power system TN-S). The earth busbar shall preferably be located near the outgoing cable terminals.

DC Boards

Main and battery boards for 110 V DC shall be plastic-enclosed of panel type and vermin proof designed, degree of protection shall be IP 43 according to IEC 60529.

Transmission and distribution boards for DC may be metal-enclosed, but shall fulfill all requirements as for the main board. The battery boards shall have separate enclosures and shall be mounted as near the batteries as possible.

Lighting Sub-Distribution Panels

Lighting sub-distribution panels shall be individually fed (no cross or ring type connection) with individual bus bars for the phases, the neutral and for protective earth grounding. Fixed mounted incoming CB and outgoing feeders with fixed mounted miniature circuit breakers (MCB), all with thermal and magnetic over-current release, as well as pulse relays/contactors for remote control, if required, shall be provided.

Each lighting and receptacle circuit shall be protected by a miniature circuit breaker; no fuses shall be permitted.

Emergency Lighting and Security Lighting sub-distribution panels shall be of sheet metal, flush fronted design. Dependent on their size and location they shall either be of free standing or flush/surface mounting type

4.6.4.3. Low Voltage Apparatus

Circuit Breakers

Circuit breakers shall be capable of breaking short-circuit power.

Air Break Switches

The low voltage switches for the AC boards shall be of Utilization Category AC 23 and DC 23 respectively. The switches shall be front-operated and have distinct ON-OFF markings and have provision for locking. Switches on the main boards shall be of plug-in type.

Switch Disconnectors

Switch disconnectors shall be of utilization category AC 23 (DC 23). Switch disconnectors shall be operated from the front of the box and have distinct OFF-ON markings with possibility for locking with padlock in OFF position.

Fuses

Power fuses shall be of blade type according to IEC 60269 -

2A Section I. Fuses maximum 25 A may be of screw type D11 (IEC 60341). The fuses shall have a visible indication device. For small apparatuses, miniature fuses 5x20 mm (IEC 60127) may be used.

Control Switches

Control switches shall be designed for 10 A and be marked OFF-AUTO-ON, etc. Control switches shall be operated from the front of the cubicles.

Current Transformers

Current transformers shall be of the dry type for mounting on busbars or cores. Secondary current shall be 1 A.

Measuring Instruments

Voltmeters and ammeters shall have dimensions 96 mm x 96 mm and be flush-mounted. The indication instruments shall be of square type with 240° scales, indication errors shall not exceed ±1.5% of the full-scale value. The instrument scales shall have a white background and the same design of figures and gradation. The indicated values shall be given directly without constants.

4.6.5. Auxiliary DC Systems

4.6.5.1. General

The 110 V DC systems shall consist of two 110 V batteries, two rectifiers, one main battery board and DC distribution board. The 48 V DC systems shall consist of one 48 V battery, two rectifiers, one main battery board and DC distribution board. Battery supervision shall be included for each.

For discharge test of batteries, a portable enclosed resistor and a fused test outlet at the DC board shall be supplied. It shall be possible to adjust the resistor for different load currents. Test shall be in accordance with BS EN 60896.

The DC systems shall be designed for the power demand of the connected loads and a future extension of at least 30%, taking into account the load diversity factor and the maximum voltage drop.

The battery shall have a sufficient capacity for maintaining the power supply of the connected systems for a period of six hours in the event of failure of the AC supply, without the terminal voltage falling below the nominal value by more than 10%. Furthermore, the battery must be dimensioned for a secure and selective operation of the short circuit protection devices (fuses).

The rectifiers shall be designed to recharge the battery, up to 90% of rated C10-capacity within 12 hours after a six-hour discharge, whilst supplying the connected loads at the same time.

The voltage at individual components when the system is at no load must not exceed the nominal voltage by more than 10%, and must not fall below the nominal voltage by more than 15% when the system is at full load.

4.6.5.2. Batteries

The batteries shall have the following main design data:

Rated voltage	110V± 10%	48V±10%
Normal float charging voltage, maximum	100% x U_N	100% x U_N
Lowest voltage, discharged battery	90% X U_N	90% X U_N
Discharging time (100% of C10)	6h	6h
Recharging time (90% of C10)	12 h	12 h
Maximum fuse tripping time	5s	5s

The Contractor shall design the capacity of the battery system, using appropriate temperature correction factor, design margin and ageing factor, in accordance with IEEE 485 Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations. The batteries shall be erected on non-corrosive stands and totally insulated from frames and earthed equipment. The batteries shall be of a type with transparent containers and be installed in maximum two layers in order to enable the observation of the acid level through the container walls. The batteries must be erected in such a way that maintenance and service can easily be carried-out. Acid resistant vessels under the batteries shall be included. Each battery cell shall be equipped with explosive retarding valves. Batteries shall be constructed in accordance with standard IEC 60086 and be installed in accordance the applicable IEC standard for the type of battery system being provided and BS EN 50272.

4.6.5.3. Rectifiers

The rectifiers shall be of solid-state constant voltage charge type and have an automatic current limitation. The rectifiers shall be equipped with volt- and ammeters (accuracy class 1.5), indication lamps, main switch and a selector switch for automatic recuperative recharging (Float/Quick charge with locking device) as well as alarm indicators for AC supply failure, and quick charging. Test outlets for 4 mm banana-plugs shall be provided.

Auxiliary contacts for above-mentioned alarms shall be provided for remote alarms, including a no-voltage relay for AC-voltage. The rectifiers shall be enclosed in painted

steel chassis with a degree of protection of IP 43 according to IEC 60529.

4.6.5.4. DC Supervision

DC-supervision of the battery systems shall be provided and shall as a minimum consist of:

- Over- and under-voltage supervision in two steps for each function of the floating voltage level.
- Earth fault supervision.
- Battery circuit supervision.
- Fuse supervision for all fuses.

If the DC-supervision is mounted in the rectifier it shall be connected at the external side of the rectifier fuse to prevent malfunction if the fuse will trip. Auxiliary contacts for the above mentioned alarms shall be provided for remote alarms.

4.6.6. Auxiliary Power Cables AC/DC, Wires and Earthing

4.6.6.1. General

The cables and wires with accessories shall be continuously rated and suitable for service under the actual climatic conditions. The cables shall withstand all electrical, thermal and mechanical stresses under the stated service conditions, and at a voltage of 10% above the rated value. The insulation level shall be 1 kV. Special mechanical protection of the cables shall be provided where required. The cables shall be protected against the short circuit current and earth fault current by fuses, with exception of use in current measuring circuits. Cables shall be protected against direct sunshine. Cables shall be marked with designation according to the cable list.

4.6.6.2. Design

The cables to be used shall be PVC-insulated, PVC-sheathed with copper conductors and copper screen. The neutral conductor shall be of the same cross-section as the phase-conductors. The surface of the sheath shall be marked as follows in English:

- Name of manufacturer
- Year of manufacture
- Cross-section area of phase-conductors and number of cores.

4.6.6.3. Cable Accessories

General

The minimum requirement for cable joints and cable terminations are that they after installation shall withstand the environmental and climatic conditions as the cable itself. They shall also fulfill the same electrical standards as the cables regarding insulation and current rating.

Cable Joints

Jointing shall be avoided. If jointing is anyway deemed necessary by the Contractor, he shall obtain the acceptance of the Contracting Officer. The jointing of conductor ends shall be done by pressing or screwing technique. The insulation may be restored by taping, molding or shrinking techniques.

Cable Terminations

Connection of low voltage cables to distribution boards, contactor cubicles, motors, etc., shall be carried out by removal of the insulation to the required length of the conductors and by connecting the ends to the terminals. The terminals shall be of screw-joint type. Special cable terminations are thus not needed.

Earth Wires

All switchboards, transformers, apparatus, etc., shall be connected to the main earthing system.

4.6.7. Control, Relay, Metering and Alarm Boards

4.6.7.1. The boards shall be made of sheet steel of at least 2mm thickness and be of vermin-proof design IP 43 according to IEC 60529. Boards shall be wired at the Contractor's workshop before delivery to Site. To facilitate transportation, the boards should be assembled in convenient sections before delivery.

4.6.7.2. All boards shall have a maximum height of 2,300mm. The boards shall be equipped with a master key-locking system. Each board shall have lighting that is switched on when the door of the cubicle is opened. Humidity controlled heaters shall be provided.

4.6.7.3. Terminal blocks for cable termination shall be mounted on the sides inside the boards and all cable entrances be supplied with glands. Terminal blocks for CT circuits shall be equipped with testing plugs for commissioning purpose. All boards shall be connected to the general earthing system. Each board shall be labeled.

4.6.8. Operation and Indication, Control Systems

4.6.8.1. General

All control and indication circuits shall be designed for 110V DC. Fuses for various DC circuits for control, relay protection, indication, etc., shall be mounted in separate boards. Each circuit shall be supervised by voltage relays giving alarm in case of lost voltage or tripped fuse.

4.6.8.2. Interlocking System

A complete interlocking system shall be incorporated in the operating circuits for motor-operated disconnectors. The purpose of the interlocking system is to prevent opening of disconnectors while circuits are still loaded. An earth switch shall be mechanically interlocked to the disconnector to which it is attached.

4.6.8.3. Indicating Instruments

The indication instruments shall have dimensions 96mm x 96mm and be flush-mounted. The indication instruments shall be of angle type with 240° scales, indication errors shall not exceed ±1.5% of the full-scale value. The instrument scales shall have a white background and the same design of figures and gradation. The indicated values shall be given directly without constants such as x10 and the like. The following panel instruments shall be provided:

Panel	220 kV	110 kV	20 kV
Line/Feeder bay	3 x V 3 x I	-	3 x I 3 x PF 3 phase MW with scale 3 phase MVAr
Transformer bay	3 x I 3 x PF 3 phase MV	3 x I 3 x PF 3 phase MW 3 phase MVAr	3 x I 3 x PF 3 phase MW 3 phase MVAr
Busbar bay	3 x V		2 x 3 x V

4.6.9. Control Cables and Earth Wires for Control Systems

4.6.9.1. Control Cables

Control cables shall be of multi-core type, PVC insulated, with screen and copper conductors. Cables shall be termite-proof in an approved manner. All cables shall be laid in plastic pipes of a suitable size and standard. Medium voltage, low voltage and control cables shall be laid in separate pipes.

For low level signals, e.g. outputs from transducers, cables shall have conductors of tin coated stranded copper wires and screen of aluminum foil and copper wires

(Electronic cables). Cables containing more than 10 cores shall be so dimensioned that at least 25% of the cores will serve as standby cores.

The cables shall fulfill the following system data:

Cable	Control	Electronic
Nominal voltage	230V	0-110 V
Maximum current	10A	2A
Insulation level	0.6/1 kV	0.6/1 kV
Frequency	DC or 50 Hz	0-1,000 Hz

As a protective jacket the cable shall have an extruded sheath of grey or white PVC in waterproof color marked with:

- Name of manufacturer
- Year of manufacture
- Cross-section area of phase-conductors and number of cores.

The cables shall be delivered in full lengths and, consequently, no joints are permitted. Cable terminations are normally not needed for these types of cables, however all cable terminations shall be provided with cable glands.

4.6.9.2. Earth Wires for Control Systems

All control boards, relay boards, marshalling boxes, transformers, apparatus, etc., shall be connected to the main earthing system.

An earth bar shall be installed in the control building for transition of earth wires in the different rooms. The earth wires shall be separated from control cables, etc. The earth wire system shall be of stranded copper wire designed for the maximum prospective fault current.

4.6.9.3. Secondary Circuits

Auxiliary cables shall be PVC-insulated for a test voltage of 2 kV, 50 Hz and shall be screened or metal-sheathed. The conductors, screens and metal sheaths shall be made of copper.

The following minimum areas shall be applicable:

Current circuits for protection relays 2.5 mm^2

Instrument, voltage and control circuits 2.5 mm^2

The auxiliary cables shall be designed for a maximum voltage drop from voltage transformers to instrument and meters of 0.1%, and to relays 1.0%. Total burden shall not

load the secondary winding of voltage transformer more than 75% of rated burden. Total burden shall load the secondary winding of a current transformer between 25% and 75% of rated burden.

The screen of control cables in connection with the outdoor switchgear shall generally be earthed at both ends. All other cables shall generally be earthed at one end only. In case of earthing at one end only, the location of the earthing shall be indicated on the diagrams.

Auxiliary conductors in apparatus cubicles such as control and relay cubicles, etc. shall be stranded PVC cables with a minimum area of 2.5 mm^2.

Conductors within cubicles and between terminal blocks and apparatus shall be laid in plastic ducts or covered with plastic bands. Conductor ends not connected to compression-type terminal blocks shall be provided with approved claw washers, which neatly retain all strands. Wiring shall be arranged to give easy access to the terminal of relays and other apparatus. All jointing and tying of wires shall be carried out only at the terminal points.

Spare cores, if any, shall be connected to terminal blocks in cubicles and marshalling boxes.

4.6.9.4. Boards and Marshalling Boxes for Control Systems

Boards and marshalling boxes shall be made of steel and designed for adverse conditions and be vermin proof. The doors shall be of the lift-off and hinged type.

Boards and boxes for indoor installation shall fulfill Degree of Protection IP 43 according to IEG - British 60529. Boards and boxes for outdoor installation shall fulfill Degree of Protection IP 54.

The cables shall be mounted so that they are protected against damage and vibrations. The cables shall enter through glands, which shall properly be above the gland plate to prevent moisture from entering the cables.

Boards and marshalling boxes located outdoors or in damp surroundings shall have ventilation and drainage openings as well as a heater for connection to 230 V, 50 Hz. They shall also be provided with lighting equipment. Boards and marshalling boxes and equipment installed in them shall be of satisfactory corrosion proof design.

All box openings shall be screened for protection against vermin, and be so arranged that entry of water is prevented. For screening of the holes, netting with at least one mesh per mm shall be used.

All marshalling boxes shall be placed at normal working

height and shall be sufficiently spacious to facilitate the connection of leads. They shall be so designed as to make markings easily legible.

Not more than two cores shall be connected to each side of a terminal block.

Each board and box, etc., shall be connected to the station earth system by a copper wire with a minimum area of 25 mm^2.

4.6.9.5. Terminal Blocks

All terminal blocks shall be equipped with visible isolating arrangements for testing purposes. They shall be provided with sockets for banana plugs, at both sides. The terminal blocks shall be insulated for 500 V and shall have provisions for marking. The terminal blocks shall be mounted to give easy access to wires, terminations and ferrules. The terminal blocks shall also give a clear view of the arrangement of the cable tails.

Terminals connected to 400/230 V shall be properly protected and separated from control circuits.

4.6.10. Alarm Equipment

An alarm annunciator shall audibly and visually identify the source and type of alarm for equipment listed in section 4.6. There is no requirement for a remote fault signal system.

4.6.11. Relay Protection

The proposed relay protection is listed below; the Contractor shall add all additional protection as necessary for their nominated plant and equipment. Relays shall be of the electronic type and not electromechanical.

220 kV Feeder:	Duplicate numerical distance protection scheme. Each protection scheme shall incorporate directional and non-directional over current and earth fault protection, circuit breaker fail protection, auto reclose, fault location and transient recorder functionality. The relays supplied for the duplicate relay protection scheme shall not be supplied by the same manufacturer. The distance scheme design will be communications assisted tripping/protection over Fiber Optic (FO) cables and intertrip signalling provided as required.
220/110 kV Busbar:	Differential protection - high impedance, with two main zones and one check zone
220/110/20 kV Transformer:	One multi function HV over current relay One multi function LV over current relay One multi function differential Transformer mounted protection including, Winding and oil temperature low level alarm, Winding and oil temperature high level trip, Oil level alarm, Gas relay (Buchholz relay), pressure relay
20 kV Feeder:	Multi function feeder over current, earth fault and over current relay
20 kV Busbar:	Over-voltage and under-voltage protection.

4.6.12. Metering Equipment

4.6.12.1. The following energy meters shall be provided:

Panel	**220/110 kV**	**20 kV**
Line/feeder bay	kWh delivered, kWh received Four-quadrant kVArh With data access facilities and pulse output, class 0.2	kWh delivered, Four-quadrant kVArh With data access facilities and pulse output, class 0.2
Transformer bay	kWh delivered, kWh received Four-quadrant kVArh With data access facilities and pulse output, class 0.2 (on 110 kV side of 220/110 kV auto transformer or on the 20 kV side of 220/20 kV transformer)	

4.6.12.2. Meters installed for monitoring of energy consumption shall be kWh delivered and kWh received for kWh (MWh) and four quadrant for kVARh (MVARh). Accuracy class for meters shall be 0.2 for active energy and 0.5 minimum for reactive energy. Meters shall have the facility for remote interrogation via modem and the

SCADA/CSCS and shall provide pulsed outputs to the metering data processors. Two data processors (main and backup) shall be supplied for recording and totaling metering pulses, with programmable 20 or 30-minute printout facilities and 20 inputs minimum for each processor.

4.6.12.3. Each Meter shall be provided with a testing terminal block enabling the meter to be switched off in a simple manner.

4.6.13. Lighting, Fittings and Accessories

4.6.13.1. General

The design of the lighting and small power system shall strictly follow the regulations of the local authorities and be in accordance with applicable standards. The equipment shall be of such performance and quantity as to perfectly suit the purpose, subject to the acceptance of the Contracting Officer's Representative. Lighting shall be white light only such as fluorescent, metal halide, or Light Emitting Diode (LED) type.

The number of lighting fixtures in rooms shall not only meet the specified illumination level, but also the shape and symmetrical arrangement of the building/room arrangement.

The system shall include provisions for ease of erection, maintenance, cleaning and lamp replacement. In determining the location and height of light fittings, consideration shall be given to the problem of lamp changing. Necessary mobile erection or maintenance devices (for example ladders, carriages, platforms) shall be provided.

All lighting fixtures complete with lamps and ballasts, instant starting control gear, chokes, compensating capacitors, etc., and of best quality materials and provided complete with all necessary installations.

4.6.13.2. Wiring

Wiring of lighting and receptacle circuits shall have copper conductors for the phase(s), for the neutral and for the protective earth conductor. Wiring shall be of neat and clear appearance.

In switch rooms, workshops, storage rooms and the like, cables shall be installed galvanized rigid steel conduits, painted after erection.

4.6.13.3. Fixture Construction

Outdoor fixtures shall be completely weather-proof. Reflectors for fluorescent fittings, metal halide fittings

and high pressure sodium fittings for use in industrial rooms and outdoors shall be constructed of vitreous enameled steel or equivalent material.

Bulk head fittings shall have cast iron bodies with prismatic front glass and vitreous enameled reflectors. Well glass fittings shall be of galvanized cast iron with wire guards wherever necessary.

Special precaution shall be taken to protect the wiring from damage by heat generated by fitting. For compensation of the inductive current of the chokes compensating capacitors shall be provided to obtain about unity power factor.

To avoid electrical shocks when touching disconnected fittings which include capacitors, discharge resistors of sufficient size shall be connected in parallel with all capacitors of more than 0.5 µF capacitance.

According to the IEC and British regulations the equipment shall be furnished with radio interference suppressers if the maximum interference voltage stated in the regulations will be exceeded.

4.6.13.4. Indoor Lighting

The lighting fixtures shall be surface mounted. Fittings for indoor lighting shall be IP 23 according to IEC 60529.

4.6.13.5. Outdoor Lighting

Fittings for outdoor lighting shall be splash-proof IP 54 according to IEC 60529. The outdoor lighting shall be operated by means of a photocell relay, connected to a changeover switch, mounted in the lighting board, with three positions: ON; PHOTOCELL RELAY; OFF.

4.6.13.6. Receptacles

In addition to the quantities of receptacles listed in the following paragraph, provide one receptacle per 5 m^2 of room area. All receptacles shall be protected with a protection earth (equipment grounding) conductor.

Single phase receptacles shall be of type C according to IEC 60309. Three phase receptacles shall be splash-proof, 3P+N+PE according to IEC 60309. Receptacles shall have a load breaker mechanically interlocked with the male device. The following receptacles shall be provided:

Control room	three 10 A, 230 VAC one three phase, 16A, 400 VAC
Auxiliary room	three 10 A, 230 VAC one three phase, 16A, 400 VAC
Office	three 10 A, 230 VAC
Store room and workshop	two 10 A, 230 VAC
Kitchen	two 10 A, 230 VAC
WC - toilet	one 10A, 230 VAC
Adjacent to outdoor power transfonmers	one 125 A, three phase outlet for oil treatment plant.

4.6.13.7. Switches

Lighting fixtures located in self-contained rooms such as offices, switchgear rooms, battery rooms, control rooms, passages, staircases, etc. shall be switched on and off locally. Where more than two switching points are required (staircases, large rooms with several entrances, etc.) push button switches shall be provided together with pulse operated relays and contactors, arranged in the associated sub-distribution boards. All other circuits shall directly be controlled from the relevant distribution board or the control room, as appropriate. Switches and receptacles installed in rooms with embedded wiring shall be flush mounted in steel wall boxes.

4.6.13.8. Lighting Intensity

The intensity of the lighting installation shall be as follows:

- Control, battery and auxiliary rooms 300 lux
- Office and kitchen 300 lux
- WC/bathroom 200 lux
- Store room and workshop 200 lux
- Outdoor, entrance and gate 50 lux
- Transformer cells 50 lux
- Switchyard, in general 10 lux
- Emergency lighting in control room 50 lux

4.7. LINE PROTECTION SIGNALING SYSTEMS

4.7.1. General

4.7.1.1. A trip signaling system via an optical ground wire (OPGW) system shall be installed to send/receive all trip signals related to the 220 kV and 110 kV line

bays.

4.7.1.2. Receipt of a trip signal from the remote substation shall be visually indicated. In addition, all relay protection, transformer guards, voltage supervision relays, etc. shall however be provided with indication to show that the respective device has been activated. The situation and the reason for any tripping shall be clear to the operator. All indications shall be manually reset.

4.7.2. Teleprotection Equipment

4.7.2.1. The teleprotection equipment shall ensure, with maximum security, availability and reliability, rapid, full duplex transmission of trip commands (direct or permissive), blocking. For enhanced security and reliability, coded signals shall be used provided that the fault clearing times as specified will be attained without fail.

4.7.2.2. The equipment shall be of modular design and either be mounted into a slot of the communications multiplex equipment or installed in racks within the communications cubicle. It shall employ full solid-state microprocessor controlled circuitry techniques with self-monitoring functions. Exchange of faulty sub-modules shall be possible without switching off the communications equipment or influencing other channels.

4.7.2.3. Computerized diagnosis/ testing and easy field programming (alarm levels, selection of permissive tripping / blocking signal features, etc.) of the equipment shall be possible. Programming and diagnosis shall preferably be carried out with a PC to be connected to the teleprotection equipment via a standardized service interface.

4.7.2.4. Additionally, the equipment shall be furnished with local failure indications and potential free contacts for external alarm annunciation. As a minimum, the following alarms shall be generated and announced:

- General (internal) fault
- Auxiliary power supply failure
- Faulty transmission path, exceeding a specified time (e.g. some seconds)
- Signal-to-noise ratio too low, exceeding a specified time
- Continuous command

- Protection signal sent
- Protection signal received.

4.7.3. PABX

4.7.3.1. A PABX shall be supplied for each substation and switching station connecting to the SDH equipment. It shall have the following capacity, but also be capable of future expansion:

	Required	Min.Future Expansion
Number of trunk cards	8	12
Number of extension cards	8	16
Number of cabled extension circuits	6	
Number of handsets	4	

4.7.3.2. The Contractor shall supply and install two optical isolators and connect two incoming PSTN circuits, which will be arranged by the Contracting Officer. One telefax machine and one telephone handset shall be supplied and installed at each substation and switching station.

4.7.4. Test Facilities

A test mode or test points shall allow checking of equipment under operating conditions. It shall be ensured that testing will neither disturb or damage the teleprotection equipment nor cause any malfunction of connected high voltage circuit breakers. Proper functioning and any malfunctions of the equipment during testing shall be indicated via LEDs. Under no circumstances shall real tripping commands be blocked or limited during tests, in order that full protection of the high voltage system is maintained. Loop tests shall be possible from each terminal station without the need of personnel at the opposite station.

4.8. COMMUNICATIONS EQUIPMENT

4.8.1. General

The primary optical network shall be based on Synchronous Digital Hierarchy (SDH) equipment using multiplexed channels on STM-1 (155 Mbit/s) links for data, telephony and protection signaling. Fiber optic patch panels shall be supplied to provide an interface for connections between fibers from the OPGW and the station communications equipment. Type FC/PC connectors shall be used. The patch panel may be installed in the same cubicle as the SDH equipment.

4.8.2. Network Services

4.8.2.1. Telephone System

The telephone exchanges (PABX) at each substation shall be linked over the SDH network by 2 Mbits/s G.703 E1 circuits.

4.8.2.2. SCADA Data

Digital communications shall be provided to connect the Remote Terminal Unit (RTU) of the CSCS at each site with the Network Control Centre. 10 Mbits/s IEEE 802.3 Ethernet data links shall be provided over the SDH. In addition, asynchronous serial links shall be provided for other equipment that may need interconnection.

4.8.2.3. Teleprotection

Digital teleprotection circuits shall be provided on the SDH network for all transmission and distribution lines. The data circuits shall use the standard 64 kbits/s G.703 (ISDN compatible) interface and shall employ multiplex section protection between the communication sites at each end of the transmission and distribution lines to provide maximum reliability.

Teleprotection signaling equipment shall be provided at the SDH access channel level.

4.8.3. Performance

4.8.3.1. The technical requirements of the equipment specified for the communications network are based on ITU-T Recommendations and other international standards.

4.8.3.2. Error performance objectives shall comply with ITU-T Recommendation G.826.

4.8.4. Redundancy

Each SDH terminal shall communicate via two separate fiber circuits in a ring configuration. Where possible, these circuits shall be connected by separate transmission lines.

4.8.5. SDH Multiplex Equipment

Digital multiplex equipment shall be provided to perform the necessary multiplexing between 2 Mbit/s and 34 Mbit/s tributaries at each site. The digital multiplex equipment shall also provide the optical interfaces to the fiber optic cables between the various sites. The digital multiplex equipment shall be in accordance with the latest ITU-T Recommendations for SDH equipment, namely; G.703, G.707, G.708, G.709, G.781, G.782, G.783, G.784, G.803, G.811, G.823, G.825, G.957 and G.958.

4.8.6. Interfaces

4.8.6.1. The types of interfaces required are:

- STM-1 Optical

- n x 2 Mbit/s

4.8.6.2. The characteristics of the multiplex interface shall conform to the ITU-T Recommendations for systems operating at 155 Mbit/s or 52 Mbit/s, namely:

- G.709 for mapping and de-mapping
- G.708, G.783 for MSOH and RSOH insertion and extraction
- G.708 and G.709 for POH generation and termination
- G.709, G.783 for Pointer generation and interpretation
- G.708 for multiplexing
- G.709 for scrambling and de-scrambling

4.8.6.3. STM-1 Optical Interface

Optical interfaces shall be provided for connection to the fiber optic cable between the various sites. In addition to the general requirements listed above, the STM-1 Optical Interface shall conform to the requirements listed in ITU-T Recommendation G.957.

The interface shall operate at a nominal optical wavelength of 1550 nm and be suitable for operation over the required distances. The optical fiber on these routes shall conform to the ITU-T Recommendation G.652. For each link, the optical interface with the lowest transmitter output power that still meets the performance objective shall be supplied.

The STM-1 Optical Interface card shall include flexible patch cords to connect the optical interface to the patch panel. The patch cords shall be terminated at the patch panel end in Type FC/PC connectors. These connectors are also preferred for the STM-1 Optical Interface.

4.8.6.4. n x 2 Megabits/s (Mbps) Interface

2 Mbps interfaces are required at each site to connect to primary multiplex equipment. Each interface card should accommodate at least 4 x 2 Mbps interfaces to provide the immediate requirement together with spare capacity for future growth. All 2 Mbps interfaces shall conform to the ITU-T Recommendations:

- G.703 section 6 for electrical characteristics. The 120 Ω balanced pair option shall be used
- G.704 for functional characteristics
- G.823 and G.783 for output jitter and jitter tolerance

The 2 Mbps interface terminations shall be 120 Ω balanced.

4.8.7. Synchronizing

4.8.7.1. If a Primary Reference Clock for the synchronization of the SDH equipment is required, it shall be installed at the same location as the network management system and comply to ITU-T Recommendation G.811.

4.8.7.2. Each multiplexer shall have the ability to choose the timing source between external timing, incoming STM-1 signal (155 Mbps) or incoming 2 Mbps. The order of priority in which these sources are chosen shall be programmable by the Contracting Officer.

4.8.7.3. The synchronization architecture shall conform to the recommendations in ITU-T Recommendation G.803 section 6. Where required according to G.803, the Contractor shall provide slave clocks compliant with ITU-T Recommendation G.812. Also, the synchronization using the ring shall be configured in such a way that synchronization is not lost to any loop node with any single break in the ring.

4.8.7.4. The SOH (Section Overhead) bits Z1 (b5-b8) shall be used to carry synchronization status messages as defined in the ITU-T Recommendation G.708. These status messages shall determine the source of the clock during normal and abnormal operation and shall be used to provide a robust synchronization network as described in ITU-T Recommendation G.803 section 6.2.7.

4.8.7.5. Each multiplexer shall be provided with a synchronization output interface conforming to ITU-T Recommendation G.703 section 10.

4.8.8. Jitter and Wander

The jitter tolerance on the STM-1 interfaces (155 Mbps) shall be in accordance with the ITU-T Recommendations G.825 and G.958. The output jitter shall be in accordance with ITU-T Recommendations G.783, G.825 and G.958. The jitter transfer function shall be in accordance with ITU-T Recommendations G.783 and G.958.

4.8.9. Channel Assignment

4.8.9.1. The multiplex supplied in the Contract shall be configured by the Contractor to provide the specified reliability for the various types of services.

4.8.9.2. The Contractor shall submit detailed multiplex design/channel assignment information to the Contracting Officer for acceptance prior to commencement of manufacture.

4.8.10. Installation

The multiplex equipment supplied in the Contract shall be installed and tested by the Contractor. Following this testing, the equipment shall be subjected to an availability test to prove compliance with the ITU-T Recommendation G.826.

4.8.11. Network Management

4.8.11.1. A Network Management System (NMS) based on Open Systems architecture conforming to the ITU-T Recommendations M.3010 and G.784 shall be provided for the SDH network. This shall be installed at the Network Control Center.

4.8.11.2. The individual network elements (I.e. DXC and ADM units) supplied to this Specification shall be interconnected as a managed SDH sub-network according to the architecture of Figure 3.4 of ITU-T Recommendation G.784.

4.8.11.3. In connecting the network elements to form this sub-network, the data channels used shall be configured in a ring-protected arrangement so that no network management capability is lost in the event of failure of any part of the ring.

4.8.11.4. The interface to each network element shall be a Q3 interface as defined in the ITU-T Recommendation G.773.

4.8.12. Maintenance Functions

4.8.12.1. Provide details of alarms and parameters monitored in the multiplex equipment and presented to the network management interface. As a minimum, these parameters shall include those listed in section 4 ITU-T Recommendation G.736.

4.8.12.2. In addition to signaling external alarms, these fault conditions shall generate consequent actions as listed in Table 1 of ITU-T Recommendation G.736.

4.8.13. Control of Service Terminal

4.8.13.1. Each network element shall be provided with an F interface to allow maintenance staff to locally interface to the network element with a hand held terminal or portable computer.

4.8.13.2. The maintenance technician shall be able to access locally all the information on alarms, settings and statistical information from each network element at the site. He shall also be able to change all software settings. The procedure for updating these software settings shall be designed to minimize the risk of the

maintenance technician causing an inadvertent malfunction of the equipment.

4.8.13.3. Provide details of measurements and settings that can be controlled on the radio with this terminal.

4.8.14. Very High Frequency (VHF) Communications Systems

4.8.14.1. A VHF communication system is required for voice communications. The system allocated frequencies are 163.425 MHz and 163.325 MHz.

4.8.14.2. The scope of supply shall include, but not be limited to, the following:

- VHF transceiver with code calling facility
- Power supply unit for base sets
- Antenna tower, Minimum 18 m, including guys, line traps, coupling devices, foundations, etc.

4.8.14.3. The transceivers shall conform to the following specifications:

a) RF output power: 30 Watts nominal

b) No. of switchable channels: 6 Frequencies matching with the existing system

c) Channel separation: 25 kHz

d) Frequency control: Synthesized

e) Display: Digital LED/LCD

f) Audio output: 2 Watts with less than 10% distortion

g) Controls: Power, volume, channel selection, code calling, operator selectable channel scan function, etc.

4.8.14.4. The Contractor shall ascertain the height of the VHF antenna tower at all substations and switching stations after carrying out a VHF survey. The minimum height of the antenna tower, however, shall be 18 m as specified above. The RF output power shall be ascertained by the Contractor after carrying out survey and design according to ITU standards.

4.8.14.5. The VHF mast shall be of galvanized steel. Aviation obstruction lights to be provided on VHF mast shall conform to the requirements of the Contracting Officer. The design wind velocity is 185 km/hr.

4.8.14.6. The base antenna shall be an omni-directional ground-plane antenna. Maximum power input shall be 100

4.8.14.7. Watts with VSWR on tuned frequencies of 1.2.

4.8.14.8. The base antenna coaxial cable shall be of copper conductor polyethylene foam insulated type. The attenuation shall not exceed 1.5 dB per 100 meters at 40 MHz. The characteristic impedance shall be 50 ohms.

4.9. COMPUTERIZED SUBSTATION CONTROL SYSTEM

4.9.1. General

4.9.1.1. This covers the design, manufacture, supply, installation, testing, commissioning and handing over of a microcomputer-based substation control system suitable for operation and data recording of the substations. All materials and parts that are not specifically mentioned hereinafter but are necessary for erection, assembly and operation of the equipment shall be furnished and are deemed to be included in the scope for this sub-section.

4.9.1.2. The Computerized Substation Control System (CSCS) shall be a microcomputer-based control and monitoring system and include protection functions.

4.9.1.3. A CSCS system is required for all substations and the switching station.

4.9.2. Design and Operation

4.9.2.1. The arrangement shall follow the latest engineering practice, ensuring optimum continuity and reliability of supply and ensure the safety of equipment and the operating staff. The highest degree of uniformity and inter changeability shall be provided.

4.9.2.2. All components shall be suitable for the local climate and storage of equipment shall be possible in closed rooms without air conditioning at a maximum ambient temperature of 55 °C. The system offered shall be suitable for operation under electrical conditions (including electrical discharge and disturbance levels) existing in high voltage substations.

4.9.2.3. The equipment shall be pre-assembled and pre-programmed at the supplier's works. It is understood that all auxiliary facilities/devices and services necessary are to be provided, i.e. for generation of data base of displays programming and testing, adjustments, parameter setting etc.

4.9.2.4. The design of the system shall be such that personnel without any computer background shall be able to

operate the system with ease and shall incorporate user-friendly features without causing undue operational delay.

4.9.2.5. The design of the hardware and software shall be suitable for 220/110/20 kV voltage levels used by the Contracting Officer to enable a standardized layout.

4.9.2.6. The CSCS shall be designed for easy modification of hardware and software and for easy extension of the substation. Maintenance, modifications or extension of components shall not require a shut down of the CSCS. Self-monitoring of single components, modules and data transfer channels shall increase the availability and reliability of the equipment and minimize maintenance requirements. Failure of individual components shall not force a total system failure.

4.9.2.7. The entire substation shall be controlled and supervised at station level, while individual 220 kV, 110 kV and 20 kV bays shall also be protected, supervised and controlled from the appropriate, control and relay panels, it shall not be possible to control the 220 kV, 110 kV and 20 kV bays at the same time from the station and individual bay level.

4.9.2.8. The bay units shall be independent of each other and the operation shall not be affected by any fault occurring at the station level or in other bay units of the substation.

4.9.2.9. Each substation control system shall consist of the following main parts:

- Man Machine Communications (MMC)
- Substation Control Computer (SCC)
- Serial high speed bus for data transmission between the different components via fiber optic links
- Bay Units (BU) for local control and protection
- Feeder related local control panels with mimic diagram pushbuttons and selector switches.
- 10 Mbps Ethernet interface for remote communication over the SDH network

4.9.2.10. The MMC system shall only contain information that is related to presentation and control of the substation.

4.9.3. Substation Control Supervision Functions

All control and monitoring functions have to provide for a secure and reliable operation of the substation, the following are the

minimum functional requirements:

- Input of binary and analogue values
- Control, interlocking, protection and supervision of the bays of the substation
- Alarm handling in the bay computers and in the station computer
- Analogue value processing
- Indication of the bay and substation status
- Indication of measured and processed analog values
- Station control via a monitor system
- Automatic chronological control of standard switching routines
- All hardware, software and telecommunication facilities for future remote control and suspension of the substation from a future Network Control Centre.
- Emergency control of each bay from the related control panels
- Synchro-check functions for all breakers
- Display of trend values
- Fault indication
- Event recording
- Evaluation and archiving of historical data.

4.9.4. Man Machine Communications System (MMC)

4.9.4.1. The MMC system shall be a high performance operator station with one operator workplace. The following functions are required:

- Presentation of user defined displays (switching status and analogue values), standard displays, trend curve displays and reports
- Effective and safe dialogues for manual control of the substation and for release of control sequence.
- Select before operation procedures are required
- Presentation of alarms and events on the operator's monitor and printouts on the printer.

4.9.4.2. The MMC systems shall be based on a computer system with a high performance 32 bit or greater computer. The systems software shall be loaded from a transportable medium (e.g. diskettes or CD ROM) and shall be stored in a dynamic read/write memory with error correction and battery back up power.

4.9.4.3. The monitor shall have a minimum size of 24"; color graphics with a high resolution are required.

4.9.4.4. The MMC shall include two high-speed printers with a standard RS232 interface. The first printer shall be a black and white type for continuous listing of all events occurring in the substation. A second color printer shall be supplied for graphic hardcopies of the displays and for reports.

4.9.4.5. For control of the substation the operator will use a functional keyboard and a mouse or track ball or similar. The keyboard shall be designed to meet client specific requirements. The operator's keyboard shall have push buttons for direct access to specific displays and functions and as well via a minimum of 8 dynamically programmed keys. The operations procedure needs to be easily used and understood.

4.9.4.6. The programming of new displays shall be via an interactive dialogue without taking the CSCS system off line.

4.9.4.7. A DC/AC converter suitable for connection to the station battery shall supply the AC power for the MMC computer, monitor and printers.

4.9.5. Bay Computers

4.9.5.1. The bay computers shall be based on a microprocessor technology and a real time operating system.

4.9.5.2. The bay computers shall perform all bay internal programs, command sequences, collection of signals and information, outputs of commands and signal processing including the processing of the signals from the protection system required for the different switchgear units of the corresponding bays.

4.9.5.3. Generally the following tasks shall be performed:

- Signal acquisition including signals from protection systems
- Acquisition of measured and counted values
- Monitoring of execution of commands
- Data pre-processing

- Data communication to the station computer and connected subsystems
- Calculation of derived operational measured values
- Generation of group signals
- Self-monitoring routines.

4.9.5.4. Power supply to the computers shall come from the station battery. The bay computers are placed together with all necessary input/output equipment in panels in the relay room of the substation control building.

4.9.5.5. Emergency control is defined as control without electronic assistance. In this status other control of this bay is without interlocking. The emergency control requires a special key. Normal control of the bay from the station computer shall be disabled, if the emergency select key is in the emergency operation position.

4.9.5.6. The electronic system shall be provided with functions for self-supervision and test. Each circuit board shall contain circuits for automatic testing of its own function. These circuits shall interact with a test and diagnostic program controlled by the central unit.

4.9.5.7. Faults in a unit have to be indicated by the illumination of a red LED on the front edge of the unit. The time for fault tracing and replacement of a faulty unit shall be reduced to a minimum. The supervision shall also comprise the power supply system, the internal system bus and the ability of the central unit to communicate with different circuit boards.

4.9.5.8. The power supply system shall have test terminals for all voltages used in the system.

4.9.5.9. The function and design of the switchgear interlocking systems shall be extremely reliable and safe. Perfect collection and processing of all switch-gear position of the whole substation must be ensured at all times and unclear information, such as intermediate switchgear positions, switchgear faults, faulty data transfer etc., must never allow switching operations. Control regulation and synchronizing functions shall require perfect collection and processing of all substation information. The information must be up to date and valid. Mal-operation of control and regulation facilities such as on-load switching of an isolator, switching on in an asynchronous state etc. shall be avoided. When the station level control and indication facilities fail, back up control shall be

possible.

4.9.6. Station Computers

4.9.6.1. The CSCS shall include a computer for supervisory functions. This computer shall be equipped with a high performance microprocessor and a real time operating system.

4.9.6.2. The station computer shall have access to all sub-systems at the bay level, collect signals and information, issue commands and perform the signal processing required for the substation.

4.9.6.3. The computer shall be placed together with all necessary input/output equipment in panels in the control room. 110 V DC from the station batteries shall supply the computer.

4.9.6.4. LED’s shall indicate the status of the respective circuits on the front of each input/output module of the station computers.

4.9.7. CSCS Communication System

Data shall be transmitted between bay and station computers by high speed fiber optic data bus.

4.9.8. Presentation, Supervision and Control

4.9.8.1. The CSCS shall be equipped with two monitors, which are connected to the station computer.

4.9.8.2. Display selection, parameter setting, alarm acknowledgement, selected printouts of reports and command outputs shall be performed from the operator's keyboard.

4.9.8.3. The system offered has to distinguish between alarm lists and event lists, selectable on the monitor by the operator. As well as the lists on the screen there shall be a chronological print out of any alarm or event in an event log.

4.9.8.4. An acoustic alarm shall indicate abnormalities and all unacknowledged alarms shall be presented on any screen selected by the operator. As a minimum, the following items shall be presented by the CSCS:

- Station diagram showing the switching status of the substation
- Diagrams of the different voltage levels
- Substation overall alarm lists

- CSCS internal alarm list
- System status list
- Substation overall event log
- Section event list
- Event and alarm log.

4.9.9. Station Diagrams and Station Control

4.9.9.1. The operational status of the substation, measured values of currents, voltages, active and reactive power flows, are to be presented on the displays. The station displays shall present diagrams for each substation voltage level.

4.9.9.2. One display shall be able to show a single line with all the relevant data. The displays shall not take longer than 2 seconds to be updated, after selection by the operator. Layouts of the displays are subject to the acceptance by the Contracting Officer, the Utility Personnel shall also be trained so that they can reconfigure the single line diagram.

4.9.9.3. To ensure a high degree of security against unwanted operations, a special operation procedure requiring "select before execution" shall be provided. After "selection" the operator shall be able to recognize the selected device on the screen and all other switching devices shall be blocked.

4.9.9.4. The computer shall check the interlocking conditions. The operator can only execute the command if the device is not blocked and interlocking conditions are violated. After command execution the operator shall receive a message, either about the new switching position or that the switching operation has been unsuccessful or has been refused.

4.9.9.5. An integrated voltage-check and synchro-check function shall also be provided (separate from that used for auto reclosing) for manual closing of the circuit breakers. The voltage-check function shall include live-bus/ dead-line conditions, dead-bus/live-line conditions and dead-bus/dead-line conditions. It shall be possible to set or sect any combinations of these conditions that will allow closing. For live-bus/live-line conditions the synchro-check function shall take precedence.

4.9.9.6. The synchro-check function shall allow circuit breaker closing only if the voltages on both sides of the breaker fulfill the pre-set conditions as to magnitude, phase and frequency difference. The

voltages shall be considered in synchronism when their phase angles are measured to with the angle adjustable from 20 to 60 degrees. During synchronizing a closing order shall only be accepted, if the synchronizing conditions are fulfilled.

4.9.10. Alarm List

4.9.10.1. Faults and errors which may occur in the substation have to be tabulated in the substation alarm list and have to be processed in order to allow them to be transmitted in future to the Network Control Centre. The alarm list shall replace a conventional alarm table. The alarm list shall constitute an actual evaluation of all station alarms. It shall contain unacknowledged alarms and persisting faults.

4.9.10.2. Date and time of occurrence shall be indicated. The time shall be displayed beside each alarm.

4.9.10.3. The operator shall be able to select pictures which contain only a section or subsection of the substation overall alarm list. The operator shall be able to acknowledge alarms at the keyboard. Acknowledged alarms shall be marked in the list.

4.9.10.4. Faults that appear and disappear without being acknowledged shall be specially marked in the alarm list. The alarm list shall be presented on the display screen. It shall be possible obtain hardcopy on the printer.

4.9.11. CSCS Internal Alarm List

The CSCS shall constitute an actual evaluation of internal CSCS alarms, e.g. of defective CSCS input/outputs or defective CSCS communication nodes. It shall contain unacknowledged alarms and persisting faults.

4.9.12. System Status List

The system status list shall show the CSCS configuration and the status of all devices in CSCS system.

4.9.13. Event List

4.9.13.1. The substation event list shall contain events that are important for the control of the substation, e.g. "Circuit Breaker Closed". The time has to be displayed before each event. The operator shall be able to call up the chronological event list on the monitor at any time for the whole substation or sections of it. A printout of each display shall be possible on the hardcopy printer.

4.9.13.2. The events shall be registered in a chronological event list in which the type of event and its time of occurrence are specified. The latest 600 events shall be stored in the computer. Previous information shall be obtainable from the printed event log. The chronological event list shall contain:

- Control operations initiated by the operator
- Indication of change of position of circuit breakers, disconnectors and earthing devices
- Indication of protective relay operations
- Fault signals from the switchgear
- Changes in the upper/lower limits of analogue measured values

4.9.14. Event and Alarm Log

The event and alarm log shall consist of the spontaneous listing of events and alarms on the event printer. This log shall contain the same events as mentioned above, but chronologically printed as soon as they occur. Additionally, the event log shall contain all alarms, with the time of each occurrence. Each alarm shall be configurable, so that a second alarm message can be printed if the alarm disappears. Events which occur when the printer is off-line (e.g. because of being out of paper) shall be queued in the computer until the printer is again available.

4.9.15. Quantity of Input and Outputs

The signals to be primarily handled are at the 220 kV, 110 kV and 20 kV level as indicated by the station single line diagram. The following signals shall be considered as a minimum:

Binary inputs (single indications):

- 8 per circuit breaker
- 5 per disconnector
- 4 per earthing switch
- 16 per line feeder from protection
- 6 from busbar protection; (220 kV only)
- 50 general auxiliaries for the whole substation.

Binary outputs (single commands):

- 2 per circuit breaker
- 2 per disconnector

- 2 per earthing switch.

Analogue inputs (8 bit measurement):

- 3 voltages per respective busbar sections
- 3 voltages per line feeder
- 3 voltages per transformer feeder
- 3 currents per line feeder or bus-coupler
- 1 active power per line feeder
- 1 active energy counter per line feeder
- 1 reactive power per line feeder
- 1 reactive energy counter per line feeder
- 3 currents per transformer winding
- 1 active power per transformer
- 1 active energy counter per transformer
- 1 reactive power per transformer
- 1 reactive energy counter per transformer

4.9.16. Power Transformer

4.9.16.1. All the status indications, binary outputs and analogues supplied with the power transformer and on-load tap changer shall be made available to the CSCS and allowed for when sizing the CSCS, including:

- Temperature alarms and trip signals
- Oil temperature alarms and trip Signals
- Buchholtz trip
- Group alarms from MCB in the local control cubicle
- Status of the cooling fan groups etc.
- Tap position of the tap changer
- Commands for raising and lowering the tap position etc.
- Local/remote
- Master/Follower

4.9.16.2. The measurement transducers shall be integrated in the RTU at the bay level, e.g. in the relay panel associated with the bay. The CSCS shall be capable of continuously trending a minimum of 20 data items selectable by the operator.

4.9.17. Interface to Future Network Control Center

4.9.17.1. The interface to the future Network Control Centre shall be provided by serial data communication. It shall be possible to control and monitor the substation in future from a yet to be built Network Control Center.

4.9.17.2. The CSCS shall support and be equipped with at least one of the following data communications protocols:

- IEC 60870-5-101/104
- DNP 3.0 (Level 3 implementation).

4.9.18. Servicing, Testing and Programming Equipment

4.9.18.1. Three portable servicing, testing and programming units shall be supplied. They shall be based on a standard laptop computer and portable printer. The portable servicing units shall be used for application programming, documentation, testing and commissioning. The portable servicing units shall be supplied with a CD ROM burner, 1000 CD ROM blank discs, and three 56 KBPS Modems. Any specialist software required shall be supplied free of charge, the specialist software shall include any future upgrades, user fees, support fees and license fees.

4.9.18.2. The laptop-based portable servicing units shall be used for the following purpose:

- Program entry
- Program testing
- Fault tracing
- Program amendment
- Graphical program documentation
- Uploading and downloading of programs including CMOS etc.
- Commissioning
- Reading of values in the data base
- Changing peripheral parameters

- Programming/reprogramming of RTUs if software is configurable.

4.9.18.3. The portable servicing units shall permit the user to study changes in the substation. The units shall be able to monitor data in the CSCS while the system is in use and to present changing variables on the display screen, selectable in a tabular or graphical format. The portable servicing units shall be supplied at the beginning of the commissioning period and be available for training of the Contracting Officer's personnel

4.9.18.4. The programming entry procedure shall be based on a graphical user interface that provides the operator with visual control of the work.

4.9.18.5. The portable servicing units shall deliver alphanumeric and full graphical documentation of the work such as printouts of the application program in graphical form.

4.9.18.6. Both of the event printers of the MMC shall be compatible with the portable servicing unit. The event printers shall be capable of printing on single sheet A3 and A4 and shall be supplied with 40 ink cartridges (or toner cartridges) each, and 40 reams of paper per printer

4.9.19. Software Capabilities

4.9.19.1. The software shall consist of basic software modules and standardized supplementary function modules, the parameters of which can be changed depending on the layout and operational concept of the substation, as the operation and configuration of the substation may change over time. The software shall be either UNIX or UNUX based; or alternatively, MS windows operating system, with Windows XP or Windows Server 2003 or later.

4.9.19.2. Security of control selections is of paramount importance and every precaution shall be taken in the software and hardware design to ensure that spurious control operations are rejected by the system and cannot occur. Failure of communication whether partial, total, intermittent or permanent, shall not lead to an erroneous control actions. Noise, either spuriously occurring or injected manually into any communication link shall not lead to a false control action.

4.9.19.3. The system software shall be standard software that has been in use by other customers.

4.9.19.4. The system shall restart automatically after halt or

loss of supply voltage; all necessary information must be kept in memory in case of loss of supply voltage.

4.9.19.5. After automatic restart, the monitors shall present the same display as existed before the restart. It shall be possible to test the CSCS while the substation is live and being controlled by the CSCS. The testing shall not present any hazards to the safe operation of the substation. Test facilities shall include functional and data tests.

4.9.19.6. The following software programming shall be deemed to be included in the scope of supply of the equipment and services as a minimum:

- Design of the data base including entering all substation data
- Design of one overall display representing the substation
- Design of the displays for each voltage level
- Design of a detailed display for each individual bay
- Design of a display for station auxiliaries.

4.9.20. Station Interlocking and Control Sequence

4.9.20.1. The control program shall make it easy to reconfigure the system by adding new feeders (lines, transformers etc.) and future modification and extension of the station shall be possible without interference with the operation of other parts of the installation (e.g. moving of existing feeders including all parameters and settings to enable installation of new feeders).

4.9.20.2. The interlocking concept shall be as follows:

a) The disconnector shall be operable only when the relevant circuit breaker is in the off position and the relevant grounding switch has been removed. Busbar change over shall be possible with the busbar isolators and bus coupler in the closed position without power supply interruptions.

b) The earthing switch is operable only when the disconnectors have been opened and the circuit is dead (i.e. no voltage)

c) Closing of circuit breakers shall only be possible when the relevant grounding switches have been removed and the protective relays and corresponding lock-out relays are not actuated or if they are actuated, the faults have been cleared and the respective lockout relays have been reset.

d) When a pressure drop signal is received from gas monitoring devices for SF6 circuit breakers, the tripping and closing signal shall be locked out.

e) The interlocking system is to be designed in such a way that testing is possible during normal operation of the CSCS.

4.9.21. Station Metering

The CSCS shall be connected to the digital outputs of the station metering equipment. The station computer software shall include the same software used in the laptop PC supplied for metering analysis. In future the automatic transmission of metering data to the Network Control Center as well as remote setting of meter parameters shall be possible.

4.9.22. Program for the Delivery of Hardware and Software

4.9.22.1. Before starting the manufacture of the CSCS equipment complying with this specification, the following shall be supplied as early as possible to the Contracting Officer:

- A functional design specification (FDS) which describes in detail the equipment and the functions of the system to be installed
- A program for FAT (Factory Acceptance Testing)

4.9.22.2. Both these documents shall be supplied for approval by the Engineer. Their purpose is to ensure that the Contractor has interpreted the specified requirements correctly and that the FAT includes testing to the degree required before the equipment leaves the factory.

4.9.22.3. In addition to the above further documents shall be submitted to the Engineer for approval of e.g. the layout of all the station displays, the data base list and the documentation of the software in the form of graphical diagrams. No factory acceptance tests shall be allowed without the approval of the FDS and the FAT.

4.9.23. Documentation

4.9.23.1. The hardware and software documentation shall comprise of, but not be limited to hard copies and soft copies of the following:

- Front view and side view of all different cubicles (front and side elevations)
- Circuit diagrams for cubicles

- Apparatus lists for cubicles
- Connection tables for cubicles
- Data base listings
- Manuals for the MMC
- Manuals for the station and bay computers
- Programming manuals.

4.9.23.2. All system hardware and software documentation and all the application hardware and software documentation shall be supplied in the English, Dari and Pashto Languages.

4.9.24. Clock System

A substation master clock shall be supplied for each substation and switching station. The master clock shall synchronize the CSCS internal clocks, the MMC internal clocks, the Bay level internal clocks, Fault Recorder internal clocks and any metering clocks. The master clock shall be synchronized by a satellite receiver (GPS). The master clock shall be battery buffered.

4.9.25. Proof of Quality

Only experienced and technically capable manufacturers of Control and Protection Systems will be accepted. In order to establish their capabilities, it is required to present the following documents:

- Block and functional diagrams showing the proposed control scheme
- Technical specifications and descriptions of systems, catalogs of equipment and devices to be used
- Brochures and references of the manufacturer supplying the CSCS
- A list of references of similar CSCS systems installed in the last 5 years

4.10. DIMENSIONING DATA

4.10.1. General Electrical Requirements

The following general electrical requirements are applicable to all high and medium voltage system apparatus and accessories.

Nominal system voltage	220 kV	110 kV
a) Rated voltage	245 kV	123 kV

b) Nominal Rated insulation level: (See Paragraph 3.2.2 for insulation co-ordination characteristics by altitude)

Rated lightning impulse withstand voltage (peak)	1,050 kV	550 kV
Rated 1 minute power-frequency withstand voltage (rms)	395 kV	230 kV
System neutral grounding	Direct compensated Peterson Coil	
c) Rated frequency	50Hz	50Hz
d) Rated current:		
Rated normal current - Busbar Bay	1,600 A	1,600 A
Rated normal current - Transformer Bay	1,250 A	1,250 A
Rated normal current – Line/Feeder Bay	1,250 A	1,250 A
Rated short time withstand current (3 second rms)	40 kA	40 kA
Rated short-circuit breaking current	40 kA	40 kA
Creepage distance for outdoor insulators, minimum value (IEC 60815)	25 mm/kV	25 mm/kV
e) Maximum ambient air temperature	45 °C	45 °C
f) Maximum relative humidity (40 °C)	100%	100%

4.10.2. Electrical Requirements for HV Specific Apparatus

The following general electrical requirements are applicable to specific high voltage system apparatus and accessories:

Nominal system voltage	220 kV	110 kV

<u>Circuit breakers</u>:

a) Rated class	Outdoor
b) Rated operation sequence	0-0.3s-CO-3m-CO
c) Rated short-circuit breaking current	40 kA

d) Rated making current 2.5 times the rated breaking current

e) Rated out-of-phase 25% of rated short breaking current

f) Total breaking time 50 ms

g) Total closing time 60 ms

Disconnectors:

Rated insulation level: (See Paragraph 2.2 for insulation co-ordination characteristics by altitude)

a) Rated lightning impulse withstand voltage

To earth and between poles	1,050 kV	550 kV
Across isolating distance	1,200 kV	630 kV

b) Rated 1 minute power-frequency withstand voltage(rms)

To earth and between poles	460 kV	230 kV
Across isolating distance	530 kV	265 kV

Current transformers:

a) Rated secondary current	1 A	1 A

Voltage transformers:

a) Rated voltage factor

Between phase and earth continuous	1.2	1.2
Between phase and earth, 30 second	1.5	1.5
b) Primary voltage	220/√3	115/√3
c) Secondary voltage	110/√3	110/√3

Lightning arrestors:

a) System voltage	245 kV	123 kV
b) Rated voltage(Ur IEC 60099-4)rms	198 kV	123 kV
c) Energy Capability Class	Class 3	Class 3
d) Nominal Discharge Current	10 kA	10 kA

Earthing system:

a) Minimum sizes of copper conductors:

Grounding loops	120 mm2
Riser	120 mm2
Connection of live neutrals	50 mm2
Connection of other steelworks not part of high-voltage structures	25 mm2

b) Maximum permissible fault current density for connection of:

System neutrals	100 A/mm2
HV-equipment	200 A/mm2
LV-equipment auxiliary power transformers, etc.	150 A/mm2

c) Grounding rods:

Diameter	16 mm
Length, minimum	3 m
Material	Copper-clad steel

d) Assumption for calculations of step voltages, according to IEEE-80:

Maximum grid potential rise	5 kV rms
Step	1 m
Body resistance	1000 Ω
Fault clearing time	1 s

e) Assumption for soil resistivity for use, according to IEEE-80:

Soil resistivity	3000 Ω-m

4.10.3. Electrical Requirements for MV Specific Apparatus

The following general electrical requirements are applicable to specific medium voltage system apparatus and accessories:

Nominal system voltage	20 kV
a) Rated voltage	24 kV
b) Rated insulation level:	
Rated lightning impulse withstand voltage (peak)	150 kV
Rated 1 minute power-frequency withstand voltage (rms)	50 kV

	System neutral grounding	direct
c)	Rated frequency	50 Hz
d)	Rated current:	
	Rated normal current - Busbar Bay	1,250 A
	Rated normal current - Transformer Bay	1,250 A
	Rated normal current - Line/Feeder Bay	630A
	Rated short time withstand current (3 second rms)	25kA
	Rated short-circuit breaking current	25kA
	Creepage distance for outdoor insulators, minimum value (IEC 60815)	25 mm/kV
e)	Maximum ambient air temperature	45° C
f)	Maximum relative humidity (40° C)	100%

Circuit breakers:

a)	Rated class	Outdoor
	Rated operation sequence	0-0.3s-CO-3m-CO
b)	Rated short-circuit breaking current	25kA
c)	Rated making current	2.5 times the rated breaking current
d)	Rated out-of-phase breaking current	25% of rated short circuit breaking current
e)	Total breaking time	50 ms
f)	Total closing time	60 ms

Disconnectors

Rated insulation level: (See section 2.2 for insulation co-ordination characteristics by altitude)

a) Rated lightning impulse withstand voltage	
To earth and between poles	125 kV
Across isolating distance	145 kV
b) Rated 1 minute power-frequency withstand voltage (rms)	
To earth and between poles	50 kV
Across isolating distance	60 kV

Current transformers:

a) Rated secondary current	1 A

Voltage transformers:

a) Rated voltage factor	
Between phase and earth continuous	1.2
Between phase and earth, 30 second	1.5
b) Primary voltage	20/√3
c) Secondary voltage	110/√3 V

Lightning arrestors

a) System voltage	24kV
b) Rated Voltage (Ur IEC 60099-4)	24 kV rms
c) Energy Capability Class	Class 2
d) Nominal discharge current	10 kA peak

Earthing system

a) Minimum sizes of copper conductors:	
Grounding loops	120 mm^2
Riser	120 mm^2
Connection of live neutrals	50 mm^2
Connection of other steelworks not part of high-voltage structures	25 mm^2
b) Maximum permissible fault current density for connection of:	
System neutrals	100 A/mm^2
HV-equipment	200A/mm^2
LV-equipment auxiliary power transformers, etc.	150 A/mm^2
c) Grounding rods:	
Diameter	20 mm
Length, minimum	3 m
Material	Copper-clad steel
d) Assumption for calculations of step voltages, according to IEEE-80:	
Maximum grid potential rise	5 kV rms
Step	1m
Body resistance	1000 Ω
Fault clearing time	1 s

Low Voltage Distribution Boards AC

a) Rated Voltage	400/230 V
b) Rated Frequency	50 Hz
c) Rated short-time withstand current	25kA

4.11. CIVIL WORKS

4.11.1. Execution of Work

4.11.1.1. Leveling of Site

A removal of top soil shall be carried out down to a minimum depth of 0.5 m.

The Contractor shall level the area by the excavation of the high areas and by the fill and compaction of the low areas. Any soft sail or other material unsatisfactory for the leveling work shall be excavated and removed from the Site.

After the bulk excavation and the filling and compacting works have been carried out, the Contractor shall remove any remaining high spots and fill in any depressions so that before the commencement of any construction work, the whole of the area has been leveled to the requisite ground level to the satisfaction of the Contracting Officer.

All necessary retaining walls shall be included in the contract.

4.11.1.2. Setting Out

Before any excavation of filling work begins, the Contractor shall set out accurately all excavation and filling lines according to the drawings and shall satisfy himself as to the correctness of all site levels shown on the drawings. During the work the Contractor shall ensure that the excavation and filling follow the said lines, and the Contractor shall set out as necessary as the works proceed, profiles and other markers for leveling purposes and he shall be in agreement with the Contracting Officer about the levels of the said profiles and markers.

4.11.1.3. Excavation

The Contractor shall excavate the ground to the lengths and widths and exact depths as indicated on the drawings required for the construction of the works. In cases where the bearing capacity of the subsoil under foundations or roads is insufficient, the excavation shall be continued to such greater depth as may be necessary. Based on the existing ground water level, the foundations shall not be deeper than necessary. All excavation may be carried out mechanically, but the final shaping and trimming of the subgrade below foundations, etc. shall be done by hand. The Contractor shall handle and remove as necessary all water which may come into the excavations and he shall provide, maintain and remove on completion all planking, strutting, shoring or piling required to support the sides of the

excavation.

The Contractor shall report all cases of unsuitable or weak ground to the Contracting Officer and shall follow the instructions given by the Contracting Officer during the excavation works. If due to negligence or mistakes on the part of the Contractor any excavations be taken to a level lower than that shown on the drawings or stated in the specification or required for the works, the Contractor shall at his own cost fill in the voids so formed to the proper level with approved fill material well compacted or, if necessary, under foundations and the like with approved blinding concrete.

4.11.1.4. Filling and Compacting

Filling of areas and around foundations and backfilling of trenches shall be executed in such a way and to such extra depths as will ensure that final surface after settlement and compacting conforms to the specified levels. All filling material shall be free from cinders, ashes, refuse vegetation or organic material, boulders and other unsuitable material.

All fill material shall be well compacted by mechanical means until the required degree of compaction is obtained. The filling material shall be placed in even layers of a depth not greater than 0.4 m and each layer shall be thoroughly compacted. A suitable power-driven roller of at least 5 tons weight, making at least 10 passes for each layer shall be used. For backfilling of narrow and steep sections the thickness of each layer shall be maximum 150 mm, each layer being compacted to required density by using a vibrating plate compactor. Filling and compacting around any pipes, cables or ducts shall be done by hand using selected materials for a depth of at least 0.5 m above such pipes, cables or ducts.

The Contracting Officer's instructions regarding the addition of water to improve compacting of fill must be adhered to. For fill under roads and foundations every effort shall be made to compact the fill material at its optimum moisture content for compacting. In any case the dry density of the compacted soil shall not be less than 95% of the maximum density according to ASSHTO T180. The complete substation area shall be surfaced with a 100 mm layer of crushed aggregate, size 32-64 mm.

4.11.1.5. Leveling

Depending on the ground socket level, leveling to the surroundings might be needed. The slope of such shall be between 1:100 and 1:50.

4.11.1.6. Disposal of Surplus

The Contractor shall remove from the Site all surplus soil or other excavated material not required or not suitable as fill material. Such material shall be transported to spoil dumps located as agreed upon with the Contracting Officer.

4.11.2. Drainage

4.11.2.1. The Contractor shall install an adequate drainage system for the new substation area. Building down pipes shall be connected to the drainage system. Open ditches are not allowed within the substation area.

4.11.2.2. The drainage system shall be designed for the relevant local climatic conditions.

4.11.3. Roads

4.11.3.1. The Contractor shall arrange for roads in the new switch yard for transport of the transformer to the transformer cell and for passage of a car to the control building. The roads shall be 6m wide and shall be gravel roads with adequate geometric design and pavement section to carry design vehicles. Design vehicles shall include longest and heaviest types of vehicles anticipated to use the facility.

4.11.3.2. The Contractor shall use the AED Design Requirements “CERP Road-Geometric Requirements and Flexible Pavement Section Design” Sections 3&4 to design the Aggregate Surface Road pavement section. Gradation requirements and road structure thickness must be developed per the design example.

4.11.3.3. Ensure Compliance with UFGS-32 15 00 Aggregate Surface Course with respect to execution of installation of aggregate including: compaction, preparation of subgrade, grade control, mixing and placing materials, layer thickness, edges of aggregate surfaced road, smoothness test, thickness control, density test, and maintenance until acceptance.

4.11.4. Foundations

4.11.4.1. The foundation for the transformers shall be constructed in reinforced concrete, with space for the whole oil volume of the transformer under the crushed aggregate and steel grating.

4.11.4.2. Transformers shall be separated by a fire proof wall.

4.11.4.3. Foundations shall normally be placed on virgin soil or well-compacted fill and be below the frost penetration depth.

4.11.4.4. If excavation has been performed to greater depth than required, sand or gravel shall be placed at

bottom of the pit to bring the excavation to the required elevation. Such material shall be placed and compacted in layers not exceeding 100 mm. Excavation pits shall be kept dry during construction and erection of foundations. Backfilling of the pits shall not be carried out until the Contracting Officer has inspected and accepted the foundation.

4.11.4.5. Excavated soil may be used as backfill if it is suitable for compacting. Rock and soil not suitable for compacting shall be removed and replaced with a suitable backfill to the satisfaction of the Contracting Officer. Backfill shall be placed in layers approximately 150 mm thick. Each layer shall be carefully compacted by means of a suitable plant

4.11.5. Fire Protection Walls

Fire protection walls are protection against heat radiation, which means they prevent the NARPad of fire and damage of plant and equipment in the neighborhood. The fire protection walls shall be designed according DIN VDE 0101 or equivalent.

4.11.6. Fences and Gates

4.11.6.1. The Contractor shall design, furnish and install a fence and gates around the whole substation area. The fence shall be 3 m high, including three numbers of 4-point galvanized barbed wire at the top. A bottom tension wire shall be provided. All parts of the fence shall be corrosion resistant, galvanized or aluminum.

4.11.6.2. The chain link shall have a mesh width of maximum 50 mm, and each wire shall have a minimum failure load of 2,000 N. Straight line posts shall have a minimum bending failure load, applied horizontally on the top, in the most unfavorable direction, of 600 N. Top and bottom tension wires shall have a minimum failure load of 5,000 N. In case of 2.5 m or higher chain link, the top wire shall be substituted by a top rail. Barbed wires shall have a minimum failure load of 3,000 N.

4.11.6.3. There shall be one main gate with one smaller gate for personnel passage. The main gate shall allow for passage of a truck, both gates shall have provision for securing by padlock. Fence posts and gates shall be set in concrete foundations of adequate strength.

4.11.6.4. Straight line posts shall have a spacing not exceeding 3 m. Guyed tension posts shall be inserted each 50 m along straight lines. End and corner posts shall be adequately braced. Straight line posts shall have 800-1,000 mm deep foundations, either a 6 inch concrete tube filled with concrete, or a directly cast foundation, at least 200 mm wide. Foundations for corner or end posts shall extend minimum 1,000 mm below surface and consist of either a

filled 9 inch concrete pipe, or be a directly cast foundation, at least 300 mm wide. The main gate shall be designed with a reinforced concrete foundation connecting both posts.

4.11.6.5. To prevent small animals from entering the substation, the space between the bottom of the chain link and the ground surface shall be filled in by a concrete kerb, either consisting of prefabricated slabs or cast at site.

4.11.6.6. To prevent dangerous touch voltages, a 35 mm' copper wire shall be buried 1 m outside the fence and 0.5 m deep. Connections between the fence and the encircling earth wire shall be made each 15 m. All corner and gateposts shall be separately connected. The encircling earth wire shall be connected to the station grounding grid.

4.11.6.7. In case of an insulated (plastic coated) fence, the encircling earth wire may be omitted. Only gateposts will be connected to the station grounding grid. The top and bottom wires (or top rails) will be divided in 50 m sections fully insulated from each other.

4.11.7. 220kV and 110kV Switchyards

4.11.7.1. The Contractor shall design and mount steel gantries with supported rigid tubular busbars of a suitable design for the 220 kV and 110 kV switchyards. The gantries shall be suitable for the incoming lines and transformer bays.

4.11.7.2. Each 220 kV and 110 kV gantry bay shall withstand a load of one three-phase 220 kV and 110 kV, respectively, overhead line of equivalent 2 x 300 mm 2 Aluminum ACSR wire, with a slack span of up to 150 m. Each 20 kV terminal pole shall withstand a minimum load of one three-phase 20 kV overhead line of 158 mm 2 ACSR conductor, with a slack span of up to 80 m.

4.11.7.3. The 220 kV and 110 kV rigid tubular busbars shall be supplied with steel supports, conductor, insulators and accessories. The scope also includes bolted termination clamps and termination arrangements for all outgoing 220 kV circuits.

4.11.7.4. The gantries and busbars shall be designed to ensure adequate clearance to other equipment, transmission lines, distribution lines, vehicles and personnel inside and outside the substation area. The poles used outside the substation area will support the 20 kV distribution lines at 9.5 m above ground level.

4.11.8. Lightning Protection

4.11.8.1. The 220 kV, 110 kV and 20 kV switchyards shall be

protected against lightning by providing earth wires or lightning rods on the strain portals for the busbars and the overhead lines. The lightning protection wires (earthwire wire) of the incoming lines shall terminate at strain portals (gantries) of the switch yard. The protected zone shall include all switchgear and transformers.

4.11.8.2. The earthing facilities necessary for lightning protection shall conform to DIN VDE 0141 or equivalent, with particular attention paid to the requirements for lightning protection in outdoor switching stations (e.g. back flashover). Lightning conductor wires and lightning rods shall be corrosion resistant.

4.12. Control Building

4.12.1.1. The control building shall include one room for the relay panel and the AC/DC equipment, a battery room, a storage room and workshop, an office, a kitchen and a WC/Bathroom. There shall be spare space to extend the control relay panels by up to 100%. The entrance into the store and the battery room could also be from outside. At a minimum the control building shall include a fire protection system, a Heating, Ventilating, and Air Conditioning (HVAC) system, and interior and exterior electrical, telecommunications, water supply and wastewater services. Water supply and wastewater service shall tie into existing public services if available or private services shall be designed and constructed by the contractor such as water wells for water supply and a sewage disposal system such as a septic system. Control building shall be designed in accordance with the International Code Council (ICC) Standards, 2012 edition and USACE AED (Afghanistan Engineering District) Design Requirements.

4.12.1.2. A desk, a chair and a bookshelf shall be provided in the control room as well as in the office room.

4.12.1.3. General

The rooms shall have painted concrete floor, with a sufficient extent of cable channels for installation of control and auxiliary power cables. All cable penetrations in floor and walls shall be sealed with fire resistance material. All cable penetrations in outer walls shall be protected against the ingress of water.

4.12.1.4. Design

The substation building shall be constructed of reinforced concrete for beams and columns, and CMU walls. The construction shall have good thermal isolation to minimize the need of air cooling. Internal walls shall have a fire resistance for 60 minutes. The penetration seals between

these rooms shall also meet this requirement. All air inlets and outlets shall be provided with applicable filters to avoid pollution of the rooms. The outer doors and windows shall be sealed. The substation building shall be designed in accordance with IBC 2012. Seismic design data shall be in accordance with UFC 3-301-01.

The design shall provide enough space for erection, operation, service and maintenance of the substation as well as for the future expansion of the control equipment with 100%.

The floors shall be steel troweled and painted in an approved manner with resistant epoxy paint. The internal wall and roof surfaces shall be painted in an approved manner with suitable plastic paint. The external walls shall be painted in an approved manner with suitable plastic paint. Walls below ground surfaces shall be painted with bituminous coat. The quality and colors as well as the application of the paints shall be approved by the Contracting Officer. The Contractor shall submit detailed information, samples and the manufacturer's recommendations for the paints for approval. The painting shall be carried out in an efficient and professional manner to the satisfaction of the Contracting Officer.

Down pipes shall be provided to lead the rain water from the roof to drainage, which shall be adequate to prevent water from entering the building and from the formation of pools on the ground near the building.

Lockable doors, complete with frames, shall be provided. They shall have the same fire resistance as the walls. The doors shall be dimensioned for transport of goods even after the completion of works.

4.12.1.5. Installations

In order to maintain a temperature in the building below +25°C, air conditioning of wall unit type shall be installed in the control room. The air-conditioning units shall be divided into several units to provide redundancy.

The floor in the battery room shall be provided with a gully made of stainless steel, connected to the sewage pipe. The floor surface shall have adequate sloping towards the gully and to be covered by tiles. The battery room shall be provided with one exhaust fan with jalousie and air inlet with grill and filter.

4.13. CONCRETE WORKS FOR SUBSTATIONS

All concrete works for substations shall be done in accordance with paragraph 3.7.

4.14. TESTS ON COMPLETION

4.14.1. General

4.14.1.1. Commissioning and testing shall be provided in accordance with Section 2.12. The procedures for the Tests on Completion shall be based on applicable standards and codes of practice and recommendations from manufacturers, and shall be specified by the Contractor in a separate document. The procedures are subject to the Contracting Officer's review. The extent of the Tests on Completion is tentatively summarized below.

4.14.1.2. A general check of the entire switchgear and ancillary equipment shall be made and shall include a check of the completeness, correctness and condition of earth connections, labeling, painted surfaces, cables, wiring, pipe work, valves, blanking plates and all other auxiliary and ancillary items.

4.14.1.3. Checks shall be made for oil and gas leaks and to ensure that insulators are clean and free from external damage. A check shall be made that loose items that are to be handed over to the Contracting Officer, e.g. blanking plates, tools, spares, are in order and are correctly stored or handed over. Shutters, earthing procedures and the interchangeability of components shall be checked. All interlocking arrangements both electrical and mechanical shall be fully checked and tested.

4.14.2. Power Transformers

After completed erection, the transformer shall be inspected and tested as follows:

a. Visual inspection for oil leakage and correct erection.

b. Insulation test of high and low voltage windings, cables and accessories.

c. Functional check of all accessories, including transformers guards, level and temperature indicators, tap changer and heating elements.

d. Oil test.

e. Visual inspection of oil level, dehydrating breather, valves, control cabinet, electric clearances between live parts and earth, earthing connections.

4.14.3. Switchgear and Control Gear

4.14.3.1. Circuit Breakers

a. Circuit breakers shall be visually inspected.

b. Contact resistance tests shall be carried out.

c. Operational tests will include local and remote trip/close.

d. For SF6 circuit breakers, testing is required on the gas system to prove the gas quantity, its dryness and its dielectric strength. The gas leakage shall also be measured.

4.14.3.2. Disconnectors, Earthing Switches and Auto-Reclosers

a. Auto-reclosers, disconnectors and earthing switches shall be subject to operation tests to confirm contact pressures, contact resistance, simultaneous operation of all phases and the ease of operation.

b. Checks shall be made of the local and remote indications and operation of auxiliary contacts.

c. Checks shall be made of the interlock system, both electrical and mechanical, between the disconnectors and earthing switches.

4.14.3.3. Voltage and Current Transformers

a. Insulation tests at 1,000 volts to earth and between windings.

b. All voltage transformers shall be checked for polarity phasing and for secondary output.

c. Burden, ratio and polarity check of all current transformers shall be carried out.

4.14.3.4. Surge Arresters and Surge Counters

Surge arresters and surge counters shall be inspected including installation and earth connection tests.

4.14.3.5. Conductors and Connections

a. Flexible connections shall be tested to ensure that the correct tensions, sags and clearances will be maintained over the range of environmental conditions and loads without stress to other equipment. If dynamometers are used to check the sags and tensions, they shall be checked both before and after use.

b. Conductivity tests are required without any exception on all connections and joints that are made on site.

c. The required torque shall be checked with a torque wrench for all bolts and nuts.

4.14.3.6. Earthing System

a. Tests shall be made on the effectiveness of the bonding and earthing which will include conductivity tests on selected joints and at the connections to equipment and structures. Checks shall also be made and precautions taken to avoid corrosion on the earthing system.

b. The resistance of the earthing system to earth shall be tested and recorded including the method and equipment used to carry out the tests.

4.14.3.7. Test of Wiring

a. Insulation resistance tests at 1,000 V AC for one minute shall if possible be carried out on all AC and DC protection, control, and alarm and indication circuits to ensure that wiring is in satisfactory condition. Visual inspection shall be made on cable glands, cable jointing, fuse or circuit breaker ratings and small panel items such as indicating lamps.

b. Static equipment which may be damaged by the application of test voltages shall have the appropriate terminals short-circuited.

c. Inter-relay, inter-unit and cubicle wiring carried out at site is to be checked to the appropriate circuit and/or wiring diagram. This may be done by using bells or buzzers. DC supplied from the station battery may also be used. Where it is found necessary during pre-commissioning work to effect site modifications to the secondary wiring, site copies of the appropriate schematic and wiring diagrams shall be suitably marked as agreed with the Contracting Officer before the circuit is commissioned.

d. Loop resistance measurements are to be made on all current transformer circuits. Separate values are required for a current transformer and lead resistances and all measurements are to be recorded on lead resistance diagrams.

4.14.3.8. Test of Relays

a. All relays are to be examined to ensure that they are in proper working condition and correctly adjusted, correctly labeled and that the relay case, cover, glass and gaskets are in good order and fit properly.

b. Secondary injection shall be carried out on all AC relays, using voltage and a current of sinusoidal wave form and rated power frequency. For Circulating current protection employing high impedance voltage operated relays, the paints of injection for relay voltage setting tests shall be across the relay and

stabilizing resistance. The operation setting for the type of protection is to be established by secondary injection where it is impractical to ascertain this value by primary injection. Injection is to be made across the appropriate relay bus wires with all associated relays, setting resistors, and intermediate current transformers connected.

c. Fault setting test to establish the value of current and voltage necessary to produce operation of the relays. These tests are to be carried out by secondary injection applied at the current transformer terminals.

4.14.3.9. Test of DC Circuits

Tests are to be carried out to prove the correctness of all DC polarities, the operating level of DC relays and the correct function of DC relay schemes, selection and control switching, indications and alarm.

4.14.3.10. Test of Instruments

Instruments shall be tested as follows: Instruments and instrument transformer circuits shall be checked for polarity of direction and for calibration including any interposing transformers or transducers. These checks shall be made on all current transformer ratios where applicable.

4.14.4. On-Load Tests

On-load tests are required but due to the hazards inherent they shall be carried out under the direct supervision of the Contracting Officer. The following tests are required:

a. An operation and stability test shall be carried out for on-load commissioning.

b. Tests for restraint shall be carried out to prove the characteristics of protective systems with directional characteristics.

c. On-load checks shall be made after the protective gear has been placed in service to ensure that all connections and test links have been replaced and test leads removed, as well as to confirm the integrity of the current transformer circuits. Where necessary, voltage readings shall be taken at the terminals on each relay to ensure that loop connections between the relays are complete. Special attention shall be paid to broken delta voltages and residual current circuits where zero voltage or current respectively may not be a proof of the completeness of the circuit.

4.14.5. Communication System Tests

4.14.5.1. All routine tests as specified in the applicable standards shall be carried out on the communication system equipment. Certificates of routine tests carried out on the equipment supplied shall be submitted for approval.

4.14.5.2. In addition, the following tests shall be carried out:

a) VHF transceiver:

i) RF level

ii) Frequency accuracy

iii) Loss for speech frequency level

iv) Signal levels

v) Nominal impedance and return loss-VF side

vi) Automatic gain control

vii) Transmit/ receive frequency difference

viii) Linearity

ix) Noise generated

x) Sensitivity (SINAD value).

4.15. Performance

All works shall be executed according to the requirements and in the manner set out in the Contract Documents. The Contractor shall design, construct and supply all materials for manufacture, tests at the manufacturer's works, transport from the works and delivery to the site, erection, tests, carry out all completion works, put into operation, remedy defects during the defects liability period for the above Plant as described in the Specifications and as shown on the Drawings. All components and accessories required for the satisfactory operation of the Plant shall be supplied as necessary.

4.16. Training

4.16.1. During the manufacture of the 220 kV CB, 110 kV CB, 220/20 kV transformers, 220/110 kV transformers and 110/20 kV transformers, the Contractor shall arrange for factory visits for Contracting Officer's appointed personnel. During each visit of 7 days, training shall be given to five appointed Utility personnel on factory inspections and witnessing of performance tests. During the erection and test period, the Contractor's supervisor shall give 7 days training, information and thorough instructions to the Contracting Officer's staff concerning the handling of the plant and the use of the operation and maintenance manuals. The appointed Utility personnel shall also have the opportunity of taking part in the

testing and commissioning of the Plant.

4.16.2. The training shall be performed according to a program approved by the Contracting Officer in advance. The price for this training shall be regarded as included in the price for installation.

- End of Section -

SECTION 01 32 01

PROJECT SCHEDULE

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.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11	(1995) Progress, Schedules, and Network Analysis Systems

1.2 SUBMITTALS

The contractor shall submit their complete project schedule as described in this section to the Contracting Office in accordance with the submittal procedures outlined in the procurement and contract requirements portion of this project. Government approval is required for submittals with a "G" designation.

SD-01 Preconstruction Submittals

Project Scheduler Qualifications; G
Preliminary Project Schedule; G
Initial Project Schedule; G
Periodic Schedule Update; G

1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating (activity status) and preparation of reports and must be a direct employee of the prime Contractor. The authorized representative shall be experienced in scheduling and have previously developed, created, and maintained at least 2 electronic schedules for projects similar in nature and complexity to this project and shall be experienced in the use of the scheduling software that meets the requirements of this specification.

PART 2 PRODUCTS

2.1 SOFTWARE

The scheduling software utilized to produce and update the schedules required herein must be capable of meeting all requirements of this specification.

2.1.1 Government Default Software

The Government intends to use Primavera P6.

2.1.2 Contractor Software

Scheduling software used by the contractor must be commercially available from the software vendor for purchase with vendor software support agreements available. The software routine used to create the required sdef file must be created and supported by the software manufacturer.

2.1.2.1 Primavera

If Primavera P6 is selected for use, provide the "xer" export file in a version of P6 importable by the Government system.

2.1.2.2 Other Than Primavera

If the contractor chooses software other than Primavera P6, that is compliant with this specification, provide for the Government's use two licenses, two computers, and training for two Government employees in the use of the software. These computers will be stand-alone and not connected to Government network. Computers and licenses will be returned at project completion.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS. Show in the schedule the sequence in which the Contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project, including the design and construction sequences, is required. The scheduling of design and construction is the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Designers, Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool.

3.1.1 Approved Project Schedule

Use the approved Project Schedule to measure the progress of the work and to aid in evaluating time extensions. Make the schedule cost loaded and activity coded. The schedule will provide the basis for all progress payments. If the Contractor fails to submit any schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

3.1.2 Schedule Status Reports

Provide a Schedule Status Report on at least a monthly basis. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress

including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

3.1.3 Default Terms

Failure of the Contractor to comply with the requirements of the Contracting Officer shall be grounds for a determination, by the Contracting Officer, that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of the contract.

3.2 BASIS FOR PAYMENT AND COST LOADING

Use the schedule as the basis for determining contract earnings during each update period and therefore the amount of each progress payment. Lack of an approved schedule update, or qualified scheduling personnel, will result in the inability of the Contracting Officer to evaluate contract earned value for the purposes of payment. Failure of the Contractor to provide all required information will result in the disapproval of the preliminary, initial and subsequent schedule updates. In the event schedule revisions are directed by the Contracting Officer and those revisions have not been included in subsequent revisions or updates, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until such revisions to the Project Schedule have been made. Activity cost loading shall be reasonable, as determined by the Contracting Officer. The aggregate value of all activities coded to a contract CLIN shall equal the value of the CLIN on the Schedule.

3.2.1 Activity Cost Loading

Activity cost loading must be reasonable and without front-end loading. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.

3.2.2 Withholdings / Payment Rejection

Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial or periodic schedule updates and subsequent rejection of payment requests until compliance is met.

In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount from each payment period until such revisions to the project schedule have been made.

3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

The computer software system utilized to produce and update the Project

Schedule shall be capable of meeting all requirements of this specification. Failure of the Contractor to meet the requirements of this specification will result in the disapproval of the schedule.

3.3.1 Critical Path Method

Use the Critical Path Method (CPM) of network calculation to generate the Project Schedule. Prepare the Project Schedule using the Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

Develop the Project Schedule to an appropriate level of detail. Failure to develop the Project Schedule to an appropriate level of detail, as determined by the Contracting Officer, will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2.1 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have Original Durations (OD) greater than 20 work days or 30 calendar days. Procurement activities are defined herein.

3.3.2.2 Design and Permit Activities

Include design and permit activities with the necessary conferences and follow-up actions and design package submission dates. Include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. This shall be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. The schedule shall include review and correction periods associated with each item.

3.3.2.3 Procurement Activities

The schedule must include activities associated with the submittal, approval, procurement, fabrication and delivery of long lead materials, equipment, fabricated assemblies and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days. A typical procurement sequence includes the string of activities: submit, approve, procure, fabricate, and deliver.

3.3.2.4 Mandatory Tasks

The following tasks must be included and properly scheduled:

a. Submission, review and acceptance of design packages.

b. Submission of the substation, transmission, and distribution line drawings.

c. Submission of pre-con submittals.

d. Submittal of DD form 1354.

e. Acquisition of long procurement materials.

f. Submission and approval of O & M manuals.

g. Submission and approval of as-built drawings.

h. Submission and approval of installed equipment lists.

i. Submission and approval of the commissioning plan.

j. Submission and approval of testing procedures for the transmission and distribution systems and substation individual components.

k. Transmission and distribution systems and substation components testing.

l. Submission and approval of testing procedures for the overall transmission and distribution systems performance and completed substation performance.

m. Transmission and distribution systems and substation testing.

n. Controls testing plan submission.

o. Controls testing.

p. Performance Verification testing.

q. Other systems testing, if required.

r. Contractor's pre-final inspection.

s. Correction of punch-list from Contractor's pre-final inspection.

t. Government's pre-final inspection.

u. Correction of punch list from Government's pre-final inspection.

v. Final inspection.

3.3.2.5 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: approvals, design reviews, environmental permit approvals by GIROA, inspections, utility tie-ins, and Notice to Proceed (NTP) for phasing requirements.

3.3.2.6 Activity Responsibility Coding (RESP)

Assign responsibility Code for all activities to the Prime Contractor, Subcontractor or Government responsible for performing the activity. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, and Notice to Proceed (NTP) for phasing requirements. Code all activities not coded with a Government Responsibility Code to the Prime Contractor or Subcontractor

responsible to perform the work. Activities shall not have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); and G/OA (Government). Unacceptable code values are abbreviations of the names of subcontractors.

3.3.2.7 Activity Work Area Coding

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew, from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different substation locations, different tower locations, and different terrain types. Activities shall not have more than one Work Area Code. Not all activities are required to be Work Area coded. A lack of Work Area coding will indicate the activity is not resource or location.

3.3.2.8 Contract Changes/Requests for Equitable Adjustment (REA) Coding (MODF)

Assign Activity code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by the Contracting Officer, with a Contract Changes/REA Code. Key all Code values to the Government's modification numbering system. Any activity or sequence of activities added to the schedule as a result of alleged constructive changes made by the Government may be added to a copy of the current schedule, subject to the approval of the Contracting Officer. Assign Activity codes for these activities with a Contract Changes/REA Code. Key the code values to the Contractor's numbering system. Approval to add these activities does not necessarily mean the Government accepts responsibility and, therefore, liability for such activities and any associated impacts to the schedule, but rather the Government recognizes such activities are appropriately added to the schedule for the purposes of maintaining a realistic and meaningful schedule. Such activities shall not be Responsibility Coded to the Government unless approved. An activity shall not have more than one Contract Changes/REA Code.

3.3.2.9 Contract Line Item (CLIN) Coding (BIDI)

Code all activities to the CLIN on the Contract Line Item Schedule to which the activity belongs. An activity shall not contain more than one CLIN Item Code. CLIN Item code all activities, even when an activity is not cost loaded.

3.3.2.10 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities based upon the phase of work in which the activity occurs. Code all activities to be indicated as either a “Design Phase” or a “Construction Phase”. Code fast track design and construction phases proposed by the Contractor to allow filtering and organizing the schedule by fast track design and construction packages. If the contract specifies construction phasing with separately defined performance periods, identify a Construction Phase Code to allow filtering and organizing the schedule accordingly. Each activity shall be identified with a single project phase and have only one Phase of Work code.

3.3.2.11 Category of Work Coding (CATW)

Assign Category of Work Code to all Activities based upon the category of work to which the activity belongs. Category of Work Code must include, but is not limited to: Design, Design Submittal, Design Reviews, Review Conferences, Permits, Construction Submittals, Approvals, Acceptance, Procurement, Fabrication, Delivery, Weather Sensitive Installation, Non-Weather Sensitive Installation, Start-Up, Test and Turnover. Assign a Category of Work Code to each activity. Each activity shall have only one Category of Work Code.

3.3.2.12 Definable Features of Work Coding (FOW1, FOW2, FOW3)

Assign a Definable Feature of Work Code to appropriate activities based on the definable feature of work to which the activity belongs. Definable Feature of Work is defined in Specification Section 01 45 00.00 10 USACE QUALITY CONTROL IN THEATER. An activity shall not have more than one Definable Feature of Work Code. Not all activities are required to be Definable Feature of Work Coded.

3.3.3 Scheduled Project Completion and Activity Calendars

The schedule interval shall extend from NTP date to the required contract completion date. The contract completion activity (End Project) shall finish based on the required contract duration in the accepted contract proposal, as adjusted for any approved contract time extensions. The first scheduled work period shall be the day after NTP is received by the Contractor. Schedule activities on a calendar to which the activity logically belongs. Activities may be assigned to a 7 day calendar when the contract assigns calendar day durations for the activity such as a Government Acceptance activity. If the Contractor intends to perform physical work less than seven days per week, schedule the associated activities on a calendar with non-work periods identified including weekends and holidays. Assign the Category of Work Code - Weather Sensitive Installation to those activities that are weather sensitive. Original durations must account for anticipated normal adverse weather. The Government will interpret all work periods not identified as non-work periods on each calendar as meaning the Contractor intends to perform work during those periods.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. Include as the first activity in the project schedule an activity called "Start Project"(or NTP). The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and with zero day duration.

3.3.3.2 Schedule Constraints and Open Ended Logic

Constrain completion of the last activity in the schedule by the contract completion date. Schedule calculations shall result in a negative float when the calculated early finish date of the last activity is later than the contract completion date. Include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the contract completion date for the

project, and with a zero day duration or by using the "project must finish by" date in the scheduling software. The schedule shall have no constrained dates other than those specified in the contract. The use of artificial float constraints such as "zero fee float" or "zero total float" are typically prohibited. There shall only be 2 open ended activities: Start Project (or NTP) with no predecessor logic and End Project with no successor logic.

3.3.3.3 Early Project Completion

In the event the Preliminary or Initial project schedule calculates an early completion date of the last activity prior to the contract completion date, the Contractor shall identify those activities that it intends to accelerate and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. The last activity shall have a late finish constraint equal to the contract completion date and the schedule will calculate positive float. The Government will not approve an early completion schedule with zero float on the longest path. The Government is under no obligation to accelerate activities for which it is responsible to support a proposed early contract completion.

3.3.4 Interim Completion Dates

Constrain contractually specified interim completion dates to show negative float when the calculated early finish date of the last activity in that phase is later than the specified interim completion date.

3.3.4.1 Start Phase

Include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and with zero day duration.

3.3.4.2 End Phase

Include as the last activity for a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the specified completion date for that phase and with zero day duration.

3.3.4.3 Phase "X" Hammock

Include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" hammock activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Do not automatically update Actual Start and Finish dates with default mechanisms that may be included in the scheduling software. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the AS and AF dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control

reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's updated schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Disable program features which calculate one of these parameters from the other.

3.3.6 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Correct out of sequence progress that continues for more than two update cycles by logic revision, as approved by the Contracting Officer.

3.3.7 Negative Lags and Start to Finish Relationships

Lag durations contained in the project schedule shall not have a negative value. Do not use Start to Finish (SF) relationships.

3.3.8 Calculation Mode

Schedule calculations shall retain the logic between predecessors and successors even when the successor activity starts and the predecessor activity has not finished. Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") will not be allowed.

3.3.9 Milestones

The schedule must include milestone activities for each significant project event including but not limited to: D/B Contract Award and Project NTP***; Preconstruciton Meeting; Data Collection/Site Investigation/Survey Completion; 35% Design Submittal***; 65% Design Submittal; 65% Design Approval and Construction NTP; 99% Design Submittal; 100% Design Submittal; ***Mobilization for Construction; Start Construction for Base and Options; Testing and Commissioning***; Base Bid and Options Construction Completion; ***Contract Completion***.

3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, then the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

3.4.1 Preliminary Project Schedule Submission

Submit the Preliminary Project Schedule, defining the Contractor's planned operations for the first 90 calendar days for approval within 15 calendar days after the NTP is acknowledged. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. Detail it for the first 90 calendar days. It may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as previously specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required Plan and Program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, the planned submissions of all early design packages, permitting activities, design review conference activities and other non-construction activities intended to occur within the first 90 calendar days. Schedule any construction activities planned for the first 90 calendar days after NTP. Constrain planned construction activities by Government acceptance of the associated design package(s) and all other specified Program and Plan approvals. Activity code any activities that are summary in nature after the first 90 calendar days with Responsibility Code (RESP) and Feature of Work code (FOW1, FOW2, FOW3).

3.4.2 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 40 calendar days after NTP. The schedule shall demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. The Initial Schedule shall be at a reasonable level of detail as determined by the Contracting Officer. Include in the design-build schedule detailed design and permitting activities, including but not limited to identification of individual design packages, design submission, reviews and conferences; permit submissions and any required Government actions; and long lead item acquisition prior to design completion. Also cover in the preliminary design-build schedule the entire construction effort with as much detail as is known at the time but, as a minimum, include all construction start and completion milestones, and detailed construction activities through the Base Bid, including all activity coding and cost loading. Include the remaining construction, including cost loading, but it may be scheduled summary in nature. As the design proceeds and design packages are developed, fully detail the remaining construction activities concurrent with the monthly schedule updating process. Constrain construction activities by Government acceptance of associated designs. When the design is complete, incorporate into the then approved schedule update all remaining detailed construction activities that are planned to occur after the Base Bid milestone.

3.4.3 Design Package Schedule Submission

With each design package submitted to the Government, submit a frag-net schedule extracted from the then current Preliminary, Initial or Updated schedule which covers the activities associated with that Design Package including construction, procurement and permitting activities.

3.4.4 Periodic Schedule Updates

Based on the result of the meeting, specified in PERIODIC SCHEDULE UPDATE

MEETINGS, submit periodic schedule updates. These submissions will enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made. Update the schedule to include detailed, lower WBS level construction activities as the design progresses, but not later than the submission of the final, un-reviewed design submission for each separate design package. The Contracting Officer may require submission of detailed schedule activities for any distinct construction that is started prior to submission of a final design submission, if such activity is authorized.

3.4.5 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11. This exact structure is mandatory, even if some fields are not used. A template SDEF compatible schedule backup file (sdef.prx) is available on the QCS website: www.rmssupport.com. The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per Day
2	RESP	4	Responsible Party (e.g. GC, subcontractor, USACE)
3	AREA	4	Area of Work
4	MODF	6	Modification or REA number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of Work
7	CATW	1	Category of Work
8	FOW1	10	Feature of Work (used up to 10 characters in length)
9	FOW2	10	Feature of Work (used up to 20 characters in length)
10	FOW3	10	Feature of Work (used up to 30 characters in length)

3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

3.5.1 Data CD/DVDs

Provide two sets of data CD/DVDs containing the current project schedule and all previously submitted schedules in the format of the scheduling software (e.g. .xer). Also include on the data CD/DVDs the Narrative Report and all required Schedule Reports. Label each CD/DVD indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file name. Each schedule must have a unique file name and use project specific settings.

3.5.2 Narrative Report

Provide a Narrative Report with the Preliminary, Initial, and each Periodic Update of the project schedule, as the basis of the progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths where the total float is less than or equal to 20 work days, a description of current and anticipated problem areas or

delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to communicate to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis. Identify and explain why any activities that, based their calculated late dates, should have either started or finished during the update period but did not.

3.5.3 Approved Changes Verification

Include only those project schedule changes in the schedule submission that have been previously approved by the Contracting Officer. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format, filtering, organizing and sorting for each schedule report shall be as directed by the Contracting Officer. Typically reports shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. The following lists typical reports that will be requested. One or all of these reports may be requested for each schedule submission.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

3.5.4.2 Logic Report

A list of detailed predecessor and successor activities for every activity in ascending order by activity number.

3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

3.5.4.4 Earnings Report by CLIN

A compilation of the Contractor's Total Earnings on the project from the NTP to the data date. This report shall reflect the earnings of specific activities based on the agreements made in the schedule update meeting defined herein. Provided that the Contractor has furnished a complete schedule update, this report shall serve as the basis of determining progress payments. Group activities by CLIN item number and sort by activity number. This report shall: sum all activities coded to a particular CLIN and provide a CLIN item percent earned value; and complete and sum CLIN items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.5 Network Diagram

The network diagram is required for the Preliminary, Initial and Periodic Updates. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

3.5.5.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

Clearly show the critical path.

3.5.5.4 Banding

Organize activities as directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC SCHEDULE UPDATE MEETINGS

Conduct periodic schedule update meetings for the purposes of reviewing the Contractor's proposed out of sequence corrections, determining causes for delay, correcting logic, maintaining schedule accuracy and determining earned value. Meetings shall occur at least monthly within five days of the proposed schedule data date and after the Contractor has updated the schedule with Government concurrence respecting actual start dates, actual finish dates, remaining durations and percent complete for each activity it intend to status. Provide a computer with the scheduling software loaded and a projector during the meeting which allows all meeting participants to view the proposed schedule update during the meeting. The meeting and resultant approvable schedule update shall be a condition precedent to a formal submission of the update as described in SUBMISSION REQUIREMENTS and to the submission of an invoice for payment. The meeting will be a working interactive exchange which will allow the Government and the Contractor the opportunity to review the updated schedule on a real time and interactive basis. The Contractor's authorized scheduling representative will organize, sort, filter and schedule the update as requested by the Government. The meeting will last no longer than 8 hours. A rough draft of the proposed activity logic corrections and narrative report shall be provided to the Government 48 hours in advance of the meeting. The Contractor's Project

Manager and Authorized Scheduler shall attend the meeting with the Authorized Representative of the Contracting Officer.

3.6.1 Update Submission Following Progress Meeting

Submit a complete update of the project schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 working days after the periodic schedule update meeting, reflecting only those changes made during the previous update meeting.

3.6.2 Status of Activities

Update information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete shall be subject to the approval of the Government prior to the meeting. As a minimum, address the following items on an activity by activity basis during each progress meeting.

3.6.2.1 Start and Finish Dates

Accurately show the status of the AS and/or AF dates for each activity currently in-progress or completed since the last update. The Government may allow an AF date to be assigned with the percent complete less than 100% to account for the value of work remaining but not restraining successor activities. Only assign AS dates when actual progress occurs on an activity.

3.6.2.2 Remaining Duration

Update the estimated RD for all incomplete activities independent of Percent Complete. Remaining Durations may exceed the activity OD or may exceed the activity's prior update RD if the Government considers the current OD or RD to be understated based on current progress, insufficient work crews actually manning the job, unrealistic OD or deficiencies that must be corrected that restrain successor activities.

3.6.2.3 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete. To allow for proper schedule management, cost load the correction of punch list from Government pre-final inspection activity(ies) not less than 1 percent of the total contract value, which activity(ies) may be declared 100 percent complete upon completion and correction of all punch list work identified during Government pre-final inspection(s).

3.6.2.4 Logic Changes

Specifically identify and discuss all logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, Contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, and other changes that have been made pursuant to contract provisions. The Government will only approve logic revisions for the purpose of keeping the schedule valid in terms of its usefulness in

calculating a realistic completion date, correcting erroneous logic ties, and accurately sequencing the work.

3.6.2.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) Delays beyond the Contractor's control, such as strikes and unusual weather. 2) Delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule that does not represent the actual or planned prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor believes it is entitled to an extension of the contract performance period, completion date, or any interim milestone date, furnish the following for a determination by the Contracting Officer: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of excusable delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is a condition precedent to any approvals by the contracting officer. In response to each Request For Proposal issued by the Contracting Officer, the Contractor shall submit a schedule impact analysis demonstrating whether or not the change contemplated by the Contracting Officer impacts the critical path.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

3.7.2 Submission Requirements

Submit a justification for each request for a change in the contract completion date of less than 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

a. A list of affected activities, with their associated project schedule activity number.

b. A brief explanation of the causes of the change.

c. An analysis of the overall impact of the changes proposed.

d. A sub-network of the affected area.

Identify activities impacted in each justification for change by a unique

activity code contained in the required data file.

3.7.3 Additional Submission Requirements

The Contracting Officer may request an interim update with revised activities for any requested time extension of over 2 weeks. Provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The Contracting Officer will approve proposed revisions to the schedule prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 WEEKLY PROGRESS MEETINGS

a. The Government and the Contractor shall meet weekly (or as otherwise mutually agreed to) between the meetings described in paragraph PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. The then current and approved schedule update shall be used for the purposes of this meeting and for the production and review of reports. The Contractor's Project Manager and the Authorized Representative of the Contracting Officer shall attend. The weekly progress meeting will address the status of RFI's, Submittals, etc.

b. Provide a bar chart produced by the scheduling software, organized by Total Float and Sorted by Early Start Date, and a two week "look-ahead" schedule by filtering all schedule activities to show only current ongoing activities and activities schedule to start during the upcoming two weeks, organized by Work Area Code (AREA) and sorted by Early Start Date.

c. The Government and the Contractor shall jointly review the reports. If it appears that activities on the longest path(s) which are currently driving the calculated completion date (driving activities), are not progressing satisfactorily and therefore could jeopardize timely project completion, corrective action must be taken

immediately. Corrective action includes but is not limited to: increasing the number of work crews; increasing the number of work shifts; increasing the number of hours worked per shift; and determining if Government responsibility coded activities require Government corrective action.

3.10 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

3.10.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

3.10.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and/or may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

3.10.3 Recovery Schedule

Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

3.11 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

3.12 TRANSFER OF SCHEDULE DATA INTO RMS/QCS

The Contractor shall download and upload the schedule data into the Resident Management System (RMS) prior to RMS databases being transferred to the Government and is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 - Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 - Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and electronic export from QCS of the application for

progress payment.

3.12 PRIMAVERA P6 MANDATORY REQUIREMENTS

If Primavera P6 is being used, request a backup file template (.xer) from the Government, if one is available, prior to building the schedule. The following settings are mandatory and required in all schedule submissions to the Government:

a. Activity Codes must be Project Level, not Global or EPS level.

b. Calendars must be Project Level, not Global or Resource level.

c. Activity Duration Types must be set to "Fixed Duration & Units".

d. Percent Complete Types must be set to "Physical".

e. Time Period Admin Preferences must remain the default "8.0 hr/day, 40 hr/week, 172 hr/month, 2000 hr/year". Set Calendar Work Hours/Day to 8.0 Hour days.

f. Set Schedule Option for defining Critical Activities to "Longest Path".

g. Set Schedule Option for defining progressed activities to "Retained Logic".

h. Set up cost loading using a single lump sum resource. The Price/Unit must be $1/hr, Default Units/Time must be "8h/d", and settings "Auto Compute Actuals" and "Calculate costs from units" selected.

i. Activity ID's must not exceed 10 characters.

j. Activity Names must have the most defining and detailed description within the first 30 characters.

-- End of Section --

SECTION 01 33 05

SUBMITTAL PROCEDURES FOR DESIGN-BUILD PROJECTS

PART 1 GENERAL

1.1 REFERENCE

The publication listed below forms a part of this specification to the extent referenced. The publication is referenced to in the text by basic designation only.

CONSTRUCTION SPECIFICATIONS INSTITUTE

Manual of Practice	Construction Specifications Institute 601 Madison Street Alexandria, Virginia 22314-1791

NATIONAL INSTITUTE OF BUILDING SCIENCES (NIBS)

UMRL	Unified Master Reference List, National Institute of Building Sciences 1090 Vermont Avenue, NW, Suite 700 Washington, DC 20005-4905 Email: nibs@nibs.org, FAX: (202) 289-1092, Tele: (202) 289-7800

MIDDLE EAST DISTRICT (formerly TRANSATLANTIC PROGRAMS CENTER (TAC))

MED Design Instructions Manual	U.S. Army Corps of Engineers Middle East District, 201 Prince Frederick Drive Winchester, Virginia 22602

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 DESIGN SUBMITTALS

Contractor Furnished design submittals are the various design documents which primarily consist of specifications, drawings and design analysis and calculations. The Design-Build Contractor shall not begin construction work until the Government has reviewed the Design-Build Contractor's final design and has cleared it for construction. Clearance for construction shall not be construed as meaning Government approval. Unless otherwise indicated, the risk for the design is the sole responsibility of the Design-Build Contractor.

The Contractor shall break the design package into constructible portions for submission to the Contracting Officer for acceptance. The design packages shall include the design documents and specifications and shall follow the Schedule of Design Submittals, below, as closely as practical. The Contractor shall show these activities in the construction schedule. Partial submissions of non-constructible packages are not acceptable.

Plans and specifications furnished shall NOT be included as part of any Design Submittal. The Contractor shall complete all work. Clearly label and date all design submittals to reflect the current design stage and date of submission to the Government to avoid confusion between current and previous submittals. Do not begin construction work until the Government has reviewed and approved the work presented in each Design Submittal, including complete resolution of all DRCHECKS$_{SM}$ comments, and the Contracting Officer has cleared work for construction. Clearance for construction shall not be construed as meaning Government approval. Unless otherwise indicated, the risk for the design is the sole responsibility of the Contractor.

The sole responsibility of ensuring that the design submittals comply with contract documents remains with the Contractor, in accordance with this section of the contract. The Government retains the right to comment on the design at any design stage, and the lack of Government comments at a given review cannot be used as a basis for the Contractor to fail to address the Government's comments on subsequent reviews, regardless of design stage. Furthermore, approval of incomplete designs will not relieve the Contractor of the responsibility for any error which may exist, and which may require rework or other appropriate adjustment to the contract terms, as determined at the sole discretion of the Government. It is the sole responsibility of the Contractor to ensure that submittals comply with the contract documents. Government review, clearance for construction, or approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract. Government review, clearance for construction, or approval of post design construction submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory.

As a minimum, design submittals shall be submitted at the following intervals:

Preliminary design reports – 35%

General Design review - 65%

Final Design review - 99%

100% Submittal review

1.2.1.1 PRELIMINARY DESIGN REPORTS – (35%)

The review of this submittal is primarily to ensure that the Contractor has at a minimum completed the sub-surface investigation. Failure to do so at the satisfaction of the Government shall constitute grounds for withholding of all progress payments.

Geotechnical Reports, indicating appropriate information for various site characteristics, soil parameters as determined by certified lab tests, allowable soil bearing capacities, correlation with foundation design parameters, and any changes in foundation design of structures furnished in the Contract; estimated settlement for building foundation loads; and all other project feature changes due to the Geotechnical Report conclusions. Geotechnical analysis of all transmission and distribution system soil borings shall be included in this design report.

Results of the site topographic survey which shall include highlighting of significant features (wadis, adjacent properties and structures, roads, etc.) to provide a detailed, overall understanding of the project site and surrounding area shall be provided; and demolition plan for existing site features.

For the electrical transmission and distribution system and substations, the documents in the Appendices are for conceptual purposes only and do not constitute a design. The Contractor shall prepare a Master Plan based on information contained in these documents. The Contractor shall participate in a Master Plan design charrette that shall be conducted at the Corps of Engineers Kandahar Area Office at Kandahar Airfield, if deemed necessary by the Government. If necessary, the Contractor shall modify and implement changes to the Master Plan based on the information gathered during the design charrette process.

For the electrical transmission and distribution system and substations, the Contactor shall verify all space requirements and code compliance in accordance with this contract. The final Master Plan shall be site-specific and it shall include the location of all temporary structures such as the construction office/storage containers and lay-down and construction debris removal areas. The Contractor shall indicate all other site features on the Master Plan regardless of whether or not they are indicated on the Government supplied Concept Plans. The Contractor shall include all information pertinent to this project into the Master Plan to achieve a complete design in accordance with the requirements of this document.

1.2.1.2 GENERAL DESIGN (65%)

It is crucial that the submittal is complete and includes all components noted below and any other pertinent information not listed which the Contractor requires to enable construction to begin as soon as possible. As a minimum, for each Contract project location the submittal shall contain:

Results of the site topographic survey which shall include highlighting of significant features (wadis, adjacent properties and structures, roads, etc.) to provide a detailed, overall understanding of the project site and surrounding area; demolition plan for existing site features; complete grading and drainage plan with existing grades, proposed grades, the Geotechnical Report and Right-of-Way Land Acquisition.

Any necessary adaptations of the Concept Plan and detailed design drawings furnished with this Contract that might be required due to actual site constraints, to include any other changes required due to adjacent property or existing topography. As noted in Paragraph 1.2.1, this would also include proposed changes to the detailed drawings if, and only if, site conditions mandate revisions.

Complete design analysis, plans and specifications for any contract feature(s) not already provided in the Contract that the Contractor would like Partial Clearance for Construction on once the Design Submittal has been approved, including project components with long ordering, fabrication and delivery times.

Outline of Construction Specification Sections to be used for other work yet to be submitted at the 99% Final Design Review submittal, and those

Specification items requiring Government Approval (GA), unless 100% Technical Specifications were provided with the Contract.

For the transmission and distribution systems, the 65% design submittal shall include a substantially complete design for all poles, towers, conductors, gear, and appurtenances necessary for a complete system.

For the substations, the 65% design submittal shall include a substantially complete design for all buildings, electrical yards, civil works, gear, and appurtenances necessary for a complete system. A partial clearance of construction can be granted upon the approval of 65% design at the discretion of the contracting officer.

1.2.1.3 FINAL DESIGN REVIEW (99%):

The review of this submittal is primarily to insure that the contract documents and design analysis are proceeding in a timely manner and that the Contract requirements and design criteria are being correctly understood and adhered to. The submittal shall consist of the following:

Draft Construction Specifications complete - all anticipated sections, edited to include only applicable requirements, if not provided as part of the Contract.

Construction Drawings complete with all 65% comments incorporated. The Contractor is expected to have completed all of his coordination checks and have the drawings in a design complete condition. The drawings shall be finalized at this time including the incorporation of any design review comments generated by all past design reviews. The drawings shall contain all the details necessary to assure a clear understanding of the work throughout construction.

The review of this submittal is primarily to insure that the contract documents and design analysis are complete and that the Contract requirements and design criteria are being correctly understood and adhered to. It is crucial that the submittal is complete and includes all components noted below and any other pertinent information not listed which the Contractor requires to enable construction to begin as soon as possible. As a minimum, for each Contract project location the submittal shall contain:

Geotechnical Report, indicating appropriate information for various site characteristics, soil parameters as determined by certified lab tests, allowable soil bearing capacities, correlation with foundation design parameters, and any changes in foundation design of structures furnished in the Contract; all other project feature changes due to the Geotechnical Report conclusions; and Right-of-Way Land Acquisition.

Results of the site topographic survey which shall include highlighting of significant features (wadis, adjacent properties and structures, roads, etc.) to provide a detailed, overall understanding of the project site and surrounding area; demolition plan for existing site features; complete grading and drainage plan with existing grades, proposed grades.

Any necessary adaptations of the Concept Plan and detailed design drawings furnished with this Contract that might be required due to actual site constraints, to include any other changes required due to adjacent property or existing topography. This would also include proposed changes to any

furnished detailed drawings if site conditions or other requirements mandate revisions.

Design Analysis complete.

Construction Specifications complete - all anticipated sections, edited to include only applicable requirements. Construction Drawings complete. The Contractor is expected to have completed all of his coordination checks and have the drawings in a design complete condition. The drawings shall be finalized at this time. The drawings shall contain all the details necessary to assure a clear understanding of the work throughout construction.

1.2.1.4 100% SUBMITTAL:

The review of this submittal is to insure that the design is in accordance with directions provided the Contractor during the design process. The only effort remaining between the Final Design Review Submittal and the 100% Submittal is the incorporation of all Government review comments. The Contractor shall submit the following documents for this review: Design Analysis, only if changes have occurred since 99% Design Submittal. The Design Analysis shall contain all explanatory material giving the design rationale for any design decisions which would not be obvious to an engineer reviewing the Final Drawings and Specifications.

Geotechnical Report, complete.
Construction Specifications, complete.
Construction Drawings, complete.

Once the design documents have been "Cleared for Construction" by the Contracting Officer, the Contractor shall clearly identify each document by annotating it as "Cleared for Construction."

1.2.1.5 Timeline:

Design submittal dates shall be included in the project schedule to be approved by the Contracting Officer. The timeline indicated should adequately show that design and construction can be completed within the contract period of performance.

1.2.2 PARTIAL DESIGN SUBMITTALS

In the interest of expediting construction, the Contracting Officer may approve partial design submittals, procurement of materials and equipment, as well as issue the Notice To Proceed (NTP) for construction of those elements of the design which have been cleared for construction. Such partial notices to proceed shall be solely at the discretion of the Contracting Officer. The Contractor must obtain the approval of the Designer of Record (DOR) and the Government’s concurrence for any Contractor proposed revision to the professionally stamped and sealed design reviewed and Cleared for Construction by the Government, before proceeding with the revision.

The Government reserves the right to non-concur with any revision to the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and cleared for construction design. Any revision to the design, which deviates from the contract requirements (i.e., the contract and the accepted proposal), will require a modification, pursuant to the Changes clause, in addition to

Government concurrence. The Government reserves the right to disapprove such a revision. Unless the Government initiates a change to the contract requirements, or the Government determines that the Government furnished design criteria are incorrect and must be revised, any Contractor initiated proposed change to the contract requirements, which results in additional cost, shall strictly be at the Contractor's expense.

The Contractor shall track all approved revisions to the reviewed and cleared for construction design and shall incorporate them into the As-Built design documentation. Editable CAD format As-Builts are required as part of this contract. The Designer of Record shall document its professional concurrence on the As-Builts for any revisions by affixing its stamp and seal on the drawings and specifications.

1.2.3 USE OF DRCHECKS$_{SM}$ FOR DESIGN SUBMITTAL COMMENT AND RESPONSE

1.2.4.1 DRCHECKS$_{SM}$ WEB LINK

All Design Submittal review comments will be documented using the standard design review tool for the U.S. Army Corps of Engineers, a web-based application called “DrChecks$_{SM}$”. The web link to DrChecks$_{SM}$ is:

https://www.projnet.org/projnet/binKornHome/index.cfm

1.2.4.2 DRCHECKS$_{SM}$ VENDOR IDENTIFICATION AND TUTORIAL

Upon notification of award, the contractor shall immediately coordinate with the Chief, Engineering Branch, to acquire a vendor identification and a brief tutorial on the use of DrChecks$_{SM}$. The contractor is responsible for providing their own DrChecks$_{SM}$ Administrator within their own design staff personnel to access and accomplish actions within DrChecks$_{SM}$.

1.2.4.3 NOTIFICATION OF DRCHECKS$_{SM}$ FILE ACCESS

The Government will complete a review at every Design Submittal stage for conformance with the technical requirements of the Contract and document all comments in DrChecks$_{SM}$. At completion of the review, a notification will be issued to the Contractor by the Contracting Officer’s representative that the particular DrChecks$_{SM}$ file will be opened to the Contractor. Until this time, the Contractor is not able to view any comments for that particular Design Submittal.

1.2.4.4 FURTHER CONTRACTOR INFORMATION AFTER DRCHECKS$_{SM}$ REVIEWS

See Paragraph 3.7.4, Government Review, for further procedures and requirements associated with Design Submittal reviews.

1.2.5 CONSTRUCTION SUBMITTALS

1.2.5.1 CONTRACTOR FURNISHED GOVERNMENT APPROVED CONSTRUCTION SUBMITTALS (GA)

Government approved construction submittals are primarily related to plans (Contractor Quality Control, Accident Prevention, Resident Management System, Area Use, etc.), schedules (Project Schedule/Network Analysis), and certificates of compliance, reports and records/statements.

In addition, GA construction submittals are required as listed below. Approval by the government or contracting officer does not relieve the Design-Build Contractor of responsibility. The designer of record shall review all construction submittals related to their design. The risk for the design and construction is the sole responsibility of the Design-Build Contractor.

a. CIVIL FEATURES

All geotechnical analysis and soil boring results.

b. ELECTRICAL FEATURES

PRODUCT DATA and SHOP DRAWINGS: conductors, insulators, mounting hardware. All product data and shop drawings related to electrical transmission and distribution system and substation.

DESIGN DATA: All design related to electrical transmission and distribution and substations.

TEST DATA: All data related to electrical transmission and distribution and substations.

d. STRUCTURAL FEATURES

PRODUCT DATA and SHOP DRAWINGS: All product data and shop drawings related to structural towers.

DESIGN DATA: All design related to electrical structural towers.

TEST DATA: All data related to structural towers.

1.2.5.2 FOR INFORMATION ONLY CONSTRUCTION SUBMITTALS (FIO)

All submittals not requiring Government approval will be for information only. These construction submittals shall be checked, stamped, signed and dated by the Contractor's Quality Control Engineer and Designer of Record, certifying that such submittal complies with the contract requirements. All Contractor submittals shall be subject to review by the Government at any time during the course of the contract. Any Contractor submittal found to contain errors or omissions shall be resubmitted as one requiring "approval". No adjustment for time or money will be allowed for corrections required as a result of noncompliance with plans or specifications. Normally submittals For Information Only will not be returned. Approval of the Contracting Officer is not required on FIO submittals.

These submittals will be used for information purposes. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications and will not prevent the Contracting Officer from requiring removal and replacement if nonconforming material is incorporated in the work.

1.2.5.3 ADDITIONAL SHOP DRAWINGS AND SUBMITTALS

In accordance with the paragraph entitled DESIGN DISCREPANCIES, the Government may request the Contractor to provide additional shop drawing and submittal type data subsequent to completion of the design.

1.2.5.4 INCOMPLETE DESIGN

The Contractor shall not use construction submittals as a means to supplant and/or supplement an incomplete design effort.

That said, the full “cleared for construction” design (i.e. drawings, specifications, design analysis) is not available for my use in the evaluation of this submittal.

1.2.5.5 Deviating From The “Cleared-For-Construction” Design

The Contractor must obtain the approval of the Designer of Record (DOR) and the Government’s concurrence for any Contractor proposed revision to the professionally stamped and sealed design reviewed and Cleared for Construction by the Government, before proceeding with the revision.

The Government reserves the right to non-concur with any revision to the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and cleared for construction design.

Any revision to the design, which deviates from the contract requirements, will require a modification, pursuant to the Changes clause, in addition to Government concurrence. The Government reserves the right to disapprove such a revision.

Unless the Government initiates a change to the contract requirements, or the Government determines that the Government furnished design criteria are incorrect and must be revised, any Contractor initiated proposed change to the contract requirements, which results in additional cost, shall strictly be at the Contractor's expense.

The Contractor shall track all approved revisions to the reviewed and cleared for construction design and shall incorporate them into the as-built design documentation per the Contract Clauses. The Designer of Record shall document its professional concurrence on the As-Builts for any revisions by affixing its stamp and seal on the drawings and specifications.

1.3 SUBMITTAL CERTIFICATION

The CQC organization shall be responsible for certifying that all submittals and deliverables have been reviewed in detail for completeness, are correct, and are in strict conformance with the contract drawings, specifications, and reference documents.

1.3.1 RESPONSIBILITY FOR ERRORS OR OMISSIONS

It is the sole responsibility of the Contractor to ensure that submittals comply with the contract documents. Government review, clearance for construction, or approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract.

1.3.1.1 GOVERNMENT REVIEW

Government review, clearance for construction, or approval of post design construction submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory.

1.3.2 SUBSTITUTIONS

No submittals for the purpose of substituting materials or equipment specified in the contract drawings, specifications, and reference documents shall be considered by the Government.

1.3.3 ADDITIONAL SUBMITTALS

In conjunction with Contract Clause 52.236-5 MATERIAL AND WORKMANSHIP, the Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work.

1.3.4 UNTIMELY AND UNACCEPTABLE SUBMITTALS

If the Contractor fails to submit submittals in a timely fashion, or repetitively submits submittals that are incomplete or not in strict conformance with the contract documents, no part of the time lost due to such actions shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

1.3.5 STAMPS

Stamps shall be used by the Contractor on all design and post design construction submittals to certify that the submittal meets contract requirements and shall be similar to the following:

Contractor (Firm Name): _____

Contract Number: _____

Contract Name: _____

I certify that this submittal is accurate, is in strict conformance with all contract requirements, has been thoroughly coordinated and cross checked against all other applicable disciplines to prevent the omission of vital information, that all conflicts have been resolved, and that repetition has been avoided and, it is complete and in sufficient detail to allow ready determination of compliance with contract requirements by the Contracting Officer.

Name of CQC System Manager: _____

Signature of CQC System Manager: _____

Date: _____

1.3.6 Designer of Record

The Design-Build Contractor (Design-Builder, D-B, or simply Contractor) shall identify, for approval, the Designer of Record (DOR) who will be responsible for each area of design. One DOR may be responsible for more than one area. All areas of design disciplines shall be accounted for by a listed, Professional Registered, DOR. The DOR(s) shall stamp, sign, and date each design drawing and other design deliverables under their responsible discipline at each design submittal stage (see Section, Contract Clause 52.236-25, REQUIREMENTS FOR REGISTRATION OF DESIGNERS).

The DOR(s) shall also be responsible for maintaining the integrity of the design and for compliance with the contract requirements through construction and documentation of the as-constructed condition by coordination, review and approval of extensions of design, material, equipment and other construction submittals, review and approval or disapproval of requested deviations to the accepted design or to the contract, coordination with the Government of the above activities, and by performing other typical professional designer responsibilities. Section 01 45 00 Contractor Quality Control further specifies experience requirements for the DOR, marking of design submittals, and responsibility for conformance with the submitted Design Quality Control Plan (DQP)."

1.4 ENGLISH LANGUAGE

All specifications, drawings, design analysis, design calculations, shop drawings, catalog data, materials lists, and equipment schedules submitted shall be in the English language.

1.5 UNITS OF MEASUREMENT

Design documents shall be prepared in accordance with the guidance offered in SECTION 01 42 15 METRIC MEASUREMENTS.

The metric units used are the International System of Units (SI) developed and maintained by the General Conference on Weights and Measures (CGPM); the name International System of Units and the international abbreviation SI were adopted by the 11th CGPM in 1960.

1.5.1 DRAWINGS

1.5.1.1 SITE LAYOUT

All site layout data shall be dimensioned in meters or coordinates, as appropriate. All details and pipe sizes shall be dimensioned in millimeters.

1.5.1.2 GEO-REFERENCE

All site plans shall be geo-referenced using the WGS 1984 coordinate system, specifically the following: WGS 1984 UTM one 41 North. If the designer is not able to use the stated coordinate system the coordinate system used shall be correlated to the stated coordinate system. A table shall be provided within the site drawing set cross referencing the WGS84 system to that utilized. This is required to allow the Government to incorporate the plans into GIS for storage, map production, and possible geospatial analysis of the different work sites.

1.5.2 DESIGN CALCULATIONS

Calculations shall be in SI units to meet the requirements of the design. Quantities on the contract drawings stated in SI units shall also be stated in SI units in the design analysis to match the drawings.

1.5.3 SPECIFICATIONS

All equipment and products shall be specified according to referenced codes and standards herein and described by appropriate units as required herein.

1.6 WITHHOLDING OF PAYMENT FOR SUBMITTALS

1.6.1 DESIGN SUBMITTALS

Payment for Design work will not be made in whole or in part until the Government has reviewed and cleared the design for construction.

1.6.2 CONSTRUCTION SUBMITTALS

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. In event under separate clause of the contract, the Contractor is allowed partial or total invoice payment for materials shipped from the Continental United States (CONUS), and/or stored at the site, the Contractor shall with his request for such payment, submit copies of approvals (ENG Form 4025) certifying that the materials that are being shipped and/or stored have been approved and are in full compliance with the contract technical specifications.

2.0 PRODUCTS

2.1 GENERAL

The following are contract deliverables which expound upon and finalize the design parameters/requirements outlined within the contract documents. They shall be prepared in such a fashion that the Prime Contractor is responsible to the Government and not as an internal document between the Prime Contractor and its Subcontractors, Vendors, Suppliers, etc.

During the course of design, the designer shall specify specific proprietary materials, equipment, systems, and patented processes by trade name, make, or catalog number. The subsequent use of construction submittals to supplant and/or supplement incomplete design effort is unacceptable. Design submittals containing non-proprietary and/or generic design criteria where proprietary items are available, will be returned for resubmission.

Since this contract requires that the drawings and specifications specify specific proprietary materials, equipment, systems, and patented processes by trade name, make, or catalog number, it is anticipated that construction shop drawings will primarily be limited to testing, construction plans (e.g., Contractor Quality Control, Accident Prevention, Resident Management System, Area Use etc), schedules (Project Schedule/Network Analysis), construction submittals (as identified in the specifications), certificates of compliance, reports, records/statements and variations.

2.2 PROJECT NARRATIVE

The Project Narrative shall be a bound set and shall contain Contract Sections 01 11 00 and 01 11 05 (and any additional Contract sections that are

appropriate). The Contract Sections shall be the latest version. Any subsequent changes to the Contract shall be clearly marked and highlighted with explanation for the changes. The Project Narrative shall also contain the general description of the project and a discussion of the design approach and design features for the project.

2.3 DESIGN ANALYSIS

2.3.1 SUBMITTAL

Only design analyses associated with the features of this contract design by the Contractor shall be submitted for review. It shall be written in the English language with SI units of measure. The design analysis is a written explanation of the project design which is expanded and revised (updated) as the design progresses. The design analysis shall contain all explanatory material giving the design rationale for any design decisions which would not be obvious to an engineer reviewing the final drawings and specifications.

The design analysis contains the criteria for, and the history of, the project design, including criteria furnished by the Government, letters, codes, references, conference minutes, and pertinent research. Design calculations, computerized and manual, are included in the design analysis. Narrative descriptions of design solutions are also included. Written material may be illustrated by diagrams and sketches to convey design concepts. Catalog cuts and manufacturer's data for all equipment items, shall be submitted. Specific requirements for the design analysis, listed by submittal phase, are noted in Paragraph 1.2.1.

2.3.2 FORMAT

Format of design analysis shall closely match the standard format referenced within the contract.

2.4 DESIGN CALCULATIONS

Only calculations associated with the features of this contract designed by the Contractor shall be submitted for review, unless site conditions mandate changes to drawings and specifications furnished with this Contract. All design calculations shall be presented such that they are easily understood, correlated with contract requirements (Section 01 11 00 and 01 11 05 criteria; codes; all other applicable or pertinent criteria) and all final conclusions clearly documented and summarized. The Design Submittal must include complete information (Soil Report, percolation test results, concrete design strengths, steel material properties, electrical loads, heat gain/loss assumptions, etc.) necessary to support all design calculations in order to easily and efficiently verify the accuracy of this information and the resulting project components shown in plans and specifications.

2.4.1 SUBMITTAL

When design calculations are voluminous, they shall be bound separately from the narrative part of the design analysis. Design calculations will include a title page, table of contents, and be indexed (tabbed) to separate distinct parts of the various analysis and design actions being accomplished to support plan drawings submitted. They shall be presented in a clear, consistent and legible format in order to quickly understand the analysis and design accomplished. Presentation shall be such that a person unfamiliar with

the project features and associated analysis and design can quickly understand the overall design process and procedures, review the information in conjunction with the given set of plans and specifications, and verify the suitability of all information submitted.

All design calculations shall explain the source of loading conditions with assumptions and conclusions explained. The analysis and design methods shall also be explained, including assumptions, theories and formulae. Include applicable diagrams that are clearly explained and correlated with related computations, whether computer or hand generated. The design calculations shall include a complete and comprehensive list of the criteria (and date or version of the criteria) that the design/analysis will be compared to (codes, Corps of Engineers Engineering Regulations, Engineering Manuals, etc.). Within the separable elements of design calculations, the engineer shall cite the specific code or reference paragraph or section as appropriate to indicate conformance to requirements.

At the beginning of each project component design section, present a summary of all load conditions and combinations required per applicable code or Corps of Engineers manual or regulation. Then clearly identify the particular load case governing the design and clearly show how the particular analysis, construction materials to be used, and the specific design meet the governing load combination.

Calculation sheets shall carry the names or initials of the engineer and the checker and the dates of calculations and checking. No portion of the calculations shall be computed and checked by the same person.

2.4.2 COMPUTER ANALYSIS

Provide a clear summary of all computer outputs and highlight in the outputs information used in the analysis and design accomplished elsewhere in the calculations.

If a computerized analysis or design program is used (either commercial software packages or unique, designer- written computer analysis/design tools), the computations shall provide clear reference to the software program and version being used and an explanation of the validity of the particular program to the given application (where has the program been used before, what input and output does the program provide, is the program a recognized Corps of Engineers or industry standard). If the program is proprietary to the Contractor (not recognized by the Corps of Engineers or industry), the Contractor shall provide a sample hand calculation to verify the results of one set of data generated by the computer program.

State exactly the computation performed by the computer. Include applicable diagrams, adequately identified. Provide all necessary explanations of the computer printout format, symbols, and abbreviations. Use adequate and consistent notation. Provide sufficient information to permit manual checks of the results.

Each set of computer printouts shall be preceded by an index and by a description of the computation performed. If several sets of computations are submitted, they shall be accompanied by a general table of contents in addition to the individual indices.

When the computer output is large, it shall be divided into volumes at logical division points. All final computer results used in design shall be separated from the total pages of computer output that might be included in the design calculations for ease of review.

2.4.3 Civil, Site Planning and Layout Mapping

The surveyor shall provide a tabulated list (bound booklet) with adjusted coordinates and elevations of all permanent survey monuments established on the project. The surveyor shall complete and submit with field books, the field adjustments computation sheets. The surveyor shall complete and submit the final survey and mapping.

A specialist shall perform land acquisition services. The preparatory Land Acquisition Specialist shall have a minimum of a Bachelor’s degree from an accredited institution and preferably at least 10 years of relevant experience in carrying out verification of property ownership and appraisals of farm lands and urban properties. Previous experience in undertaking social studies and analysis in the power sector developments is desirable.

The plans shall include, but not be limited to the following:

a. Location plan showing the location of the existing structures and proposed site improvements on an overall plan of the entire base.

b. Site plan showing the horizontal location of the proposed structures, fences, walls, and all other site improvements in relation to each other and existing site features. The site plan shall show detailed geometric design of the site and utilities, including applicable dimensions of facilities, setbacks, etc. The Contractor provided topographic survey shall serve as the base map for the site plan.

c. Grading plan showing the existing and proposed site grading and any surface or subsurface drainage facilities. A contour interval of 0.25 meters shall be used. Final contours shall be furnished to show the full scope of the project. Spot elevation at all pertinent locations including but not limited to grade breaks, stabilized surfaces, corners of asphalt pavement and concrete pavement joints, fence corners, building corners, controlling elevations of ditches or drainage courses, and entry control points will be included on the grading plan. Ground floor elevation for each structure will be included on the grading plan. The Contractor provided topographic survey shall serve as the base map for the grading plan.

d. Utility plan showing existing and proposed domestic water distribution system, sanitary sewer system, and storm sewer system including pipe size, pipe slope, gravity flow pipe inverts, trench details, etc. Details of utility system shall be provided.

e. Construction details providing sufficient detail to accurately construct the required site features.

f. Demolition plans shall clearly delineate all existing features to be removed.

g. Tower Structure Drawings shall show the following data and information for structures:

a) An outline drawing of the structure showing all basic design dimensions;

b) Electrical clearances;

c) Specified loading conditions;

d) Wind loads on the structure at each point of application;

e) Stress diagrams or computer data so that the client can readily check the strength of the structure from the loading conditions specified;

f) A detail of the conductor, overhead ground wire and foundation attachments where not specified by the Engineer, including design calculations;

g) All shop drawings of structure and structure members and legs shall show the item assembled in place, clearly indicating all dimensions, the size, number and lengths of bolts required in each connection;

h) A bill of materials shall be prepared in tabulation form, listing all materials required for fabrication and assembly of the structure. The list shall show the number of items required and the total weight of each part.

2.5 SPECIFICATIONS

Specifications for most work associated with this Contract may have been furnished to the Contractor and only specifications produced by the Contractor should be submitted for review. If the Contractor determines that features of this contract design by the Contractor require additional specifications, they shall be submitted for review and approval. Specifications shall be prepared in accordance with the UFGS (Uniform Facilities Guide Specifications) format. The Contractor-prepared specifications shall include as a minimum, all applicable specification sections referenced by the UFGS. Where the UFGS does not reference a specification section for specific work to be performed by this contract, the Site-Adapt Contractor shall be responsible for creating the required specification in the UFGS format.

2.5.1 USE OF UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFGS)

If additional specifications are deemed necessary by the Contractor, UFGS (Uniform Federal Guide Specifications) are required. Where US codes and standards are referenced in the UFGS for material, the contractor may substitute equivalent IEC and/or British Standards. Current UFGS information may be obtained at the following location: http://www.wbdg.org/ccb/browse_org.php?o=70.

Specifications for UFGS are in SpecsIntact format. SpecsIntact is government sponsored software used to edit specifications for government contracts. The software is available at the following link: http://specsintact.ksc.nasa.gov/.

2.5.2 QUALITY CONTROL AND TESTING

Any additional specifications deemed necessary by the Contractor shall include required quality control and further indicate all testing to be conducted by the Contractor, its subcontractors, vendors and/or suppliers.

2.5.3 AMBIGUITIES AND INDEFINITE SPECIFICATIONS

Ambiguities, indefinite specification requirements (e.g., highest quality, workmanlike manner, as necessary, where appropriate, as directed etc) and language open to interpretation is unacceptable.

2.5.4 INDUSTRY STANDARDS

2.5.4.1 STANDARDS

The Specifications shall be based on IEC and/or British Standards. Customarily accepted publications may be found in the UNIFIED MASTER REFERENCE LIST (UMRL) which may be located at the following URL: http://www.wbdg.org/ccb/ccb.php

To access the UMRL select the “Unified Facilities Guide Specifications” tab and scroll down to Unified Master Reference List (UMRL) (PDF version).

This document lists publications referenced in the Unified Facilities Guide Specifications (UFGS) of the Corps of Engineers (USACE), the Naval Facilities Engineering Command (NAVFAC), the Air Force Civil Engineer Support Agency (AFCESA), and the guide specifications of the National Aeronautics and Space Administration (NASA). This document is maintained by the National Institute of Building Sciences (NIBS) based on information provided by the agencies involved and the standards producing organizations. The listing is current with information available to NIBS on the date of this publication.

Standards referenced in specifications and drawings prepared by the Contractor shall be by specific issue; the revision letter, date or other specific identification shall be included.

References in the specification to U.S. (American) standards (e.g. ASTM, ASME, Factory Mutual (F.M.), National Electrical Manufacturer's Association (NEMA), ANSI, IEEE, Underwriter's Laboratories (U.L.), etc.) for construction materials and equipment, is made to establish a level of electrical quality and standardization for this project. Material conforming to other internationally recognized standards such as British Standards (BS), and International Electrotechnical Commission (IEC), or Deutsches Institut fur Normung (DIN) standards may be acceptable in lieu of compliance with U.S. material standards depending on the application, and if approved by the Contracting Officer. Material and equipment installed under this contract shall be for the appropriate application.

If the contractor chooses to use such substitute material, he must demonstrate that equipment complying with foreign standards meet or exceed the same level of quality and standards provided by the referenced standards in these specifications. The contractor shall submit data sheets for the proposed equipment meeting those standards for approval prior to the material procurement.

2.5.5 AED DESIGN REQUIREMENTS DOCUMENTS

AED Design Requirements (latest version) documents shall be adhered to in this contract. These documents are available from the COR or may be downloaded here: http://www.aed.usace.army.mil/Design.asp. These documents shall be used as the basis for design and construction, and for selecting options within the United Facilities Guide Specifications (UFGS). With the exception of all electrical systems for transmission and distribution and for substation buildings, it is the contractor's option to use specifications contained in the AED Design Requirements Documents, when provided, or to adapt the UFGS specifications to match the requirements provided in the AED Design Documents and specifications. All electrical systems shall be designed and constructed in strict accordance with the codes and standards explicitly referenced in this contract. Site or project specific data and requirements in the AED Design Requirements documents shall supersede UFGS language where there are differing criteria which must be evaluated and selected.

2.6 DRAWINGS

2.6.1 COMPUTER ASSISTED DESIGN AND DRAFTING (CAD)

Only personnel proficient in the preparation of CAD drawings shall be employed to modify the contract drawings or prepare new drawings. The CAD deliverables shall meet the requirements of the A/E/C CAD Standards (V 3.0 or newer). The A/E/C CAD Standards may be downloaded at the CAD/BIM Technology Center at the following link:
https://cadbim.usace.army.mil/default.aspx?p=s&t=13&i=4 or the AED-N website http://www.aed.usace.army.mil/engineeringtop2010.asp under the "Government Provided CAD Files" link.

The Contractor shall furnish all soft copy design submittals (and As-Builts) using software applications in either DWG format (Auto Desk, AutoCad Release 2013 or newer) or DGN format (Bentley Systems, MicroStation, version 8.0 or newer). Use of unregistered or student copies of software applications to prepare design drawings IS NOT PERMITTED. In addition, the Contractor is required to submit the softcopy design submittals in PDF (Adobe Acrobat) format.

CD media submitted containing the softcopy design submittals shall be organized per the instructions below and the diagram in Section 1335a:

CD Title:

Project Name and Location: Project Number:
Submittal Number: Date:
Contractor Name, Address, Telephone Number and email

Folders and Folder Contents/Structure:

Main Folder Name	Subfolders, Files and File	Description

Administrative	Multiple PDF files	Files shall include the contract, task order, approved modifications, approved BCDs, approved variations and non-administrative modifications (do not
Design Analysis	One pdf file with identical contents as the printed document of the	All data, discussion, calculations and information presented in the
Specifications	One folder specifications in word format. One folder with	All specification sections including table of contents edited as appropriate for the submittal stage of the
Geotechnical Report	One file in pdf format	All data, graphs, charts and tables generated during the
PDF Drawings	One Binder of pdf files.	PDF Drawings. Files will be saved in a Binder and organized in the
CAD Drawings	DGN or DWG files organized in the following folders. Each folder shall contain only drawings pertaining to that discipline. General (Cover Sheet/ Index of Drawings, Vicinity Maps) Civil Architectural Structural Mechanical Plumbing Electrical Telecommunications	CAD Drawings. All referenced files are to be attached without drive or directories and placed in the same folder it is referencing. Do not save or use paths. Do not use live nesting when attaching reference files.

Notes:

1. The administrative folder shall provide documents submitted by the contractor and received from the COR related to the contract. These documents shall include Requests for Information related to design issues, Variation Requests, Modifications to the Contract. In addition, the folder shall contain a copy of the signed contract, relevant task orders and change orders.

2. DO NOT INCLUDE standard drawings or specifications provided to the contractor as part of the contract or as part of the contract.

2.6.2 DRAWINGS

Drawings shall be prepared in the English language with metric (SI) units of measure. All drawings and details of the working drawings shall be labeled and cross-referenced, thoroughly checked and coordinated with other engineering disciplines. At the final design submittal (100%) the Contractor shall have incorporated all design review comments generated by previous

design review(s), have completed all of the constructability and coordination comments, and have the drawings in a Ready-to-Build condition. The drawings shall be complete at this time and contain all the details necessary to ensure a clear understanding of the work throughout construction. Prior to submitting the 100% Final Design drawings, the Contractor shall follow the procedures as described in the MED Design Requirements for CAD Design Guide.

2.6.3 DRAWING SIZE BORDER SHEETS

All drawings shall be prepared in size "A1" border sheets (594mm by 841mm). Hardcopy design submissions may be printed on half size drawing sheets (“A3”, 297 mm by 420 mm) for purposes of saving paper and for ease of review. If drawings are not readable in the half size reduction, the Contractor shall submit all drawings in A1 border sheets. All final contract drawing sets (As-Builts) shall be submitted on A1 border sheets. Drawing sheets shall be trimmed to specified size if necessary.

2.6.4 SEQUENCE OF DESIGN DRAWINGS

Referencing the A/E/C CAD Standard the sequence of drawings shall follow the sequence as shown below:

Discipline

1. General

2. Hazardous Materials

3. Survey/Mapping

4. Geotechnical

5. Civil

6. Landscape

7. Structural

8. Architectural

9. Interiors

10. Equipment

11. Fire Protection

12. Plumbing

13. Process

14. Mechanical

15. Electrical

16. Telecommunications

17. Resource

18. Other Disciplines

19. Sub-Contractor/Shop Drawings

20. Operations

2.6.5 DRAWING FOLDER STRUCTURE

CAD files shall be organized in folder names as described in Paragraph 2.6.4. For multi-building projects, a folder of each building type shall be created and the applicable folders shown in each building type folder.

2.6.6 DRAWING SHEET ASSEMBLY

CAD files will be organized in what is described as “Option 1a” (page 9 in the A/E/C CAD Standards Drawing Sheet Assembly manual), normally referred to as “Model Space and Paper Space” in Autodesk Autocad applications and “Design Model and Sheet Model” in Bentley Microstation applications. All files will be drawn consistently in the same manner using this option throughout the entire project.

2.6.7 MODEL FILES

Model files represent the building’s physical layout and components such as floor plans, elevations and details. Model files shall be drawn to full size (1:1) in metric units in the default model view. Floor Plan Model files represent one floor. Example: do not use one model drawing file to draw several floor plan drawings with several border files. One paper space layout shall be provided per plotted sheet. Model files being referenced into another shall have insertion coordinates (x,y,z) of 0,0,0 in model space. The exception for model files with insertion coordinates other than 0,0,0 shall be the civil site plans (using Georeferencing and real-world coordinates.) Dimensioning shall be in millimeters unless noted otherwise, drawn associatively, and not be “forced”. Example: if a wall is drawn 1:1, as 150 mm but the dimensioned number is modified to 200, this is unacceptable.

2.6.8 BORDER SHEET FILES

Border sheet files are referenced into drawing files (in Paper Space) for plotting and viewing purposes. Every border sheet file has a drawing area, Title Block information and sheet trim border. The Afghanistan Engineer District – North uses a common Title Block sheet border for each project. The project Title Block sheet border with "sheet independent" data is referenced into each drawing. When a drawing file is created, "sheet dependent" Title Block data, such as the Sheet Identification and Title, is added to the specific drawing file and located in Paper Space where the Title Block is referenced and viewed. AED-S Title Block drawings may be downloaded at: http://www.aed.usace.army.mil/engineeringtop2010.asp under the “Government Provided CAD Files” link.

2.6.9 LAYER/LEVEL NAMES

Layer or level files names shall follow the guidelines of the A/E/C CAD Standards V4.0. For AutoCAD, [discipline].dwt (drawing template files) shall be used to import the proper layers that will be inclusive of the correct line type, color, and line thickness of the respective layer. Templates to be

used are found on the CAD/BIM Technology Center at the following link: https://cadbim.usace.army.mil/default.aspx?p=s&t=13&i=4, or at AED- N's website: http://www.aed.usace.army.mil/engineeringtop2010.asp under the "Government Provided CAD Files" link.

2.6.10 DRAWING FILE NAMING CONVENTION

The sheet identifier will consist of the discipline designator, the sheet type designator and the sheet sequence number as referenced in the A/E/C CAD Standards V4.0.

2.6.11 SHEET IDENTIFICATION BLOCK

The sheet identifier will follow the format of the border sheet file. This will consist of the discipline designator, the sheet type designator and the sheet sequence number as referenced in the A/E/C CAD Standards Manual.

2.6.12 DRAWING SCALES

The scales indicated on the following list shall be the guide in determining the scale for all drawings. Bar scales on drawings are preferred as printed copies may lose their plotted scale through generational copying. The Contractor may, at its option, make exceptions to the scales indicated, if approved in writing by the Contracting Officer.

TYPICAL DRAWING SCALES	
DRAWING TYPE	METRIC
SITE PLAN	1:200
	1:400
	1:500
	1:600
	1:700
	1:1000
	1:2000
	1:5000
	1:6000
	1:10000
	1:20000
FLOOR PLAN	1:50
	1:100
ROOF PLAN	1:200
EXTERIOR ELEVATIONS	1:100
	1:200
INTERIOR ELEVATIONS	1:50

	1:100
CROSS SECTIONS	1:50
	1:100
	1:200
WALL SECTIONS	1:20
STAIR DETAILS	1:10
DETAILS	1:5

2.6.13 SYMBOLS, LINE STYLES, & PATTERNS

Approved symbols, line styles, and patterns shall be in accordance with AEC CAD Standards V 3.0 or newer (see Appendix D of the A/E/C CAD Standards). The approved symbols, line styles, and patterns associated with AutoCAD software maybe downloaded at the following link: https://tsc.wes.army.mil/products/standards/aec/aecstdsym.asp

2.6.14 PLOTTER PREPARED ORIGINAL DRAWINGS AND PDF FILES

Design files shall be developed in anticipation of plotting on a monochrome, vector plotter. Line density shall be equivalent to that produced by black India ink: half tone plots are only acceptable where the half-tone color setting of RGB (red, green blue) settings equal a value of 153. (Please refer to the A/E/C CAD Standards). Drawings plotted in color are not acceptable. Manual changes to plotted originals are not acceptable. A separate Adobe PDF file shall be made of each drawing file oriented in “Landscape”. Each PDF drawing file shall then be compiled into one “binder” PDF file for each set of drawings Following the order of the Sheet Index.

2.6.15 TITLE AND REVISION BLOCK

Only AED-S Title and Revision Blocks are allowed. These are available at AED-N’s website for download at: http://www.aed.usace.army.mil/engineeringtop2010.asp under the “Government Provided CAD Files” link.

2.6.16 LEGENDS

For each submittal, legends of symbols and lists of abbreviations shall be placed on the drawings. They shall include all of the symbols and abbreviations used in the drawing set, but shall exclude any symbols and abbreviations not used. Since many symbols are limited to certain design disciplines, there is a definite advantage to the use of separate legends on the initial sheet of each design discipline or in the Standard Details package for each discipline. If legends have not been shown by discipline, a legend shall be placed on the first drawing.

2.6.17 LOCATION/COLUMN GRID

To facilitate the location of project elements and the coordination of the various disciplines' drawings, all plans shall indicate a column line or

planning grid, and all floor plans (except structural plans) shall show room numbers.

2.6.18 COMPOSITE AND KEY PLANS

If the plan of a large building or structure must be placed on two or more sheets in order to maintain proper scale, the overall plan (key plan) shall be placed on one sheet at a smaller scale to accommodate entire building/site. Key plans shall be used not only to relate large scale plans to total floor plans but also to relate individual buildings to large complexes of buildings. This key plan with match lines shall be referenced on all segmented drawings and shall be placed in a convenient location to indicate the relative location of the represented plan area by crosshatching.

2.6.19 SPECIFICATIONS PLACED ON THE DRAWINGS

Details of standard products or items which are adequately covered by specifications shall not be included on the drawings.

2.6.20 REVISIONS

Drawing revisions shall be prepared only on the original CAD files. A revision history (located in the Title Block) is required on all sheets.

2.6.21 BINDING

All volumes of drawing prints shall be firmly bound and shall have covers of heavier bond than the drawing sheets. If posts are used to fasten sheets together, the drilled holes on the bond edges of the sheets shall be on 8-1/2-inch centers.

2.6.22 GOVERNMENT PROVIDED FILES

All CAD related files provided by the Government to the Contractor (AutoCad and MicroStation Afghanistan Engineering District-North Title Block and Cover/Index sheet files, AutoCAD template files) may be downloaded through the following Afghanistan Engineering District-North website:

http://www.aed.usace.army.mil/engineeringtop2010.asp under the “Government Provided CAD Files” link. If Contractor is unable to access this site, a CD will be provided upon request to the Project Manager.

2.7 EXECUTION

2.8 GENERAL

2.8.1 DESIGN CONCEPT COORDINATION MEETING

Shortly after Notice To Proceed (NTP) the Government or contractor may suggest meeting(s) to review the Design Submittal process or discuss various aspects of the contract to enable prompt and efficient initiation of contract actions. Meeting(s) will be held to assure attention is focused on key project requirements (necessary contractor design and Government review that is required to provide Construction Clearance), to discuss features and items of work that need to be submitted early due to long lead time items, or discuss other concepts/ideas that will help accelerate the contract work.

Other Design Coordination meetings may be requested throughout the contract period if Government review of various contractor Design Submittals indicate poor design and plan or specification quality in order to clearly explain the changes and improvements required of the contractor, assure understanding of Government comments, code references and required investigations and calculations, to move forward with acceptable design and satisfactory plans and specifications.

2.8.2 GOVERNMENT DESIGN CHANGES

Government design changes which do not increase construction costs shall be made at no charge to the Government. The Contracting Officer may request design submittals in addition to those listed when deemed necessary to adequately describe the work covered in the contract documents. Submittals shall be made in the respective number of copies and to the respective addresses set forth in the paragraph entitled SUBMITTAL PROCEDURE. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

2.9 SUBMITTAL REGISTER

2.9.1 DESIGN SUBMITTALS

The Contractor shall submit as part of his Project Schedule Design Submittal milestone dates. The Contractor shall post all actual dates of submittal actions (including clearance for construction) as they occur.

2.9.2 CONSTRUCTION SUBMITTAL REGISTER (ENG FORM 4288)

Attached to this section is ENG Form 4288 which the Contractor is responsible for developing for this contract. All design and construction submittals shall be shown on this register. The submittal register shall be the controlling document and will be used to control all submittals throughout the life of the contract. The Contractor shall maintain and update the register on a monthly basis for the Contracting Officer's approval.

2.10 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both design and construction submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care will be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

2.11 PROGRESS SCHEDULE

The Contractor shall prepare and submit a design progress schedule to the Contracting Officer. The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The progress schedule shall show, as a percentage of the total design price, the various items included in the contract and the order in which the Contractor proposes to carry on the work, with dates on which he will start the features of the work and the contemplated dates for completing same. Significant milestones such as review submittals shall be annotated. The Contractor shall assign sufficient

technical, supervisory and administrative personnel to insure the prosecution of the work in accordance with the progress schedule. The Contractor shall correct the progress schedule at the end of each month and submit as required to the Contracting Officer. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

2.12 SCHEDULING

2.12.1 DESIGN SUBMITTALS

Adequate time (a minimum of fourteen (14) full calendar days exclusive of mailing time) shall be allowed for review and comment in DrChecks$_{SM}$. This time period starts on the next full day after delivery of the Design Submittal. If the Contractor fails to submit design submittals in a timely fashion, or repetitively submits design submittals that are not in strict conformance with the Contract documents, no part of the time lost due to such actions shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

2.12.2 CONSTRUCTION SUBMITTALS

Contractor furnished Government Approved Construction Submittals (GA) for items noted in Paragraph 1.2.5 of this Section, or others as required by the COR, shall be submitted to the Area or Resident Office, per directions given at the Pre-Construction meeting. Adequate time (a minimum of fourteen (14) full calendar days exclusive of mailing time) shall be allowed for review and comment.

2.12.3 POST DESIGN CONSTRUCTION SUBMITTALS

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of fourteen (14) full calendar days exclusive of mailing time) shall be allowed for review and approval. If the Contractor fails to submit post design construction submittals in a timely fashion, or repetitively submits submittals that are not in strict conformance with the Contract documents, no part of the time lost due to actions shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

2.13 SUBMITTAL PROCEDURE

2.13.1 DESIGN SUBMITTALS

2.13.1.1 Submittal Format

One (1) half-size hard copy and two (2) soft copies (electronic version) of all design submittals (calculations, reports of field tests, design analysis, plans, specifications, etc) shall be transmitted to the Government at the following address, by means of ENG Form 4025:
U.S. Army Corps of Engineers
Transatlantic Afghanistan (TAA)
Bagram Area Office
APO, AE 09354

The soft copy (electronic version) and CD case shall both be clearly labeled (hand written information is not acceptable – typed labels are required) with contract information (contract #, title, contractor name, specific design submittal stage including if it is a Resubmittal, date of submission, components of the submittal – design analysis, plans, specifications, and if more than one CD then state 1 of “X”, 2 of “X”, etc., anti-virus information below, etc.)

The Contractor shall scan the soft copy (electronic version) of each Design Submittal using most up-to-date version of recognized Industry-standard anti-virus software (Symantec, Norton, etc.) to insure that no viruses are contained in it prior to acceptance. The label shall indicate it has been scanned for viruses and the anti-virus software and version clearly indicated.

2.13.1.2 RESIDENT/AREA ENGINEER OFFICE

Complete design submittals (five copies) shall be provided to the Area and/or Resident Engineer Office. At the Pre-Construction meeting, the Contractor will be furnished the Area and/or Resident Office address to which these submittals shall be provided along with the number and size of hard and soft (electronic version) copies required for these offices.

2.13.1.3 EDITABLE CAD FORMAT AS-BUILTS

This is a Design Build project and in accordance with the Contract Clauses the Government has non-exclusive rights to use the design on other projects. Therefore, the As-Builts furnished to the Government must be in an editable format. See specification section AS-BUILT DRAWINGS for all requirements associated with submission of editable CAD format As-Builts required as part of this contract.

2.13.2 NOT USED

2.13.3 SUBMITTAL NUMBERING SYSTEM

Instructions on the numbering system to be used for construction submittals follows.

2.13.3.1 SUBMITTALS

Shop drawings and materials are listed on the Submittal Register (ENG Form 4288) as follows:

List is prepared according to contract specifications and drawings, picking up all items involved in the project.

This list is divided into sections as indicated in the specifications. For example:

Section 01015 "Technical Requirements"

Section 01335 “Design Submittals”

Section 02831 "Chain-Link Fence"

Section 02710 "Sub-drainage System"

Section 03300 "Concrete For Building Construction"

Section 04200 "Masonry"

2.13.3.2 NUMBERING PROCEDURES FOR TRANSMITTAL ON ENG FORM 4025

Each Specification Section will have various requirements for submittals (design information, product data, test reports, procedures, etc.) to the Government for Approval (GA) or For Information Only (FIO). Items from different Sections cannot be submitted on the same ENG Form 4025. When furnishing one or more items from the same Section at a given time, a single ENG Form 4025 can be used to identify and submit these items. Block ‘b” of the 4025 entitled “DESCRIPTION OF ITEM SUBMITTED” should provide an accurate and unique description of each item being proposed by the Contractor. Item numbers (block “a” of the 4025 entitled “ITEM NO.”) will be automatically generated in QCS for each ENG Form 4025. QCS will track and automatically generate the “ITEM NO.” for all following ENG Form 4025s for the same Section number. To illustrate, a transmittal for the 65% Design Submittal required by Section 01335 might have the following Items:

ITEM NO. 1 Topographic Information

ITEM NO. 2 Geotechnical Report

ITEM NO. 3 Foundation Design

ITEM NO. 4 65% Plans

ITEM NO. 5 Outline of Construction Specifications to be used

If this was the first submittal furnished by the Contractor for Section 01335, then a Transmittal Number of 01335-1 would be generated using QCS. As new transmittals are generated in QCS, the last digit of the transmittal is increased incrementally, as follows:

Transmittal No. 01335-2

Transmittal No. 01335-3

Transmittal No. 01335-4

and so forth. The first transmittal submitted from each Specification Section will be “-1”, in other words, there will never be a “Transmittal No. 01335-0”.

The above illustration is true for all other Specification Sections included in the Request for Proposal or in the Construction Specifications compiled by the Contractor in the prosecution of work under the contract.

2.13.3.3 RESUBMITTALS

Should the Contractor be required to resubmit any transmittal due to one or more items on that transmittal being Coded “C” (Cleared for Construction, except as noted in attached comments, Resubmission Required) or “E” (NOT

Cleared for Construction, see attached comments, resubmission required) by the Government, QCS will be used to generate the same transmittal number followed by the number "-1" for the first re-submittal, "-2" for the second re- submittal, "-3" for the third re-submittal, etc.

As an example, assume the 65% Design Submittal is provided to the Government as Transmittal 01335-9. Due to omissions or errors in that Submittal which result in a Code “E” being given, then the subsequent 65% Design Re-submittal #1 would be “Transmittal 01335-9.1”. Should a re-submittal again be necessary, it would be Design Re- submittal #2 and would be submitted as “Transmittal 01335-9.2”.

The purpose of this system is to avoid deviations from the Submittal Register and to track submittals in both RMS and DrChecks$_{SM}$. It should be noted that a new transmittal number following the above system CANNOT be generated in QCS unless the prior transmittal has been given a Code. If the Contractor is having difficulty generating the correct transmittal number, contact the COR to resolve the matter.

The Contractor use the above nomenclature and date of submission to the Government for Plan Cover Sheets; title blocks for all drawings; all Specification Cover Sheets; all specification pages; all Design Analysis Cover Sheets and associated pages; and similar labeling for all other documents included in the submittal.

2.13.4 VARIATIONS

If design or construction submittals show variations from the contract parameters and/or requirements due to site conditions, the Contractor shall justify such variations in writing, at the time of submission. Additionally, the Contractor shall also annotate block "h" entitled "variation" of ENG FORM 4025. After design submittals have been reviewed and cleared for construction by the Contracting Officer, no resubmittal for the purpose of substituting materials, equipment, systems, and patented processes shall be considered.

2.13.5 NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

2.14 REVIEW OF CONTRACTOR PREPARED DESIGN DOCUMENTS

2.14.1 GENERAL

The work under contract will be subject to continuous review by representatives of the Contracting Officer. Additionally, joint design review conferences with representation by all organizations having a direct interest in the items under review may be held. The Contractor shall furnish copies of all drawings and related documents to be reviewed at the review conference on

or before the date indicated by the Government. Additional conferences pertaining to specific problems may be requested by the Contractor or may be directed by the Contracting Officer as necessary to progress the work. The Contractor shall prepare minutes of all conferences and shall furnish two copies to the Contracting Officer within seven (7) days after the conference.

2.14.2 INDEPENDENT DESIGN REVIEW

The Contractor shall have someone other than the Designer or Design Team perform an independent technical review of all specifications, drawings, design analysis, calculations, and other required data prior to submission to the Government that follows the “MED Design Manual”. Design Checklists (all disciplines) should be submitted with the 99% design per the Design Manual. This review shall insure the professional quality, technical accuracy, and the coordination of all design analysis, drawings and specifications, and other services furnished under this contract have been accomplished. Work must be organized in a manner that will assure thorough coordination between various details on drawings, between the various sections of the specifications, and between the drawings and specifications. The Contractor shall thoroughly cross-check and coordinate all work until he is professionally satisfied that no conflicts exist, vital information has not been omitted, and that indefinite language open to interpretation has been resolved. Upon completion of this review, the Contractor shall certify that each design submittal is complete, accurate, is in strict conformance with all contract requirements, that repetition has been avoided, that all conflicts have been resolved, and that the documents have thoroughly coordinated and cross checked against all the applicable disciplines to prevent the omission of vital information.

2.14.3 CONTRACTOR'S QUALITY CONTROL ORGANIZATION REVIEW

The Contractor shall thoroughly review each submittal prior to submission to the Contracting Officer to assure it is complete, correct and unified. This review shall be for the purposes of eliminating errors, interferences, and inconsistencies, and of incorporating design criteria, review comments, specifications, and any additional information required. The Contractor shall give evidence of such review of all items in each submittal ENG Form 4025, by annotating Column “g” (titled “For Contractor Use Code”) of this Form with the letter “A,” meaning the Contractor has reviewed it and is indicating it is “Approved as Submitted”. Design submittals submitted to the Contracting Officer without evidence of the above requirements or the Contractor's certified approval will be returned for resubmission. No part of the time lost due to such resubmissions shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

2.14.4 GOVERNMENT REVIEW

Within 14 days after Notice to Proceed, the Contractor shall submit, for approval, a complete design schedule with all submittals and review times indicated in calendar dates. The Contractor shall update this schedule monthly. After receipt, the Government will be allowed fourteen (14) full days to review and comment on all Design Submittals, except as noted below. This time period starts on the next full day after delivery of the Design Submittal.

If a design submittal is deficient (errors on ENG Form 4025; incorrect drawing title block information; missing or incomplete features required in

the submittal; etc.), it will be returned immediately without further review for correction and resubmission. The review time will begin when the corrected submittal is received. The Contractor may be liable for liquidated damages owed to the Government for returned design submittals due to deficiencies.

The contractor shall not begin construction work until the Government has reviewed the Contractor's Design Submittal and cleared it for construction. Clearance for construction does not mean Government approval. Government review shall not be construed as a complete check but will evaluate the general design approach and adherence to contract parameters. The Government Review is often limited in time and scope. Therefore, the Contractor shall not consider any review performed by the Government as an excuse for incomplete work.

Upon completion of the review the Contractor will be notified by the Contracting Officer Representative that the DrChecks$_{SM}$ file is open for viewing and response to comments. The Contracting Officer will indicate whether the Design Submittal, or portions thereof, has or has not been cleared for construction using the following action codes:

A – Cleared for Construction

B – Cleared for Construction, except as noted in attached comments

C – Cleared for Construction, except as noted in attached comments, resubmission required

E - NOT Cleared for Construction, see attached comments, resubmission required

F – Receipt acknowledged, does not comply as noted with contract requirements.

These codes shall NOT be used by the Contractor.

Design submittals Cleared for Construction by the Contracting Officer shall not relieve the Contractor from responsibility for any design errors or omissions and any liability associated with such errors, nor from responsibility for complying with the requirements of this contract.

2.14.4.1 INCORPORATION OF GOVERNMENT REVIEW COMMENTS

The Contractor shall review each comment, furnish a complete response in DrChecks SM as to how the comment will be addressed in the Design Analysis, Plans and Specifications, or other Design Submittal stipulations required in this Contract. The Contractor will then incorporate each comment into the design submittal along with other work required at the next Design Submittal stage. The Contractor shall furnish disposition of all comments in DrChecks SM , with the next scheduled submittal. The disposition shall identify action taken with citation of location within the relevant design document. Generalized statements of intention such as "will comply" or "will revise the specification" are not acceptable. During the design review process, comments will be made on the design submittals that will change the drawings and specifications. The Government will make no additional payments to the Contractor for the incorporation of comments. Review comments are considered part of the contract administration process.

If the Contractor disagrees technically with any comment or comments and does not intend to comply with the comment, he must clearly outline, with ample justification, the reasons for noncompliance within five (5) days after close of review period in order that the comment can be resolved.

The Contractor is cautioned that if he believes the action required by any comment exceeds the requirements of this contract, he should flag the comment in DrChecks$_{SM}$ as a scope change, and notify the COR in writing immediately.

If a design submittal is over one (1) day late in accordance with the latest design schedule, the Government review period may be extended 7 days. Submittal date revisions must be made in writing at least five (5) days prior to the submittal.

2.14.4.2 CONFERENCES

As necessary, conferences will be conducted between the Contractor and the Government to resolve review comments.

A review conference may be held at the completion of review and subsequent Contractor response for each design submittal. The review conference will be held at the Corps District Office in Kandahar, Afghanistan. The Contractor shall bring the personnel that developed the design submittal to the review conference.

2.14.4.3 DESIGN DEFICIENCIES

Design deficiencies noted by the Government shall be corrected prior to the start of design for subsequent features of work which may be affected by, or need to be built upon, the deficient design work.

2.14.5 DESIGN DISCREPANCIES

The Contractor shall be responsible for the correction of incomplete design data, omissions, and design discrepancies which become apparent during construction. The Contractor shall provide the Contracting Officer with a proposed recommendation for correcting a design error, within three (3) calendar days after notification by the Contracting Officer. The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification.

If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor. Should extensions of design, fabrication plans and/or specific manufacturer's details be required as a result of a Government issued Change Order, the Government will make an equitable adjustment in accordance with Contract Clause 52.243-4 entitled CHANGES.

2.15 PHASED OR "FAST-TRACK" DESIGN

2.15.1 GENERAL

If approved by the Government, design and construction sequencing may be effected on an incremental basis as each approved phase or portion (e.g., demolition, geotechnical, site work, exterior utilities, foundations, substructure, superstructure, exterior closure, roofing, interior construction, mechanical, electrical, etc.) of the design is completed.

2.15.2 SEQUENCE OF DESIGN-CONSTRUCTION (FAST-TRACK)

After receipt of the Contract Notice to Proceed (NTP) the Contractor shall initiate design, comply with all design submission requirements and obtain Government review of each submission. The contractor may begin construction on portions of the work for which the Government has reviewed the final design submission and has determined satisfactory for purposes of beginning construction. The Contracting Officer will notify the Contractor when the design is cleared for construction. The Government will not grant any time extension for any design resubmittal required when, in the opinion of the Government, the initial submission failed to meet the minimum quality requirements as set forth in the contract.

2.15.3 NOTICE-TO-PROCEED FOR LIMITED CONSTRUCTION

If the Government allows the Contractor to proceed with limited construction based on pending minor revisions to the reviewed Final Design submission, no payment will be made for any in-place construction related to the pending revisions until they are completed, resubmitted and are satisfactory to the Government.

2.15.4 IN-PLACE CONSTRUCTION PAYMENT

No payment will be made for any in-place construction until all required submittals have been made, reviewed and are satisfactory to the Government.

2.15.5 COMMENCEMENT OF CONSTRUCTION

Construction of work may begin after receipt of the clearance for construction (Notice to Proceed) for each design phase. Any work performed by the Contractor prior to receipt of the clearance for construction, shall be at the Contractor's own risk and expense. Work cleared for construction that does not conform to the design parameters and/or requirements of this contract shall be corrected by the Contractor at no additional cost or time to the Government.

2.16 CONDUCT OF WORK

2.16.1 PERFORMANCE

Perform the work diligently and aggressively, and promptly advise the Contracting Officer of all significant developments.

2.16.2 TELEPHONE CONVERSATIONS

Prepare a summary, and promptly furnish a copy thereof to the Contracting Officer, of all telephone conversations relating to the design work under this contract.

2.16.3 COOPERATION WITH OTHERS

Cooperate fully with other firms, consultants and contractors performing work under the program to which this contract pertains, upon being advised by the Contracting Officer that such firms or individuals have a legitimate interest in the program, have need-to-know status, and proper security clearance where required.

2.16.4 TECHNICAL CRITERIA

All designs, drawings, and specifications shall be prepared in accordance with the contract documents and with the applicable publications referenced therein. As soon as possible, the Contractor shall obtain copies of all publications applicable to this contract. Availability of publications (where to purchase) is contained in Specification Section 01420 entitled: SOURCES FOR REFERENCE PUBLICATIONS. Any deviations from the technical criteria contained in the contract documents or in the applicable publications, including the use of criteria obtained from the user or other sources, must receive prior approval of the Contracting Officer. Where the technical criteria contained or referred to herein are not met, the Contractor will be required to conform his design to the same at his own time and expense.

2.16.5 CONFLICTS

Any conflicts, ambiguities, questions or problems encountered by the Contractor in following the criteria shall be immediately submitted in writing to the Contracting Officer with the Contractor's recommendations. Prior to submission to the Government the Contractor shall take appropriate measures to obtain clarification of design criteria requirements, to acquire all pertinent design information, and to incorporate such information in the work being performed.

2.16.6 DESIGN PRIORITIES

The design of this project shall consider the remote location and harsh environment of this project and the impact this will have on sources of technical supply, the cost of construction, the low level of maintenance, and the difficulty of obtaining replacement parts. Unless stated otherwise in this contract, the following design priorities shall be followed.

2.16.6.1 CONSTRUCTION LIFE SPAN

Buildings and facilities shall be designed and constructed to serve a life expectancy of more than 25 years, to be energy efficient, and to have finishes, materials, and systems that are low maintenance and low life cycle cost.

2.16.6.2 NOT USED

2.16.6.3 STANDARDIZATION

Use of standardized materials, products, equipment, and systems is necessary to minimize the requirements for replacement parts, storage facilities, and service requirements.

2.16.6.4 TOPOGRAPHIC SURVEYS, EASEMENTS, AND UTILITIES

Unless otherwise stated in the contract, the Contractor will be responsible for detailed topographic mapping, available easements, and utility information for the project.

2.16.6.5 HORIZONTAL AND VERTICAL CONTROL

The mapping shall be based on the base coordinate system. If the base system cannot be found, the surveyor shall use any established monuments. If monuments have been destroyed or do not exist, an assumed horizontal and vertical datum shall be established, using arbitrary coordinates of 10,000n and 10,000e and an elevation of 1,000 meters. The horizontal and vertical control established on site shall be a closed loop with third order accuracy and procedures. Provide three (3) concrete survey monuments at the survey site. All of the control points established at the site shall be plotted at the appropriate coordinate point and shall be identified by name or number, and adjusted elevations. The location of the project site, as determined by the surveyor shall be submitted in writing to the Contracting Officer. The site location shall be identified by temporary markers, approved by the Contracting Officer before proceeding with the surveying work.

2.16.6.6 TOPOGRAPHY REQUIREMENTS

A sufficient quantity of horizontal and vertical control shall be established to provide a detailed topographic survey at 1:500 scale with one quarter meter contour intervals minimum. Intermediate elevations shall be provided as necessary to show breaks in grade and changes in terrain.

The contours shall accurately express the relief detail and topographic shapes. In addition, 90 percent of the elevations or profiles interpolated from the contours shall be correct to within one-half of the contour interval and spot elevations shall be correct within plus or minus 20 millimeters.

Spot elevations affecting design of facilities shall be provided. Specifically, break points or control points in grades of terrain such as tops of hills, bottoms of ditches and gullies, high bank elevations, etc.

All surface and sub-surface structures features within the area to be surveyed shall be shown and identified on the topographic maps. In addition, these features shall be located by sufficient distance ties and labeled on the topographic sheets to permit accurate scaling and identification.

The location and sizes of potable, sanitary, electrical and mechanical utilities within the survey site shall be shown on the survey map. Sanitary manholes and appurtenances shall show top elevations and invert elevations.

2.16.7 OCCUPATIONAL SAFETY AND HEALTH ACT

The facilities, systems, and equipment designed under this contract shall comply with the Occupational Safety and Health Act (OSHA), Code of Federal Regulations, Title 29, Chapter XVII, Parts 1910 and 1926. Any problems in incorporating these standards due to conflicts with other technical criteria shall be submitted to the Contracting Officer for resolution.

2.16.8 ASBESTOS CONTAINING MATERIALS

Asbestos containing material (ACM) will not be used in the design of new structures or systems. In the event no other material is available which will

perform the required function or where the use of other material would be cost prohibitive, a waiver for the use of asbestos containing materials must be obtained from AED.

2.16.8.1 EXISTING CONSTRUCTION

Asbestos containing materials (ACM) presently included in existing construction to be rehabilitated or otherwise modified as a result of this project shall be removed and a non-asbestos containing material substituted in lieu thereof.

2.16.8.2 SUSPECTED ASBESTOS CONTAINING MATERIALS

All such structures and systems shall be inspected to determine the presence or probable presence of ACM. When ACM is suspected, a documented survey will be performed. The survey will be developed into an abatement design and will be made a part of the design documents. In the event no other material is available which will perform the required function or the use of a substitute material would be cost prohibitive due to initial cost and tear-out of existing construction, a waiver for the retention of the asbestos containing material must be obtained from the Contracting Officer.

2.17 ATTACHMENTS

The following attachments form an integral part of this specification:

ENG FORM 4025 -Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificate of Compliance (2 pages)

ENG FORM 4288 - Submittal Register

Figure 1 -Index Sheet Logo/Signature Block (A-E)

Figure 2 -Continuation Sheet Logo/Signature Block (A-E)

Figure 3 -Title Block for Continuation Sheets

Figure 4 -Revision Block

Figure 5 -Finished Format Size

-- End of Section --

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE *(Read instructions on the reverse side prior to initiating this form)*	DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____
SPECIFICATION SEC. NO. *(Cover only one section with each transmittal)*	PROJECT TITLE AND LOCATION		CHECK ONE: THIS TRANSMITTAL IS FOR ☐ FIO ☐ GOV'T. APPROVAL

ITEM NO. *a.*	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* *b.*	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See instruction no. 8)* *c.*	NO. OF COPIES *d.*	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE *g.*	VARIATION *(See instruction No. 6)* *h.*	FOR CE USE CODE *i.*
				SPEC. PARA. NO. *e.*	DRAWING SHEET NO. *f.*			

REMARKS

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated.

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED *(List by Item No.)*	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

ENG FORM 4025-R, MAR 95 *(ER 415-1-10)* EDITION OF SEP 93 IS OBSOLETE. SHEET___ OF ___ (Proponent: CEMP-CE)

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.

2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.

3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.

4. Submittals requiring expeditious handling will be submitted on a separate form.

5. Separate transmittal form will be used for submittals under separate sections of the specifications.

6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".

7. Form is self-transmittal, letter of transmittal is not required.

8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.

9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A	--	Approved as submitted.	E	--	Disapproved (See attached).
B	--	Approved, except as noted on drawings.	F	--	Receipt acknowledged.
C	--	Approved, except as noted on drawings. Refer to attached sheet resubmission required.	FX	--	Receipt acknowledged, does not comply as noted with contract requirements.
D	--	Will be returned by separate correspondence.	G	--	Other *(Specify)*

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG Form 4025-R)

SUBMITTAL REGISTER

(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPECIFICATION SECTION

ACTIVITY NO	TRANS-MITTAL NO.	ITEM NO	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL										CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
					DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	O&M MANUALS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATER-IAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
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ENG FORM 4288-R, JAN 1997 EDITION OF MAR 95 IS OBSOLETE. PAGE _____ OF _____ PAGES (Proponent: CEMP-CE)

PE v1.00

INDEX SHEET LOGO/SIGNATURE BLOCK (A-E)

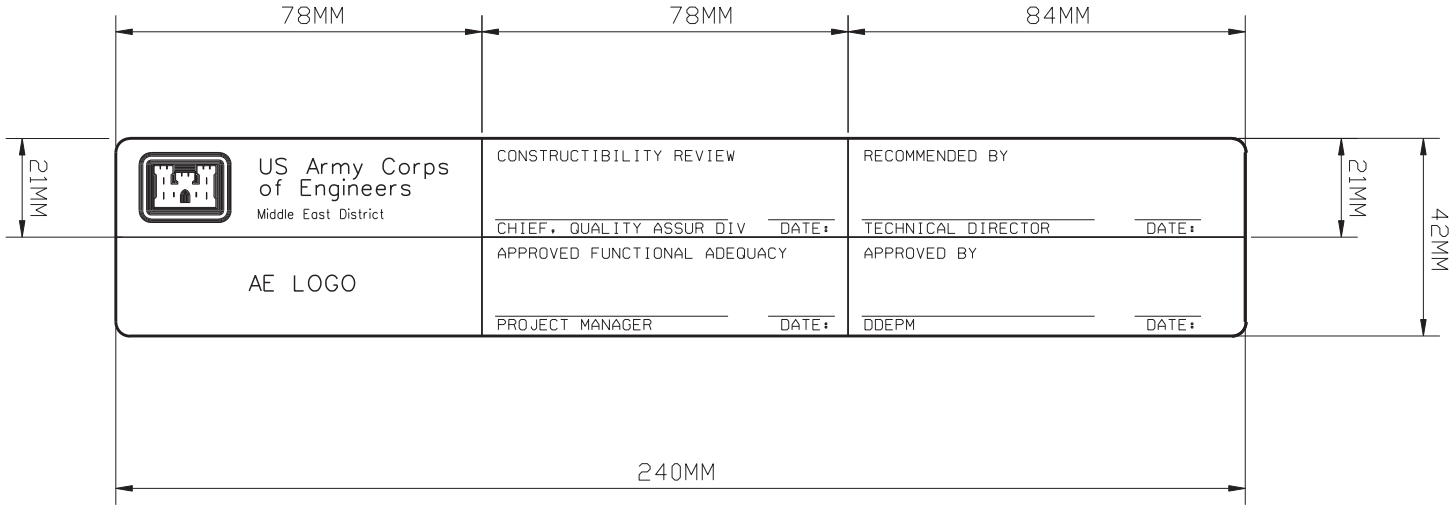


FIGURE 1

CONTINUATION SHEET LOGO/SIGNATURE BLOCK (AE)

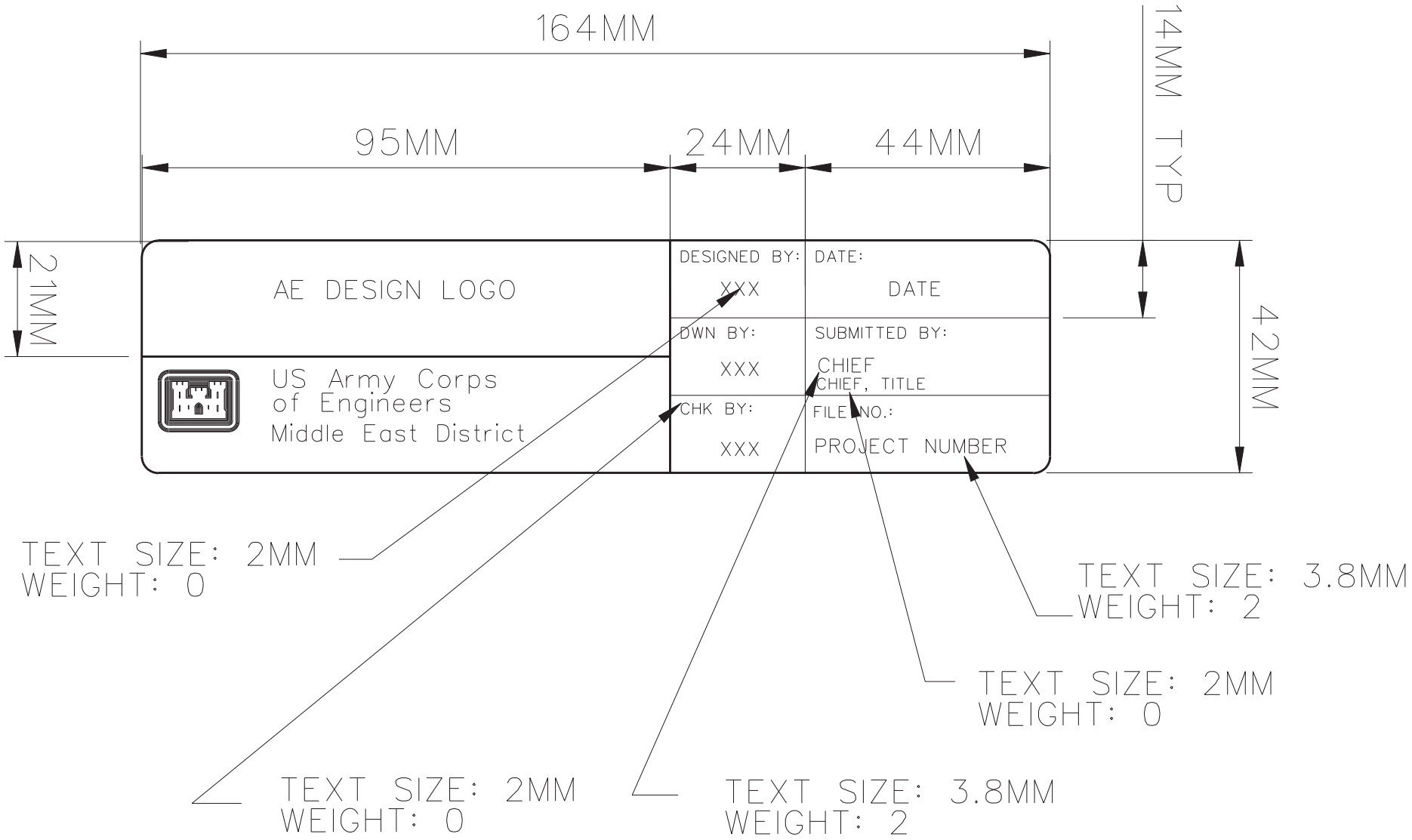
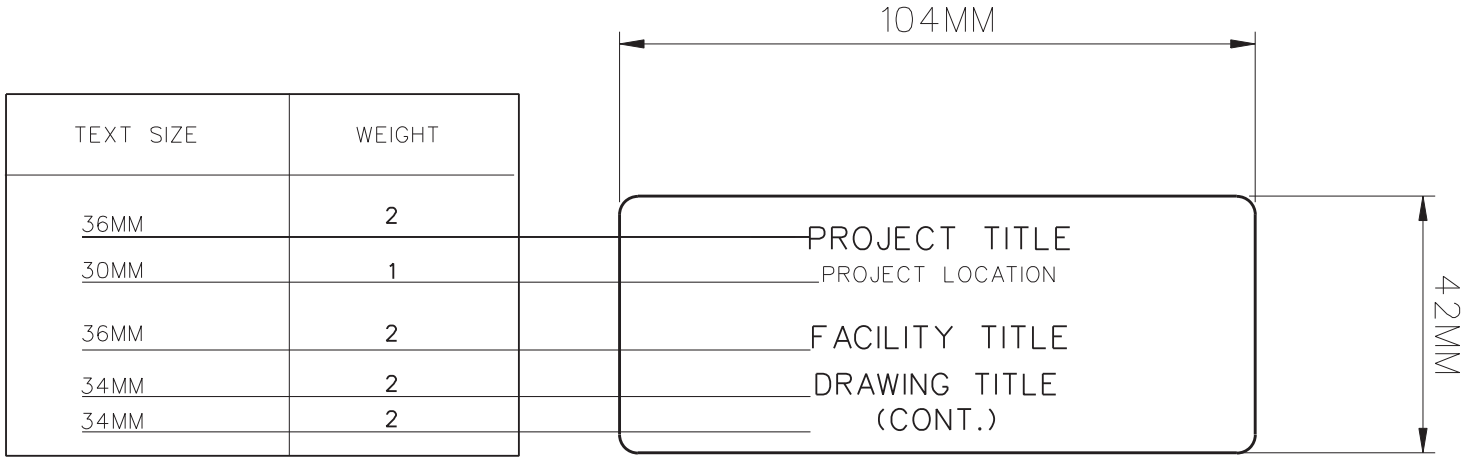


FIGURE 2

TITLE BLOCK FOR CONTINUATION SHEETS



TEXT SIZE	WEIGHT
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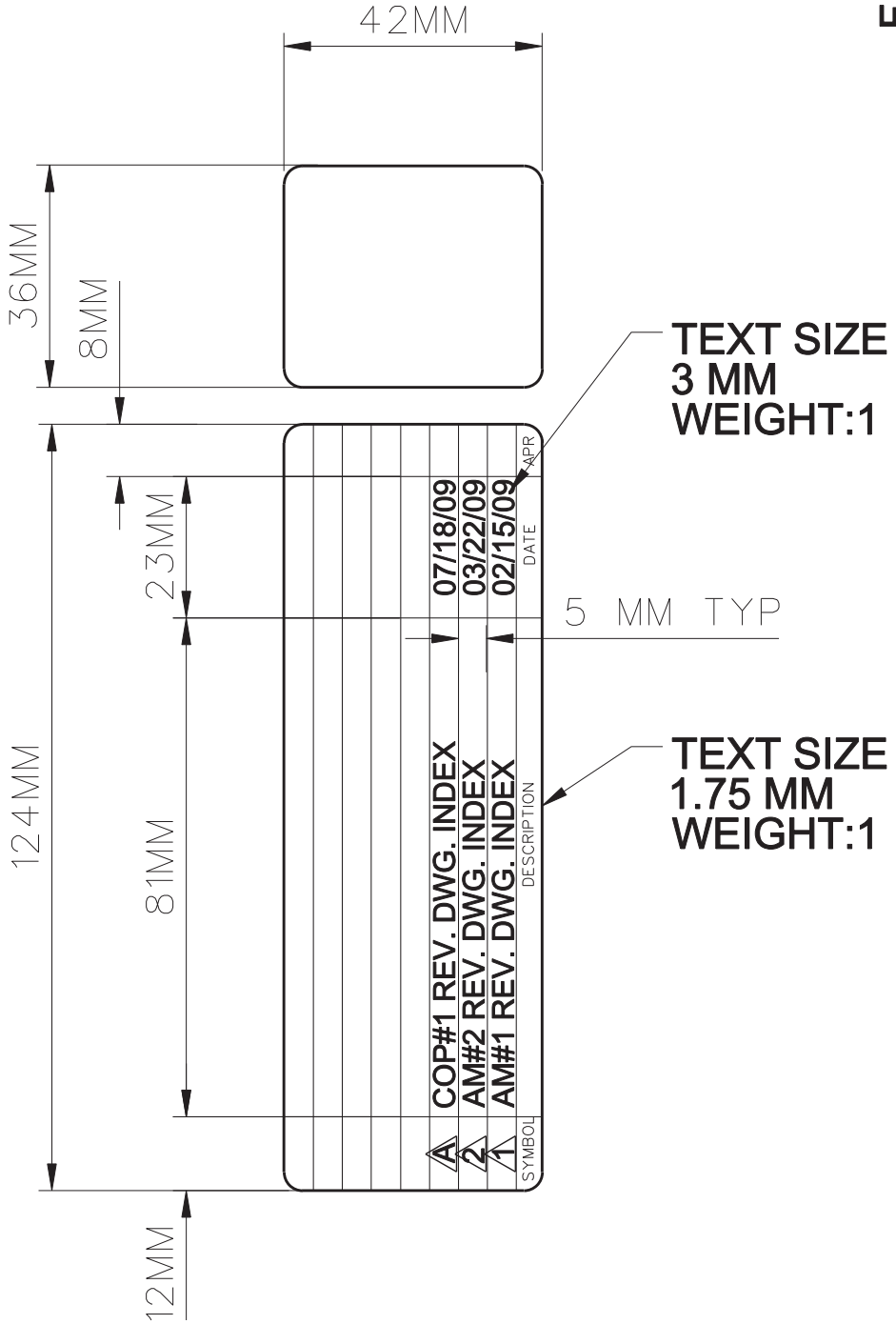
30MM	1
36MM	2
34MM	2
34MM	2

FIGURE 3

FIGURE 4

INDEX SHEET LOGO AND REVISION BLOCK



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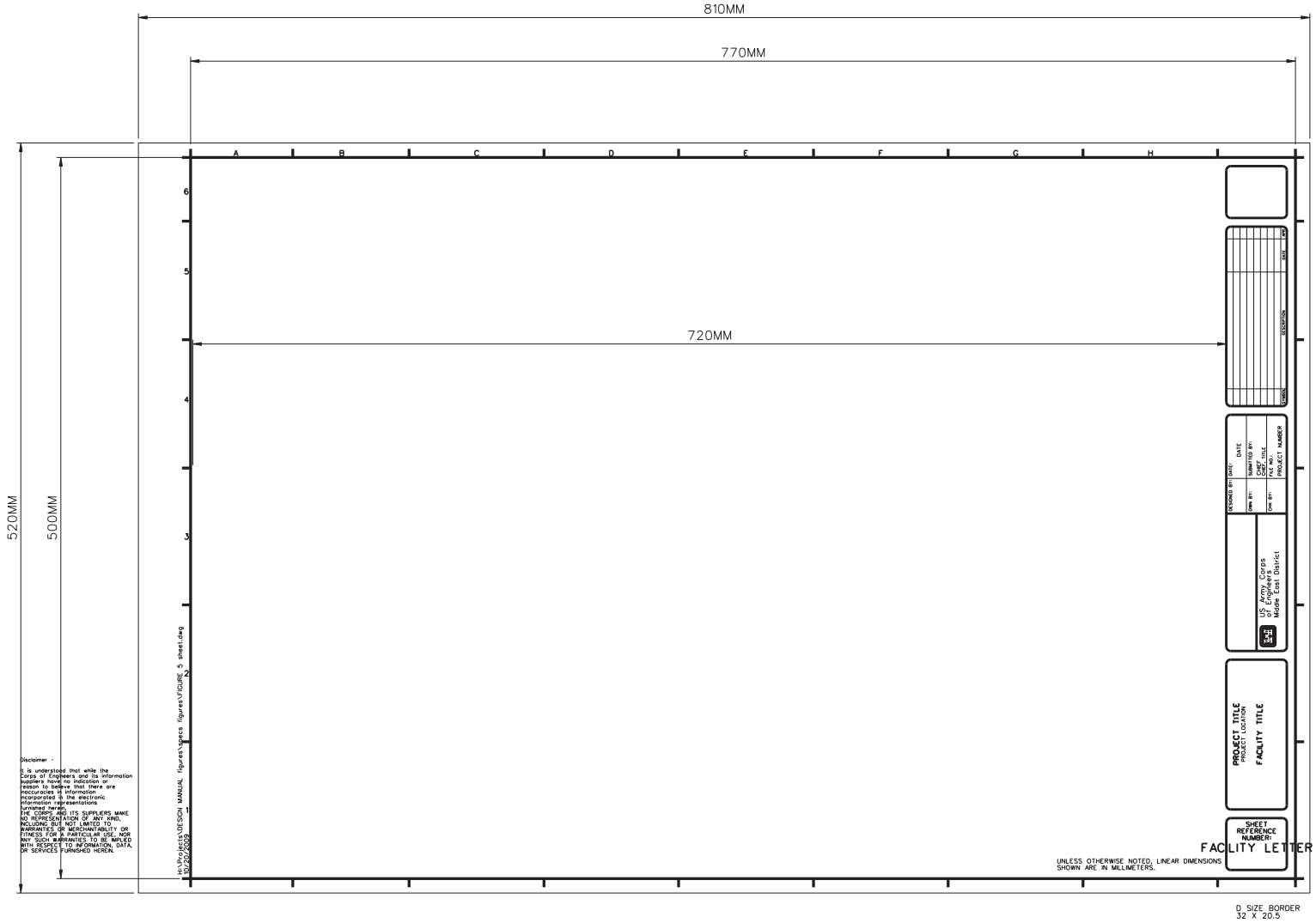


NOTES:

1. SEE FIGURES 6 THRU 9 FOR TITLE BLOCK DEFINITIONS.

FIGURE 5

SECTION 01 35 26

GOVERNMENT SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 NOT USED

1.2 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 SOCIETY OF SAFETY ENGINEERS (ASSE / SAFE)

ASSE / SAFE A10.32	Fall Protection (2004)
ASSE / SAFE A10.34	Protection of the Public on or Adjacent to Construction Sites (2001; R 2005)
ASSE / SAFE Z359.1	Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components (2007)

ASME INTERNATIONAL (ASME)

ASME B30.22	Articulating Boom Cranes (2005)
ASME B30.3	Tower Cranes (2009)
ASME B30.5	Mobile and Locomotive Cranes (2007)
ASME B30.8	Floating Cranes and Floating Derricks (2010)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	Standard for Portable Fire Extinguishers (2010)
NFPA 241	Standard for Safeguarding Construction, Alteration, and Demolition Operations (2009)
NFPA 51B	Standard for Fire Prevention During Welding, Cutting, and Other Hot Work (2009; TIA 09-1)
NFPA 70	National Electrical Code (2011)

NFPA 70E	Standard for Electrical Safety in the Workplace (2009; Errata 09-1)

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	Safety and Health Requirements Manual (2008; Change 1-2010; Change 3-2010; Errata 1-2010)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards (OSHA)
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.500	Fall-Protection

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Government acceptance is required for submittals with a "G, A" designation.

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, A

Fall Protection and Prevention Plan; G, A

Activity Hazard Analysis (AHA); G, A

Confined Space Entry Plan; G, District Safety Office

Crane Critical Lift Plan; G, A

Proof of qualification for Crane Operators; G, A

Demolition Plan; G, A

Excavation Plan; G, A

Severe Storm Plan; G, A

SD-06 Test Reports

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports"

Accident Reports

Crane Reports

Monthly Exposure Reports

Contractor Safety Self-Evaluation Checklist

SD-07 Certificates

Confined Space Entry Permit

Hot Work Permit

Mechanized Equipment Certification

Crane Certificate of Compliance

Submit one copy of each permit/certificate attached to each Daily Quality Control Report.

1.3 DEFINITIONS

a. Competent Person for Fall Protection

A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.

b. High Visibility Accident

Any mishap which may generate publicity and/or high visibility.

c. Medical Treatment

Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

d. Operating Envelope

The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers and crane walkers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

e. Qualified Person for Fall Protection

A person with a recognized degree or professional certificate, extensive knowledge, training and experience in the field of fall protection who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

f. Recordable Injuries or Illnesses

Any work-related injury or illness that results in:

1. Death, regardless of the time between the injury and death, or the length of the illness;

2. Days away from work (any time lost after day of injury/illness onset);

3. Restricted work;

4. Transfer to another job;

5. Medical treatment beyond first aid;

6. Loss of consciousness; or

7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

g. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

1.4 QUALITY ASSURANCE

1.4.1 PERSONNEL QUALIFICATIONS

1.4.1.1 SITE SAFETY AND HEALTH OFFICER (SSHO)

a. The SSHO must meet the requirements of EM 385-1-1 section 1 and ensure that the requirements are met for the project. Provide a Safety oversight team that includes a minimum of one (1) person at each project site to function as the Site Safety and Health Officer (SSHO). The SSHO or an equally-qualified Designated Representative/alternate shall be at the work site at all times to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. The SSHO's training, experience, and qualifications shall be as required by EM 385-1-1 paragraph 01.A.17, entitled SITE SAFETY AND HEALTH OFFICER (SSHO), and all associated sub-paragraphs, and reviewed by the District Safety Office before COR or ACOR acceptance.

b. A Competent Person shall be provided for all of the hazards identified in the Contractor's Safety and Health Program in accordance with the accepted Accident Prevention Plan, and shall be on- site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the Contracting Officer for acceptance in consultation with the Safety Office.

c. Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management,

surveillance, inspections, and safety enforcement for the Contractor. The Contractor Quality Control (QC) person cannot be the SSHO on this project.

d. The SSHO shall meet the following requirement: Certification card for 30-hour OSHA construction safety class or equivalent within the last 3 years. SSHO must be fluent in English and the local language for communication with the GDA. Competent person training as needed.

e. Site Safety and Health Officer (SSHO) shall meet the requirements of EM 385-1-1

1. The SSHO shall have a minimum of ten (10) years of safety-related work on construction projects with a minimum of five (5) years of safety experience on high voltage electrical projects of at least 220 kV involving substations and transmission lines.

2. The SSHO(s), as a minimum, must have completed the 30-hour OSHA Construction safety class or as an equivalent, 30 hours of formal construction safety and health training covering the subjects of the OSHA 30-hour course (see Appendix A, paragraph 4.b. in EM385-1-1 applicable to the work to be performed and given by qualified instructors.

f. SSHOs shall maintain this competency through 24 hours of formal safety and health related coursework every four (4) years.

g. The Contractor Quality Control (QC) or the superintendant cannot be the SSHO on this project, even though the QC has safety inspection responsibilities as part of the QC duties.

1.4.1.2 COMPETENT PERSON FOR CONFINED SPACE ENTRY

A Competent Person meeting the requirements of EM 385-1-1 shall be assigned in writing by the Government Designated Authority (GDA) to assess confined spaces and who possesses demonstrated knowledge, skill and ability to:

a. Identify the structure, location, and designation of confined and permit-required confined spaces where work is done;

b. Calibrate and use testing equipment including but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;

c. Assess hazardous conditions including atmospheric hazards in confined space and adjacent spaces and specify the necessary protection and precautions to be taken;

d. Determine ventilation requirements for confined space entries and operations;

e. Assess hazards associated with hot work in confined and adjacent space and determine fire watch requirements; and

f. Maintain records required.

1.4.1.3 SITE CRANE OPERATORS

Crane Operators shall:

a. Meet the requirements in USACE EM 385-1-1, Section 16 and Appendix I;

b. Be qualified for mobile cranes with Original Equipment Manufacturer (OEM) rated capacitates of 50,000 pounds or greater, by a source such as a union, a government agency, or an organization that tests and qualifies Crane Operators; and

c. Provide proof of current qualification.

1.4.2 REGULATORY REQUIREMENTS

a. In addition to the detailed requirements included in the provisions of this contract, comply with the most recent addition of USACE EM 385-1-1, and the following host nation laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern. All updates to EM385-1-1 shall be incorporated into specifications and APP. These updates as well as the EM 385-1-1 electronic version may be found at the following link: http://publications.usace.army.mil/publications/eng-manuals/EM_385-1-1_languages/EM-385-1-1_English_2008/toc.html.

b. The Contractor shall submit for acceptance a DBA Insurance Plan describing how the requirements will be met including:

1. Properly and promptly submit an injury claim within seven days of the incident;

2. Provide Resident/Area Engineer with copies of submitted claim;

3. Gather contact information of workers and their family;

4. Follow-up on the claim's status;

5. Provide weekly claims report status to the Resident/Area Engineer;

6. Provide prompt payment to an injured worker, or the family of a deceased worker; and

7. Provide Resident/Area Engineer confirmation that payment has been provided from DBA Insurance provider.

1.4.3 MEETINGS

1.4.3.1 PRECONSTRUCTION CONFERENCE

The Preconstruction Conference shall occur as described in Section 00 73 00 SPECIAL CONTRACT REQUIREMENTS and encompass the following criteria:

1. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety

and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

2. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

3. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

4. The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting for Design Build Contracts.

1.4.3.2 SAFETY MEETINGS

Shall be conducted and documented as required by EM 385-1-1. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report.

1.4.3.3 PRE-OUTAGE COORDINATION MEETINGS

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

PART 2 PRODUCTS

2.1 COMPETENT ACCIDENT PREVENTION PLAN (APP)

a. The Contractor shall use a qualified person to prepare the written site-specific APP in both English and all native languages of the workers. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1.

b. Specific requirements for some of the APP elements are described below. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific.

c. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer.

d. In addition to following the requirements defined by EM 385-1-1, the Contractor shall submit for approval as part of the APP a DBA Insurance Plan describing how the requirements in Section 00 73 00 SPECIAL CONTRACT REQUIREMENTS will be met including:

1. Properly and promptly submit an injury claim within seven days of the incident;

2. Provide Resident/Area Engineer with copies of submitted claim;

3. Gather contact information of workers and their family;

4. Follow-up on the claim's status;

5. Provide weekly claims report status to the Resident/Area Engineer;

6. Provide prompt payment to an injured worker, or the family of a deceased worker; and

7. Provide Resident / Area Engineer confirmation that payment has been provided from DBA Insurance provider.

e. Submit the APP to the Contracting Officers Representative (COR) or USACE Area/Resident Office Engineer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

f. Once accepted by the Contracting Officers Representative or Area/Resident Office Engineer, the APP and attachments will be reviewed for completeness and sent to the USACE Safety Office for technical review and acceptance and enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the COR, until the matter has been rectified.

g. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the COR, project superintendent, SSHO and quality control manager. Should any hazard become evident, stop work in the area, secure the area, and develop a plan to remove the hazard. Notify the COR within 24 hours of discovery. In the interim, all necessary action shall be taken to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment.

h. Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site.

i. The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

j. The APP will be readily available to all workers on the worksite in all native languages of the workers.

2.2 ACTIVITY HAZARD ANALYSIS (AHA)

a. The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1, and shall be written in both English and in all native languages of the workers. Submit the AHA for review at least 15 calendar days prior to the start of each phase and format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

b. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

c. The activity hazard analyses shall be developed using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

2.3 USACE ENGINEERING MANUAL 385-1-1

In addition to the requirements outlines in Appendix A of USACE EM 385-1-1, the following is required:

2.3.1 QUALIFICATIONS

a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. Specify the duties of each position.

b. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.

2.3.2 CONFINED SPACE ENTRY PLAN

Develop a confined and/or enclosed space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, OSHA Directive 2.100, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous

conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

2.3.3 CRANE CRITICAL LIFT PLAN

Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. Submit 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.H. Table 16.

2.3.4 FALL PROTECTION AND PREVENTION PLAN

The program documentation shall be site specific and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 1.8 m. A qualified person for fall protection shall prepare and sign the program documentation. Include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Revise the Fall Protection and Prevention Program documentation every six months for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted Fall Protection and Prevention Program documentation at the job site for the duration of the project. Include the Fall Protection and Prevention Program documentation in the Accident Prevention Plan (APP).

2.3.5 EXCAVATION PLAN

A plan shall be develop taking in consideration the type of soil and the depth, it shall fallow the requirements of section 25.A and be site specific.

2.4 REPORTS

2.4.1 ACCIDENT REPORTS

All accidents occurring incidentally to the project shall be investigated, reported, analyzed and documented. For recordable injuries and illnesses, as defined in 1.3.f and property damage accidents resulting in at least $2,000 in damages, to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 5 calendar days of the accident. The Contracting Officer will provide copies of any required or special forms on accident for less than $2,000.00 or not recordable injuries.

2.4.2 ACCIDENT NOTIFICATION

Notify the Contracting Officer as soon as practical, but not later than four (4) hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $2,000. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where

accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

2.4.3 MONTHLY EXPOSURE REPORTS

The Monthly Exposure Report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms. Contractors must report exposure hours to include lost time accidents monthly and provide the monthly exposure data by the 7th day of the following month. The Resident Office shall complete the review of this data by the 10th day.

2.4.4 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contractor Safety Self-Evaluation Checklist shall be submitted to Contracting Officer in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, attached to monthly billing request. This checklist shall be a Quality Control measure established by the Contractor to ensure Safety evaluations are performed daily by site safety and health personnel and evaluated for needed improvements at a minimum rate of once a month.

2.4.5 CRANE REPORTS

a. Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix I and as specified herein with Daily Reports of Inspections.

b. Provide a Certificate of Compliance for each crane entering an activity under this Contract (see Contracting Officer for a blank certificate). State within the certificate that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance comply with 29 CFR 1926 and USACE EM 385-1-1 Section 16 and Appendix I. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. For cranes at DOD activities in foreign countries, certify that the crane and rigging gear conform to the appropriate host country safety standards. Also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). Post certifications on the crane.

2.5 HOT WORK

a. Submit and obtain a written permit prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, from the Base Fire Department or as directed by the Contracting Officer. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in

accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

b. When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and have in their possession the emergency contact phone number.

ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DIVISION/DEPARTMENT IMMEDIATELY.

2.6 SAFETY INFORMATION

2.6.1 DISPLAY

a. Within one (1) calendar day after commencement of work, Contractor shall erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, shall be deemed as meeting the requirement for a bulletin board. All documentation shall be in English and in the native language of all workers on site. Include and maintain information on safety bulletin board as required by EM 385-1-1, section 01.A.06.

b. Additional items required to be posted include:

1. Confined space entry permit;

2. Hot work permit; and

3. Deficiency tracking log.

2.6.2 REFERENCE MATERIAL

Contractor shall maintain safety-related references applicable to the project, including those listed in the article "References," on site at all times.

2.6.3 EQUIPMENT MANUALS

Contractor shall maintain applicable equipment manufacturer's manuals on site at all times.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

3.1.2 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor shall:

1. Secure outside equipment and materials and place materials that could be damaged in protected areas.

2. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

3. Ensure that temporary erosion controls are adequate.

3.1.3 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. The Government has no responsibility to provide emergency medical treatment. Military medical clinics may provide emergency treatment for serious injuries; the contractor is responsible for coordination with the local military medical clinic prior to mobilization.

3.1.4 DRUG PREVENTION PROGRAM

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employee uses illegal drugs or consumes alcohol during work hours. Ensure there are no employees under the influence of drugs or alcohol during work hours. After accidents, collect blood, urine, or saliva specimens and test the injured and involved employees for the influence of drugs and alcohol. A copy of the test shall be made available to the Contracting Officer upon request.

3.1.5 PERSONNEL DUTIES

a. The Site Safety and Health Officer (SSHO) and / or Superintendent shall perform the following duties as described herein:

1. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily quality control report;

2. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors;

3. Maintain applicable safety reference material on the job site;

4. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings;

5. Implement and enforce accepted APPS and AHAs;

6. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. Post a list of unresolved safety and health deficiencies on the safety bulletin board;

7. Ensure sub-contractor compliance with safety and health requirements. Failure to perform the above duties will result in dismissal of the superintendent, QC Manager, and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement; and

8. Maintain a list of hazardous chemicals on site and their material safety data sheets.

b. Failure to perform the above duties will result in dismissal of the superintendent and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

3.1.6 TRAINING

3.1.6.1 NEW EMPLOYEE INDOCTRINATION

a. New employees (prime and sub-contractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

b. The AHA shall be presented to workers performing the activity in their native language, either in writing or by a qualified interpreter and documentation of the presentation proven via signature of the worker(s).

3.1.6.2 PERIODIC TRAINING

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

3.1.6.3 TRAINING ON ACTIVITY HAZARD ANALYSIS (AHA)

Prior to beginning a new phase, training will be provided to all personnel on the worksite according to the Activity Hazard Analysis (AHA)

3.2 DAILY TOOLBOX SAFETY MEETINGCONSTRUCTION AND / OR OTHER WORK

a. Before initiation of work at the job site, an Accident Prevention Plan (APP), written by the Contractor for the specific work and hazards of the contract and implementing in detail the pertinent requirements of EM 385-1-1, will be reviewed and found acceptable by designated Government personnel. Specific requirements for development of the accident prevention plan are found in sections 01.A and Appendix A of EM 385-1-1.

b. Before beginning each activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform the work, activity hazard analysis (AHA) shall be prepared by the Contractor performing the work activity. See paragraph 01.A.13 of EM 385-1-1.

c. The Contractor shall require subcontractors to submit their plan of operations showing methods they propose to use in accomplishing major phases of work.

d. The Contractor shall be prepared to discuss the plans in conferences convened by the Contracting Officer prior to starting work on each major phase of operation. Plans shall include all pertinent information such as layout of haul roads, access roads, storage areas, electrical transmission and distribution lines, methods of providing minimum exposure to overhead loads, and methods of access to work areas. The plan for accomplishing the initial work phase shall be submitted within 15 calendar days after

award of the contract. Plans for subsequent major phases of work shall be submitted not later than 15 calendar days prior to initiation of work on each major phase.

e. All areas where construction, demolition, alteration, building, or similarly related activities take place, all workers shall have the following minimum personal protective clothing and equipment:

1. Short sleeve shirt;

2. Long trousers;

3. Steel-toed safety boots;

4. Hard hat;

5. Eye protection / Safety glasses;

6. Reflective Vests;

7. Gloves, as needed; and

8. Hearing Protection, as needed.

3.2.1 HAZARDOUS MATERIALS

Comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

3.2.1.1 HAZARDOUS MATERIAL EXCLUSIONS

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. The Radiation Safety Officer (RSO) must be notified prior to excepted items of radioactive material and devices being brought on base.

3.2.1.2 UNFORESEEN HAZARDOUS MATERIAL

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e.29 CFR Part 1910.1000). If additional material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to contract clauses.

3.3 CONTROL OF HAZARDOUS ENERGY

3.3.1 GENERAL

a. Contractor shall ensure that each employee is familiar with and complies with these procedures and USACE EM 385-1-1, Section 12, Control of Hazardous Energy.

b. The Contractor shall, at the Contracting Officer’s request, apply lockout/tag out tags and take other actions that, because of experience and knowledge, are known to be necessary to make the particular equipment safe to work on for government owned and operated systems. No person, regardless of position or authority, shall operate any switch, valve, or equipment that has an official lockout/tag out tag attached to it, nor shall such tag be removed except as allowed by this section.

c. No person shall work on any energized equipment including, but not limited to activities such as erecting, installing, constructing, repairing, adjusting, inspecting, un-jamming, setting up, trouble shooting, testing, cleaning, dismantling, servicing and maintaining machines equipment of processes until an evaluation has been conducted identifying the energy source and the procedures which will be taken to ensure the safety of personnel. Only qualified personnel shall perform work on electrical circuits.

d. A supervisor who is required to enter an area protected by a lockout/tag out tag will be considered a member of the protected group provided he notifies the holder of the tag stub each time he enters and departs from the protected area. Identification markings on building light and power transmission and distribution circuits shall not be relied on for established safe work conditions.

e. Before clearance will be given on any equipment other than electrical (generally referred to as mechanical apparatus), the apparatus, valves, or systems shall be secured in a passive condition with the appropriate vents, pins, and locks. Pressurized or vacuum systems shall be vented to relieve differential pressure completely. Vent valves shall be tagged open during the course of the work. Where dangerous gas or fluid systems are involved, or in areas where the environment may be oxygen deficient, system or areas shall be purged, ventilated, or otherwise made safe prior to entry.

3.3.2 TAG PLACEMENT

a. Lockout/tag out tags shall be completed in accordance with the regulation printed on the back thereof and attached to any device which, if operated, could cause an unsafe condition to exist. If more than one group is to work on any circuit or equipment, the employee in charge of each group shall have a separate set of lockout/tag out tags completed and properly attached.

b. When it is required that certain equipment be tagged, the Government will review the characteristics of the various systems involved that affect the safety of the operations and the work to be done; take the necessary actions, including voltage and pressure checks, grounding, and venting, to make the system and equipment safe to work on; and apply such lockout/tag out tags to those switches, valves, vents, or other mechanical devices

needed to preserve the safety provided. This operation is referred to as "Providing Safety Clearance."

3.3.3 TAG REMOVAL

When any individual or group has completed its part of the work and is clear of the circuits or equipment, the supervisor, project leader, or individual for whom the equipment was tagged shall turn in his signed lockout/tag out tag stub to the Contracting Officer. That group's or individual's lockout/tag out tags on equipment may then be removed on authorization by the Contracting Officer.

3.4 EXCAVATIONS

Perform soil classification by a competent person in accordance with 29 CFR 1926.

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect, and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly. All excavations shall conform to the requirements of Section 25 of EM 385-1-1.

3.4.1 UTILITY LOCATIONS

a. Prior to any excavation activities, the appropriate digging permit must be obtained.

b. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

c. All underground utilities discovered will be flagged a distance of one-half (1/2) meter on each side of the location, and any markings made during the utility investigation must be maintained throughout the contract.

d. Damage occurring to existing utilities, when the above procedures are not followed, will be repaired at the Contractor’s expense.

3.4.2 UTILITY LOCATION VERIFICATION

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 610 mm of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility expose the utility by hand digging every 30.5 m if parallel within 1.5 m of the excavation.

3.4.3 SHORING SYSTEMS

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on-site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.4.4 TRENCHING MACHINERY

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.5 UTILITIES WITHIN CONCRETE SLABS

Utilities located within concrete slabs or pier structures, bridges, and the like, are extremely difficult to identify due to the reinforcing steel used in the construction of these structures. Whenever contract work involves concrete chipping, saw cutting, or core drilling, the existing utility location must be coordinated with station utility departments in addition to a private locating service. Outages to isolate utility systems shall be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.5.1 WORK IN CONFINED SPACES

a. Contractors entering and working in confined spaces performing general industry work are required to follow the requirements of OSHA 29 CFR Part 1926.

b. USACE personnel entering and working in confined spaces performing non-maritime facility work are required to follow the requirements of OPNAVINST 5100.23G Chapter 27.

c. Comply with the requirements in Section 34 of USACE EM 385-1-1, OSHA 29 CFR 1910.146 and OSHA 29 CFR 1926.21(b)(6). Any potential for a hazard in the confined space requires a permit system to be used.

3.5.2 SIGNAGE

a. Provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces.

b. Signs shall read as follows:

"DANGER -- PERMIT-REQUIRED CONFINED SPACE -- DO NOT ENTER"

c. Provide in bold letters a minimum of 25 mm in height and constructed to be clearly legible with all paint removed.

d. The signal word "DANGER" shall be red and readable from 1520 mm.

3.5.3 PROCEDURES

a. The Contractor shall comply with the requirements in Section 34 of USACE EM 385-1-1. Any potential for a hazard in the confined space requires a permit system to be used.

b. Entry procedures shall prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 34 of USACE EM 385-1-1 for entry procedures.)

c. All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.

d. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.

e. Ensure the use of rescue and retrieval devices in confined spaces greater than 1.5 m in depth. Conform to Section 34 of USACE EM 385-1-1.

f. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

g. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 34 of USACE EM 385-1-1.

h. Daily Entry Permit shall be posted in a conspicuous place, close to the confined space entrance.

3.6 DEMOLITION

3.6.1 DEMOLITION PLAN

The Contractor shall submit a written demolition plan for all demolition work to be carried on the site. In addition, the demolition plan shall be signed by a Professional Registered Engineer and meet the requirements of the Corps of Engineers Safety and Health Manual, EM 385-1-1, section 23. The demolition plan shall be submitted to the Contracting Officer at least 1 week before the beginning of the work, including structural calculations for the demolition, if necessary. The demolition work shall not begin before the Contractor has received a written approval from the Contracting Officer.

3.6.2 PROTECTION OF PERSONNEL

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workers remove debris or perform other work in the immediate area.

3.6.3 PROTECTION OF STRUCTURES

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the COR. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

Interior concrete or masonry walls shall be demolished from the top down unless a Registered Engineer can demonstrate that an alternate method poses no additional safety hazards

3.7 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

3.7.1 GENERAL

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include: company policy; identify responsibilities; education and training requirements; fall hazard identification; prevention and control measures; inspection, storage; care and maintenance of fall protection equipment and rescue and evacuation procedures.

3.7.2 TRAINING

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. A competent person for fall protection shall provide the training. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.B.

3.7.3 FALL PROTECTION EQUIPMENT AND SYSTEMS

a. The Contractor shall enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21.

b. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, Paragraphs 21.N through 21.N.04. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase.

c. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ASSE/SAFE A10.32.

3.7.3.1 PERSONAL FALL ARREST EQUIPMENT

Personal fall arrest equipment, systems, subsystems, and components shall meet ASSE/SAFE Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabineers' shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m. The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

1.4.4 FALL PROTECTION FOR ROOFING WORK

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:

1. For work within 1.8 m of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

2. For work greater than 1.8 m from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

b. Steep Sloped Roofs:

1. Work on steep-sloped roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

3.7.5 ANCHORAGE

a. Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person for fall protection in accordance with ANSI Z359.1. Exiting horizontal lifeline anchorages shall be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

b. Leave in place fall protection anchorage, conforming to ASSE/SAFE Z359.1, installed under the supervision of a qualified person in fall protection, for continued customer use and so identified by signage stating the capacity of the anchorage (strength and number of persons who may be tied-off to it at any one time).

3.7.6 HORIZONTAL LIFELINES

Design, install, certify and use under the supervision of a qualified person horizontal lifelines for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.7.7 GUARDRAILS AND SAFETY NETS

Design, install and use guardrails and safety nets in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

3.7.8 RESCUE AND EVACUATION PROCEDURES

A Rescue and Evacuation Plan shall be prepared by the Contractor and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. The Rescue and Evacuation Plan shall be included in the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

3.8 SCAFFOLDING

a. Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access to scaffold platforms greater than 6 m in height shall be accessed by use of a scaffold stair system.

b. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 6 m in height. The use of an adequate gate is required.

c. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted Fall Protection and Prevention Plan.

d. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Special care shall be given to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills.

e. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above 1.8 m or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.9 FALLING OBJECT PROTECTION

All areas must be barricaded to safeguard employees. When working overhead, barricade the area below to prevent entry by unauthorized employees. Construction warning tape and signs shall be posted so they are clearly

visible from all possible access points. When employees are working overhead all tools and equipment shall be secured so that they will not fall. When using guardrail as falling object protection, all openings shall be small enough to prevent passage of potential falling objects.

3.10 EQUIPMENT

3.10.1 MATERIAL HANDLING EQUIPMENT

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.10.2 WEIGHT HANDLING EQUIPMENT

a. Cranes and derricks shall be equipped as specified in EM-385-1-1 section 16.

b. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.

c. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.

d. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and follow the requirements of USACE EM 385-1-1 Section 11 and ASME B30.5, or ASME B30.22, as applicable.

e. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.

f. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves to the satisfaction of the Contracting Officer that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

g. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.

h. All employees shall be kept clear of loads about to be lifted and of suspended loads.

i. The Contractor shall use cribbing when performing lifts on outriggers.

j. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

k. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

l. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

m. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

n. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

o. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. Prior to conducting lifting operations the contractor shall set a maximum wind speed at which a crane can be safely operated based on the equipment being used, the load being lifted, experience of operators and riggers, and hazards on the work site. This maximum wind speed determination shall be included as part of the activity hazard analysis plan for that operation.

3.10.3 MECHANIZED EQUIPMENT

a. Proof of qualifications for operator shall be kept on the project site for review.

b. Manufacture specifications, or owner's manual for the equipment, shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

3.10.4 EXPLOSIVES

Explosives of any kind are not allowed under any circumstances under this Contract within the ANSF Installation.

3.11 CRYSTALLINE SILICA

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with USACE EM 385-1-1, Appendix 06.H. The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.12 ELECTRICAL

3.12.1 CONDUCT OF ELECTRICAL WORK

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable

identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers will be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

3.12.2 PORTABLE EXTENSION CORDS

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. Immediately removed from service all damaged extension cords. Portable extension cords shall meet the requirements of NFPA 70E and OSHA electrical standards.

3.13 CLEANING

a. The Contractor shall be responsible for cleaning up. The Contractor shall require his personnel to keep the immediate work site clean of all dirt and debris resulting from work under this contract. Accumulated dirt and debris shall be hauled off and disposed of in accordance with local law and at least once a week by the Contractor. Additionally, all debris in work areas shall be cleaned up daily or more frequently if necessary. Construction debris may be temporarily located in an approved location; however garbage accumulation must be removed each day.

b. Stairwells used by the Contractor during execution of work shall be cleaned daily. Cloths, mops, and brushes containing combustible materials shall be disposed of or stored outside of the buildings in tight covered metal containers. Paints and thinners shall not be poured into inlets of the interior or exterior sewage system. Paint, stains, and other residues on adjacent surfaces or fixtures caused by the Contractor shall be carefully removed and cleaned to original finish. Upon completion of the work, the Contractor shall remove all construction equipment, materials and debris resulting from the work. The entire work site and the area used by Contractor personnel shall be left clean.

-- END OF SECTION --

US Army Corps of Engineers

USACE PRIME CONTRACTOR
Monthly Record of Work-Related Injuries/Illnesses & Exposure

Month _____
Year _____

In accordance with the provisions of EM 385-1-1, Section 01 Program Management, Paragraph 01.D Accident Reporting and Recording, sub-paragraphs 01.D.05, you (the Prime Contractor) shall provide a monthly record of all exposure and accident experience incidental to the work (this includes exposure and accident experience of the Prime Contractor and its sub-contractor(s). As a minimum , these records shall include exposure work hours and a record of occupational injuries and illnesses that include the data elements listed below. Definitional criteria for each data element is found in 29 CFR Part 1904. If the maintenance of OSHA 300 Logs are required by OSHA, most of this information can be obtained from those logs. If data on log provided below is revised after it is submitted to USACE, Contractor shall provide a revised report to the GDA. You must complete the USACE ENG Form 3394, Report of Accident Investigation Report for all recordable accidents. If you're not sure whether a case is recordable, call your local Safety and Occupational Health Office for help.

USACE Command _____
Contractor Name _____
Contract Number _____
Project Title _____
City _____ **State** _____
USACE Office Overseeing Work:

Identify the person							Describe The Case		Classify the case													
(A)		(B1)	(B2)	(B3)	(C)	(D)	(E)	(F)	Using these categories, check ONLY the most serious result for each case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:							
															(M)							
Company Name	Prime or Sub (P or S)	Age	Gender	Date Employee Began Work on Job Covered by Contract	Job Title (e.g., Welder)	Date of injury or onset of illness (mo./day)	Where the event occurred (e.g. Loading dock north end)	Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death	Days away from work	Remained at work: Job transfer or restriction	Remained at work: Other record-able cases	On job transfer or restriction (days)	Away from work (days)	Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other Illnesses
									(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
									0	0	0	0	0	0	0	0	0	0	0	0

For Government Use Only

TYPE OF WORK ACTIVITY (Choose One):

Construction		Environmental Remed.	
Opn & Main.		Superfund	
Eng. Services		FUDS	
Dredging		IRP	
Rsch. & Dev.		FUSRAP	
Emerg. Opns.		Ordinance/Expl. Cleanup	
Other		Environmental Other	

Type of Contract (Choose One):

Civil Works	
Military Programs	
Other	

Exposure Hours	
Month	
Year to Date	

Certification of Record	
Name of Person Submit. Record	
Signature	
Date	

Page ___ of ___

HOT-WORK PERMIT

For use of this form, see AR 420-90; the proponent agency is ACSIM

1. LOCATION	2. DATE	3. PERMIT NO.
4. TYPE OF WORK	5. START TIME	6. FINISH TIME
7.a. NAME OF PERSON RESPONSIBLE FOR HOT-WORK AT JOB SITE *(Contractor/Government Employee)*	7.b. SIGNATURE	

PRECAUTIONS BEFORE OPERATIONS

CHECKLIST	CHECK ONE	
	YES	NO
8. Did Fire Department Inspector inspect site?		
9. Are there procedures for Fire Department emergency notification? *(Emergency No.)*		
10. Are combustibles in area noted?		
11. Should combustibles be covered? *(If yes, note in remarks)*		
12. Are proper extinguishers on hand?		
13. Is wet-down necessary? *(If yes, note in remarks)*		
14. Is smoking permissible at work sites?		
15. Is continuous fire watch required?		
16. Is Fire Department standby required?		
17. Are other precautions required? *(If yes, note in remarks)*		

18.a. FIRE DEPARTMENT INSPECTOR'S SIGNATURE	18.b. DATE

PRECAUTIONS AFTER OPERATIONS

CHECKLIST	CHECK ONE	
	YES	NO
19.a. Was Fire Department notified after hot-work operation was completed?		
19.b. Time:		
20.a. Did Fire Department inspector inspect work site?		
20.b. Time:		
21. Are after work conditions safe? *(If no, note in remarks)*		
22. Are heat producing devices safe if left at work site?		

23.a. FIRE DEPARTMENT INSPECTOR'S SIGNATURE	23.b. DATE

24. REMARKS

NOTE: PERMIT VALID ON DAY OF OPERATION AT ONE LOCATION ONLY

DA FORM 5383-R, SEP 92 EDITION OF JAN 85 IS OBSOLETE USAPPC V1.00

SECTION 01 35 53

SECURITY

1.1 SPECIFIC CONTRACT SECURITY ASSESSMENT

The Contractor will construct the Project in an active war zone where International Security Assistance Forces (ISAF) may conduct offensive and defensive operations against a variety of hostile forces, to include members of the Taliban. The Contractor understands that it may not receive any support whatsoever in securing the Project site and in securing the transportation of materials to the Project site. Neither U.S. Government nor other ISAF forces are available to provide exclusive security for the Project. The Contractor is responsible for securing the Project site and in securing the transportation of materials to the Project site. The Contracting Officer possesses no ability to control the operations of either ISAF or hostile forces. The Government, acting in its sovereign capacity in its prosecution of its operations, may take actions which directly or indirectly affect the Contractor. These kinds of acts are general in application, not specifically directed at the Contractor. The Contractor recognizes that such actions may be taken, and that they will not entitle the Contractor to make claims for excusable or compensable delays. The Contractor possesses sufficient information about the specific security situation at the site to enable it to formulate an appropriate security plan. The Contractor understands that the security situation at the Project is subject to significant transformation in a short time span based on the changing operational picture in the region. The Contractor’s security plan will take this factor into account.

1.2 GOVERNMENT PREREQUISITES TO CONTRACTOR DEPLOYMENT OF SITE SECURITY PERSONNEL

The following regulations and policies apply to Contractor-Provided Site Security Personnel:

a. DODI 3020.41; Contractor Personnel Authorized to Accompany the U.S. Armed Forces; 3 OCT 2005 (available at www.dtic.mil/whs/directives/corres/pdf/302041p.pdf).

b. DODI 3020.50; Private Security Contractors (PSCs) Operating in Contingency Operations; 22 JUL 2009 (available at www.dtic.mil/whs/directives/corres/pdf/302050p.pdf).

c. USCENTCOM Contracting Command, Acquisition Instruction; 5 NOV 2010 (available at http://c3-training.net/policy.html).

d. DFARS Subpart 225.74, Defense Contractors Outside the United States. The Contractor understands its responsibilities under these regulations, policies, and standard contract clauses, as well as its responsibilities under Afghan law, with regard to its contracts for and employment of security personnel. The Contractor is not authorized to deploy any site security personnel until it complies with all prerequisites identified in these references. The Contractor acknowledges that its repeated failure to comply with these regulations, policies, and standard contract clauses constitute grounds for the Government to terminate the Contractor for default.

1.3 GOVERNMENT REPRESENTATIVES

During the Project, USACE may disseminate essential security information to the Contractor and will attempt to assist with any Contractor's questions and concerns. The USACE Area Office OIC/NCOIC will serve as the Area Office Security Officer and the Resident Office OIC/NCOIC will serve as the Resident Office Security Officer (collectively "the Security Officers").

1.4 SECURITY COORDINATION

Contractor will be required to coordinate construction site security with any Afghan or Coalition Forces and Local Governments that are available, if any, to assist the Contractor on a case-by-case basis. Coordination does not include nor imply making any unauthorized or illegal payments to the local ANA/ANP or Local/Provincial Government Officials for permission or protection to construct the project. The Contractor will immediately inform the Government if asked to make any such payments, and the Government will provide further direction to the Contractor. Corruption will not be tolerated at any level, under any circumstances. Conducting business in this manner will be grounds for termination of the contract.

1.5 SECURITY PLAN

The Security Officers will review and approve all current and future Contractor security plans prior to submittal approval by the authorized representative of the Contracting Officer. The Security Officers shall ensure that all Contractor security plans are in accordance with the Contract requirements. The security plans shall address movement of Contractor labor, material, and equipment. The Security Officers will lead the quality assurance program to ensure Contractors are executing their approved security plans. The Government will not allow the Contractor to start work on the Project site without an approved security plan.

1.5.1 Security Rating

Each contract or task order will be assigned a rating by the Area Office Security Officer. This rating will determine the level of approval for the security plan. Assistance from the District's J2/J3 may be required to assess the rating. Ratings and approval levels are below:

a. Extremely High Risk: District Commander

b. High Risk: Deputy CDR, Chief of E&C, Area OIC, J2 OIC, or J3 OIC

c. Moderate Risk: Chief of Construction, Area OIC/NCOIC, or Area Engineer

d. Low Risk: Resident OIC/NCIOC, Resident Engineer

The rating assigned is in no way an indication that the security situation at the site will remain at a constant level throughout the Project.

1.5.2 Site Security for Projects Outside of Active Coalition Force Bases

The Contractor shall develop a site security plan and program to provide 24 hr/7 days a week security for the Project throughout its performance. The security plan must consider all construction-related sites; batch plants,

material sources, stockpiles, worker camps and any other location where there is a major construction effort. The plan must also address security as it relates to the transportation of materials, equipment, personnel, and other items and individuals to the site. The Contractor is expected to perform all required actions to protect the construction site compound from theft and vandalism and personnel from physical harm. These measures are strictly for the protection and defense of the on-site people and property; Contractors are not authorized to conduct any type of offensive operations. For security of road construction, transportation of supplies, and equipment convoys, see the appropriate section below. The Contractor will be relieved of providing security for a completed section of transmission line and tower structures from vandalism only. Completed sections shall consist of double dead end towers (usually 4-6 km apart) and shall be 100 percent physically constructed. This does not relieve the Contractor from testing and commissioning which shall be performed prior to contract completion. Submit for approval a request for release of security for each completed section to the Contracting Officer.

1.5.3 Estimated Threat Assessment

The Contractor is expected to develop a site security plan to cover a range of security operations from low to high threat. Included in this security plan will be the capability for a surge of manpower and equipment required during high threat conditions. The Contractor is expected to notify all on-site personnel of increased threats and protective action to take.

1.5.4 Additional Civilian Arming Requirements

The Contractor must include in its security plan, and must continue to maintain throughout the Project, current information on the following items for all its armed civilian personnel: MOI license number, AISA license, armed Contractor & subcontractor company names, contract number/title, contracting agency (USACE-AES), type of work, number/type of weapons authorized, POC for company with contact details, Government Contracting Officer and COR with contact details, number of security personnel by type (U.S., Afghan, Other), company’s country of registration/origin, names, photos, and tazkira numbers of security personnel as well as those personnel with access to weapons/ammo and those persons who will be handling or transporting explosives. In addition the Contractor will immediately update any change to the coordinates of the Contractor’s base camps, quarries, and current work locations. The Contractor shall submit, prior to the commencement of construction, a plan for security protection, with a list of the chain of command. Perimeter security shall prevent unauthorized site access and provide safety protection to the Contractor workforce and government personnel for the duration of the project.

1.6 SECURITY PLAN SUBMITTAL REQUIREMENTS

Contractors will submit all security plans in accordance with contract Section 01 33 05 SUBMITTAL PROCEDURES FOR DESIGN-BUILD PROJECTS.

1.7 COMMUNICATION

The Contractor will operate a 24/7 security operations center with communication capability to each guard on duty and the ability to notify all on-site personnel of increased threats and protective actions to take. The operations center will also have 24/7 communication with the local Coalition,

ANA, or ANP security forces. The Contractor shall have communication with the Resident Office Security Officer at all times for rapid emergency response; the Resident Office Security Officer will give the Contractor the District J2/J3 contact information. Communication can be via cell phone, email, satellite phones, VHF, HF, CODAN, text, or other communication technologies compatible with the Government's capabilities. The Contractor will provide the Government with their contact information (names, numbers, frequencies, email addresses, transponder IDs, etc.) for the site encompassing all available communication means.

1.8 CONTRACTOR PROVIDED EQUIPMENT

The Contractor will provide the operational security equipment including but not limited to weapons, radios, uniforms, vehicles, vehicle fuel, phones, and other equipment as proposed by the Contractor to provide complete site security.

1.9 CRITICAL INFORMATION TO REPORT

The Government is responsible for the management and oversight of DOD Contracted AC/PSCs delivering services throughout Afghanistan. Given the impact of either Contractor misbehavior or catastrophic attacks against Contractors, it is critical that information regarding AC/PSC incidents is communicated quickly and accurately to the Government for purposes of management, fact-finding, and mitigation where necessary. The Government must receive the information addressed below. The Contractor will report any of these information requirements immediately to the Resident Office Security Officer:

a. AC/PSC Escalation of Force to include the use of weapons resulting in the death or injury of an Afghan citizen, coalition, or U.S. service member, other government official, or Contractor

b. AC/PSC accidents, traffic, or otherwise, resulting in the death or injury of an Afghan citizen, coalition, or U.S. service member, governmental official, or Contractor.

c. Attacks against AC/PSC activities by Anti-Afghan Forces resulting in the death or injury of an Afghan citizen, coalition or US service member, governmental official, or Contractor.

d. Reports of "lost convoys." These are AC/PSC escort or independent activities which have lost contact with their companies.

e. AC/PSC Escalation of Force, accidents, or other activities that result in significant damage to Afghan or USG vehicles, materials or facilities.

f. Anti-Afghan Force actions including small arms fires (SAF), RPG fire, indirect fire (IDF), improvised explosive devices (IEDs), and/or complex attacks against AC/PSC activities. Contractor accidental or negligent discharge of a weapon.

--End of Section--

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1819 L Street, NW, 6th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: info@ansi.org
Internet: http://www.ansi.org/

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191-4400
Ph: 703-295-6300 - 800-548-2723
Fax: 703-295-6333
E-mail: member@asce.org
Internet: http://www.asce.org

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)
1800 East Oakton Street
Des Plaines, IL 60018-2187
Ph: 847-699-2929
Fax: 847-768-3434

E-mail: customerservice@asse.org
Internet: http://www.asse.org

ASME INTERNATIONAL (ASME)
Three Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-854-7179 or 800-843-2763
Fax: 212-591-7674
E-mail: infocentral@asme.org
Internet: http://www.asme.org

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9585
Fax: 610-832-9555
E-mail: service@astm.org
Internet: http://www.astm.org

BRITISH STANDARDS INSTITUTE (BSI)
389 Chiswick High Road
London W4 4AL
United Kingdom
Ph: +44 (0)20 8996 9001
Fax: +44 (0)20 8996 7001
E-mail: cservices@bsi-global.com or info@bsigroup.com
Internet: http://www.bsi-group.com

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)
1600 Clifton Road
Atlanta, GA 30333
Ph: 404-639-3311 or 800-232-4636
E-mail: cdcinfo@cdc.gov
Internet: http://www.cdc.gov

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 Hoes Lane or 2001 L Street, NW. Suite 700
Piscataway, NJ 08855-1331 or Washington, DC 20036-4910 USA
Ph: 732-981-0060 or 800-701-4333
Fax: 732-562-6380
E-mail: onlinesupport@ieee.org or ieeeusa@ieee.org
Internet: http://www.ieee.org

INTERNATIONAL CODE COUNCIL (ICC)
5360 Workman Mill Road
Whittier, CA 90601
Ph: 1-888-422-7233
Fax: 562-908-5524
E-mail: webmaster@iccsafe.org
Internet: www.iccsafe.org

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
3, rue de Varembe, P.O. Box 131
CH-1211 Geneva 20, Switzerland
Ph: 41-22-919-0211
Fax: 41-22-919-0300
E-mail: custserv@iec.ch

Internet: http://www.iec.ch

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
1, ch. de la Voie-Creuse
Case Postale 56
CH-1211 Geneve 20 Switzerland
Ph: 41-22-749-01-11
Fax: 41-22-733-34-30
E-mail: central@iso.ch
Internet: http://www.iso.org

INTERNATIONAL TELECOMMUNICATION UNION (ITU)
For documents not available from Dept of Commerce:
Sales Service
International Telecommunication Union
Place des Nations
CH-1211 Geneve 20 Switzerland
Ph: 41-22-730-5852
Fax: 41-22-733-5853
E-mail: itumail@itu.int
Internet: http://www.itu.int

For documents available from Dept of Commerce:
U.S. Dept of Commerce
National Technical Information Service (NTIS)
5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6050 or 1-888-584-8332
FAX: 703-605-6887
E-mail: info@ntis.gov
Internet: http://www.ntis.gov

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
Superintendent of Documents at
U.S. Government Printing Office
732 North Capitol Street, NW
Washington, DC 20401-0001
Ph: 202-783-3238
Fax: 202-512-1800
E-mail: ContactCenter@gpo.gov
Internet: http://www.gpo.gov/help

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 617-770-3000 or 800-344-3555
Fax: 617-770-0700
E-mail: webmaster@nfpa.org
Internet: http://www.nfpa.org

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)
Mail Stop C-34
4676 Columbia Parkway
Cincinnati, OH 45226
Ph: 513-533-8611
Fax: 513-533-8285
E-mail: nioshdocket@cdc.gov

Internet: http://www.cdc.gov/nchs/products.htm

U.S. ARMY CORPS OF ENGINEERS (USACE)
Order CRD-C DOCUMENTS from:
Headquarters Points of contact
441 G Street NW
Washington, DC 20314-1000
Ph: 202-761-0011
E-mail: hq-publicaffairs@.usace.army.mil
Internet: http://www.wes.army.mil/SL/MTC/handbook.htm
Order Other Documents from:
USACE Publications Depot
Attn: CEHEC-IM-PD
2803 52nd Avenue
Hyattsville, MD 20781-1102
Ph: 301-394-0081
Fax: 301-394-0084
E-mail: pubs-army@usace.army.mil
Internet: http://www.publications.usace.army.mil/

U.S. Code
Office of the Law Revision Counsel
Internet: http://uscode.house.gov/lawrevisioncounsel.shtml

U.S. DEPARTMENT OF STATE (SD)
2201 C Street, NW
Washington, DC 20520
Ph: 202-647-4000
Internet: http://www.state.gov

U.S. DEPARTMENT OF TRANSPORTATION (DOT)
1200 New Jersey Ave. SE
Washington, DC 20590
Ph: 202-366-4000
Internet: http://www.dot.gov

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
8601 Adelphi Road
College Park, MD 20740-6001
Ph: 866-272-6272
Fax: 301-837-0483
E-mail: contactcenter@gpo.gov
Internet: http://www.archives.gov
Order documents from:
Superintendent of Documents
U.S.Government Printing Office (GPO)
732 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: http://www.gpoaccess.gov

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not used

SECTION 01 42 15

METRIC MEASUREMENTS

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 E 621(1994e1; R 1999) Use of Metric (SI) Units in Building Design and Construction (Committee E-6 Supplement to E380)

IEEE/ASTM SI 10(2002) American National Standard for Use of the International System of Units (SI): The Modern Metric System

1.2 GENERAL

This project includes metric units of measurements. The metric units used are the International System of Units (SI) developed and maintained by the General Conference on Weights and Measures (CGPM); the name International System of Units and the international abbreviation SI were adopted by the 11th CGPM in 1960. A number of circumstances require that both metric SI units and English inch-pound (I-P) units be included in a section of the specifications. When both metric and I-P measurements are included, the section may contain measurements for products that are manufactured to I-P dimensions and then expressed in mathematically converted metric value (soft metric) or, it may contain measurements for products that are manufactured to an industry recognized rounded metric (hard metric) dimensions but are allowed to be substituted by I-P products to comply with the law. Dual measurements are also included to indicate industry and/or Government standards, test values or other controlling factors, such as the code requirements where I-P values are needed for clarity or to trace back to the referenced standards, test values or codes.

1.3 USE OF MEASUREMENTS IN SPECIFICATIONS

Measurements in specifications shall be either in SI or I-P units as indicated, except for soft metric measurements or as otherwise authorized. When only SI or I-P measurements are specified for a product, the product shall be procured in the specified units (SI or I-P) unless otherwise authorized by the Contracting Officer. The Contractor shall be responsible for all associated labor and materials when authorized to substitute one system of units for another and for the final assembly and performance of the specified work and/or products.

1.3.1 Hard Metric

A hard metric measurement is indicated by an SI value with no expressed correlation to an I-P value. Hard metric measurements are often used for field data such as distance from one point to another or distance above the

floor. Products are considered to be hard metric when they are manufactured to metric dimensions or have an industry recognized metric designation.

1.3.2 Soft Metric

a. A soft metric measurement is indicated by an SI value which is a mathematical conversion of the I-P value shown in parentheses (e.g. 38.1 mm (1-1/2 inches)). Soft metric measurements are used for measurements pertaining to products, test values, and other situations where the I-P units are the standard for manufacture, verification, or other controlling factor. The I-P value shall govern while the metric measurement is provided for information.

b. A soft metric measurement is also indicated for products that are manufactured in industry designated metric dimensions but are required by law to allow substitute I-P products. These measurements are indicated by a manufacturing hard metric product dimension followed by the substitute I-P equivalent value in parentheses (e.g., 190 x 190 x 390 mm (7-5/8 x 7-5/8 x 15-5/8 inches)).

1.3.3 Neutral

A neutral measurement is indicated by an identifier which has no expressed relation to either an SI or an I-P value (e.g., American Wire Gage (AWG) which indicates thickness but in itself is neither SI nor I-P).

1.4 COORDINATION

Discrepancies, such as mismatches or product unavailability, arising from use of both metric and non-metric measurements and discrepancies between the measurements in the specifications and the measurements in the drawings shall be brought to the attention of the Contracting Officer for resolution.

1.5 RELATIONSHIP TO SUBMITTALS

Submittals for Government approval or for information only shall cover the SI or I-P products actually being furnished for the project. The Contractor shall submit the required drawings and calculations in the same units used in the contract documents describing the product or requirement unless otherwise instructed or approved. The Contractor shall use IEEE/ASTM SI 10 and ASTM E 621 as the basis for establishing metric measurements required to be used in submittals.

-- End of Section --

SECTION 01 45 00

QUALITY CONTROL

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 D 3740(2010)	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329(2009)	Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-1-12	(2006; Change 1) Engineering and Design -- Quality Management

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all associated costs will be included in the applicable Bid Schedule unit or lump-sum prices.

1.3 Submittals

Government approval is required for submittals with a "G" designation.

SD-01 Preconstruction Submittals

Quality Control Plan; G

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system in compliance with the Contract Clause titled "Inspection of Construction." QC consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. Cover all design and construction

operations, both onsite and offsite, and be keyed to the proposed design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent must maintain a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 QUALITY CONTROL PLAN

Submit no later than 14 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The Government will consider an interim plan for the first 30 days of operation. Design and construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

3.2.1 Content of the CQC Plan

Include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, designers of record, consultants, architect/engineers (AE), fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager who reports to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Copies of these letters must be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, designers of record, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 01 33 05 SUBMITTAL PROCEDURES FOR DESIGN-BUILD PROJECTS.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and

person responsible for each test. (Laboratory facilities approved by the Contracting Officer must be used.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.2 Additional Requirements for Design Quality Control (DQC) Plan

The following additional requirements apply to the Design Quality Control (DQC) plan:

a. Provide and maintain a Design Quality Control (DQC) Plan as an effective quality control program which will assure that all services required by this design-build contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, all documents must be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product shall not perform the independent technical review (ITR). Correct errors and deficiencies in the design documents prior to submitting them to the Government.

b. Include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Include review and correction periods associated with each item. This should be a forward planning as well as a project monitoring tool. The schedule reflects calendar days and not dates for each activity. If the schedule is changed, submit a revised schedule reflecting the change within 7 calendar days. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit at each design phase as part of the project documentation these completed checklists. ER 1110-1-12 provided some useful information in developing checklists.

c. Implement the DCQC Plan by an Design Quality Control Manager who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated. This individual must

be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. Notify the Contracting Officer, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

The Contracting Officer will notify the Contractor in writing of the acceptance of the DQC Plan. After acceptance, any changes proposed by the Contractor are subject to the acceptance of the Contracting Officer.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Postaward Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 5 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and the Contracting Officer and will become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager, a Design Quality Manager, and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager must receive direction and authority from the CQC System Manager and serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff must maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff will

be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization who is responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager must have a Bachelor’s degree in Engineering or Sciences, with a minimum of 5 years as a CQCSM or Superintendent, with a minimum of 2 of those five years on high voltage electrical projects of at least 220 kV involving substations and transmission lines. This CQC System Manager must be on the site at all times during construction and be employed by the prime Contractor. The CQC System Manager must be assigned no other duties. Identify in the plan an alternate to serve in the event of the CQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, civil, structural, submittals clerk. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan.

Experience Matrix

Area	Qualifications
Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 yrs related experience
Electrical	Graduate Electrical Engineer from Internationally accredited university, with 2 yrs of field experience working directly with transmission/distribution line and substation construction in the field.
Structural	Graduate Civil Engineer (with Structural Track or Focus) or Construction Manager

	with 2 yrs experience or person 5 years of experience supervising structural features of work in the field with a construction company
Submittals	Submittal Clerk with 2 yr experience
Concrete, Pavements and Soils	Materials Technician with 2 yrs experience for the appropriate area
Design Quality Control Manager	Registered Architect or Professional Engineer licensed in one of the states of the United States of America (or other recognized licensure process from the U.S. or another country through which an engineer becomes authorized to provide professional services to the public), with 2 yrs of field experience working directly with transmission/distribution line and substation construction in the field.

3.4.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager must have completed the course entitled "Construction Quality Management For Contractors". This course is periodically offered at the Construction Trades Training Center (CTTC) in Jalalabad. For enrollment, contact the following:

Mhd. Haris
mharis@afghanreconstruction.org
0700 08 0602

Or

Pervaiz
adpzmuj@yahoo.com
0700 61 3133

Classes are currently offered twice per month but for current schedules, the Contractor is advised to contact CTTC for enrollment.

3.4.5 Organizational Changes

Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, must comply with the requirements in Section 01 33 05 SUBMITTAL PROCEDURES FOR DESIGN-BUILD PROJECTS. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control must be conducted by the CQC System Manager for each definable feature of the construction work as follows:

3.6.1 Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, there are no outstanding RFI’s regarding feature of work, and after copies are at the work site. This phase includes:

a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.

b. Review of the contract drawings.

c. Check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. Review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Discussion of the initial control phase.

k. The Government must be notified at least 72 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government must be notified at least 72 hours in advance of beginning the initial phase. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. Procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing

laboratory at the project site. Perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel must meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $3000 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Conduct an inspection of the work by the CQC Manager near the end of the work, or any increment of the work established by a time stated in the

SPECIAL CONTRACT REQUIREMENTS Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications, as required by paragraph DOCUMENTATION. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph must be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative must be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notify the Contracting Officer at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

Maintain current records providing factual evidence that required quality control activities and/or tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

g. Offsite surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Review (ITR) team, the ITR review comments, responses and the record of resolution of the comments.

k. Contractor's verification statement.

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. Furnish the original and one copy of these records in report form to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days must be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports must be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

--End of Section--

CONTRACTOR PRODUCTION REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

CONTRACT NO: Enter Cnt# Here	TITLE AND LOCATION: Enter Title and Location of Construction Contract Here	DATE: Enter Date (DD/MMM/YY)
		REPORT NO: Enter Report # Here
CONTRACTOR: Enter The Contractor's Company Name Here	SUPERINTENDENT: Enter Superintendent's Name Here	

AM WEATHER	PM WEATHER	MAX TEMP (F)	MIN TEMP (F)
Enter AM Weather Data Here	Enter PM Weather Data Here	Enter Max Temp Here	Enter Min Temp Here

WORK PERFORMED TODAY

Schedule Activity No.	WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

JOB SAFETY

WAS A JOB SAFETY MEETING HELD THIS DATE? (If YES attach copy of the meeting minutes)	☐ YES	☐ NO	TOTAL WORK HOURS ON JOB SITE, THIS DATE, INCL CON'T SHEETS	
WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? (If YES attach copy of completed OSHA report)	☐ YES	☐ NO	CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT	
WAS CRANE/MANLIFT/TRENCHING/SCAFFOLD/HV ELEC/HIGH WORK/ HAZMAT WORK DONE? (If YES attach statement or checklist showing inspection performed.)	☐ YES	☐ NO		
WAS HAZARDOUS MATERIAL/WASTE RELEASED INTO THE ENVIRONMENT? (If YES attach description of incident and proposed action.)	☐ YES	☐ NO	TOTAL WORK HOURS FROM START OF CONSTRUCTION	

Schedule Activity No.	LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED	☐ SAFETY REQUIREMENTS HAVE BEEN MET.

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB (INDICATE SCHEDULE ACTIVITY NUMBER)

Schedule Activity No.	Submittal #	Description of Equipment/Material Received

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY. INDICATE HOURS USED AND SCHEDULE ACTIVITY NUMBER.

Schedule Activity No.	Owner	Description of Construction Equipment Used Today (incl Make and Model)	Hours Used

Schedule Activity No.	REMARKS

CONTRACTOR/SUPERINTENDENT DATE

CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE Enter (DD/MMM/YY)

REPORT NO Enter Rpt # Here

PHASE | CONTRACT NO Enter Cnt# Here | CONTRACT TITLE Enter Title and Location of Construction Contract Here

PREPARATORY

WAS PREPARATORY PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL PREPARATORY PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work	Index #

INITIAL

WAS INITIAL PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL INITIAL PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work	Index #

FOLLOW-UP

WORK COMPLIES WITH CONTRACT AS APPROVED DURING INITIAL PHASE? YES ☐ NO ☐

WORK COMPLIES WITH SAFETY REQUIREMENTS? YES ☐ NO ☐

Schedule Activity No.	Description of Work, Testing Performed & By Whom, Definable Feature of Work, Specification Section, Location and List of Personnel Present

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)

Schedule Activity No.	Description

REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

Schedule Activity No.	Description

REMARKS (Also Explain Any Follow-Up Phase Checklist Item From Above That Was Answered "NO"), Manuf. Rep On-Site, etc.

Schedule Activity No.	Description

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.

AUTHORIZED QC MANAGER AT SITE DATE

GOVERNMENT QUALITY ASSURANCE REPORT

DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

Schedule Activity No.	Description

GOVERNMENT QUALITY ASSURANCE MANAGER DATE

4296/2 (9/98) SHEET 1 OF 1

SECTION 01 45 05

QUALITY CONTROL SYSTEM (QCS)

PART 1 GENERAL

1.1 Contract Administration

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor must use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. The Contractor module, user manuals, updates, and training information can be downloaded from the RMS web site. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

Administration
Finances
Quality Control
Submittal Monitoring
Scheduling
Import/Export of Data

1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record will also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01 32 01.00 10 PROJECT SCHEDULE, Section 01 33 05 SUBMITTAL PROCEDURES, and Section 01 45 00 QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith will be included in the contract pricing for the work.

1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor will be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.3 SYSTEM REQUIREMENTS

See requirements on web site.

1.4 RELATED INFORMATION

1.4.1 QCS User Guide

After contract award, download instructions for the installation and use of QCS from the Government RMS Internet Website. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

1.4.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.5 CONTRACT DATABASE

Prior to the pre-construction conference, the Government will provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by using the Government's SFTP repository built into QCS import/export function. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.6 DATABASE MAINTENANCE

Establish, maintain, and update data in the QCS database throughout the duration of the contract at the Contractor's site office. Submit data updates to the Government (e.g., daily reports, submittals, RFI's, schedule updates, payment requests, etc.) using the Government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, e-mail or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA CD-ROM). The QCS database typically includes current data on the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

Contain within the database the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, deliver Contractor administrative data in electronic format.

1.6.1.2 Subcontractor Information

Contain within the database the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Assign each subcontractor/trade a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, deliver subcontractor administrative data in electronic format.

1.6.1.3 Correspondence

Identify all Contractor correspondence to the Government with a serial number. Prefix correspondence initiated by the Contractor's site office with "S". Prefix letters initiated by the Contractor's home (main) office with "H". Letters must be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

1.6.1.4 Equipment

Contain within the Contractor's QCS database a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.6.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Control checklists.

1.6.1.6 Request For Information (RFI)

Exchange all Requests For Information (RFI) using the Built-in RFI generator and tracker in QCS.

1.6.2 Finances

1.6.2.1 Pay Activity Data

Include within the QCS database a list of pay activities that the Contractor must develop in conjunction with the construction schedule. The sum of all pay activities must be equal to the total contract amount, including modifications. Group pay activities Contract Line Item Number (CLIN); the sum of the activities must equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.6.2.2 Payment Requests

Prepare all progress payment requests using QCS. Complete the payment request worksheet, prompt payment certification, and payment invoice in QCS. Update the work completed under the contract, measured as percent or as specific quantities, at least monthly. After the update, generate a payment request report using QCS. Submit the payment request, prompt payment certification, and payment invoice with supporting data using the Government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, e-mail or a CD-ROM may be used. A signed paper copy of the approved payment request is also required, which will govern in the event of discrepancy with the electronic version.

1.6.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements. Maintain this data on a daily basis. Entered data will automatically output to the

QCS generated daily report. Provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01 45 00 QUALITY CONTROL. Within seven calendar days of Government acceptance, submit a QCS update reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS must be the Contractor's official report. Summarize data from any supplemental reports by the Contractor and consolidate onto the QCS-generated Daily CQC Report. Submit daily CQC Reports as required by Section 01 45 00 QUALITY CONTROL. Electronically submit reports to the Government within 24 hours after the date covered by the report. Also provide the Government a signed, printed copy of the daily CQC report.

1.6.3.2 Deficiency Tracking.

Use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. Maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. Regularly update the correction status of both QC and QA punch list items.

1.6.3.3 QC Requirements

Develop and maintain a complete list of QC testing and required structural and life safety special inspections required by the International Code Council (ICC), transferred and installed property, and user training requirements in QCS. Update all data on these QC requirements as work progresses, and promptly provide this information to the Government via QCS.

1.6.3.4 Three-Phase Control Meetings

Maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.6.3.5 Labor and Equipment Hours

Log labor and equipment exposure hours on a daily basis. This data will be rolled up into a monthly exposure report.

1.6.3.6 Accident/Safety Reporting

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. Regularly update the correction status of the safety comments. In addition, utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 300.

1.6.3.7 Features of Work

Include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.6.3.8 Hazard Analysis

Use QCS to develop a hazard analysis for each feature of work included in the CQC Plan. Address any hazards, or potential hazards, that may be associated with the work.

1.6.4 Submittal Management

The Government will provide the initial submittal register in electronic format. Thereafter, maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. Use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update must be produced using QCS. QCS and RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.6.5 Schedule

Develop a construction schedule consisting of pay activities, in accordance with Section 01 32 01 PROJECT SCHEDULE. Input and maintain in the QCS database this schedule either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01 32 01 PROJECT SCHEDULE). Include with each pay request the updated schedule.

1.6.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data from RMS, and schedule data using SDEF.

1.7 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. Ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.8 DATA SUBMISSION VIA CD-ROM

The Government-preferred method for Contractor's submission of QCS data is by using the Government's SFTP repository built into QCS export function. Other data should be submitted using E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of CD-ROM for data transfer. Export data onto CDs using the QCS built-in export function. If used, submit CD-ROMs in accordance with the following:

1.8.1 File Medium

Submit in English required data on CD-ROM conforming to industry standards used in the United States.

1.8.2 CD-ROM Labels

Affix a permanent exterior label to each CD-ROM submitted. Indicate on the label in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.8.3 File Names

The files will be automatically named by the QCS software. The naming convention established by the QCS software must not be altered.

1.9 MONTHLY COORDINATION MEETING

Update the QCS database each workday. At least monthly, generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, meet with the Government representative to review the planned progress payment data submission for errors and omissions.

Make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

--End of Section--

SECTION 01 57 20

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

Minimize environmental pollution and damage that may occur as the result of construction operations. Environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable Afghanistan environmental laws and regulations. Any delays resulting from failure to comply with environmental laws and regulations shall be the Contractor's responsibility.

For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural, and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, land, and includes management of visual esthetics, noise, solid waste, and erosion from storm water, as well as pollutants.

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.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 260	Hazardous Waste Management System: General
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
40 CFR 68	Chemical Accident Prevention Provisions

1.2 DEFINITIONS

1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners, excess paints, excess solvents, waste solvents, and fuel / oils / lubricants.

1.2.4 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor must discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the waters of Afghanistan shall occur.

1.2.5 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers,creeks, and/or waters of Afghanistan and would require a permit to discharge water from the project.

1.2.6 Hazardous Material (HM)

The term “Hazardous Material” is used to define a useful product that requires special management because it has hazardous characteristics (ignitability, corrosivity, reactivity, or toxicity) that could pose dangers to human health or the environment. A HM becomes a Hazardous Waste when it can no longer be used for its intended purpose.

1.2.7 HAZARDOUS WASTE (HW)

The term “Hazardous Waste” is used to define a discarded material with properties that could pose dangers to human health or the environment. A HW either exhibits a hazardous characteristic or is specifically listed as a HW by the EPA or by the State.

1.2.8 Abbreviations And Acronyms

a. BACT Best Available Control Technology
b. BMP Best Management Practice
c. COR Contracting Officer's Representative
d. ECO Environmental Compliance Officer
e. HM Hazardous Material HW Hazardous Waste
f. HW Hazardous Waste

g. HWT Hazardous Waste Technician
h. KO Contracting Officer
i. PPE Personal Protective Equipment
j. USACE US Army Corps of Engineers

1.3 QUALITY ASSURANCE

1.3.1 Laws And Regulations

The Contractor shall comply with all applicable Afghanistan environmental, natural and cultural resources, and historic preservation laws and regulations.

1.3.2 Subcontractors

Ensure compliance with this section by subcontractors, suppliers, and vendors.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G, RO

Joint Condition Survey & Report; G, RO

1.5 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction activities or delivery of materials to the site, submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern must be defined within the Environmental Protection Plan as outlined in this section. Address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but are considered necessary, must be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan must be current and maintained onsite by the Contractor.

1.5.1 Compliance

No requirement in this Section will relieve the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor will be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

1.5.2 Contents

Include in the environmental protection plan, but not limit it to, the following:

a. Name(s) of the on-site Environmental Manager who is(are) responsible for ensuring adherence to the Environmental Protection Plan and monitoring and documenting environmental procedures.

b. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan must include monitoring and reporting requirements to assure that the control measures are effective.

c. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on the site.

d. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

e. Include in the Spill Control plan the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. Include in this plan, as a minimum:

(1) The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual will immediately notify the Contracting Officer if a reportable quantity is released to the environment. Include in the plan a list of the required reporting channels and telephone numbers.

(2) A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

(3) The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.

(4) The methods and procedures to be used for expeditious contaminant cleanup.

f. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

g. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

h. A contaminant prevention plan that identifies potentially hazardous substances to be used on the job site and identifies the intended actions to prevent introduction of such materials into the air, water, or ground. Update the plan as new hazardous materials are brought onsite or removed from the site.

i. A hazardous waste plan that identifies potentially hazardous waste that may be generated by the project.

j. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, decontamination water, hydrostatic test water, and water used in flushing of lines.

k. A historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on the project site; and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in the area are discovered during construction. Include in the plan methods to assure the protection of known or discovered resources, identifying lines of communication between Contractor personnel and the Contracting Officer.

1.5.3 Appendix

Attach to the Environmental Protection Plan, as an appendix, copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents.

1.6 JOINT CONDITION SURVEY & REPORT

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer will make a joint condition survey. Immediately following the survey, the Contractor will prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report will be signed by both the the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

1.7 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations from the drawings, plans and specifications, requested by the Contractor and which may have an environmental impact, will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.8 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with environmental, natural and cultural resources, and historic preservation laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. After receipt of such notice, the Contractor will inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or equitable adjustments allowed for any such suspensions.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 ENVIRONMENTAL PERMITS AND COMMITMENTS

Obtaining and complying with all environmental permits and commitments required by Afghanistan environmental, natural and cultural resources, and historic preservation laws and regulations.

3.2 LAND RESOURCES

Confine all activities to areas defined by the drawings and specifications. Identify any land resources to be preserved within the work area prior to the beginning of any construction. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval, except in areas indicated on the drawings or specified to be cleared. Ropes, cables, or guys will not be fastened to or attached to any trees for anchorage unless specifically authorized. Provide effective protection for land and vegetation resources at all times, as defined in the following subparagraphs. Remove stone, soil, or other materials displaced into uncleared areas.

3.2.1 Work Area Limits

Mark the areas that need not be disturbed under this contract prior to commencing construction activities. Mark or fence isolated areas within the general work area which are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. The Contractor's personnel must be knowledgeable of the purpose for marking and/or protecting particular objects.

3.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved must be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

3.2.3 Erosion and Sediment Controls

Providing erosion and sediment control measures is the Contractor's responsibility. Select and maintain the erosion and sediment controls such that water quality is not degraded as a result of the Contractor's construction activities. Construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as indicated on the drawings. BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. Remove any temporary measures after the area has been stabilized.

3.2.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities will be made only when approved. Erosion and sediment controls must be provided for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas must be controlled to protect adjacent areas.

3.2.5 Tree Protection

All costs associated with tree protection requirements required by specifications and drawings are the full responsibility of the Contractor. The Contractor shall exercise care when excavating trenches in the vicinity of trees.

3.3 WATER RESOURCES

Monitor all water areas affected by construction activities to prevent pollution of surface and ground waters. Monitor construction activities to prevent pollution of surface and ground waters. Do not apply toxic or hazardous chemicals to soil or vegetation unless otherwise indicated.

3.3.1 Cofferdams, Diversions, and Dewatering Operations

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to maintain compliance with designated uses of the surface water body.

3.3.2 Stream Crossings

Stream crossings (wet or dry) shall allow movement of materials or equipment without blocking the natural flow of water, if water became present.

3.4 AIR RESOURCES

3.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; must be controlled at all times, including weekends, holidays and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or

outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs.

3.4.2 Odors

Odors from construction activities must be controlled at all times. The odors must not constitute a health hazard.

3.4.3 Sound Intrusions

Keep construction activities under surveillance and control to minimize environment damage by noise.

3.4.4 Burning

All areas within facility perimeter fence line are designated as no burn areas.

3.5 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL3.5.1 Chemicals and Chemical Wastes

Dispense chemicals ensuring no spillage to the ground or water. Perform and document periodic inspections of dispensing areas to identify leakage and initiate corrective action. This documentation will be periodically reviewed by the Government. Collect chemical waste in corrosion resistant, compatible containers. Collection drums must be monitored and removed to a staging or storage area when contents are within 150 mm of the top. Wastes will be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.5.2 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

The Contractor shall, at a minimum, manage and store hazardous material and waste in an area designed and operated to provide appropriate segregation for different waste streams, including those that are chemically incompatible. Each area will have warning signs appropriate for the waste being accumulated at that site. Facilities or areas shall provide adequate ventilation, containment, and protection from the elements. Provide warning signs, limit access to the facility, and lock it when it is unattended. Contractor vehicles are not considered a proper storage facility. No HM or HW shall be stored in vehicles overnight or for any length of time. The Contractor shall protect HM and HW from the weather by placing it in a safe covered location. The Contractor shall be responsible for storage, describing, packaging, labeling, and marking hazardous waste and hazardous material.Take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing or storage. Segregate hazardous waste from other materials and wastes, protect it from the weather by placing it in a safe covered location. Storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material is the Contractor's responsibility. Spills of hazardous or toxic materials must be immediately reported to the Contracting Officer. Cleanup and cleanup

costs due to spills are the Contractor's responsibility.

3.5.3 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles must be conducted in a manner that affords the maximum protection against spill and evaporation.

3.5.4 Waste Water

Disposal of waste water will be as specified below.

a. Waste water from construction activities shall not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction related waste water off-site, unless on-site disposal is approved by the Contracting Officers Representative.

b. Water generated from the flushing of lines after decontamination or decontamination in conjunction with hydrostatic testing or only hydrostatic testing shall be discharged into the sanitary sewer with prior approval and/or notification to the Waste Water Treatment Plant's Operator.

3.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources will be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3.7 BIOLOGICAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The protection of threatened and endangered animal and plant species, including their habitat, is the Contractor's responsibility in accordance with Afghanistan laws and regulations.

3.8 MAINTENANCE OF POLLUTION CONTROL FACILITIES

Maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.9 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered or uncovered, the Contractor will immediately stop work in that area and

immediately inform the Contracting Officer.

3.10 POST CONSTRUCTION CLEANUP

The Contractor will clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area must be graded, filled and the entire area restored to its original condition, unless otherwise indicated.

3.11 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for the work specified in this section and all costs in connection therewith shall be included in the costs of all the bid items.

-- End of Section --

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors shall compile and prepare data and deliver to the Contractor prior to the training of Owner Agency personnel. The Contractor shall compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and SUBMITTAL PROCEDURES provided in the procurement and contract requirements portion of this project.

1.1.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.1.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Items without a specified data package requirement in the individual technical sections shall use Data Package 3.

1.1.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.1.4 O&M Database

Develop a database from the O&M manuals that contains the information required to start a preventative maintenance program.

1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.2.1.2 Operator Prestart

Include procedures required to install, set up, and prepare each system for use.

1.2.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.2.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.2.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as adjustment, inspection, and recording readings.

1.2.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.2.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.2.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.2.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that

requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.2.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.2.5.1 Product Submittal Data

Provide a copy of all Product Data submittals required in the applicable technical sections.

1.2.5.2 Manufacturer's Instructions

Provide a copy of all Manufacturer's Instructions submittals required in the applicable technical sections.

1.2.5.3 O&M Submittal Data

Provide a copy of all Operation and Maintenance Data submittals required in the applicable technical sections.

1.2.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.2.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.2.5.6 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.2.5.7 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.2.5.8 Testing and Performance Data

Include completed pre-functional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

1.2.5.9 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.3 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

a. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Full as-built sequence of operations.

c. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).

1.4 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.4.1 Data Package 1

a. Safety precautions

b. Cleaning recommendations

c. Maintenance and repair procedures

d. Warranty information

e. Contractor information

f. Spare parts and supply list

1.4.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Preventive maintenance plan and schedule

e. Cleaning recommendations

f. Maintenance and repair procedures

g. Removal and replacement instructions

h. Spare parts and supply list

i. Parts identification

j. Warranty information

k. Contractor information

1.4.3 Data Package 3

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Environmental conditions

g. Preventive maintenance plan and schedule

h. Cleaning recommendations

i. Troubleshooting guides and diagnostic techniques

j. Wiring diagrams and control diagrams

k. Maintenance and repair procedures

l. Removal and replacement instructions

m. Spare parts and supply list

n. Product submittal data

o. O&M submittal data

p. Parts identification

q. Warranty information

r. Testing equipment and special tool information

s. Testing and performance data

t. Contractor information

1.4.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Preventive maintenance plan and schedule

i. Cleaning recommendations

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Corrective maintenance man-hours

p. Product submittal data

q. O&M submittal data

r. Parts identification

s. Warranty information

t. Personnel training requirements

u. Testing equipment and special tool information

v. Testing and performance data

w. Contractor information

1.4.5 Data Package 5

a. Safety precautions

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Product submittal data

m. Manufacturer's instructions

n. O&M submittal data

o. Parts identification

p. Testing equipment and special tool information

q. Warranty information

r. Testing and performance data

s. Contractor information

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 78 36

WARRANTY OF CONSTRUCTION AND DESIGN

PART 1 GENERAL

1.1 WARRANTY OF CONSTRUCTION

a. Foremost and in addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Contracting Officer takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Contracting Officer takes possession.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Contracting Officer-owned or controlled real or personal property, when that damage is the result of:

1) The Contractor's failure to conform to contract requirements; or

2) Any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause.

e. The Contractor's warranty with respect to work restored, repaired or replaced will run for 1 year from the date of restoration, repair or replacement. This provision applies equally to all items restored, repaired, or replaced under paragraph (c) and (d) above.

f. The Contracting Officer will notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage. Repair work necessary to correct a warranty condition which arises to threaten the health or safety of personnel, the physical safety of property or equipment, or which impairs operations, habitability of living spaces, etc., will be performed by the Contractor on an immediate basis as directed verbally by the Contracting Officer. Written verification will follow verbal instruction.

g. If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of verbal or written notice, the Contracting Officer shall have the right to replace, repair, or

otherwise remedy the failure, defect, or damage at the Contractor's expense.

h. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

1) Obtain all warranties that would be given in normal commercial practice;

2) Require all warranties to be executed, in writing, for the benefit of the Contracting Officer, if directed by the Contracting Officer; and

3) Enforce all warranties for the benefit of the Contracting Officer, if directed by the Contracting Officer.

i. In the event the warranty under paragraph (b) of this clause has expired, the Contracting Officer may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

j. This warranty shall not limit the Contracting Officer's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

k. The Prime Contractor shall designate a representative to attend and chair warranty meetings that will be held each month at the project site for the duration of the warranty period, with Contracting Officer and subcontractor personnel as necessary. The meeting shall review past warranty corrections and response times, open warranty items, up-coming scheduled corrections, site investigations, and other issues.

1.2 ADDITIONAL WARRANTY REQUIREMENTS

1.2.1 Pre-Warranty Conference

a. Prior to contract completion and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of the Paragraph: WARRANTY OF CONSTRUCTION. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting.

b. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of the service representative which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This single point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Contracting Officer inquiry on warranty work action and status. This requirement does not relieve the Contractor of any Contractual responsibilities in connection with the paragraph: WARRANTY OF CONSTRUCTION.

c. Local service area is defined as the area in which the contractor or his representative can meet the response times as described in paragraph 1.2.4 and in any event shall not exceed 325 km radius of the construction sites.

1.2.2 Equipment Warranty Identification

The Contractor shall provide warranty identification tags on all mechanical and electrical equipment installed under this contract. Tags and installation shall be in accordance with the requirements of Paragraph: EQUIPMENT WARRANTY IDENTIFICATION TAGS.

1.2.3 Warranty Service Calls

The Contractor or his local service representative will respond to the site, to a call within the time periods as follows: Four (4) hours for substation equipment and eight (8) hours for distribution line equipment.

1.2.4 Equipment Warranty Booklet

At or before 30 days prior to final inspection and acceptance of the work, the Contractor shall submit the data mentioned as follows:

The Contractor shall provided a Booklet, which consists of a listing of all equipment items (see paragraphs a. and b. below) which are specified to be guaranteed along with the warranty papers for each piece of equipment. Three (3) legible bound copies of the booklet shall be submitted for approval and shall be indexed alphabetically by equipment type. For each specific guaranteed item, the name, address, and telephone number shall be shown on the list for the subcontractor who installed equipment, equipment supplier or distributor, and equipment manufacturer. Completion date of the guarantee period shall correspond to the applicable specification requirements for each guaranteed item. The names of service representatives that will make warranty calls along with the day, night, weekend and holiday contacts for response to a call within the time period specified shall also be identified.

a. For Equipment in Place: The equipment list shall show unit retail value and nameplate data including model number, size, manufacturer, etc. This would include capital equipment and other nonexpendable supplies of a movable nature that are not affixed as an integral part of the facility and may be removed without destroying or reducing the usefulness of the facility. Some examples are spare parts, special tools, maintenance equipment, instruments, installed under this contract.

b. For Installed Building Equipment: The equipment list shall show unit retail value and nameplate data including model number, size, manufacturer, etc. This would include items of equipment and furnishings (including material for installation thereof), which are required to make the facility usable and are affixed as a permanent part of the structure. Some examples are lighting fixtures, equipment cabinets, electrical distribution equipment, and control systems installed under this contract.

1.3 SUBMITTALS

Contracting Officer approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only.

SD-11 Closeout Submittals

Equipment Warranty Booklet

1.4 EQUIPMENT WARRANTY IDENTIFICATIONS TAGS

1.4.1 GENERAL REQUIREMENTS

The Contractor shall provide warranty identification tags on all Contractor furnished equipment which is Contractor installed.

1.4.1.1 Tags and Information

The tags and information shall be similar in format and size to the exhibits provided by this specification, and shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and shall be installed in a position that is easily (or most easily) noticeable. If the equipment surface is not suitable for adhesive back, Contractor shall submit his alternative to the Contracting Officer for review and approval. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

1.4.1.2 Tags for Warranted Equipment

The tag for his equipment shall be similar to the following:

```
+-----------------------------------------+
|            EQUIPMENT WARRANTY           |
|                                         |
|      CONTRACTOR FURNISHED EQUIPMENT     |
|                                         |
|                                         |
| MFG----------------MODEL NO.----------- |
|                                         |
| SERIAL NO.------------------------------ |
|                                         |
| CONTRACT NO.---------------------------- |
|                                         |
| CONTRACTOR NAME------------------------- |
|                                         |
| CONTRACTOR ADDRESS---------------------- |
|                                         |
| CONTRACTOR TELEPHONE-------------------- |
|                                         |
| CONTRACTOR WARRANTY EXPIRES------------- |
|                                         |
| IN CASE OF WARRANTY ACTION FIRST CONTACT |
|                                         |
|     [DEH] [BCE] AT [TELEPHONE NUMBER]   |
|                                         |
+-----------------------------------------+
```

1.4.1.3 Exclusion to Providing Tags

If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag. The Contractor's warranty expiration date and the final manufacturer's warranty expiration date will be determined as specified by the Paragraph "WARRANTY OF CONSTRUCTION".

1.4.2 EXECUTION

The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment. The Contractor shall be responsible for scheduling acceptance inspection with the Contracting Officer (verbal and written notification required). If this inspection is delayed by the Contractor, the Contractor shall, at his own expense, update the in-service and warranty expiration dates on these tags.

1.4.3 Equipment Warranty Tag Replacement

Under the terms of this contract, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include a data warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be similar to the original tag, except that it should include the scope of repair and that the contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement. In the case of repair, the repair only will be

covered by the extended warranty. In the case of replacement of a component, the component only will be covered by the extended warranty. In these cases, the original tags will not be removed, but an additional tag will be installed for the repair or component replacement.

1.5 WARRANTY OF DESIGN

a. Foremost and in addition to any other warranties in this contract, the Contractor warrants that the design shall be performed in accordance with the Contract requirements. Design and design related construction not conforming to the Contract requirements shall be corrected at no additional cost.

b. The period of this warranty shall commence upon final completion and the Contracting Officer’s acceptance of the work, or in the case of the Contracting Officer's beneficial occupancy of all or part of the work for its convenience, prior to final completion and acceptance, at the time of such occupancy.

c. This design warranty shall be effective from the above event through the Statue of Limitations and Statute of Repose, as applicable to the state that the project is located in.

d. The rights and remedies of the Contracting Officer provided for under this clause are in addition to any other rights and remedies provided in this contract or by law.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

SECTION 01 78 39

AS-BUILT DRAWINGS

PART 1 GENERAL

1.1 DEFINITIONS

The definitions listed below form a part of this specification.

1.1.1 Red-Line Drawings

Accepted design drawings marked-up to show actual work performed to include necessary sketches, modification drawings, shop drawings and notes. Green ink is used to indicate work deleted from the contract. Red ink is used for additions and deviations from the contract.

1.1.2 As-Built Drawings

Professionally finished bond paper drawings and electronic CADD files developed from the accepted design drawings that include all of the information from the redline drawings and suitable for half-size reproduction.

1.1.3 Black-Line Drawings

Paper drawings reproduced from electronic Computer-Aided Design Drawings (CADD) files or high quality reproducible drawings.

1.1.4 Full-Size Drawings

22 inches x 34 inches nominal size drawings with all details visually readable so that half-size plot will fit on 11 inches x 17 inch sheets .

1.1.5 Modification Circle

Denote modifications using a circle with a horizontal line through the center. The top half will contain the letter "R" with the bottom half containing the Modification number, unless directed otherwise. The lettering standard will be 1/8-inch Arial.ttf.

1.1.6 Electronic CADD Files

Electronic CADD files are files saved on CD-ROM in accordance with appropriate CADD standard. The CADD standard will include level on/off status, special characters, line weights, font, and size requirements.

1.1.7 Accepted Design Drawings

Construction set of complete design drawings, which have been accepted by the Contracting Officer, for the construction phase of the contract.

1.2 REFERENCES

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE ECB 2006-15	Engineering and Construction Bulletin No. 2006-15 - Standardizing Computer Aided Design (CAD) and Geographic Information Systems (GIS) Deliverables for all Military Design and Construction Projects

USACE A/E/C A/E/C CADD Standards, Most Current Release

https://cadbim.usace.army.mil/CAD

1.3 GENERAL REQUIREMENTS

The work includes creation of bond paper drawings and electronic CADD files on AutoCAD 2015 for as-built drawings to accurately depict existing conditions of the project. As-Built Drawings will become the permanent record drawings of the construction. The Contractor is responsible for development of electronic CADD files in accordance with USACE A/E/C CADD standards.

AutoCAD 2010 Standard shall utilize the National CADD standards (USACE A/E/C).

The As-Built drawings shall include all major features of the work and all details to the same level as the accepted design set of drawings. All changes from the accepted design drawings shall be shown on the as-builts. Changes include actual work performed; deviations resulting from Contracting Officer’s responses to Requests for Information or Serial letters; and modifications to the contract. Where accepted design drawings or specifications allow for options, only the option selected and actually constructed shall be shown on the As-Built Drawings. Systems designed or enhanced by the Contractor such as control systems, communication systems, and letters of clarification, shall be accurately and neatly recorded on the As-Built Drawings using the same symbols, terminology, and general quality as the original set of accepted design drawings. All sheets affected by a change shall be revised. The transmittal requirements for the As-built Drawings shall be shown as events on the Contractor prepared project schedule.

1.4 PAYMENT

In accordance with the clause "Payment Under Fixed - Price Construction Contracts", which provides for progress payments on estimates of work accomplished which meets the standards of quality established under the contract, $(number of drawings in accepted design package x $250 per sheet) will be withheld from payment for the creation of As-Built drawings until the final as-built drawings are delivered to the Contracting Officer, including any necessary revisions and subject to the approval of the Contracting Officer.

Completed As-Built drawing files shall be submitted within 60 calendar days of turning the completed project over to the Owner Agency.

1.5 TRANSMITTAL OF AS-BUILT DRAWINGS

1.5.1 100 Percent Preliminary As-Built Drawings

Upon notification and receipt of substantial completion of construction, the Contractor shall produce 100 Percent Preliminary As-Built Drawings indicating as-built conditions on AutoCAD 2010 with "clouding". This as-built set of drawings shall consist of all of the project drawings. The As-Built CADD files and drawings which include all changes up to the time the 100 Percent Preliminary Drawings shall be sent as stated below. The Contractor shall draw attention to all drawing changes by "clouding" the affected area. This "clouding" shall be accomplished on AutoCAD 2010 layer G-ANNO-REVS of the drawing file. The 100 Percent Preliminary Drawings shall consist of one (1) set of CADD files on a CD-ROM and one (1) full-size set of the Black-Line Drawings and both shall be submitted to the Contracting Officer. Both documents shall be submitted at least three (3) weeks prior to the final acceptance inspection unless otherwise directed by the Contracting Officer. The Contracting Officer will notify the Contractor in writing of approval / disapproval. The Contractor shall not submit the Final Drawings until he receives the Contracting Officer letter approving the 100 Percent Preliminary Drawings.

1.5.2 Final As-Built Drawings

The Contractor shall produce Final As-Built Drawings in AutoCAD 2010 without "clouding". The As-Built preparation process is provided in paragraph As-Built Preparation below. The Final Drawings shall include all changes. The Final Drawings in the form of a CD-ROM shall be submitted to the Contracting Officer no earlier than the day of acceptance of the project and no later than thirty (30) days after the date on the acceptance letter for the Preliminary Drawing unless otherwise directed by the Contracting Officer. The contractor shall submit the following documents to the Contracting Officer for the final As-Built drawings submittal:

a. One (1) set of CADD files on CD-ROM (folder name containing as-built files shall be designated "AS-BUILTS" on each CD-ROM). Both CD case and CD-ROM shall contain the name of the project, location, specification number, and contract number, and words "As-Built Record Set"). The folder shall contain drawings, indexes and reference files related to all as-builts.

b. One (1) full-size set of bond paper As-Built Drawings, along with a ll red-lined hard copy drawings prepared by the Contractor during construction.

Contracting Officer will forward one (1) full-size set of drawings along with CD-ROM to the customer.

1.5.3 As-Built Preparation

Both preliminary and final electronic as-built drawings shall be produced in accordance with the following process for AutoCAD 2014 drawings:

1.5.3.1 Not Used

1.5.3.2 Format for AutoCAD (*DWG) Files

Preparation of As-built Drawings shall be in accordance with USACE A/E/C requirements and/or match the detail shown on the accepted design drawings. The requirements listed below are general guidelines.

a. When opened, the drawing shall be seen exactly as it should be plotted.

b. The view shall be zoomed to fit the border.

c. All information in the title block shall filled in.

d. The information in the title block shall be correct.

e. All files shall reference an AutoCAD border supplied by the Omaha District placed in the layout/sheet model at a scale of 1 and at the location (0,0).

f. All unnecessary information outside the border shall be deleted.

g. All files shall be purged/compressed.

h. All xrefs shall be included.

i. All fonts used shall be included with the set, even if it is the standard AutoCAD fonts.

j. An ASCII text file shall be provided with the following information: the name and phone number of the person we need to contact if we have problems, and the version of AutoCAD used to create and/or work on the drawings.

k. Pen tables for plotting shall be supplied.

l. Each sheet/design shall have its own file and file name with only one layout/sheet per design file.

m. All proxy graphics shall be exploded to allow editing with AutoCAD without the use of Autodesk desktop software.

n. Half toning shall be accomplished by using the color 8 and setting the pen table to plot color 8 to half tone.

o. Any new drawing file added shall have a file name that begins with the following project code: BU61

1.6 PROCEDURE

The Contractor shall create a set of electronic CADD files and full-size Red-Line Drawings to fully indicate As-Built conditions. The Red-Line Drawings shall be maintained at the site, in a current condition until the completion of the work and shall be available for review by the Contracting Officer at all times. All as-built conditions shall be on the Red-Line Drawings within two (2) days after the work activity is completed. The Contractor shall not convert electronic drawing files from one software language to another (i.e. Microstation to AutoCAD or AutoCAD to Microstation).

1.7 TITLE BLOCKS

The contract number and the specification number (if available) shall be shown on all sheets. "RECORD DRAWING" shall be added below the title block on all sheets. All modifications to the contract shall be posted in ascending order. The top line of the revision box shall state "REVISED TO SHOW AS-BUILT CONDITIONS" and dated. All modifications to all plans, sections, or details, shall have a modification number placed in the revision box. The statement "GENERAL REVISIONS" may be used when applicable.

1.8 PROCEDURES FOR POSTING MODIFICATION CHANGES TO DRAWINGS

Follow directions in the modification for posting descriptive changes. A Modification Circle shall be place at the location of each deletion. The highest modification number on the sheet should be shown in the modification circle in the "DATE" and "DRAWING CODE" boxes of the title block. For all new details or sections that are added to a drawing, place a Modification Circle by the detail or section title.

For changes to a drawing, place a Modification Circle by the title of the affected plan, section or detail titles (each location). For changes to schedules on drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule. The Modification Circle size shall be 1/2-inch diameter unless the area where circle is to be placed is crowded. Use smaller size circle for crowded areas.

1.9 WORD ABBREVIATIONS

Abbreviations shown on the abbreviation sheet shall be used to describe all work items. Additional word abbreviations, not found on the abbreviation sheet but necessary to describe the work, shall be properly identified and incorporated with the other standard word abbreviations. Abbreviations shall conform to USACE A/E/C CAD Standards.

1.10 LEGEND SHEETS

Symbols, which conflict with those on the original accepted design legend sheet, shall not be used. Additional symbols necessary to depict any additional work items, shall be properly identified and added to the legend sheet or supplemental legend. Those projects that do not have legend sheets may use supplemental legends on each sheet where symbol is shown.

1.11 CONTRACTOR SHOP DRAWINGS

Contractor shop drawings, which supersede data on the accepted design plans and/or additional drawings, prepared by the Contractor, shall be incorporated into the As-Built Drawings. Design plans prepared by Contractor shall include the designer's name on the As-Built Drawings.

1.12 INDEXING OF DRAWINGS

If drawings are added to the portfolio of drawings to depict as-built conditions, the index of drawings shall be revised accordingly.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

As-Built drawings shall include as-built information to the same level of detail as shown on the original details, unless otherwise specified. The Contractor shall provide any additional full-size drawings as required to display all the details.

3.2 SITE WORK

3.2.1 Utilities

All utilities shall be shown whether active, inactive, shown on the original accepted design drawings, or found on-site. The type of utility, location, general direction, size, material make-up and depth shall be shown. The location and description of any utility line or other installations of any kind known to exist within the construction area shall be shown. The location shall include dimensions to permanent features.

3.2.2 GPS Survey of As-Built Utility Lines/Points

All new underground utility lines (including electrical power and communications) shall be located during installation using Global Positioning Satellite (GPS) surveying grade equipment. The Contractor shall survey top of duct bank of electrical power and communications lines and associated fixtures (manholes, test points, meters, ground points, and all point features along the new utility lines). Electrical power and communications, lines shall be surveyed at all manholes, tees, corners, changes in direction and at intervals along the line which will accurately depict the location of the line in both horizontal and vertical directions. Survey data accuracy of ± 150 MM or .15 M from actual position shall be maintained.

3.2.3 Structures

Structures above and below ground shall be shown. The size, material make-up, location, height, and/or depth shall be shown. Manholes shall show rim elevation and invert elevations as applicable. Transmission and distribution structures shall show electrical equipment and voltage rating.

3.2.4 Grades

Grade or alignment of roads, structures, or utilities shall be corrected if any changes were made from the contract drawings. Elevations shall be corrected if changes were made in site grading.

3.3 STRUCTURAL

3.3.1 Steel/Concrete

Shop drawings that deviate from the accepted design drawings shall be incorporated in the As-Built Drawings.

3.4 ELECTRICAL

3.4.1 PANELS

All accepted design drawing panel schedules shall be revised to show as-built conditions. Home-run circuit designation on electrical drawings shall accurately correspond to the as-built panel schedules.

3.4.2 Controls

All control diagrams in accepted design drawings shall be revised to reflect as-built conditions, and setpoints.

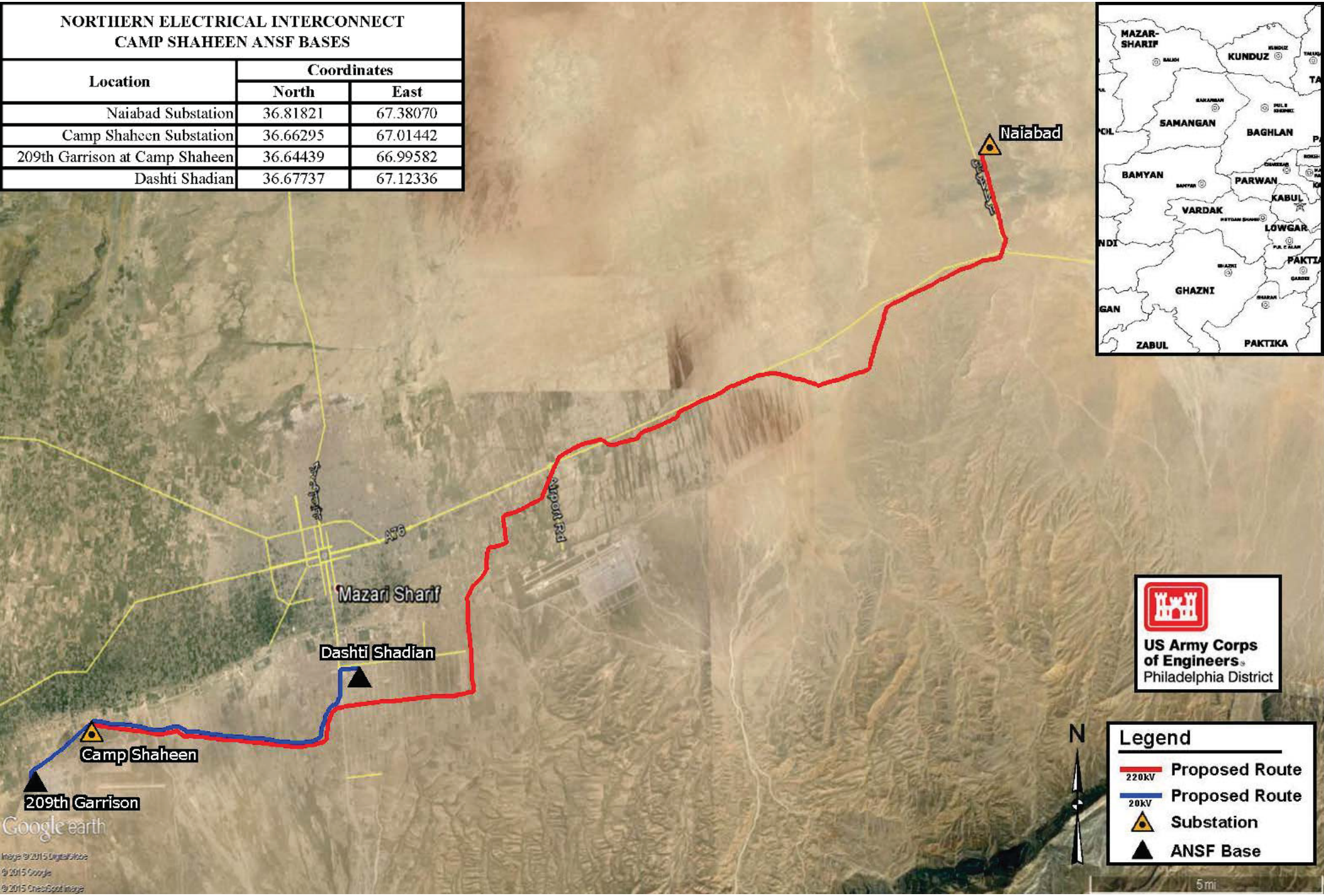
-- End of Section --

Appendix A

Project Area Map

NORTHERN ELECTRICAL INTERCONNECT
CAMP SHAHEEN ANSF BASES

Location	Coordinates	
	North	East
Naiabad Substation	36.81821	67.38070
Camp Shaheen Substation	36.66295	67.01442
209th Garrison at Camp Shaheen	36.64439	66.99582
Dashti Shadian	36.67737	67.12336



Appendix B

Transmission and Distribution Systems Plans and Profiles

ES-100	Northern Electrical Interconnect Plan and Profile Cover Sheet (Terrain Descriptions)
ES-101 TO ES-139	NAIABAD to SHAHEEN 220 Kv Transmission Plan and Profile Drawings
ES-140 TO ES-142	SHAHEEN SUBSTATION to CAMP SHAHEEN 20 Kv Distribution Plan and Profile Drawings
ES-143 TO ES-153	SHAHEEN SUBSTATION to DASHTI SHADIAN 20 Kv Distribution Plan and Profile Drawings

PLAN AND PROFILE LEGEND	
SYMBOL	DESCRIPTION
———	TRANSMISSION CENTERLINE
●	STRUCTURE LOCATION
△	POINTS OF INTEREST

TRANSMISSION LINE CIRCUIT	TERRAIN TYPE*			
	MOUNTAINOUS (km)	ROUGH (km)	HILLY (km)	DESERT (km)
NAIABAD TO SHAHEEN 220 kV	0.0	0.0	3.5	42.5
SHAHEEN TO CAMP SHAHEEN 20 kV	0.0	0.0	0	2.8
SHAHEEN TO DASHTI SHADIAN 20 kV	0.0	0.0	0	11.5

GENERAL NOTES:

1. ALL TRANSMISSION AND DISTRIBUTION LINE DRAWINGS INCLUDING ELEVATIONS, DETAILS, AND STRUCTURES ARE INDICATIVE OF THE CONCEPTUAL DESIGN REQUIRED FOR PROJECT COMPLETION. DRAWINGS ARE PRELIMINARY AND ONLY PROVIDE APPROXIMATE ALIGNMENT, TOWER LOCATIONS AND TOWER HEIGHTS. IT SHALL BE THE RESPONSIBILITY OF THE DESIGN/BUILD CONTRACTOR TO DETERMINE ACTUAL LOCATIONS, NUMBER OF STRUCTURES, TYPE OF STRUCTURES AND STRUCTURE HEIGHT DURING THE DESIGN PHASE IN ACCORDANCE WITH THE SPECIFICATIONS.

*TERRAIN TYPE

- MOUNTAINOUS TERRAIN IS CHARACTERIZED BY AREAS OF EXTREME TERRAIN CONSISTING OF SEVERE ELEVATION CHANGES ALONG THE PRELIMINARY TRANSMISSION LINE CORRIDOR. THE DIFFICULTY LEVEL OF CONSTRUCTION ACCESS MAY BE CONSIDERED HIGH.
- ROUGH TERRAIN IS CHARACTERIZED BY AREAS OF HARSH TERRAIN CONSISTING OF LARGE ELEVATION CHANGES ALONG THE PRELIMINARY TRANSMISSION LINE CORRIDOR. THE DIFFICULTY LEVEL OF CONSTRUCTION ACCESS MAY BE CONSIDERED MEDIUM.
- HILLY TERRAIN IS CHARACTERIZED BY AREAS OF MILD TERRAIN CONSISTING OF MODERATE ELEVATION CHANGES ALONG THE PRELIMINARY TRANSMISSION LINE CORRIDOR. THE DIFFICULTY LEVEL OF CONSTRUCTION ACCESS MAY BE CONSIDERED MODERATE.
- DESERT TERRAIN IS CHARACTERIZED BY AREAS OF FLAT OR SAND DUNE TERRAIN WITH SUBTLE CHANGES IN ELEVATION ALONG THE PRELIMINARY TRANSMISSION LINE CORRIDOR. THE DIFFICULTY LEVEL OF CONSTRUCTION ACCESS MAY BE CONSIDERED LOW IN THE FLAT TERRAIN AND MODERATE IN THE SAND DUNE TERRAIN.

*NOTE: HEIGHTS OF STRUCTURES SHOWN IN DRAWINGS ARE TO HEIGHT OF LOWEST CONDUCTOR.

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Philadelphia District

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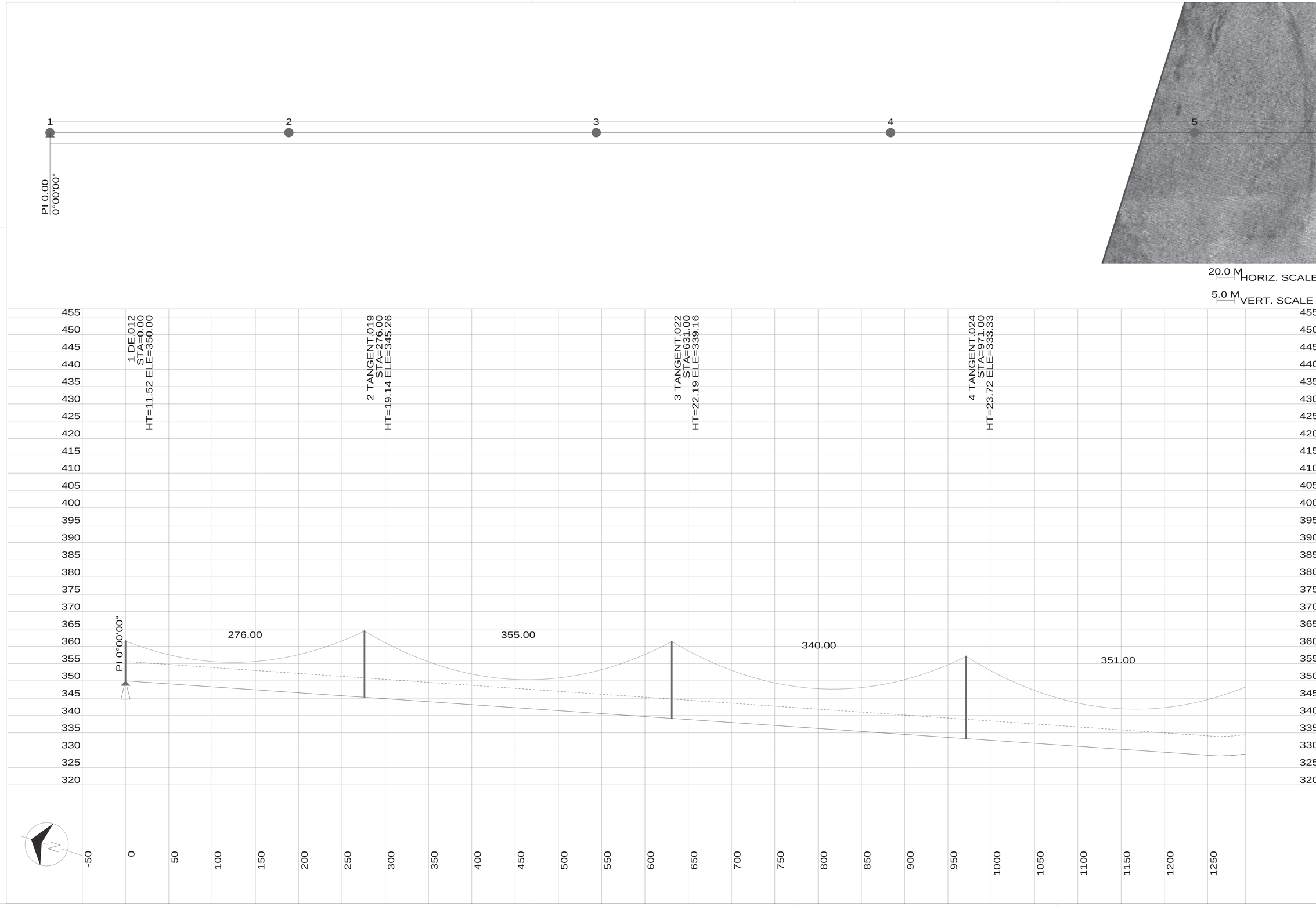
DATE: 5/17/2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
PLOT SCALE: 1cm = 20m
PLOT DATE: 5/17/2015
SIZE: ANSI D
FILE NAME:

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN 220/20 kV
TRANSMISSION AND DISTRIBUTION LINE
COVER SHEET

SHEET NUMBER
ES-100



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.

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DESIGNED BY: M. SOSNA
DWN BY: MRS
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SUBMITTED BY:
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CONTRACT NO.:
FILE NUMBER:
PLOT SCALE: 1CM = 20M
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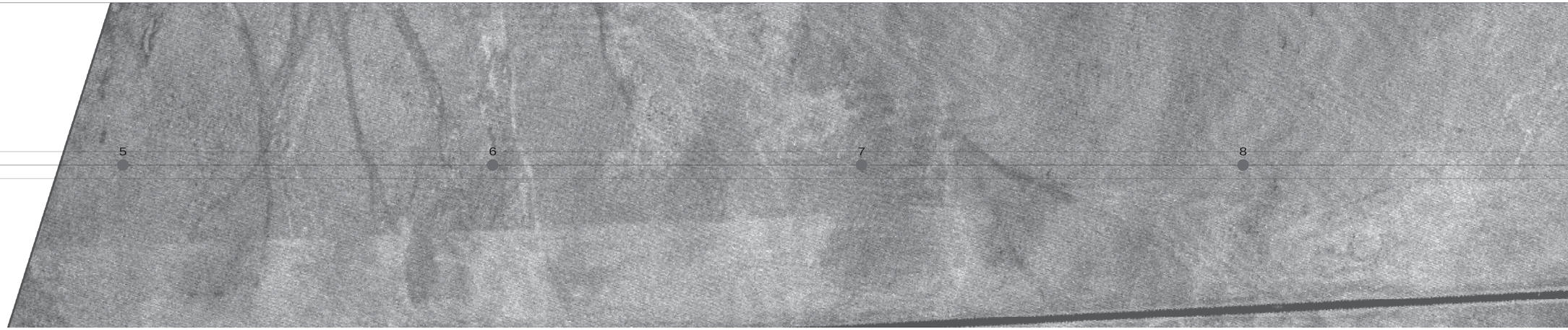
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

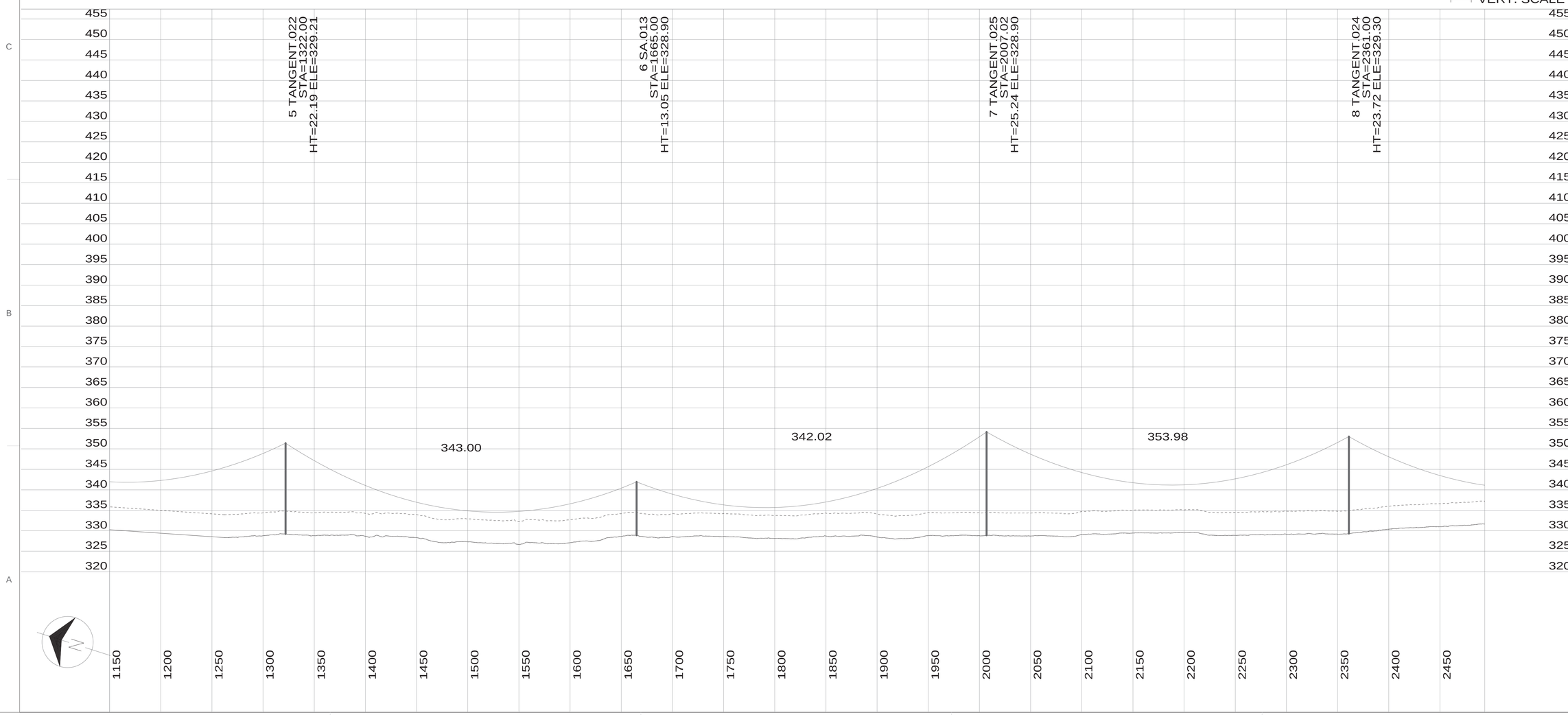
NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-101



20.0 M HORIZ. SCALE

5.0 M VERT. SCALE



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGNED BY: M. SIDSNA
DATE: 5/17/2015
DWN BY: MRS
CKD BY:
SOLICITATION NO.:
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CONTRACT NO.:
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PLOT DATE: 06/17/2015
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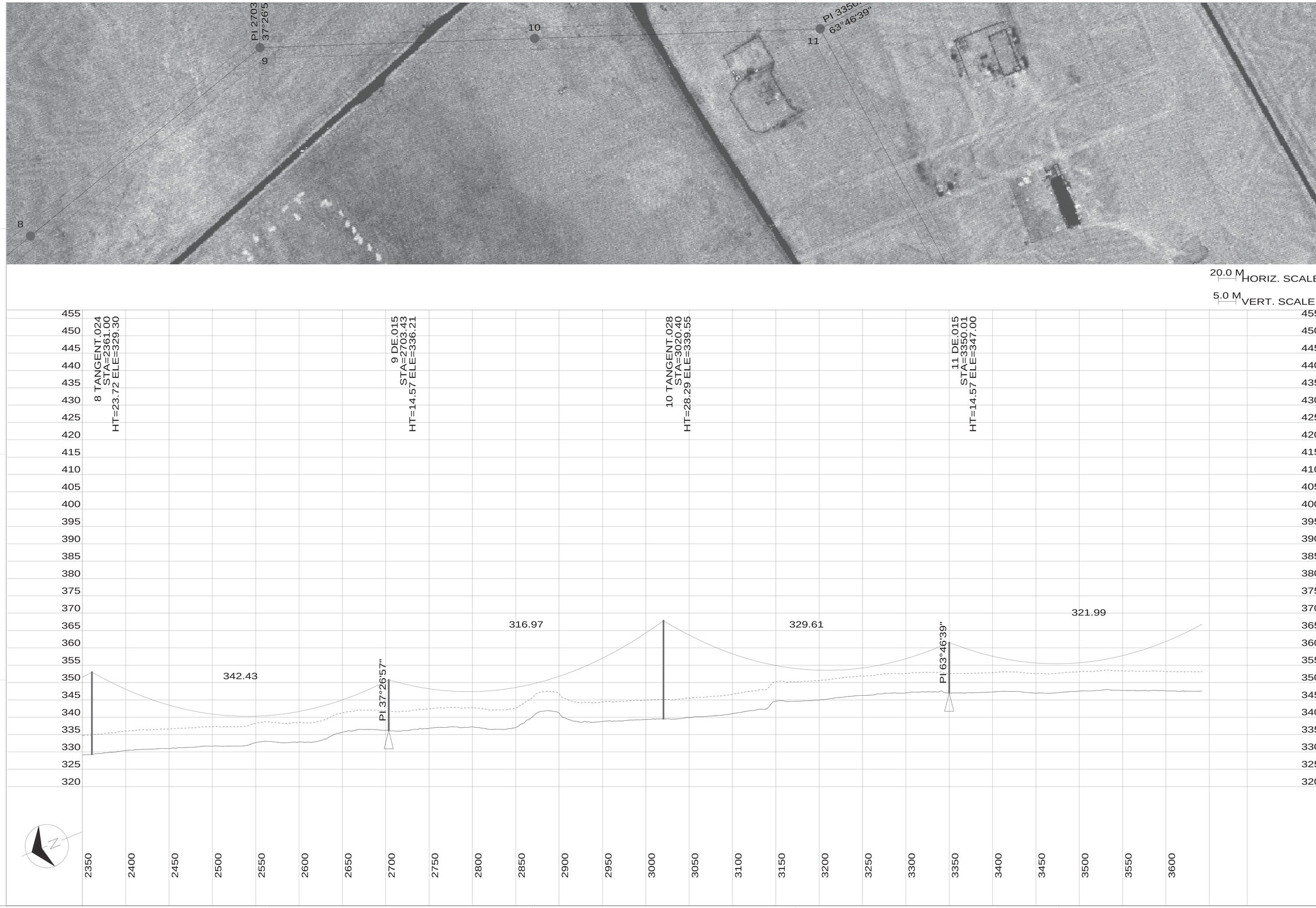
FILE NAME:
FILE NUMBER:

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SIJAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-102



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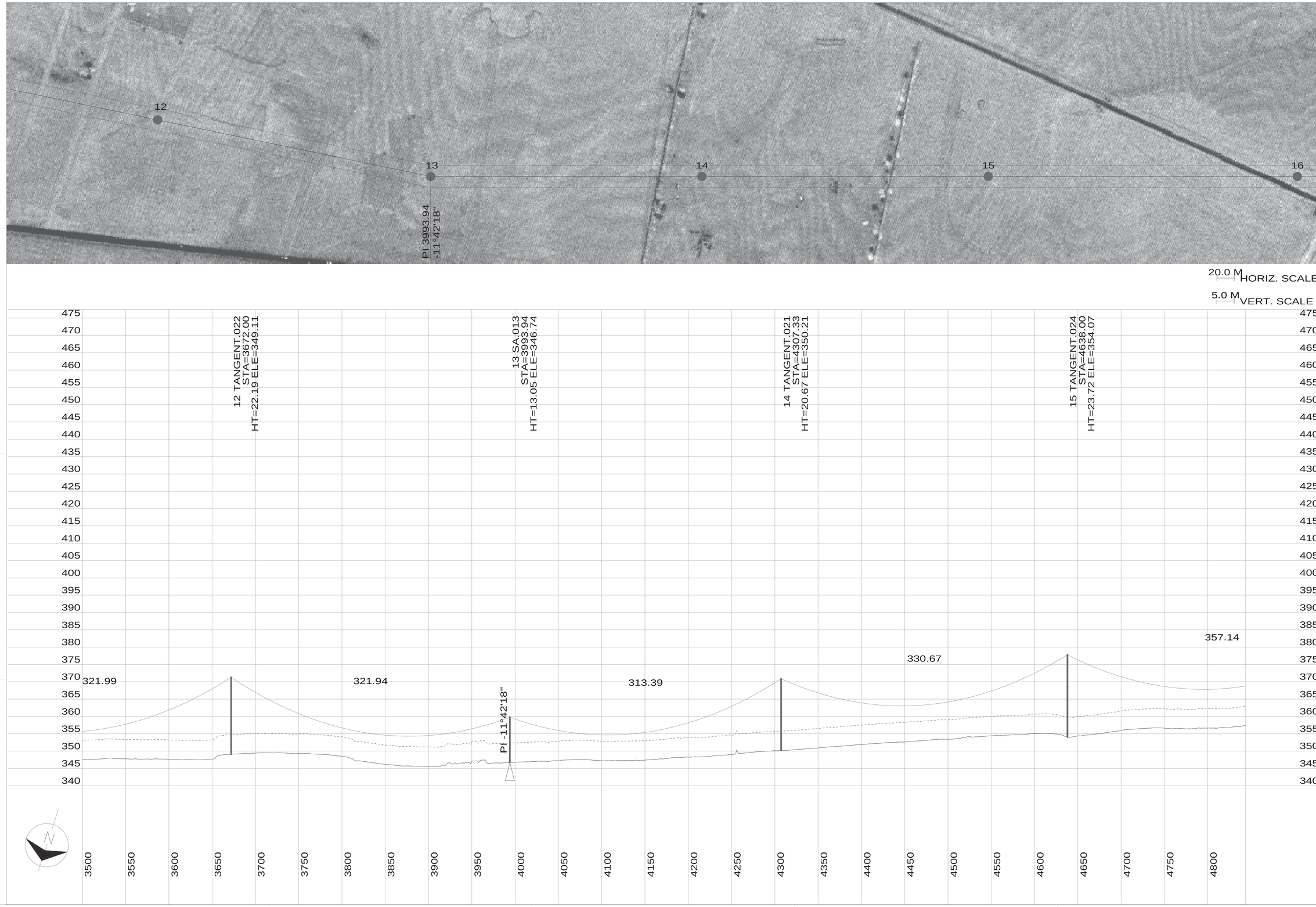
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-103



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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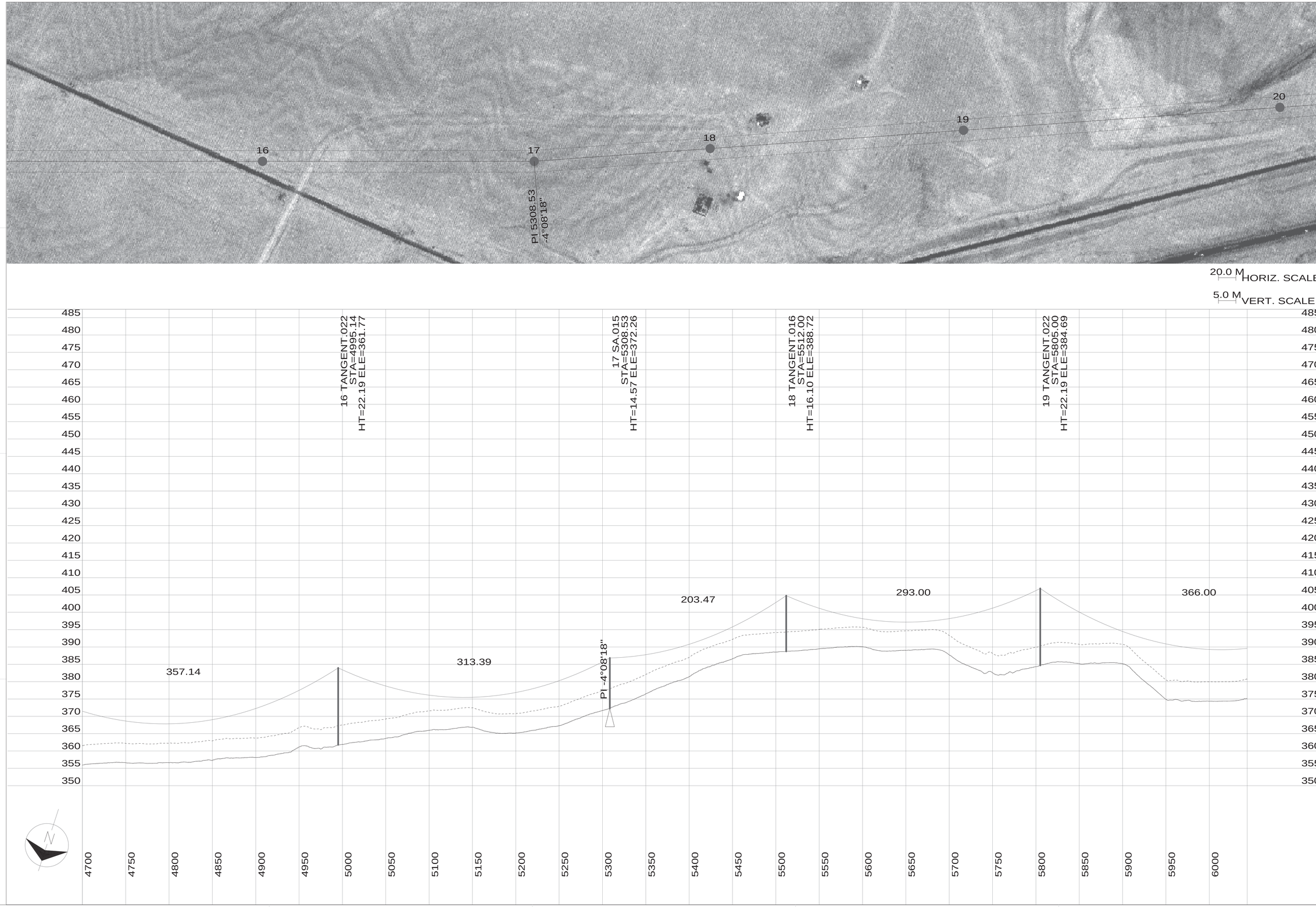
DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-104



US ARMY CORPS OF ENGINEERS
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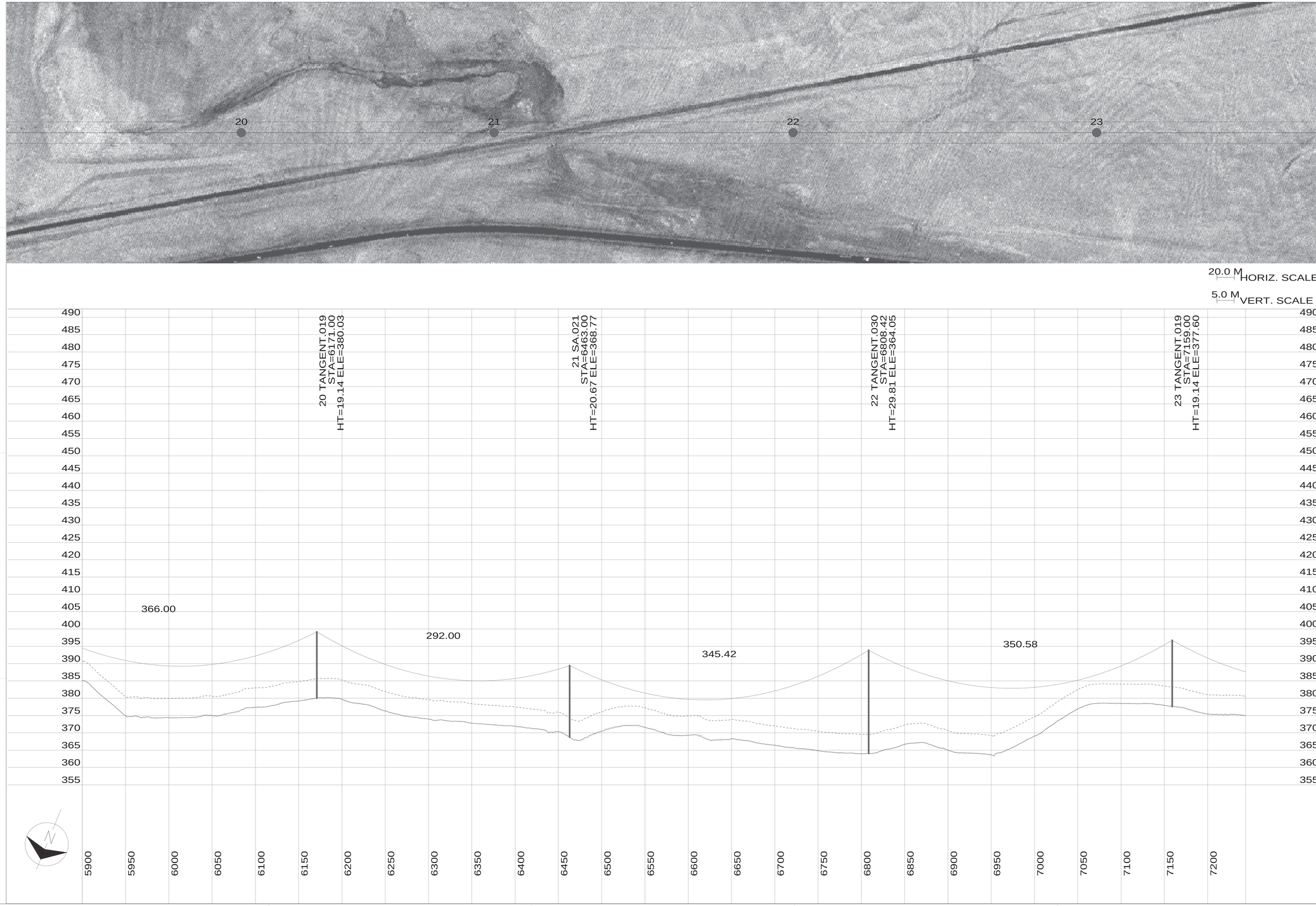
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-105



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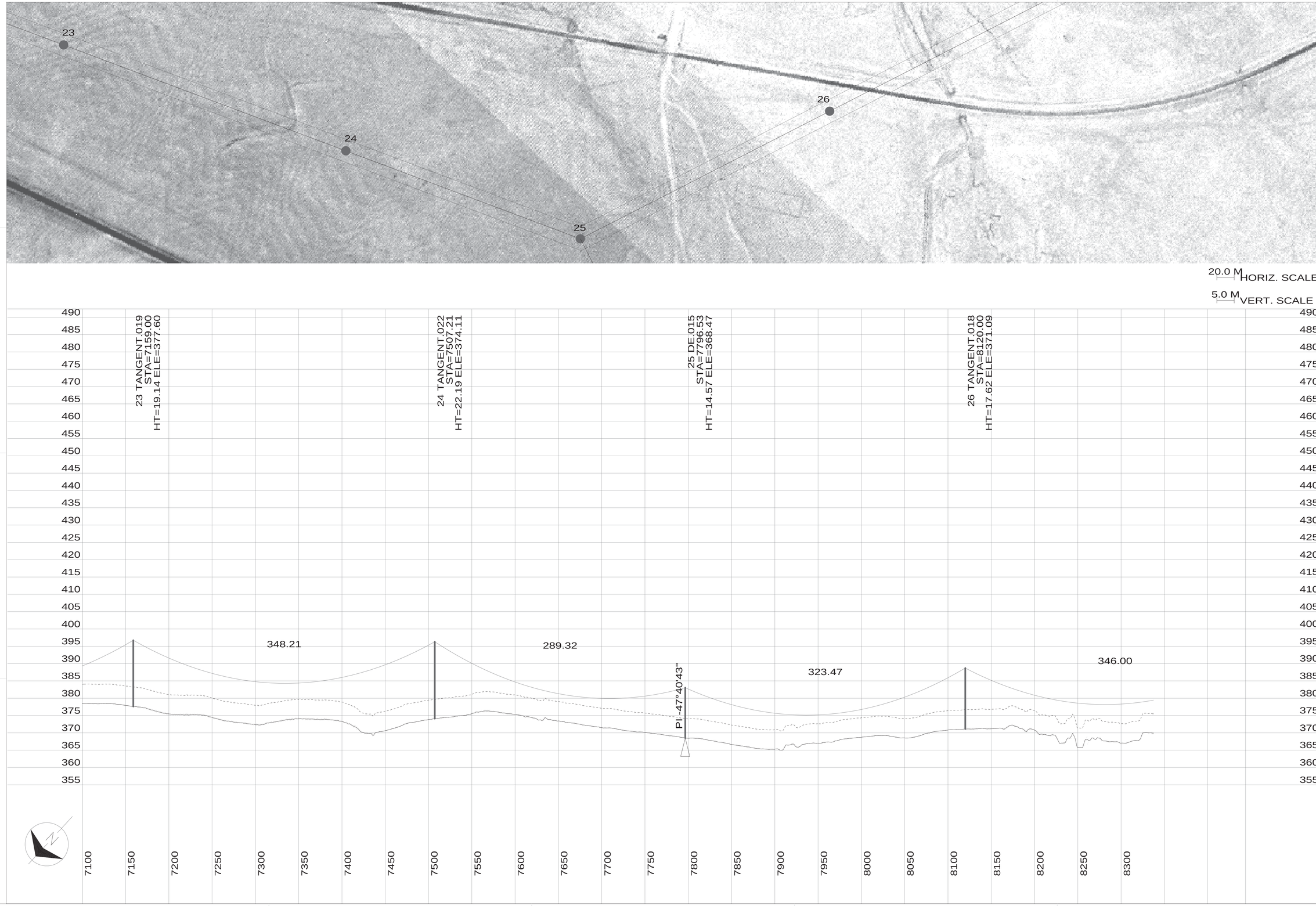
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-106



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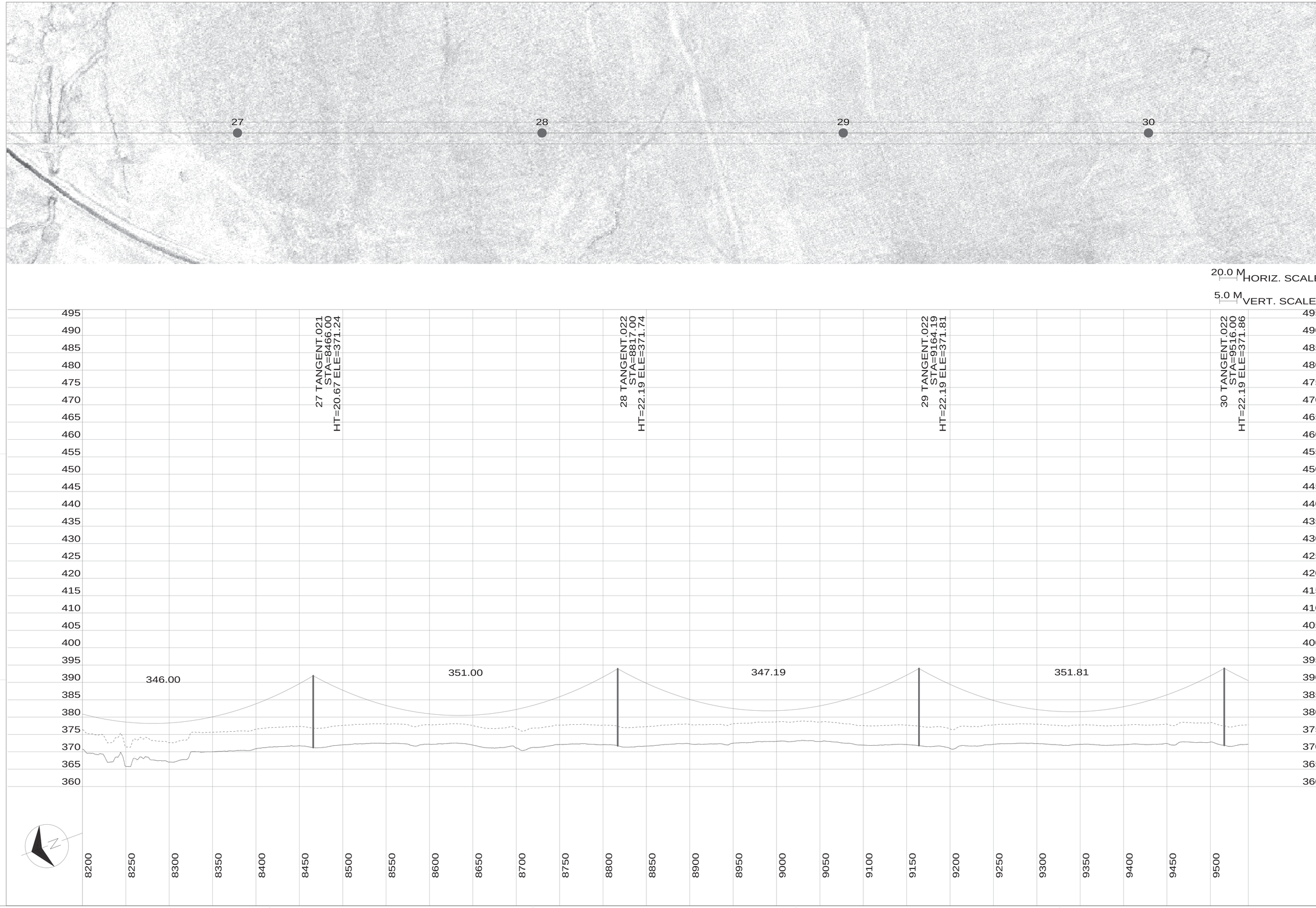
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-107



US ARMY CORPS OF ENGINEERS
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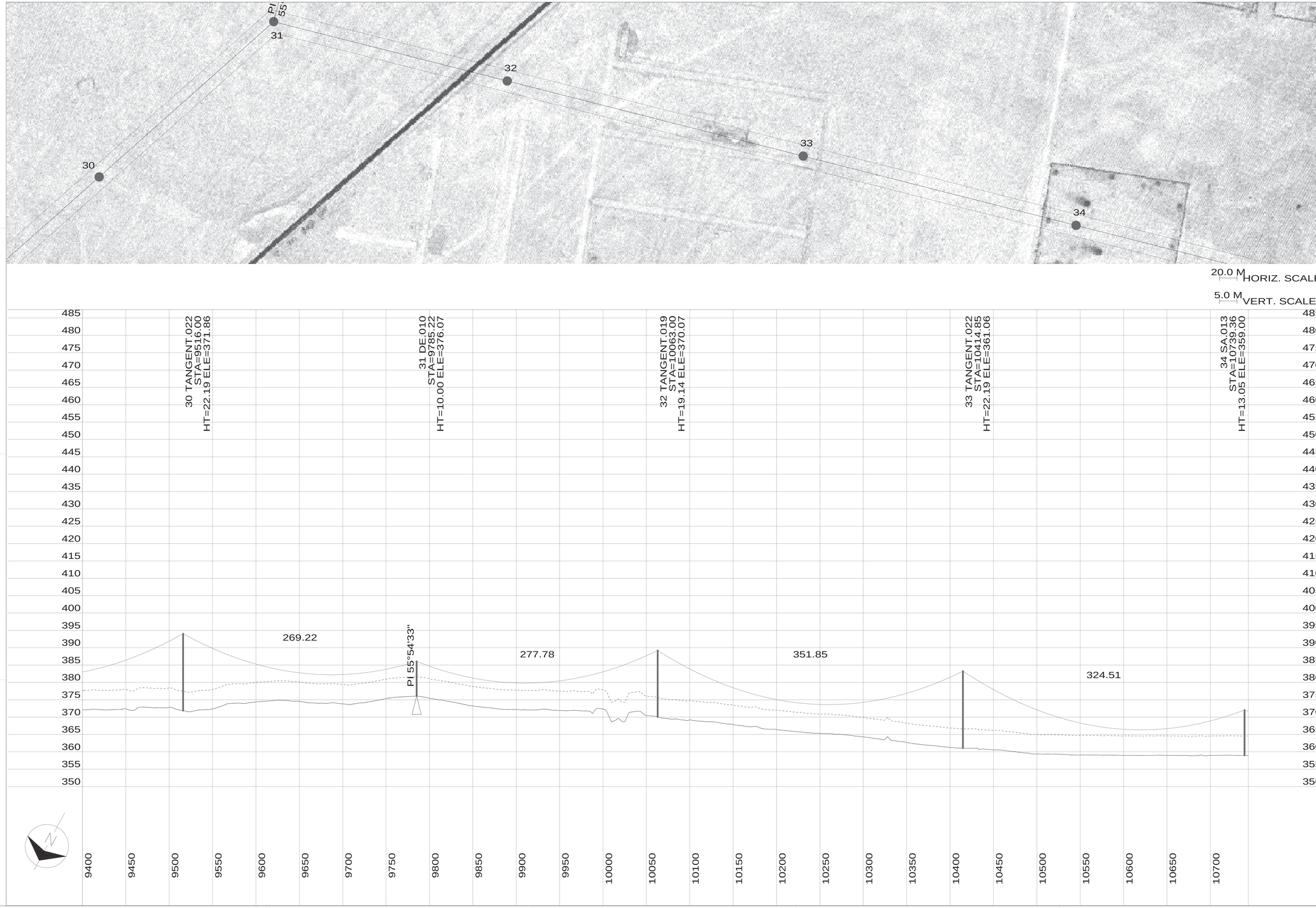
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-108



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PHILADELPHIA DISTRICT

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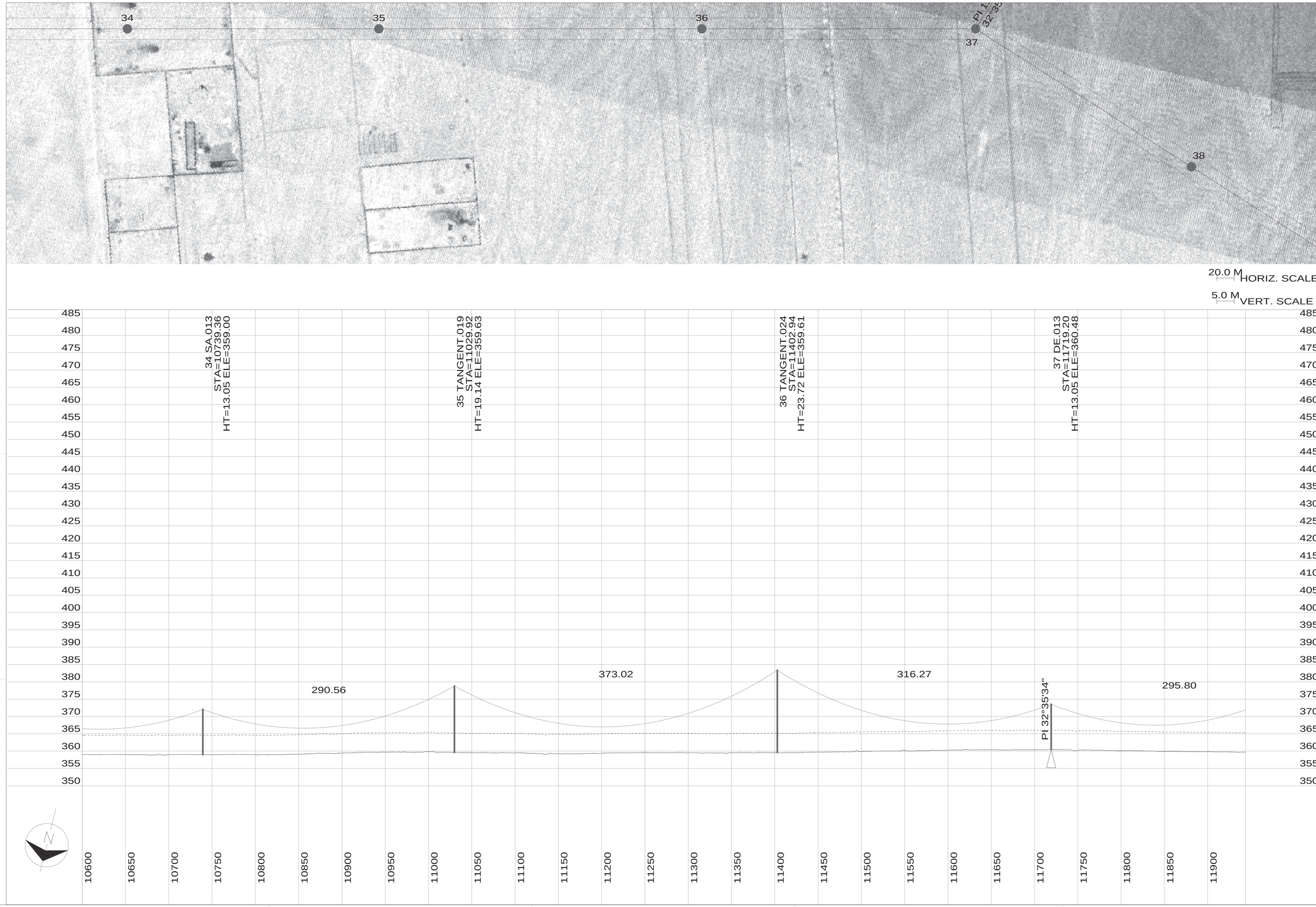
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-109



US ARMY CORPS OF ENGINEERS PHILADELPHIA DISTRICT

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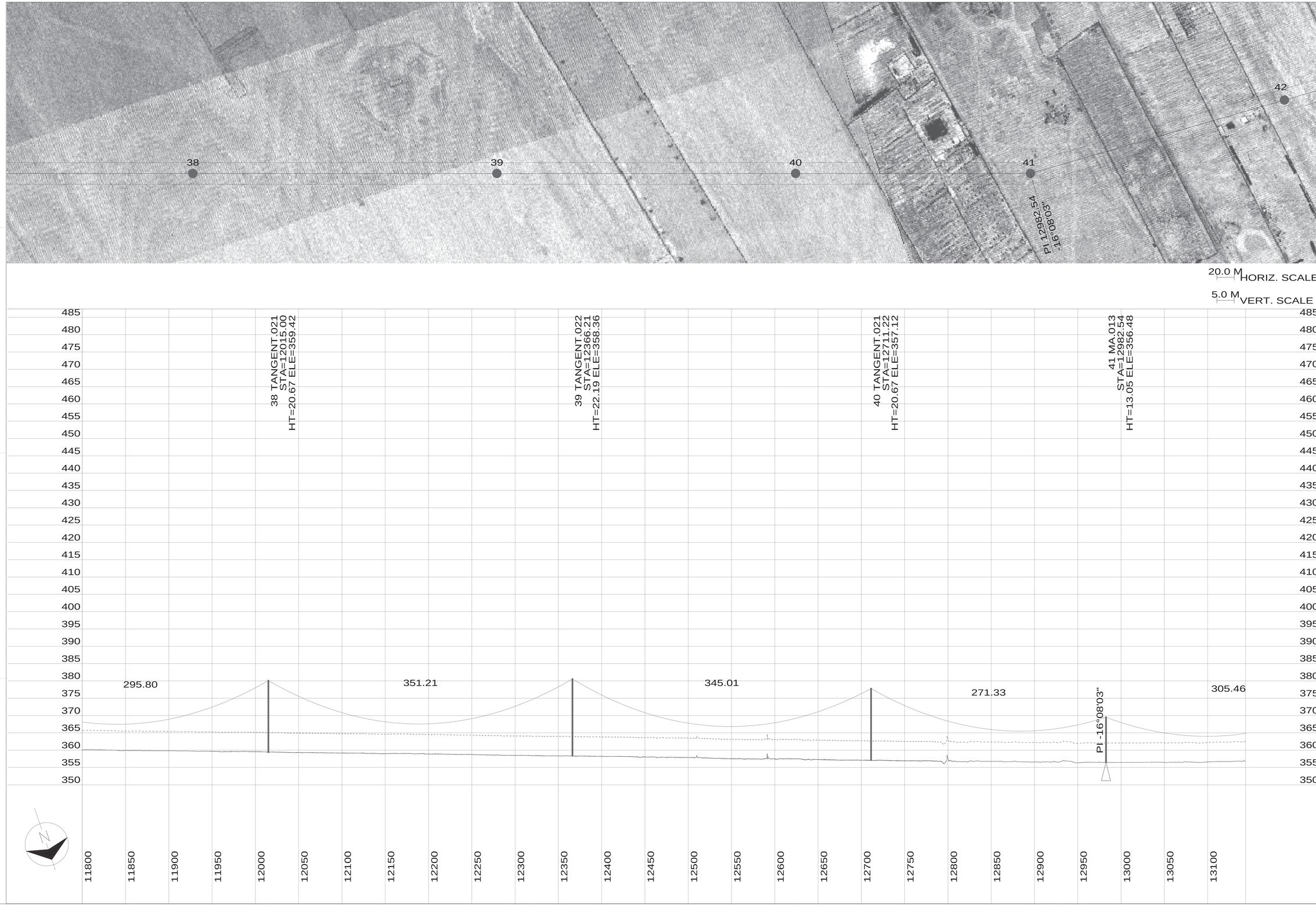
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR NORTHERN ELECTRICAL INTERCONNECT PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-110



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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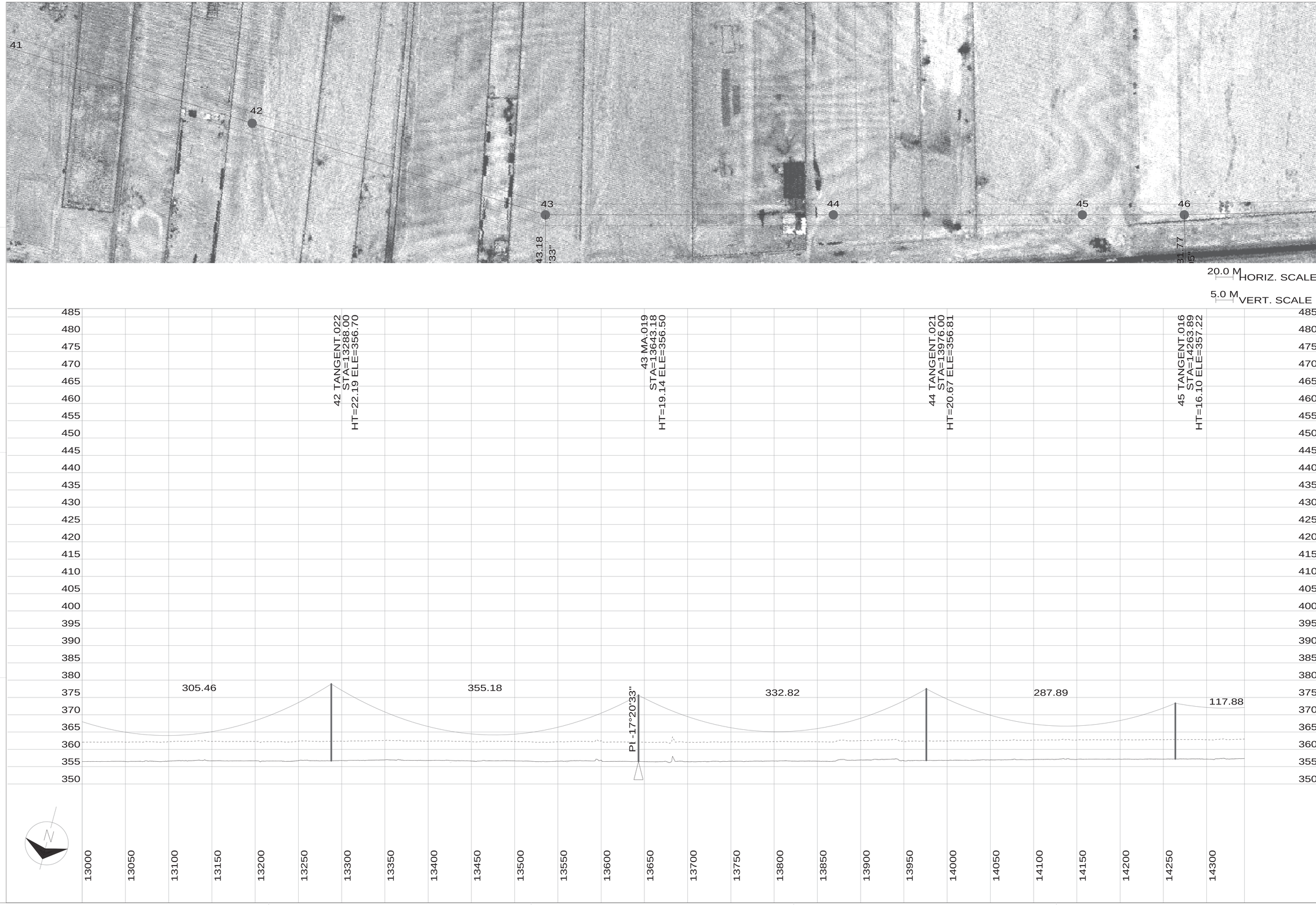
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-111



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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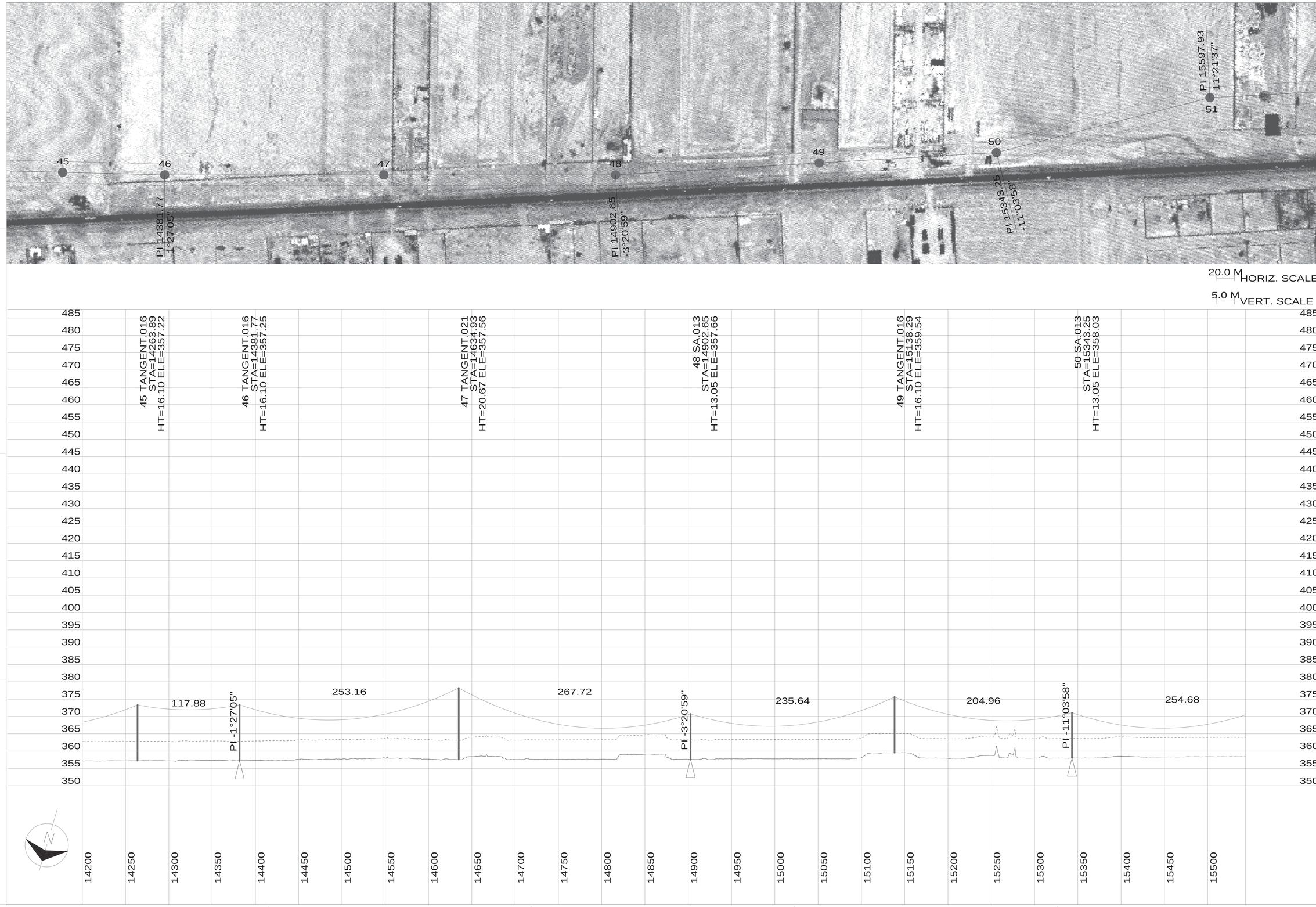
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-112



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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U.S. ARMY CORPS OF ENGINEERS
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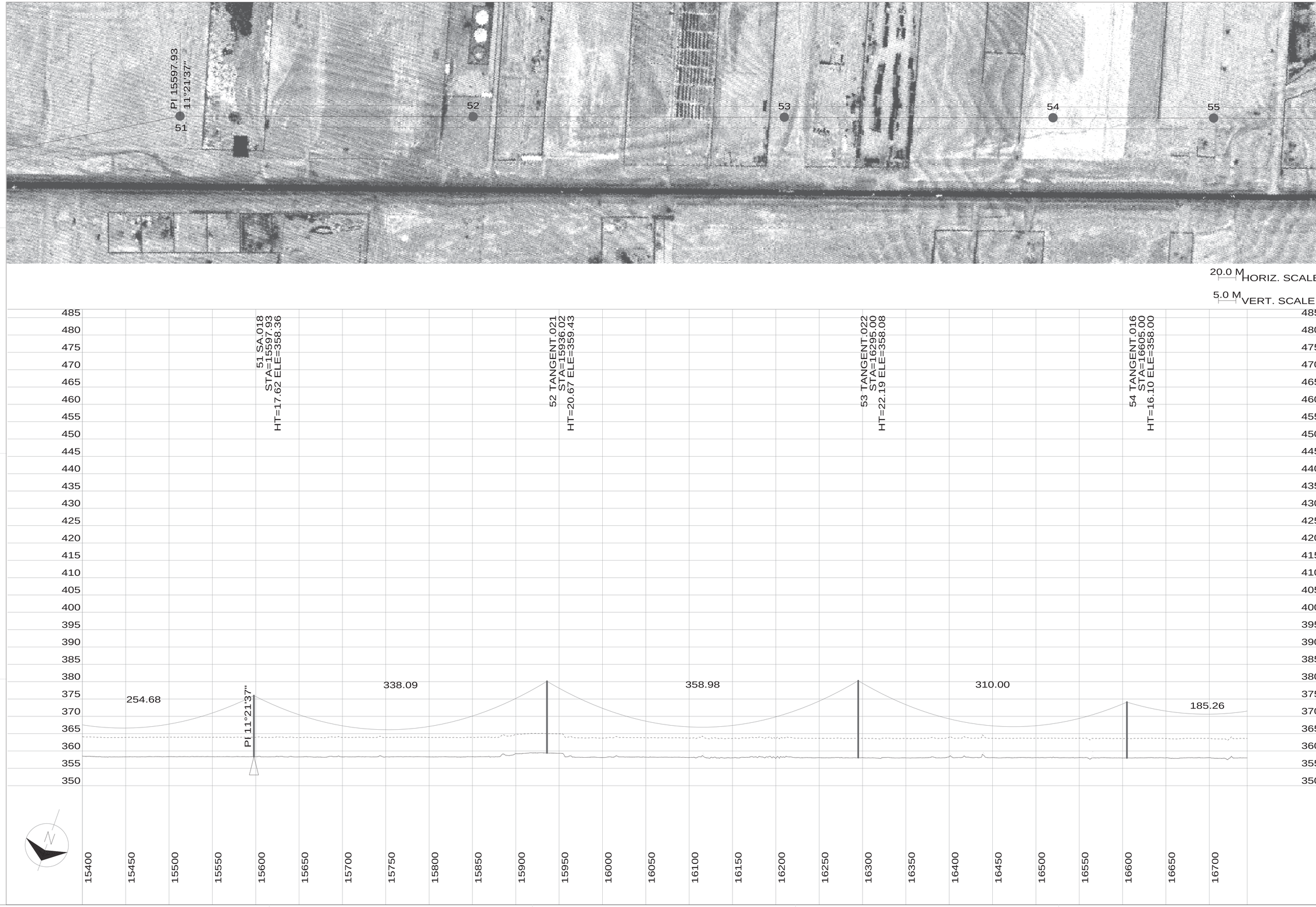
DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-113



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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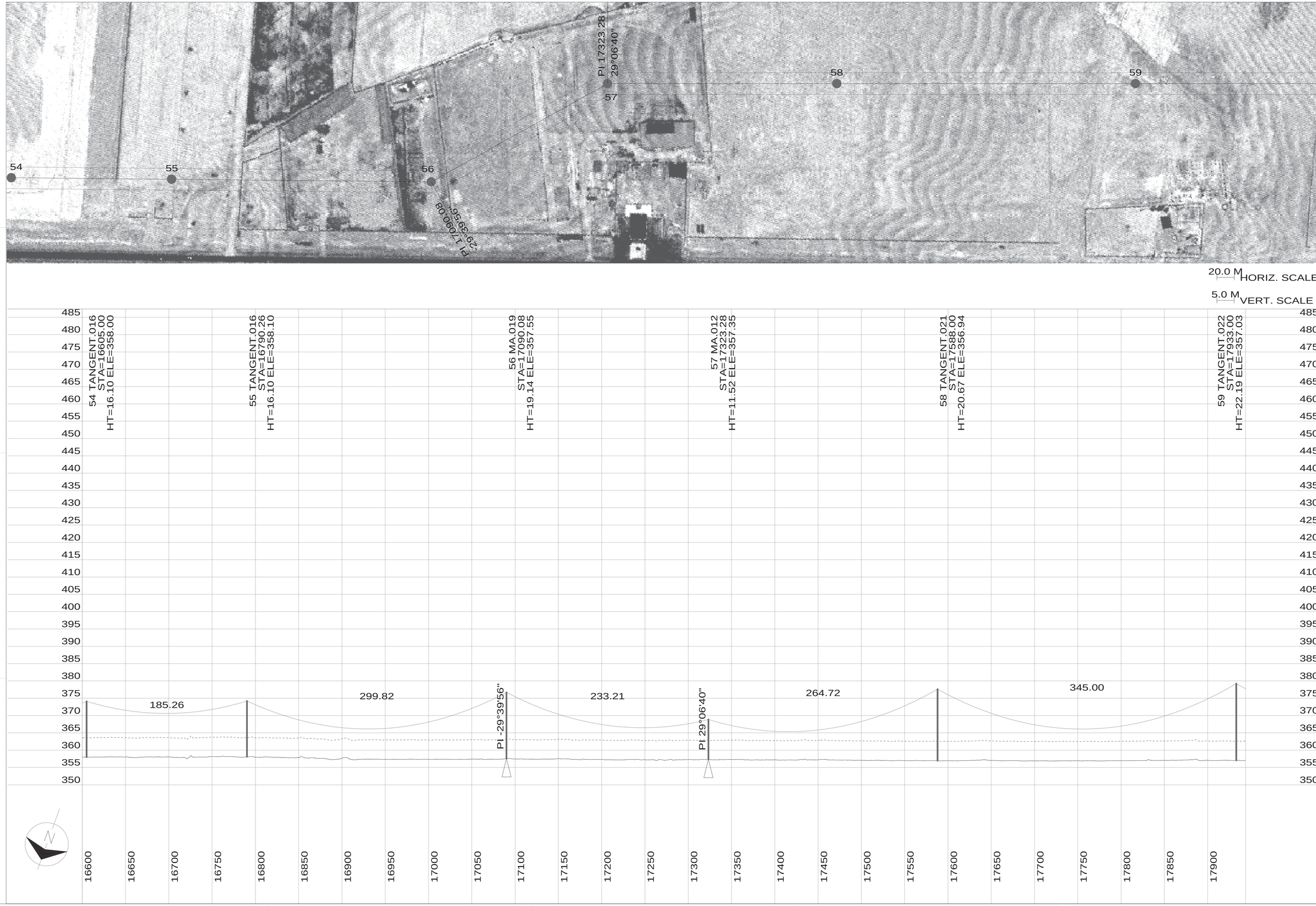
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-114



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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U.S. ARMY CORPS OF ENGINEERS
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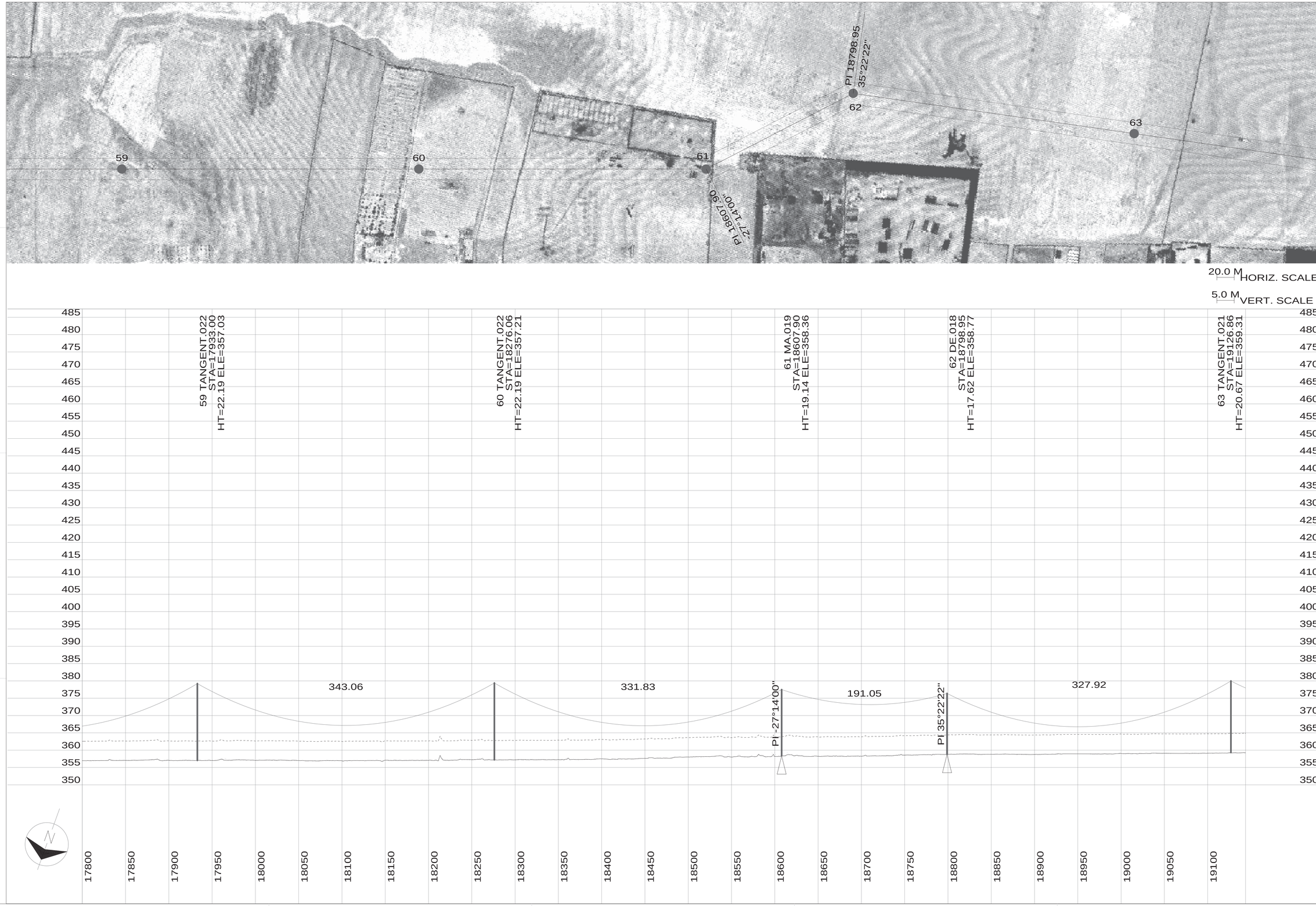
DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SIAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-115



US ARMY CORPS OF ENGINEERS
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U.S. ARMY CORPS OF ENGINEERS
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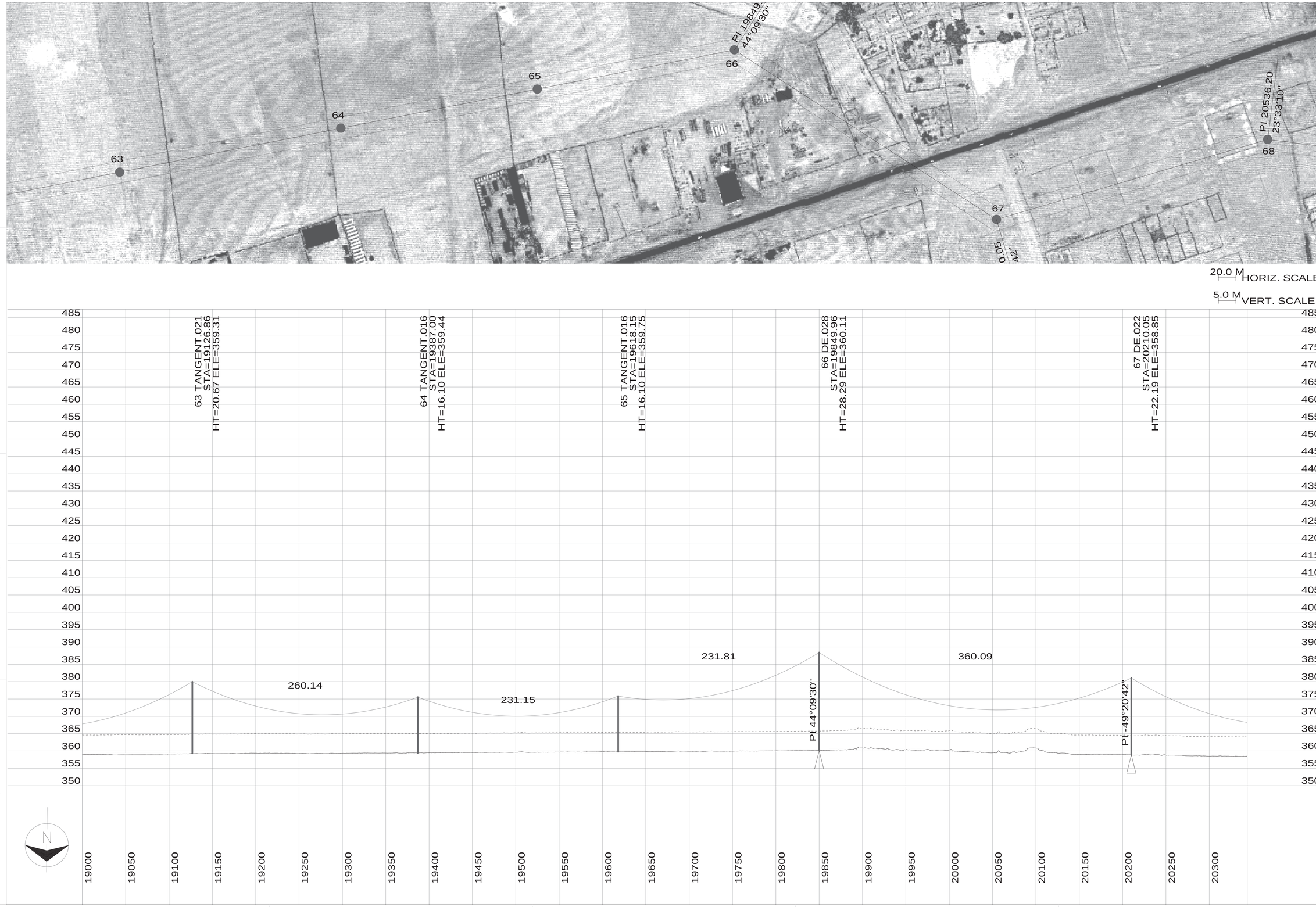
DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SIAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-116



US ARMY CORPS OF ENGINEERS
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U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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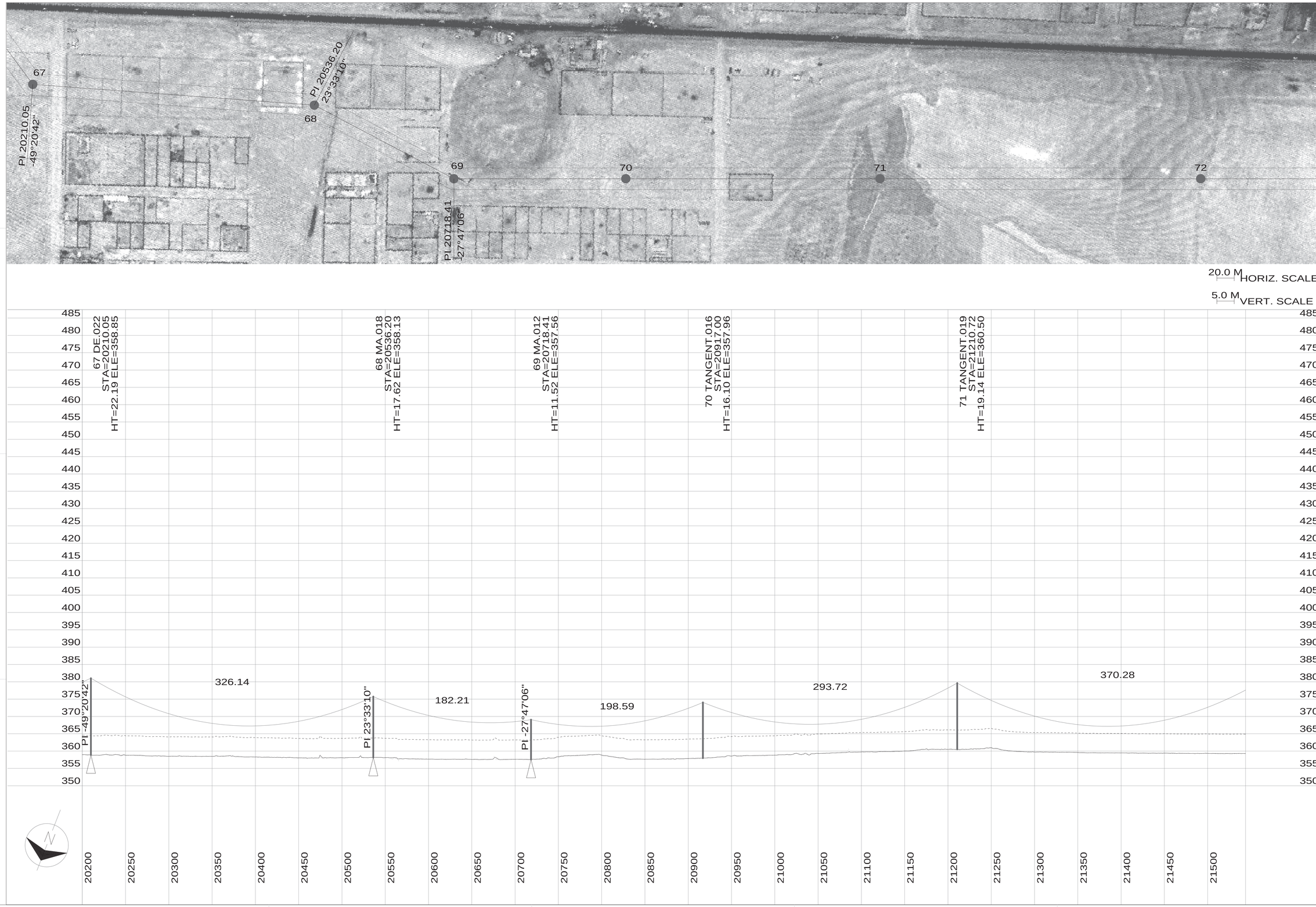
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-117



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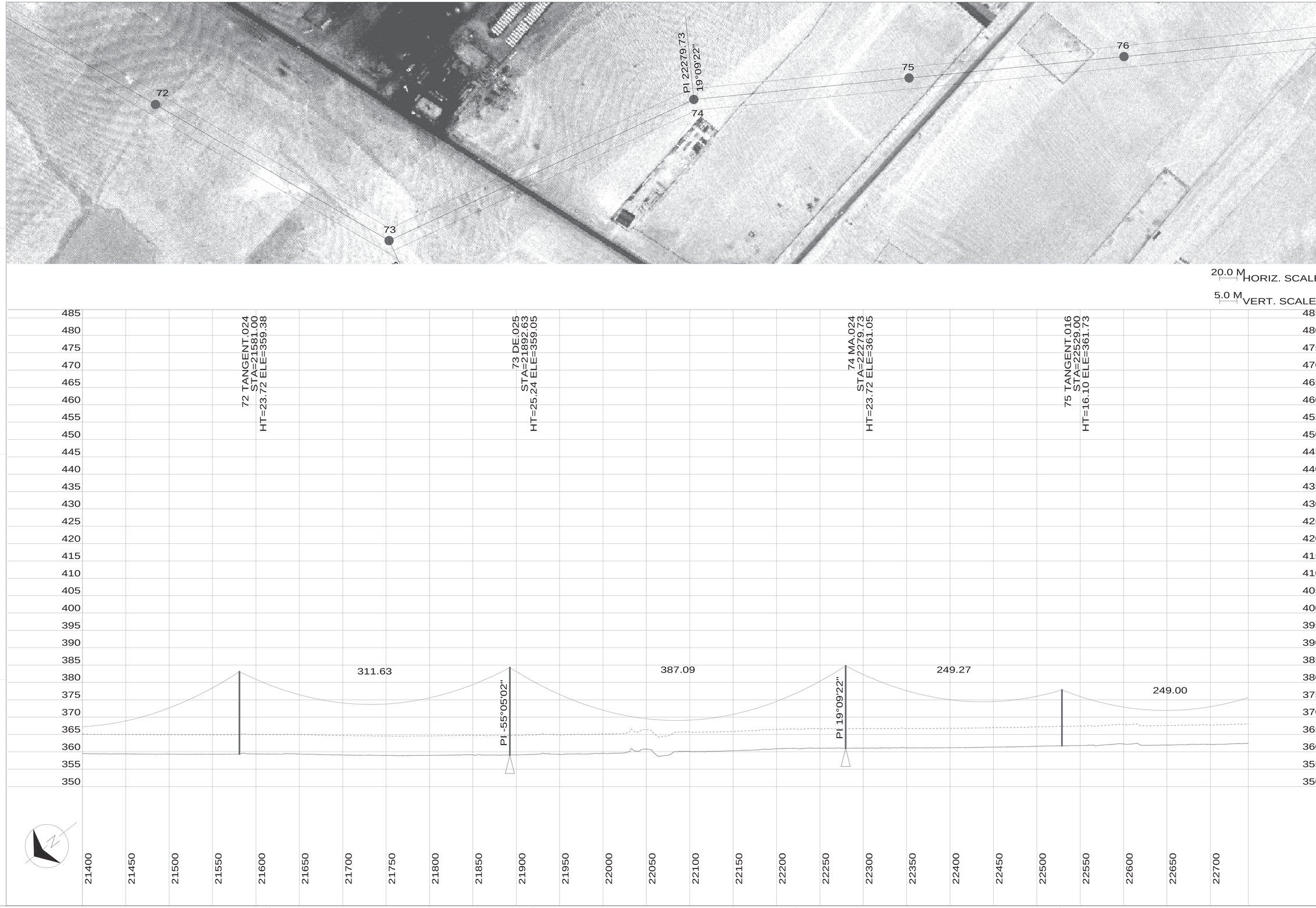
DESIGN / BUILD RFP FOR NORTHERN ELECTRICAL INTERCONNECT PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-118



US ARMY CORPS OF ENGINEERS
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TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
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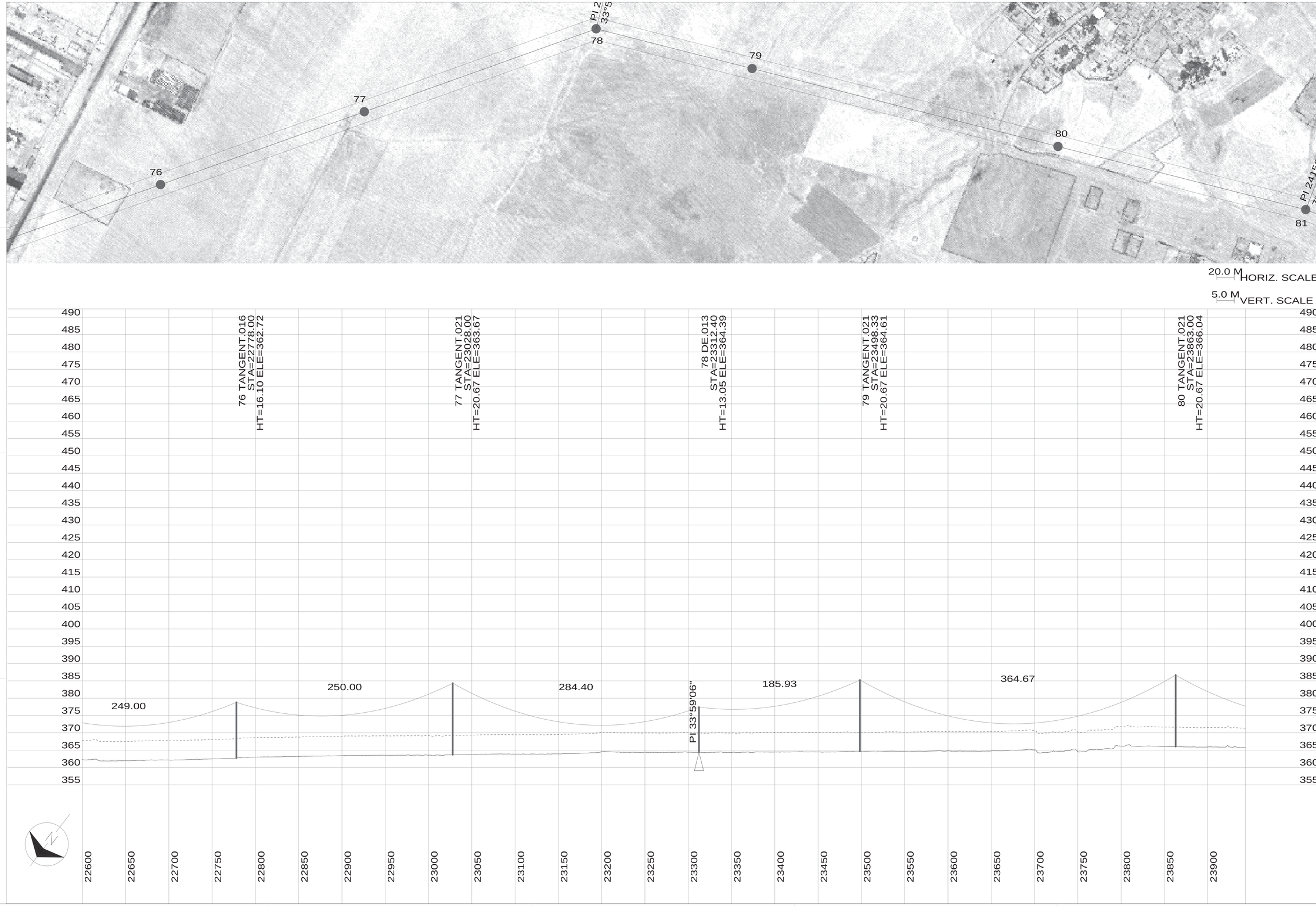

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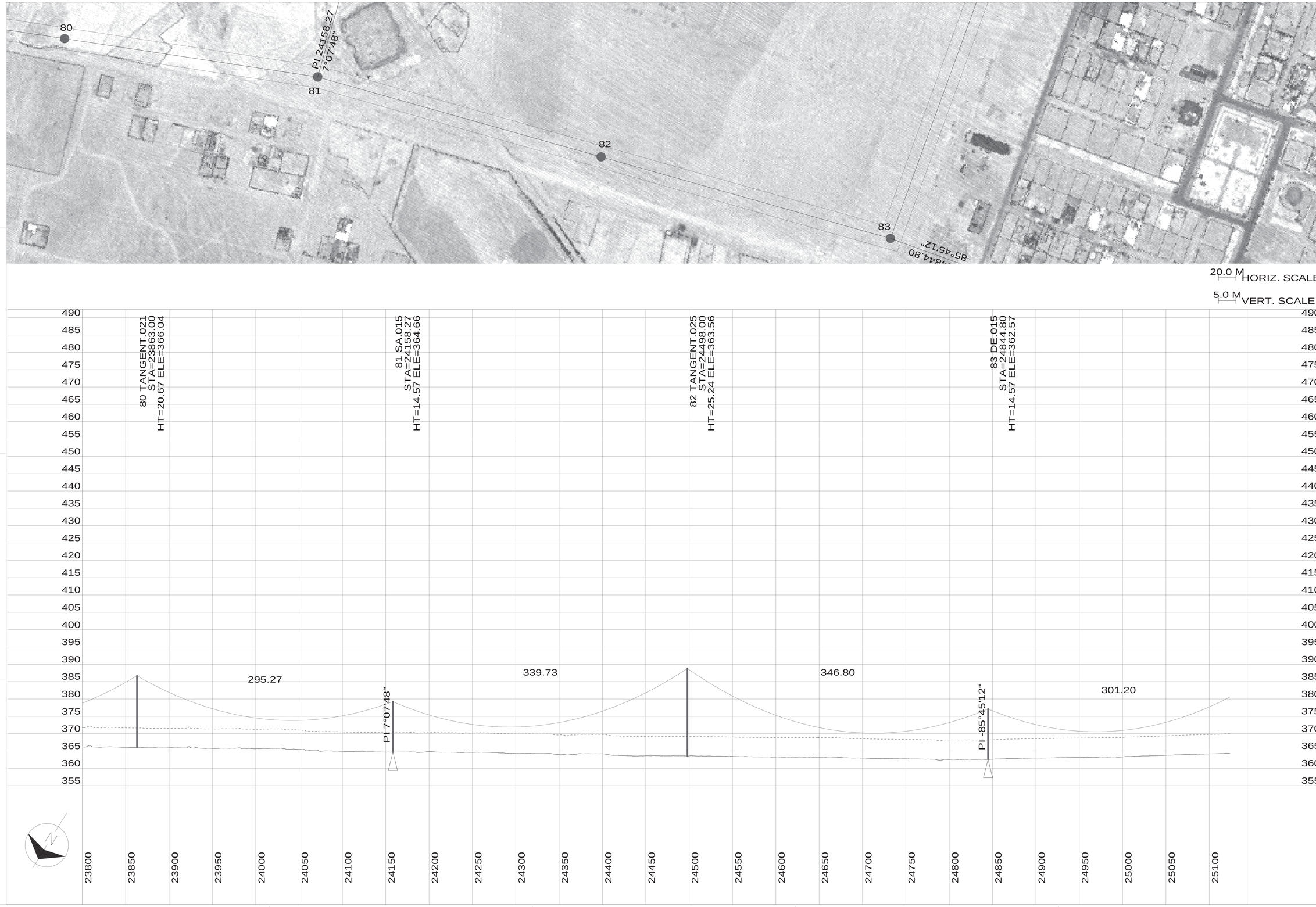
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR NORTHERN ELECTRICAL INTERCONNECT PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-120



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

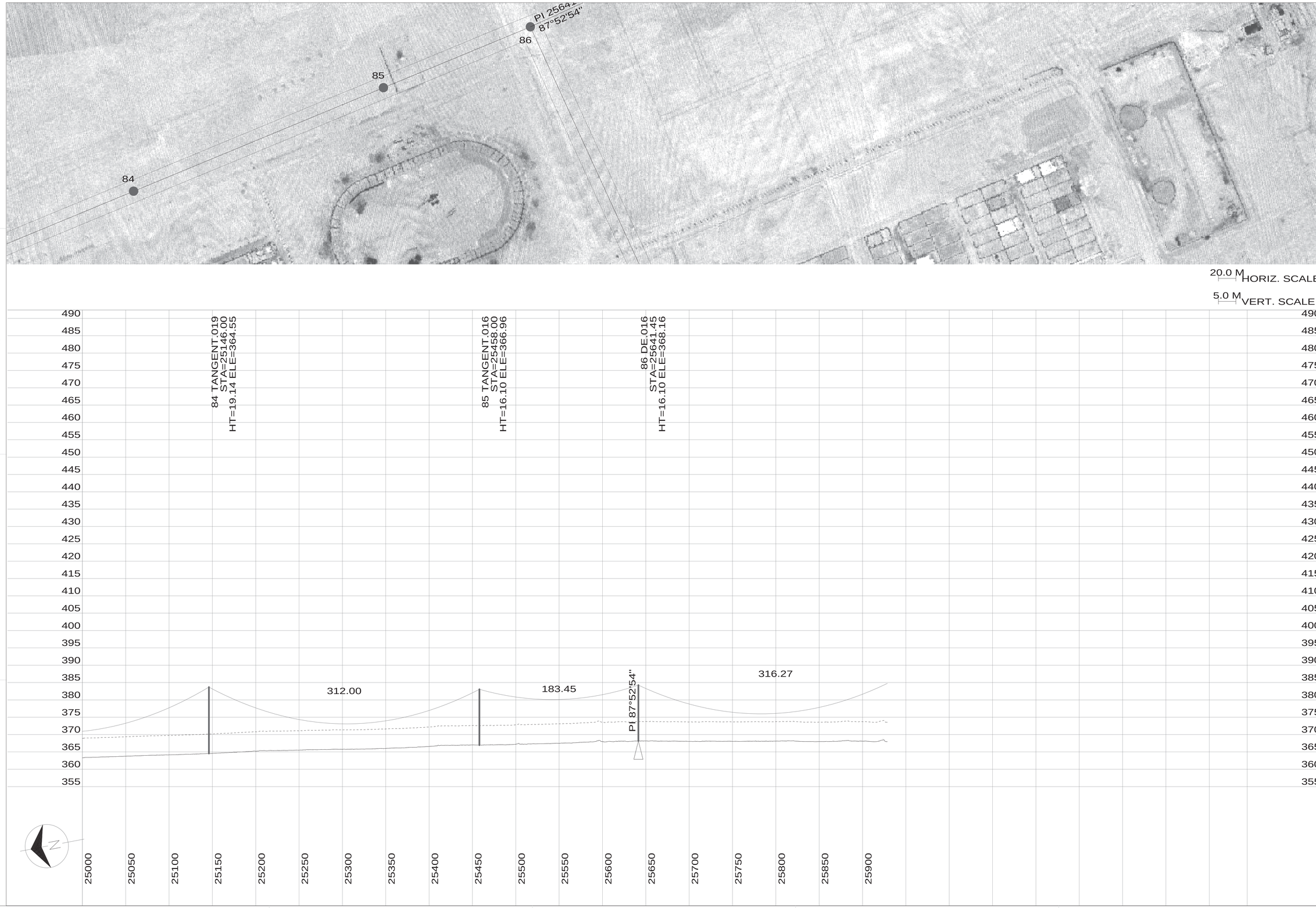
DESIGNED BY: M. SOSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1CM = 20M
PLOT DATE: 05/17/2015
SIZE: ANSI D
FILE NAME:
DATE: 5/17/2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-121



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

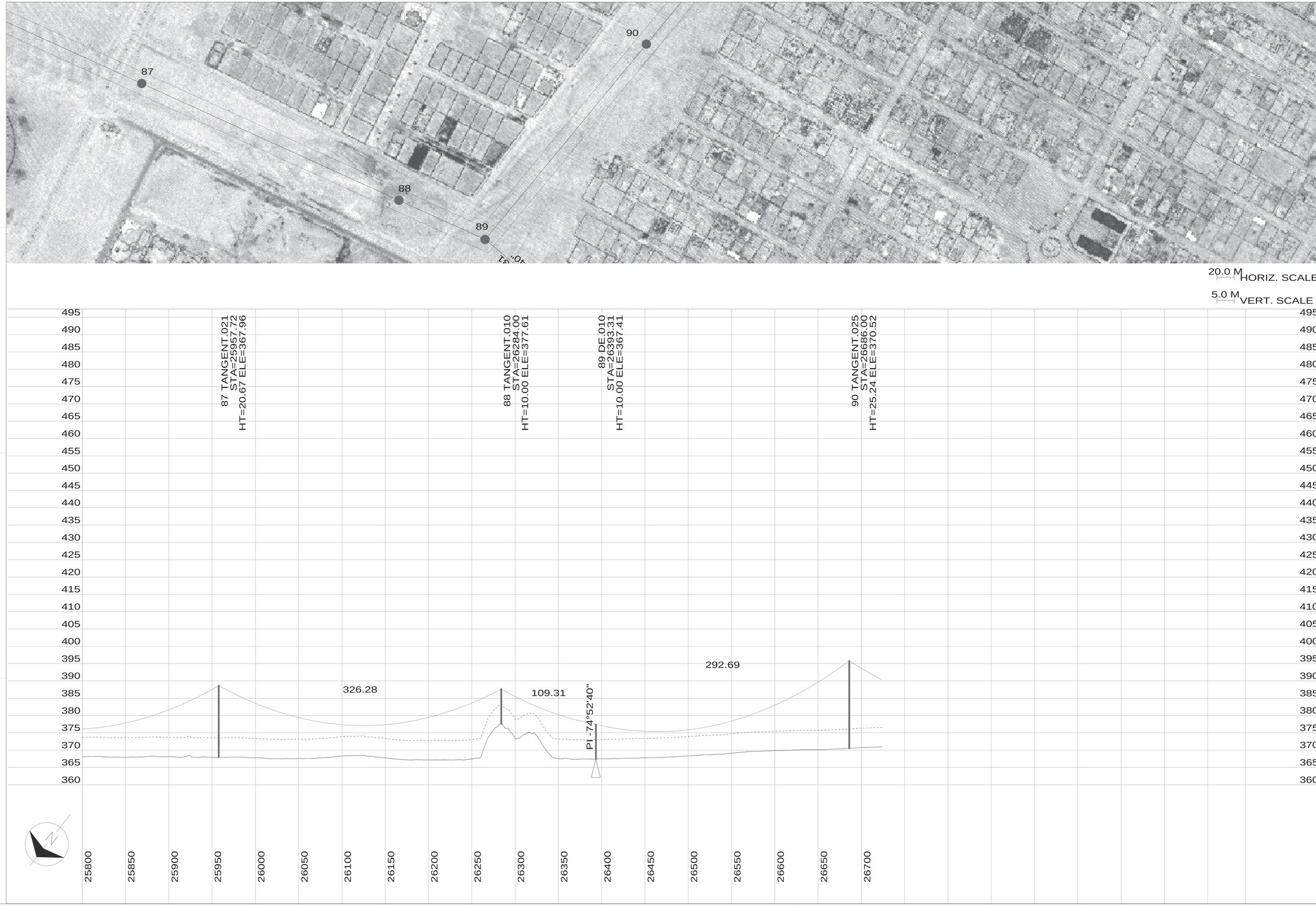
DESIGNED BY: M. SOSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
DATE: 5/17/2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
PLOT SCALE: 1CM = 20M
PLOT DATE: 05/17/2015
SIZE: ANSI D
FILE NAME:

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-122



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.

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DESIGNED BY: M. SOSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1CM = 20M
PLOT DATE: 05/17/2015
SIZE: ANSI D
FILE NAME:
DATE: 5/17/2015
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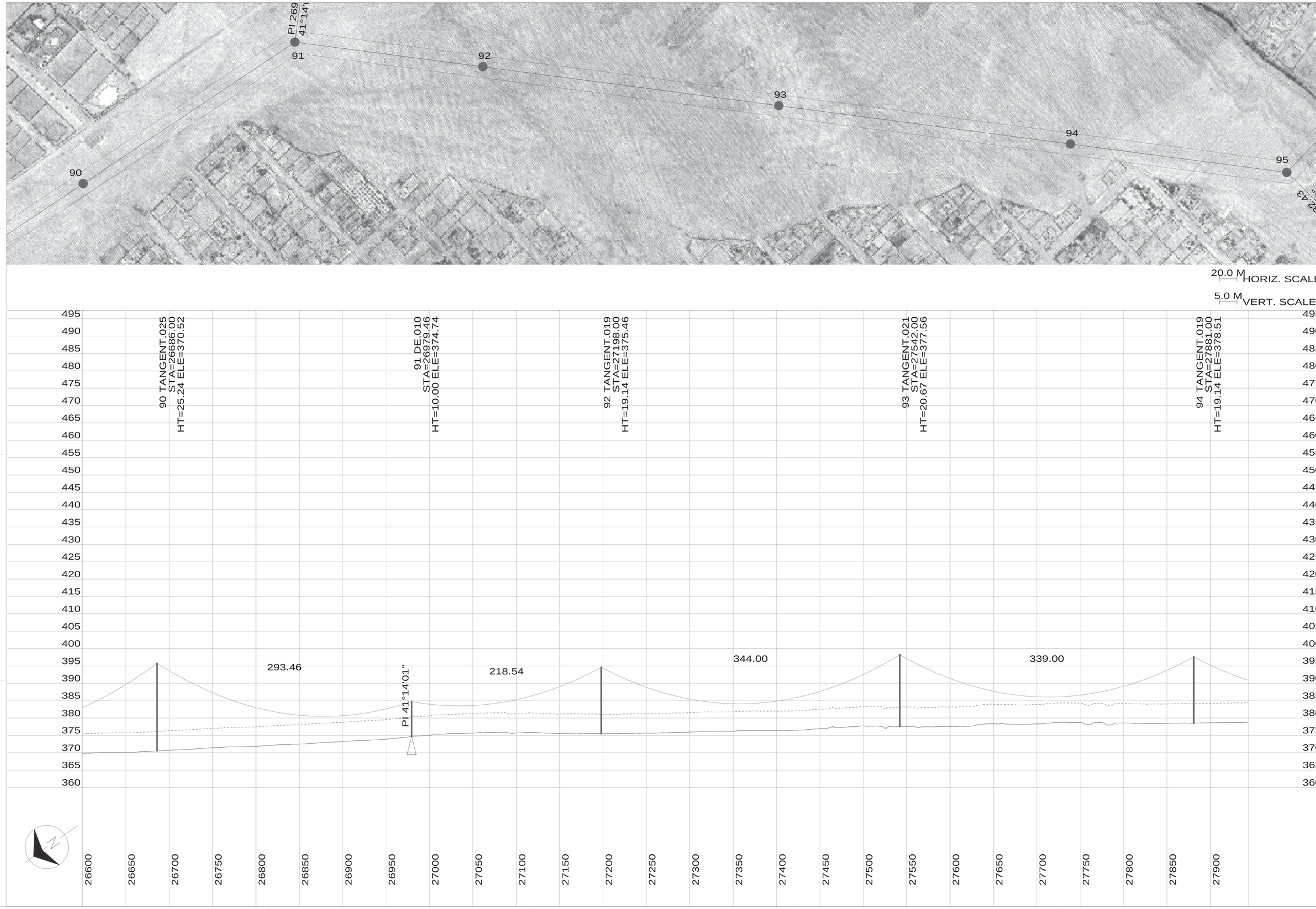
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-123



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

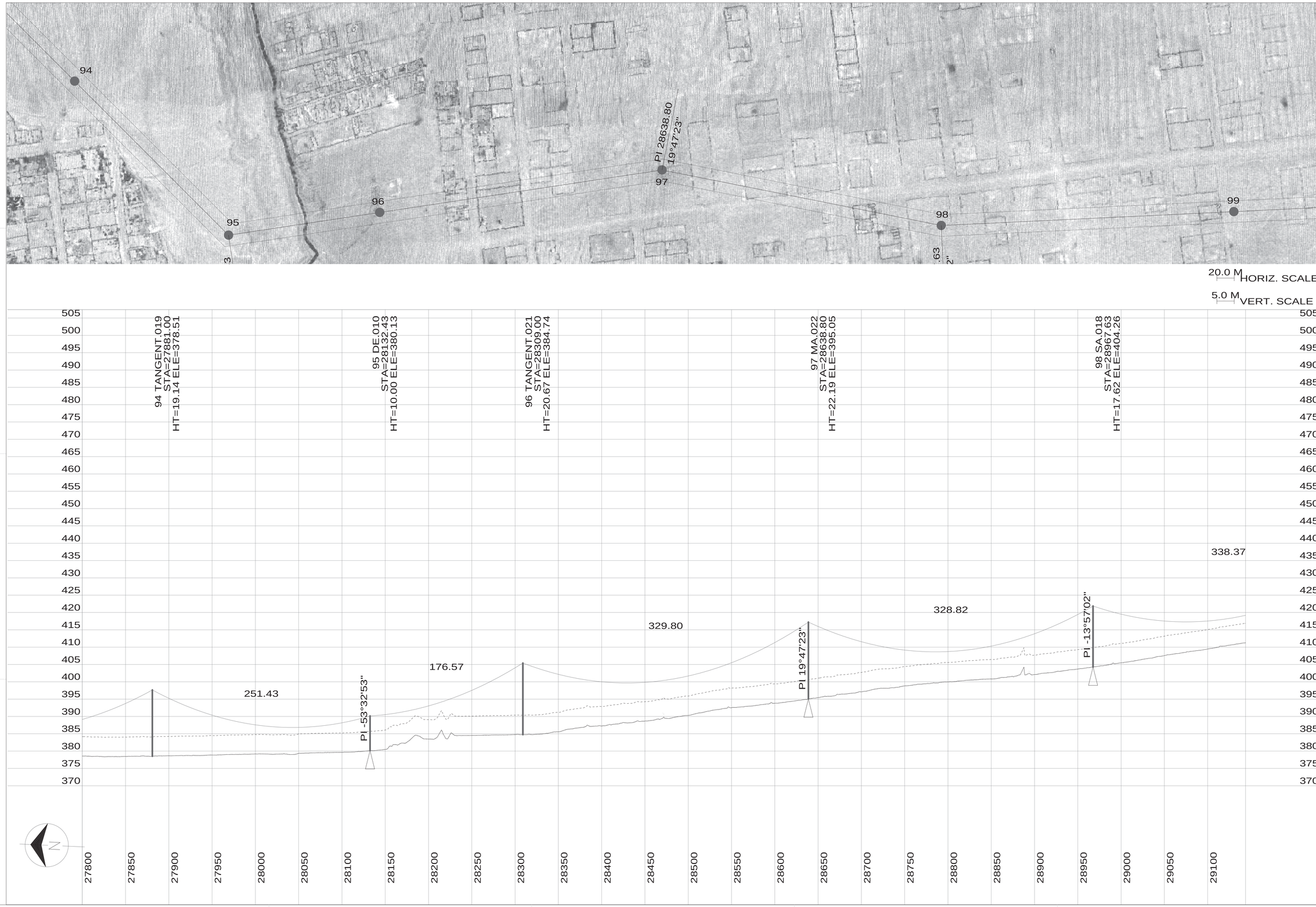
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGNED BY: M. SIDSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
DATE: 5/17/2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
PLOT SCALE: 1:20M
PLOT DATE: 06/17/2015
SIZE: ANSI D
FILE NAME:

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-124



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.

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DESIGNED BY: M. SOSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1CM = 20M
PLOT DATE: 05/17/2015
SIZE: ANSI D
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DATE: 5/17/2015
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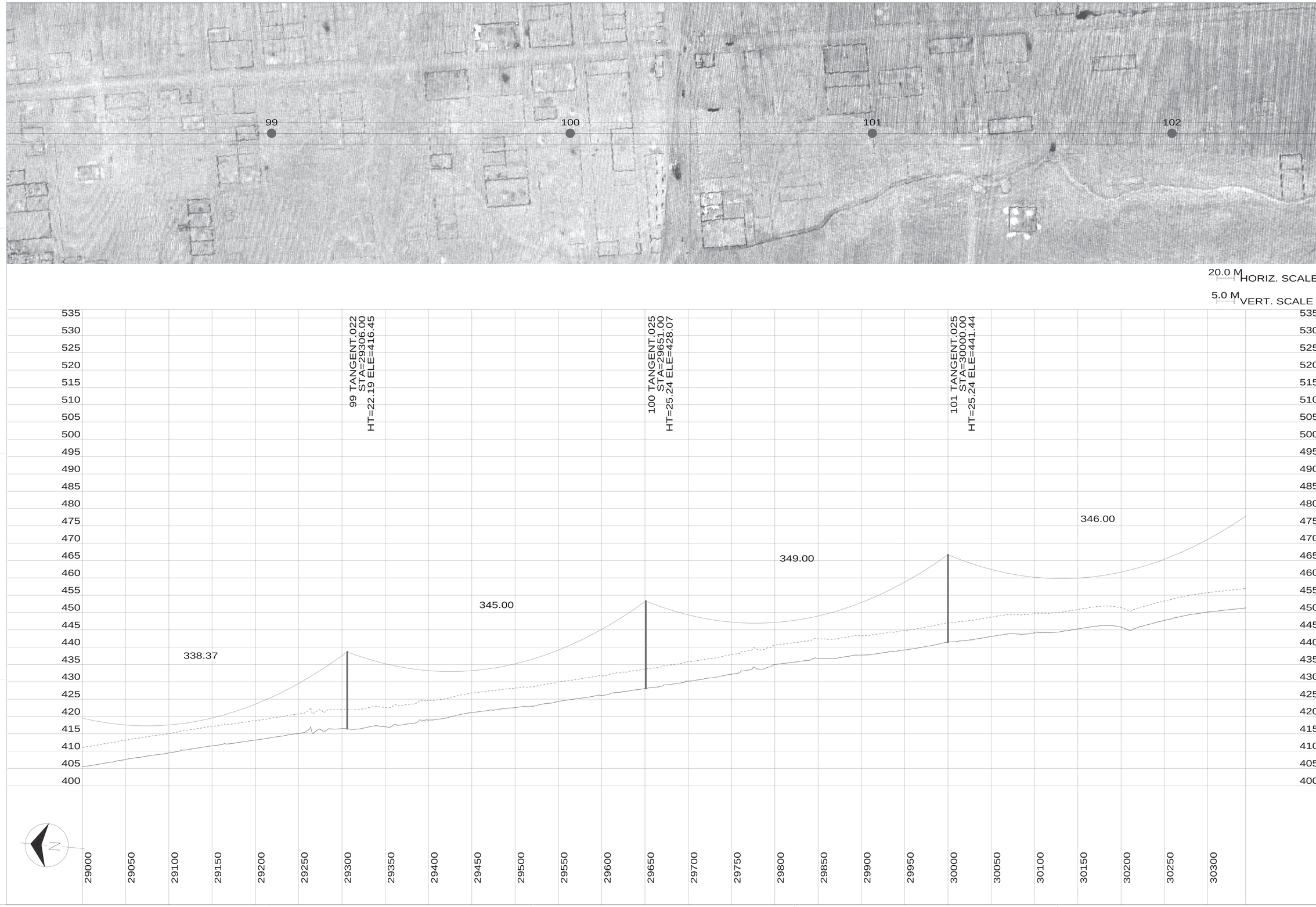
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-125



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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DESIGNED BY: M. SOSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1CM = 20M
PLOT DATE: 05/17/2015
SIZE: ANSI D
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DATE: 5/17/2015
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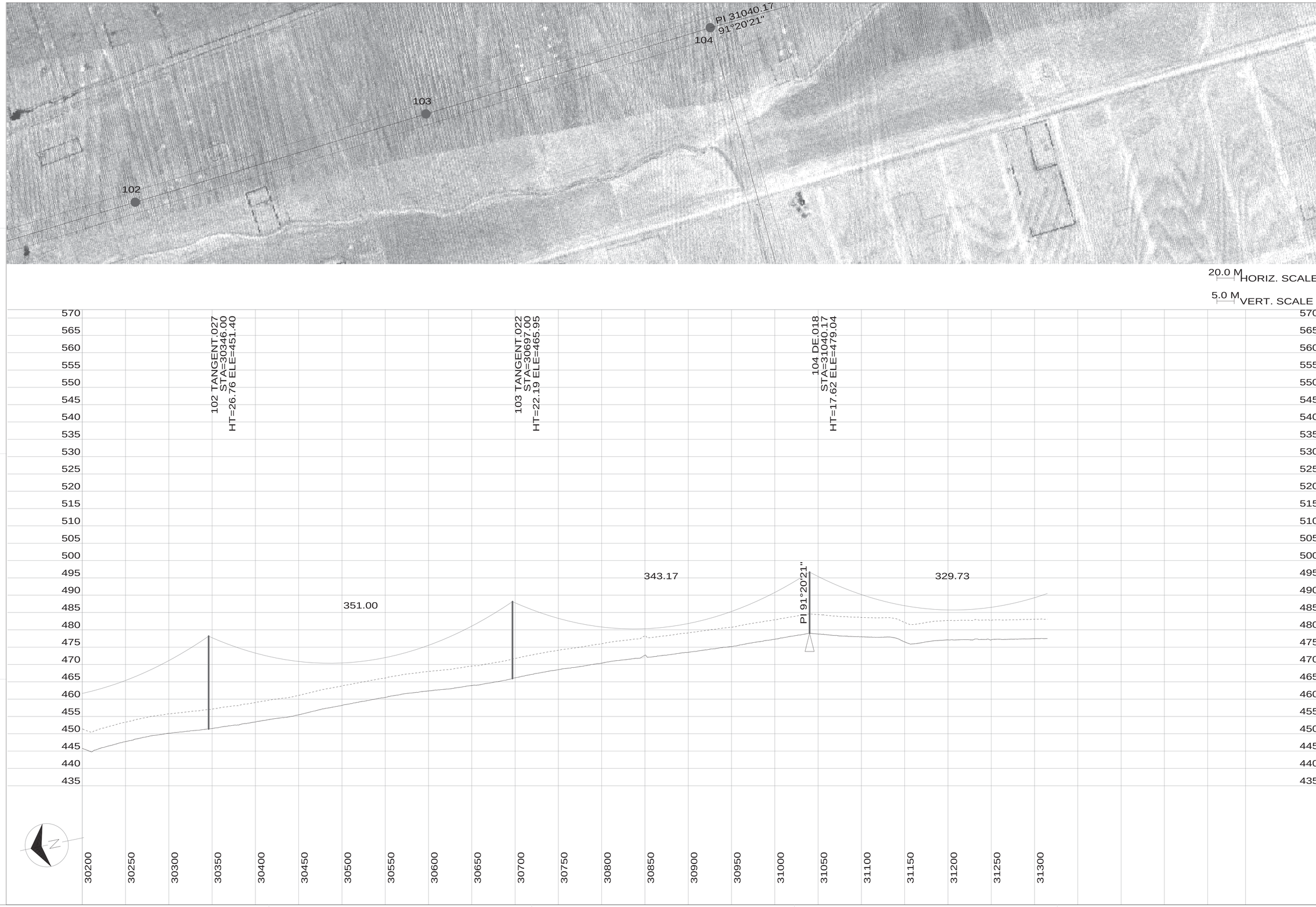
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-126



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

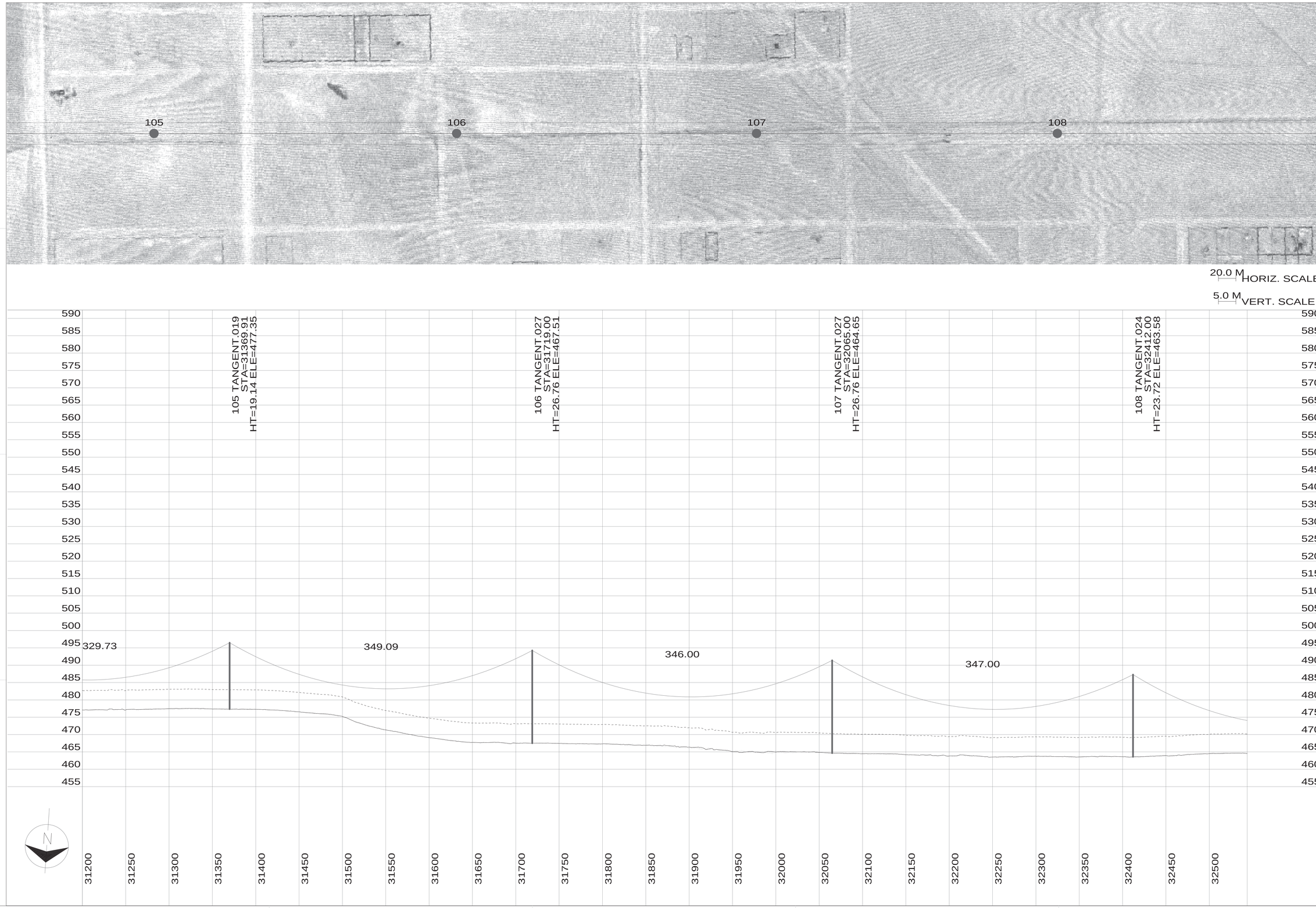
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGNED BY: M. SIYSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
DATE: 5/17/2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
PLOT SCALE: 1:20
PLOT DATE: 05/17/2015
SIZE: ANSI D
FILE NAME:

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SIAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-127



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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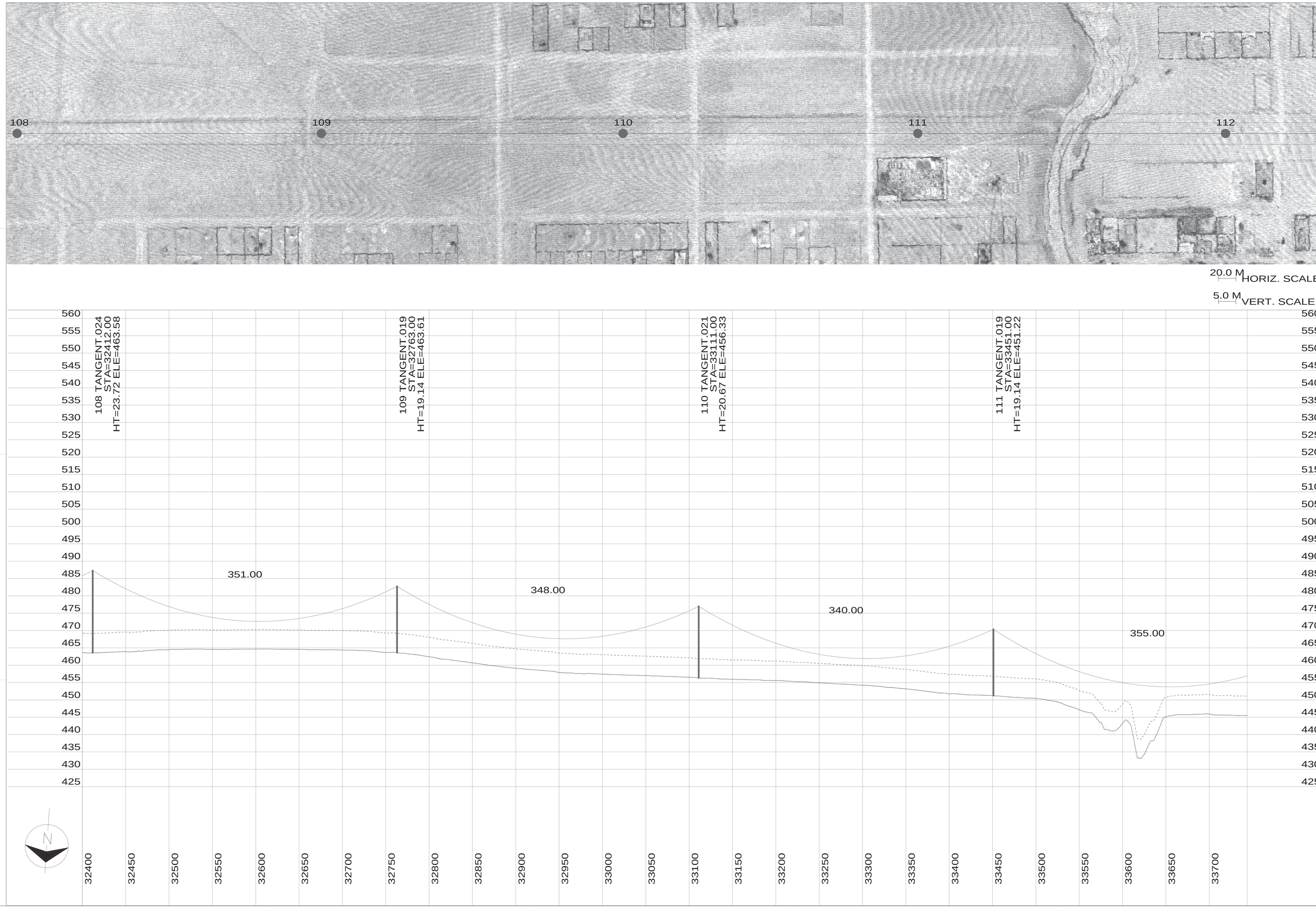
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-128



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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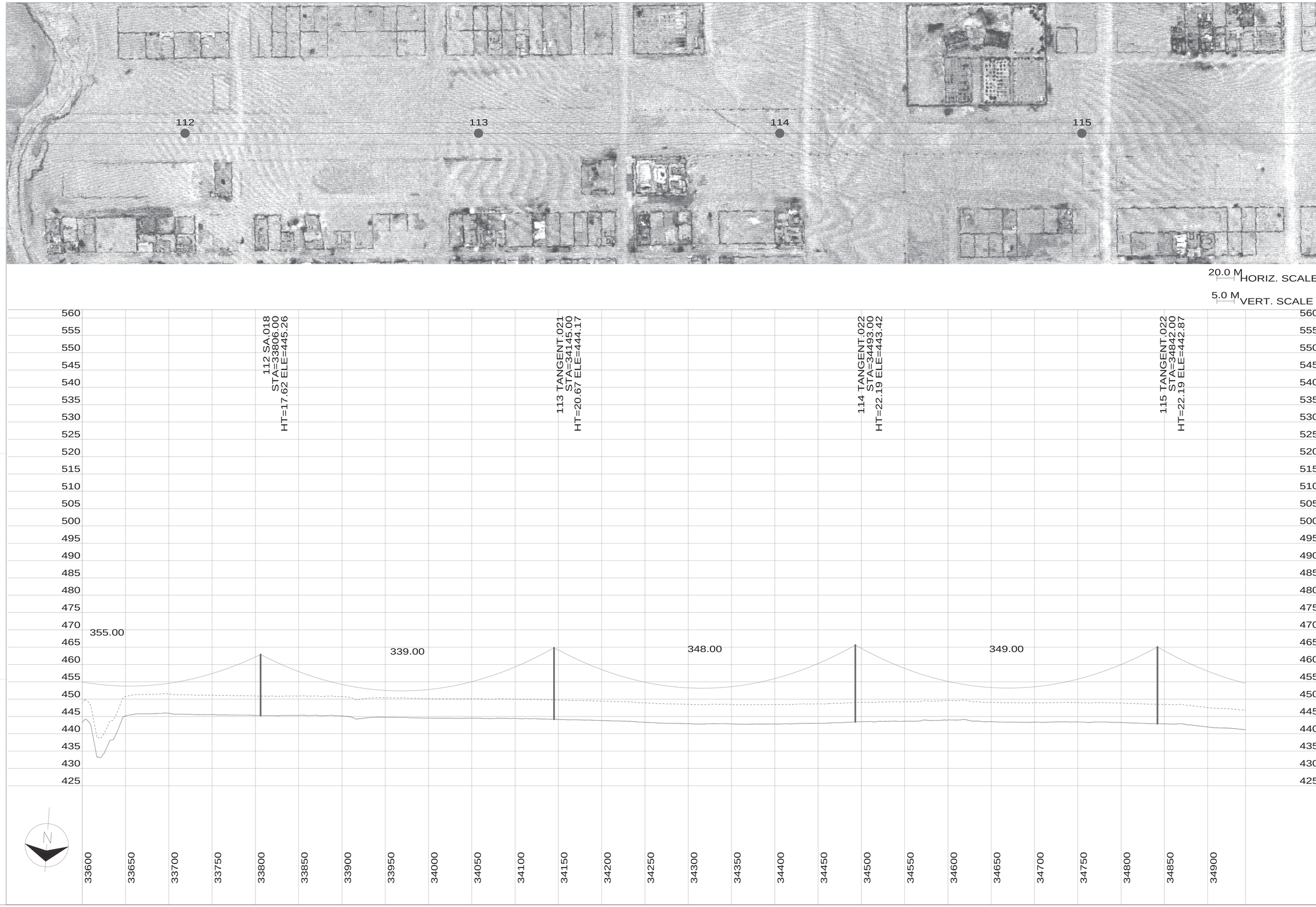
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-129



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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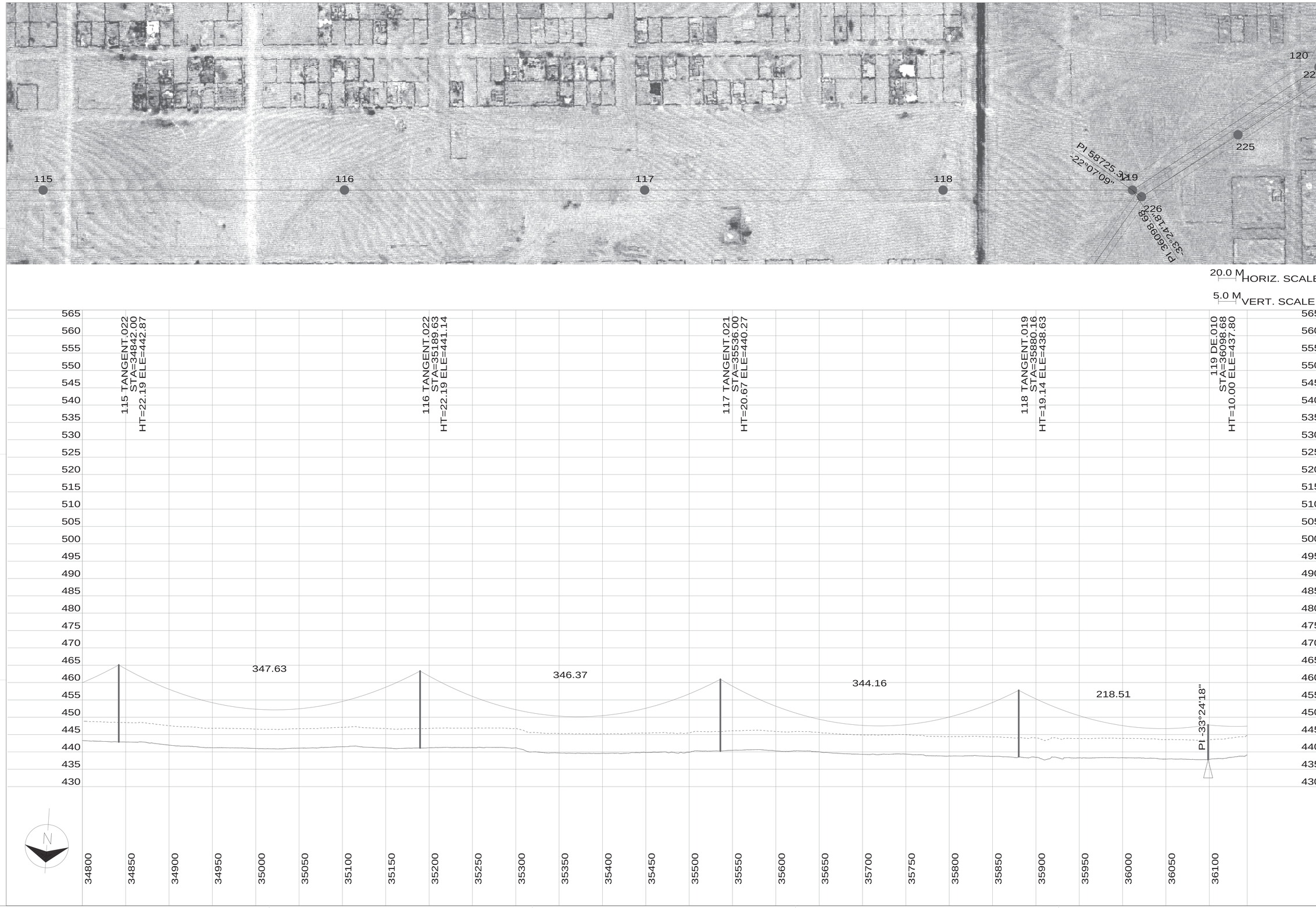
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-130



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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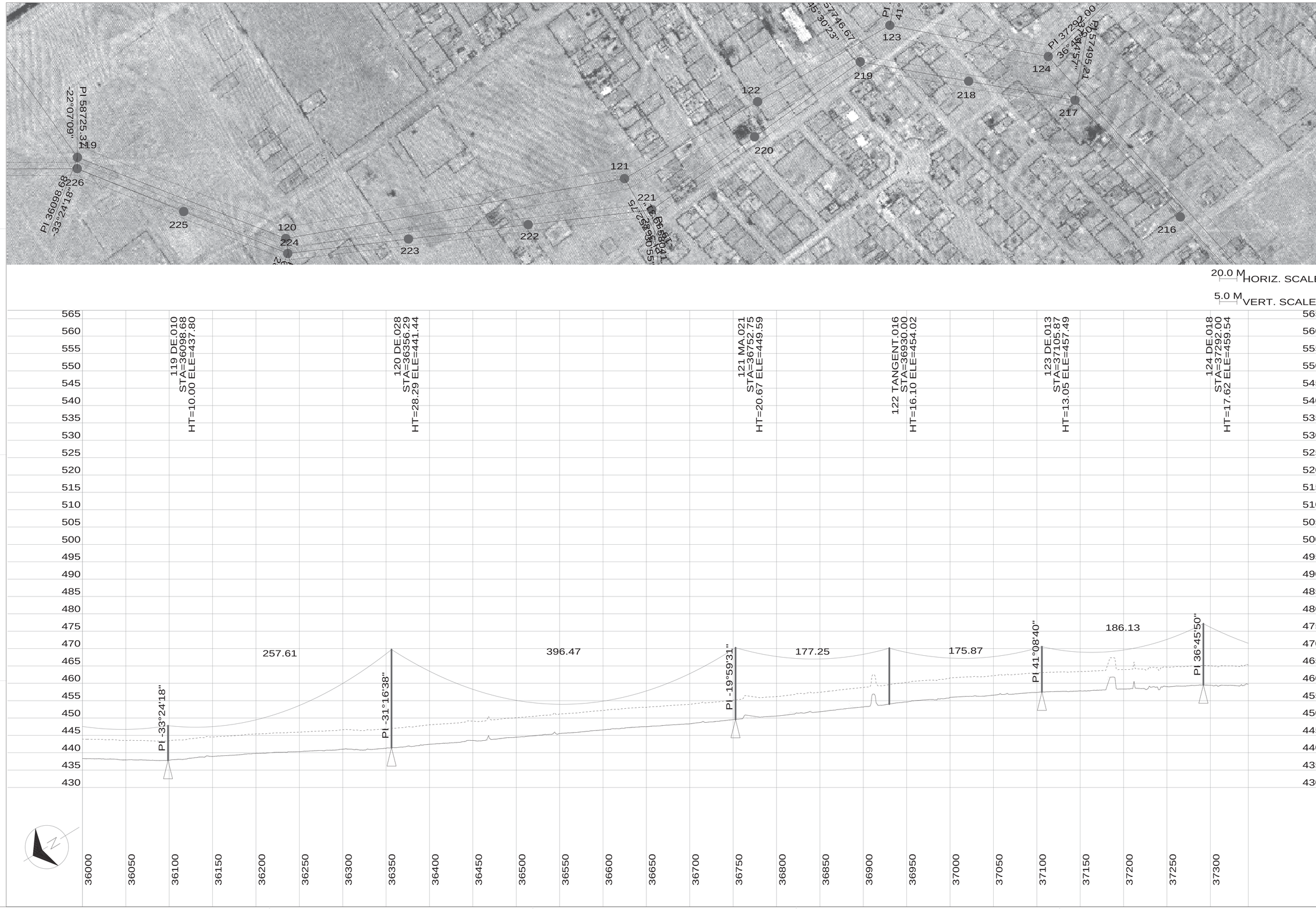
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-131



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

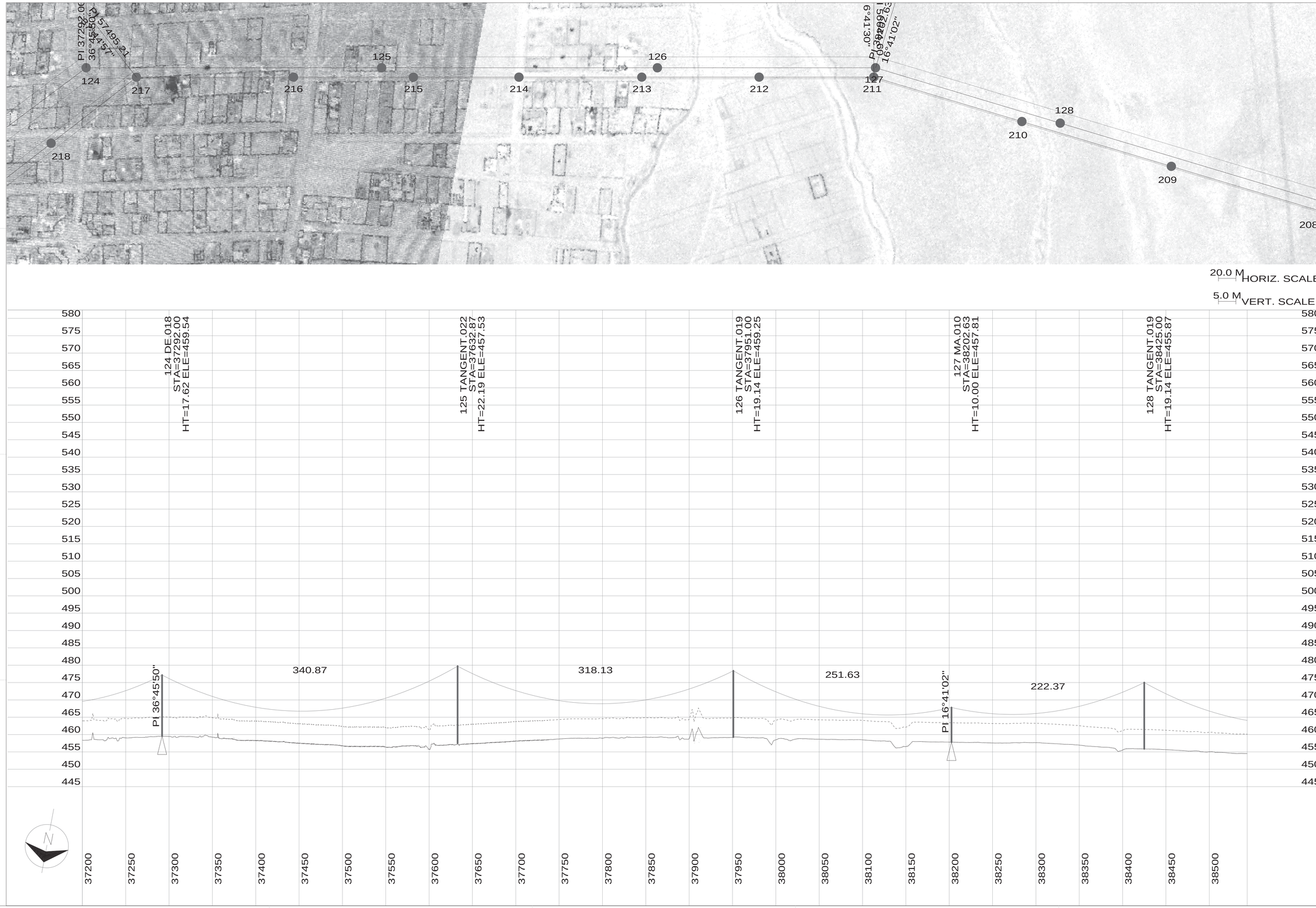
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGNED BY: M. SIDSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
DATE: 5/17/2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
PLOT SCALE: 1:20 FSM
PLOT DATE: 06/17/2015
SIZE: ANSI D
FILE NAME:

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SIAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-132



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.

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DESIGNED BY: M. SOSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1CM = 20M
PLOT DATE: 05/17/2015
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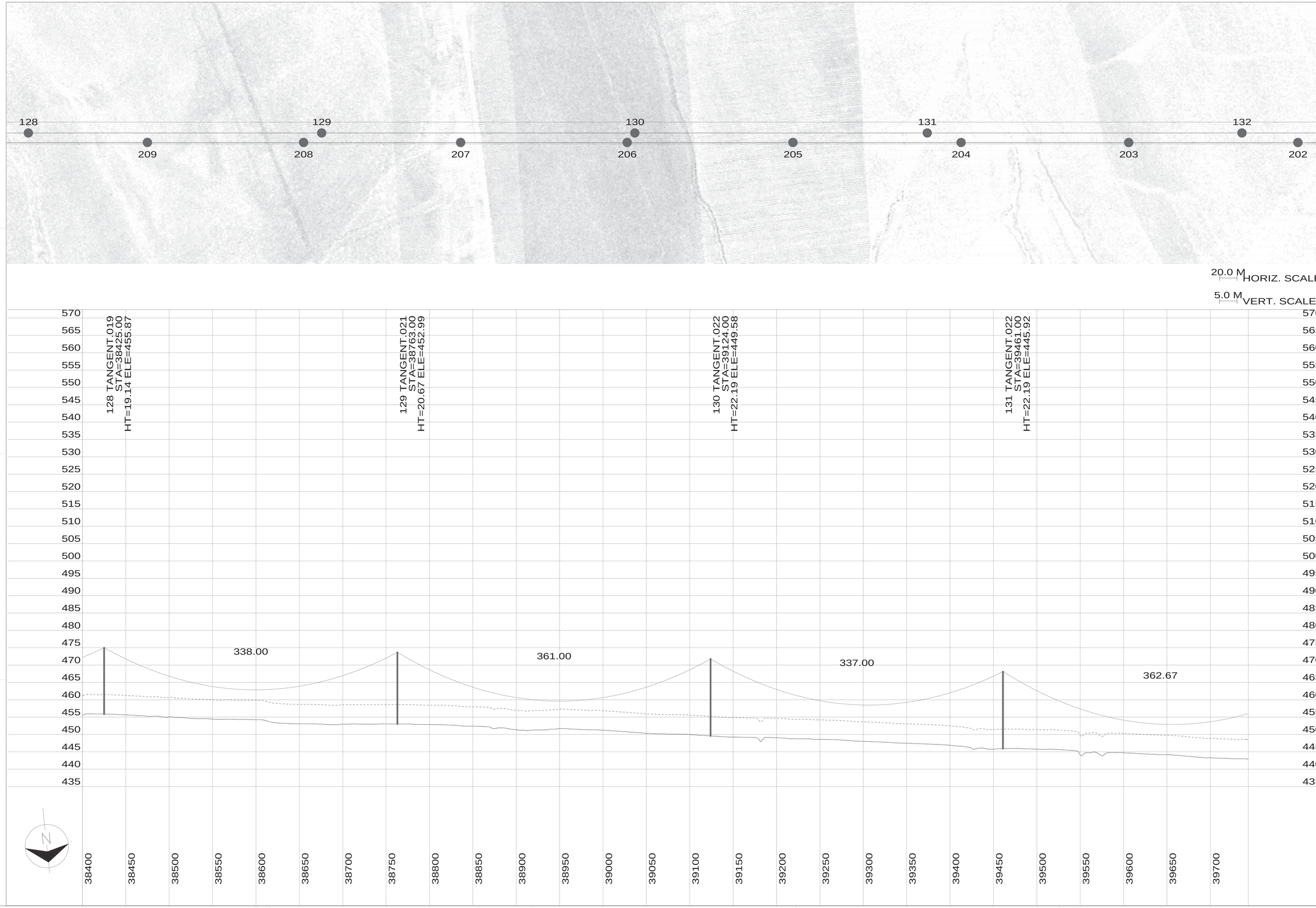
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-133



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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DESIGNED BY: M. SOSNA
DWN BY: MRS
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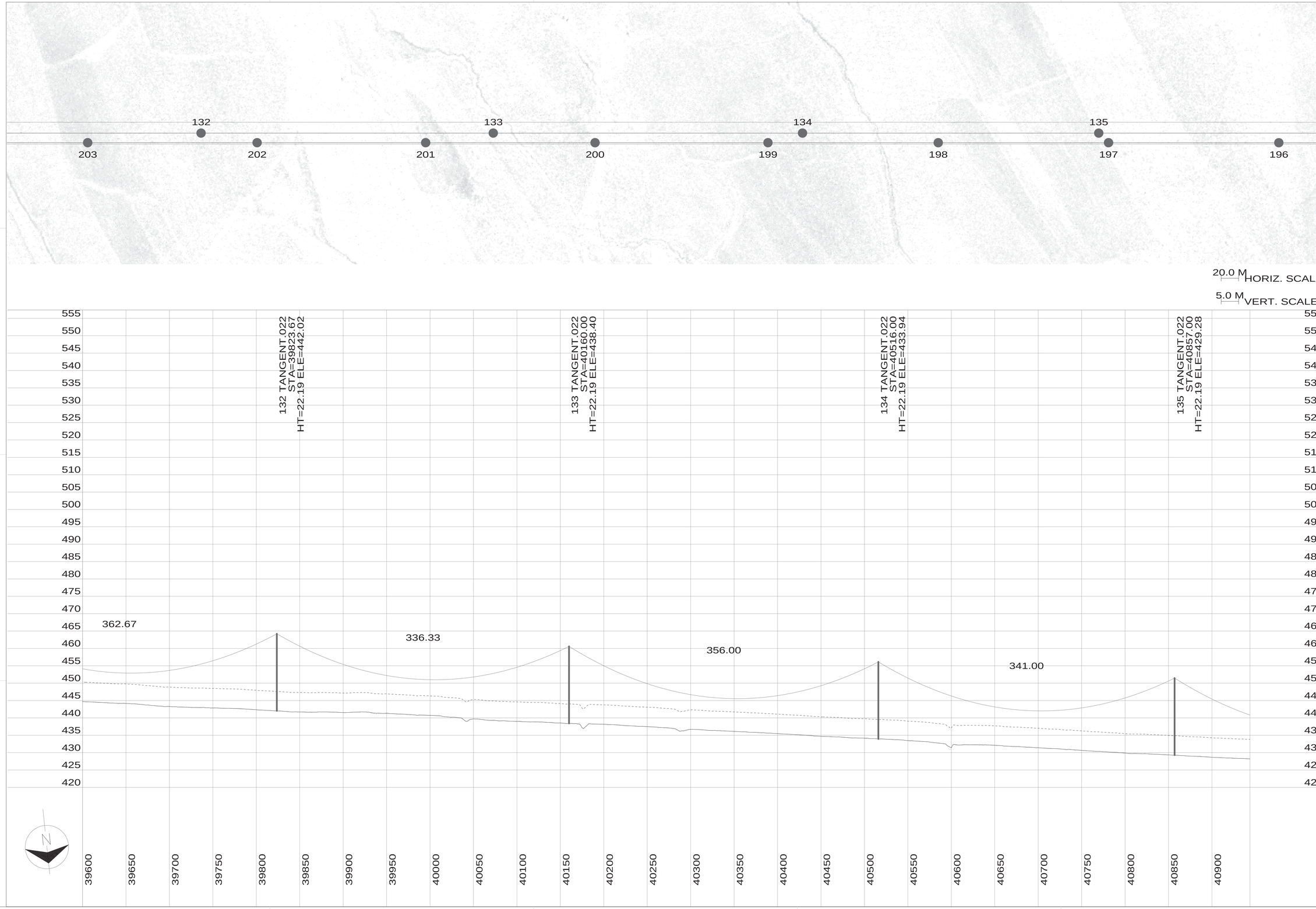
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-134



US ARMY CORPS OF ENGINEERS PHILADELPHIA DISTRICT

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DESIGNED BY: M. SOSNA
DWN BY: MRS
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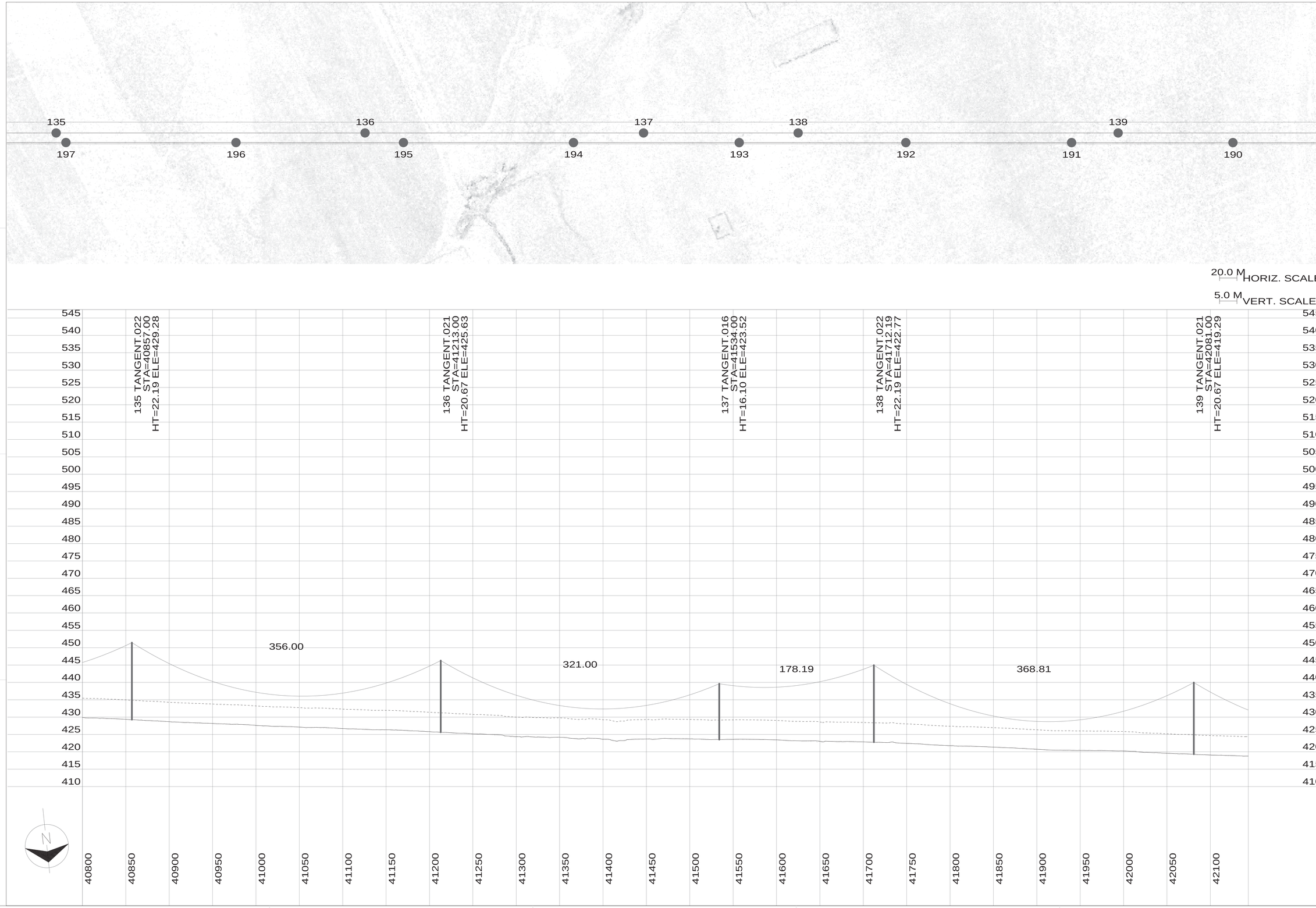
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR NORTHERN ELECTRICAL INTERCONNECT PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-135



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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DWN BY: MRS
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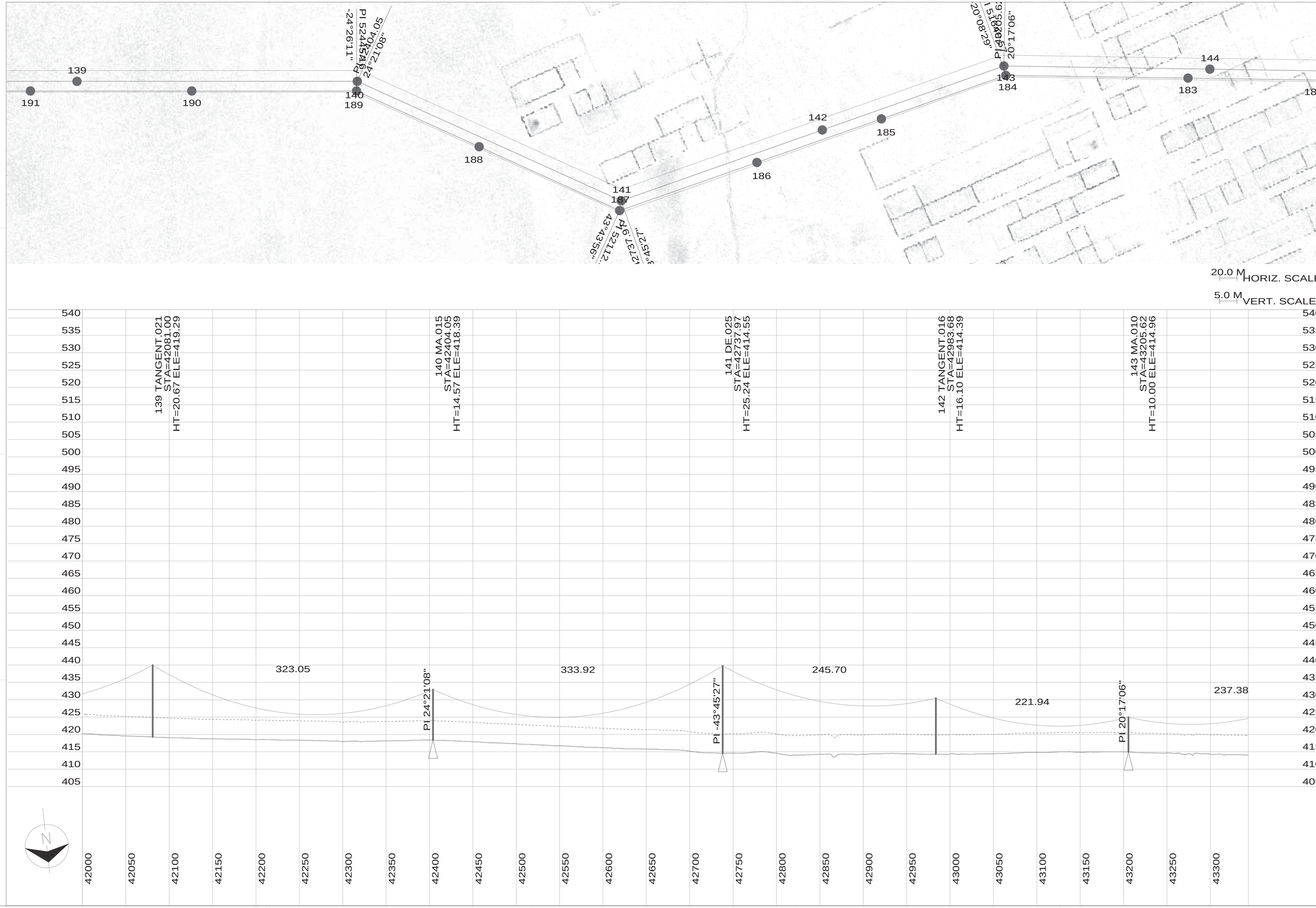
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-136



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGNED BY: M. SIDSNA
DATE: 5/17/2015
DWN BY: MRS
CKD BY:
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SUBMITTED BY:
CONTRACT NO.:
PLOT SCALE: 1:20M
PLOT DATE: 06/17/2015
FILE NUMBER:
SIZE: ANSI D
FILE NAME:

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SIAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-137

US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGNED BY: M. SIDSNA
DATE: 5/17/2015
DWN BY: MRS
CKD BY:
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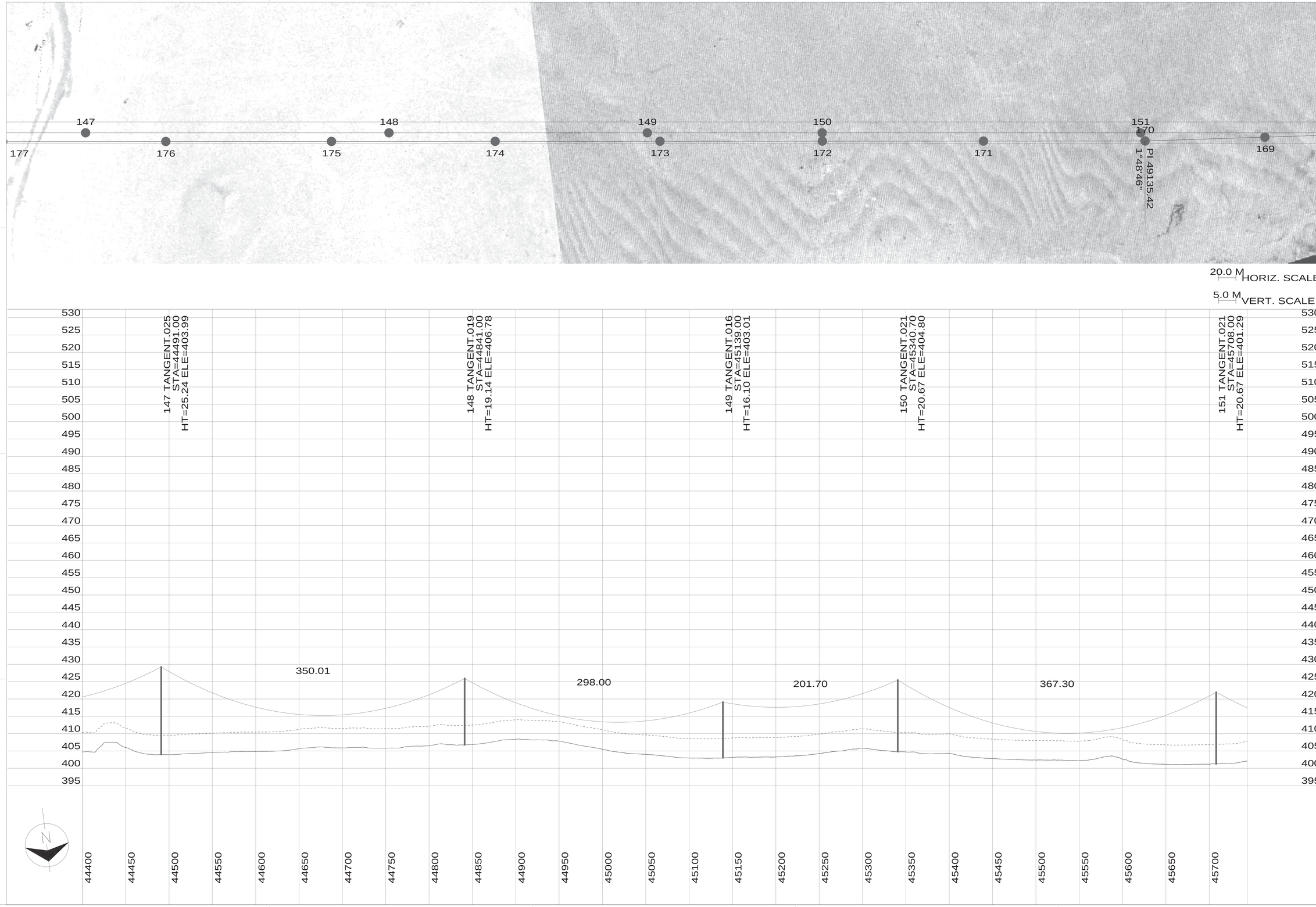
SUBMITTED BY:
CONTRACT NO.:
PLOT SCALE: 1:20M
PLOT DATE: 06/17/2015
FILE NUMBER:
SIZE: ANSI D
FILE NAME:

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 kV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-138



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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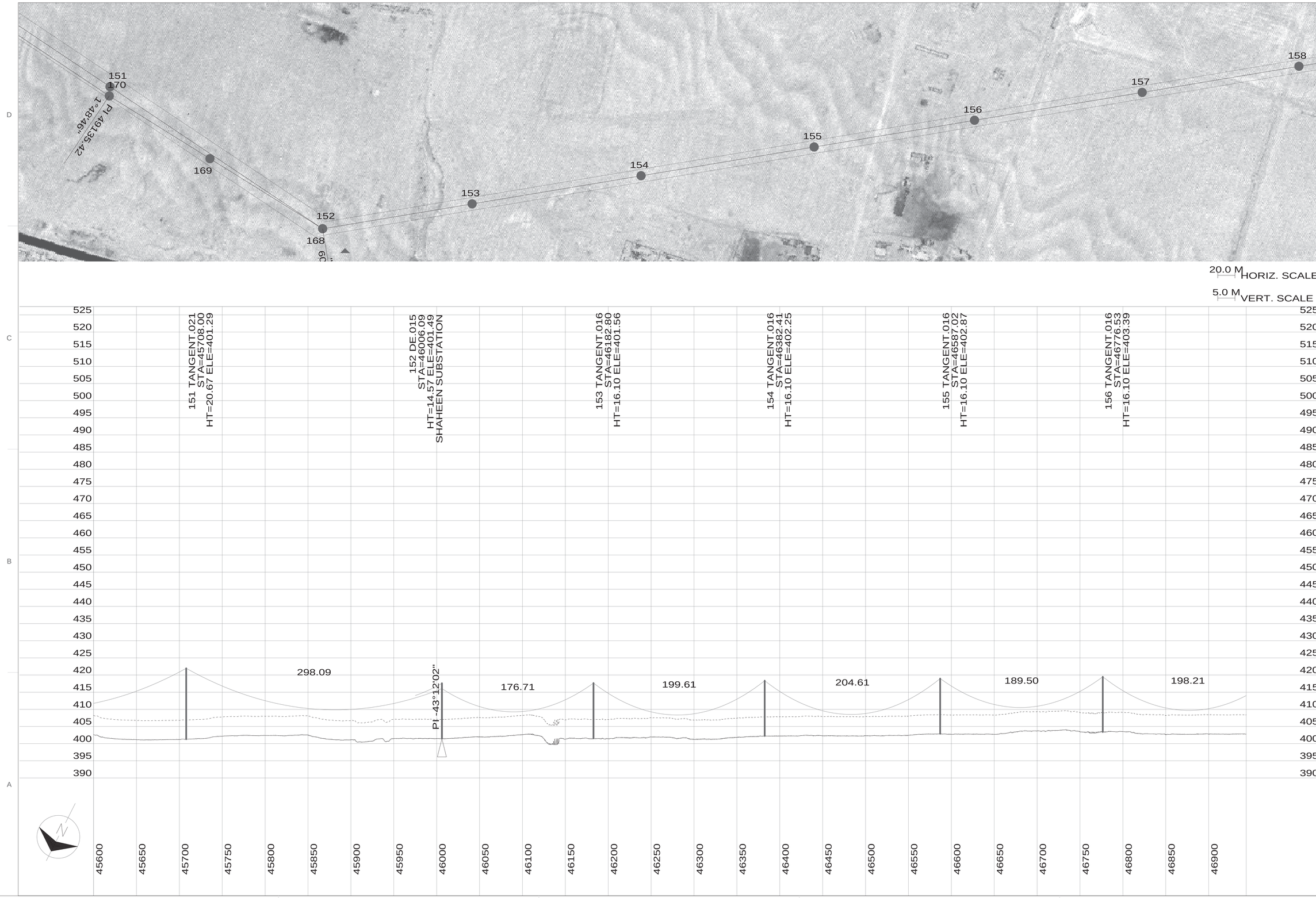
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NAIABAD TO SHAHEEN SUBSTATION 220 KV
TRANSMISSION LINE PLAN AND PROFILE

SHEET NUMBER
ES-139



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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U.S. ARMY CORPS OF ENGINEERS
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SUBMITTED BY:
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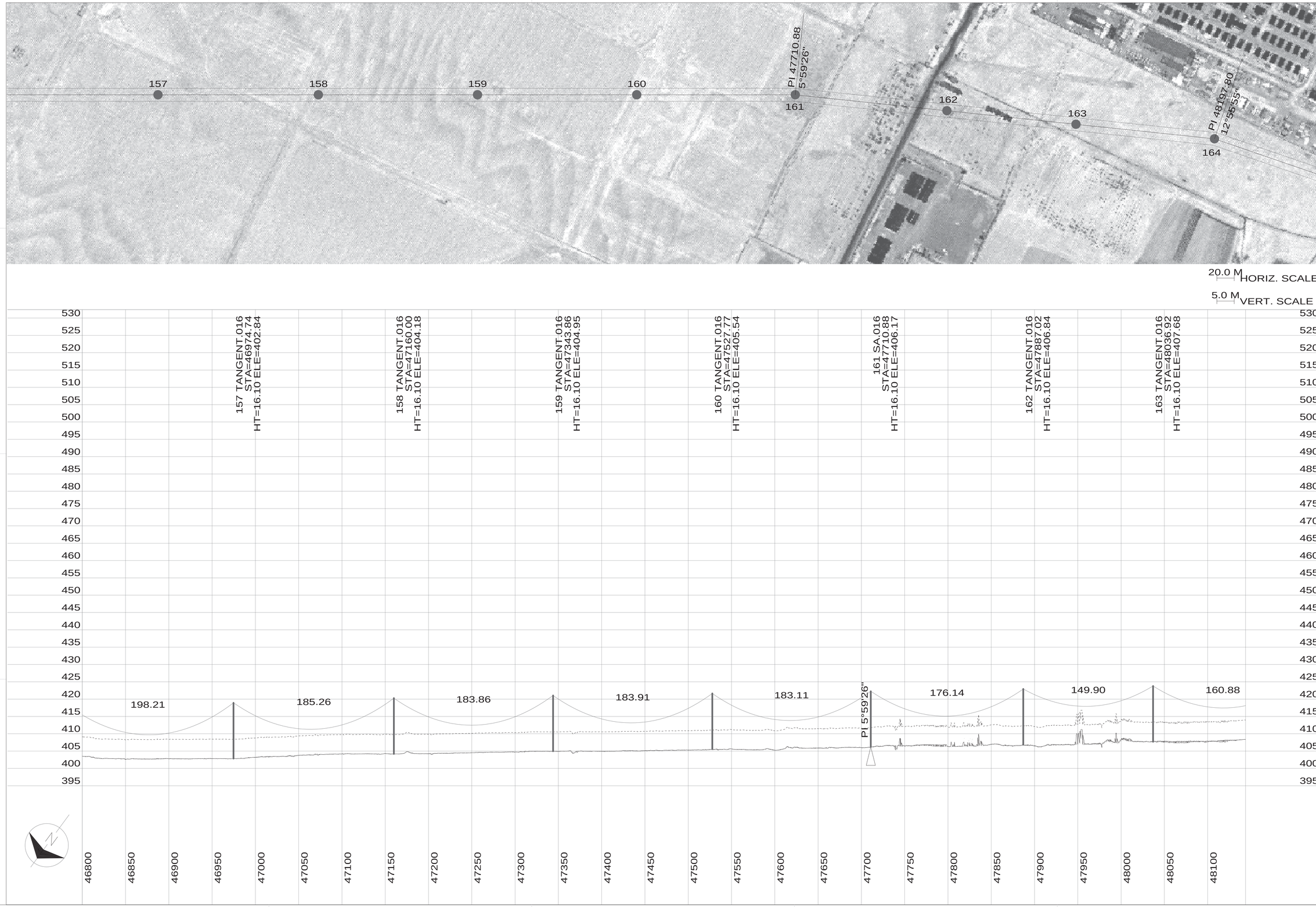
FILE NAME:

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

SHAHEEN SUBSTATION TO CAMP SHAHEEN 20 KV
DISTRIBUTION LINE PLAN AND PROFILE

SHEET NUMBER
ES-140



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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U.S. ARMY CORPS OF ENGINEERS
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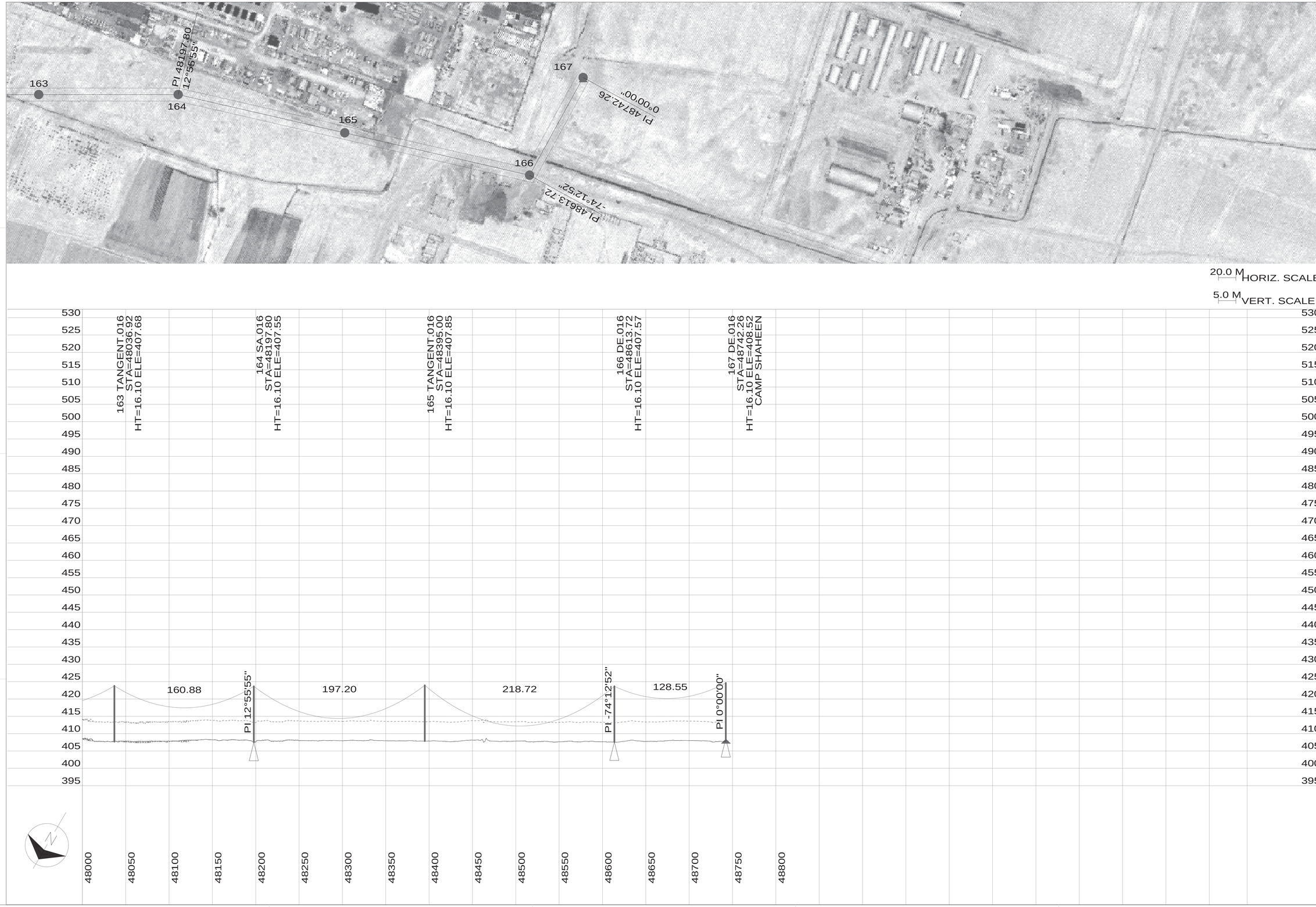
DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

SHAHEEN SUBSTATION TO CAMP SHAHEEN 20 KV
DISTRIBUTION LINE PLAN AND PROFILE

SHEET NUMBER
ES-141



US ARMY CORPS OF ENGINEERS
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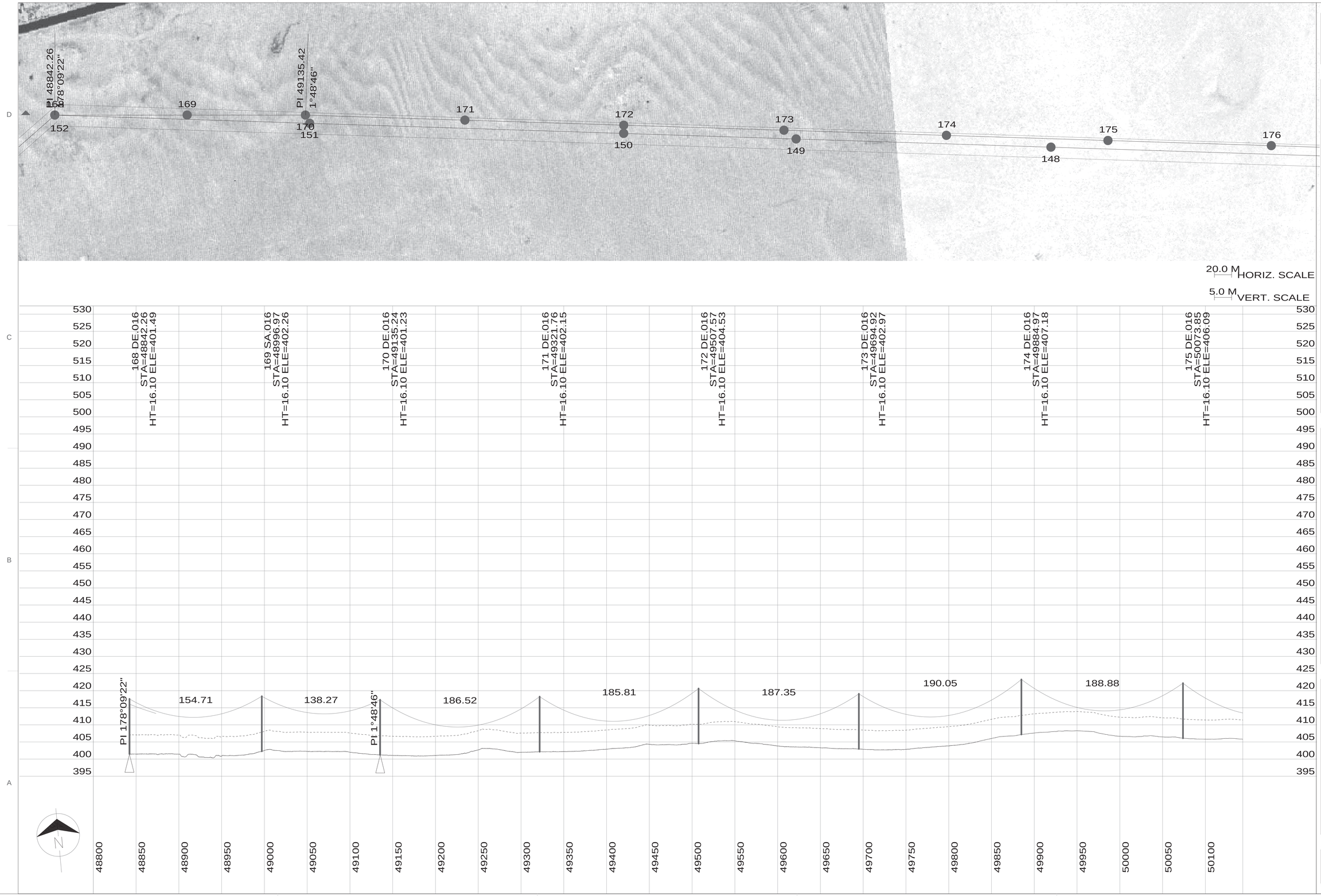
PROJECTS, AFGHANISTAN

SHAHEEN SUBSTATION TO CAMP SHAHEEN 20 KV
DISTRIBUTION LINE PLAN AND PROFILE

SHEET NUMBER
ES-142



US ARMY CORPS OF ENGINEERS
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MARK	DESCRIPTION	DATE	APPR.

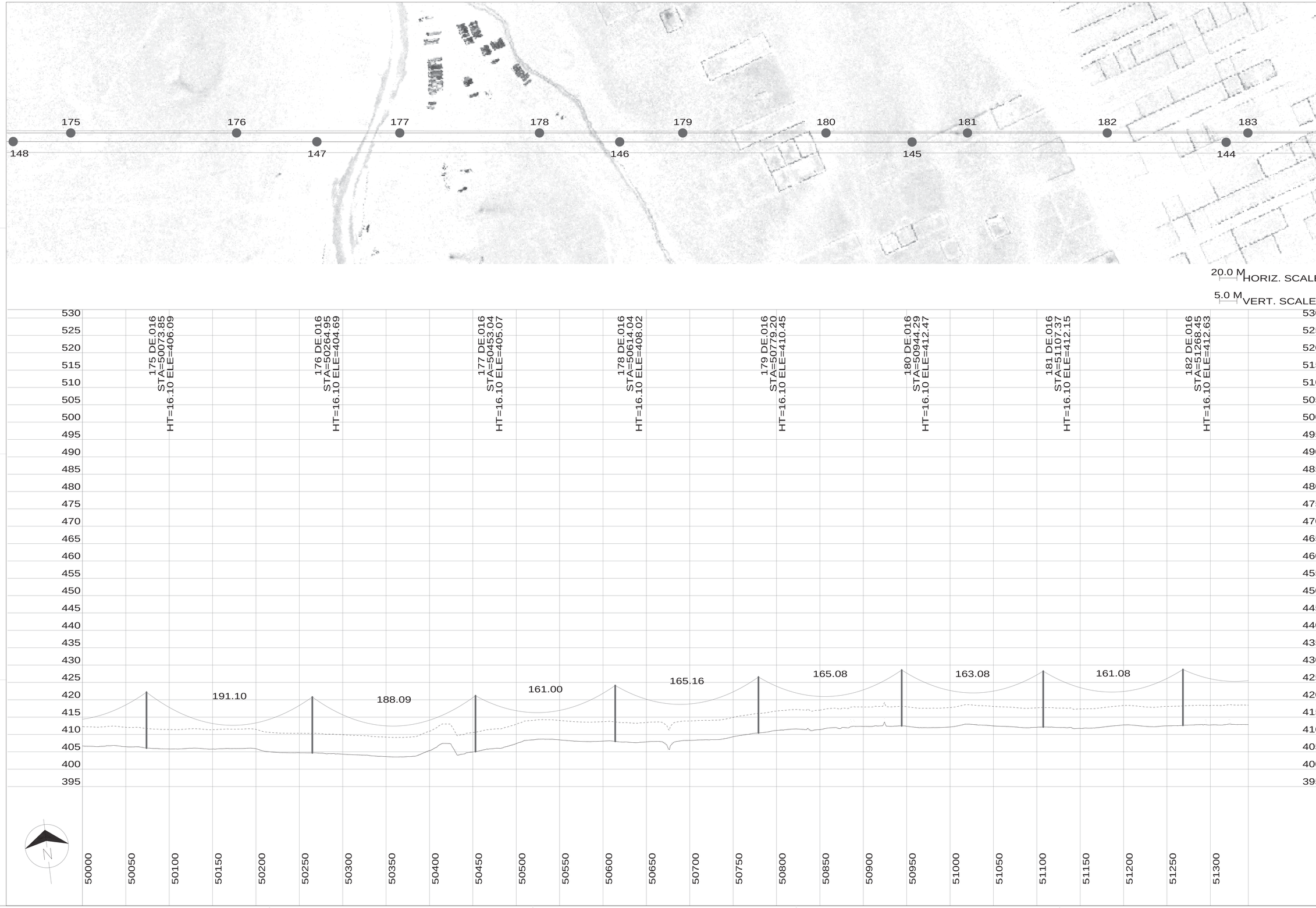
DESIGNED BY: M. SOSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1CM = 20M
PLOT DATE: 05/17/2015
SIZE: ANSI D
FILE NAME:
DATE: 5/17/2015
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

SHAHEEN SUBSTATION TO DASHTI SHADIAN 20 KV
DISTRIBUTION LINE PLAN AND PROFILE

SHEET NUMBER
ES-143



US ARMY CORPS OF ENGINEERS PHILADELPHIA DISTRICT

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U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

DESIGNED BY: M. SIDSNA
DWN BY: MRS
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1:20M
PLOT DATE: 06/17/2015
SIZE: ANSI D
FILE NAME:
DATE: 5/17/2015
SOLICITATION NO.:
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FILE NUMBER:

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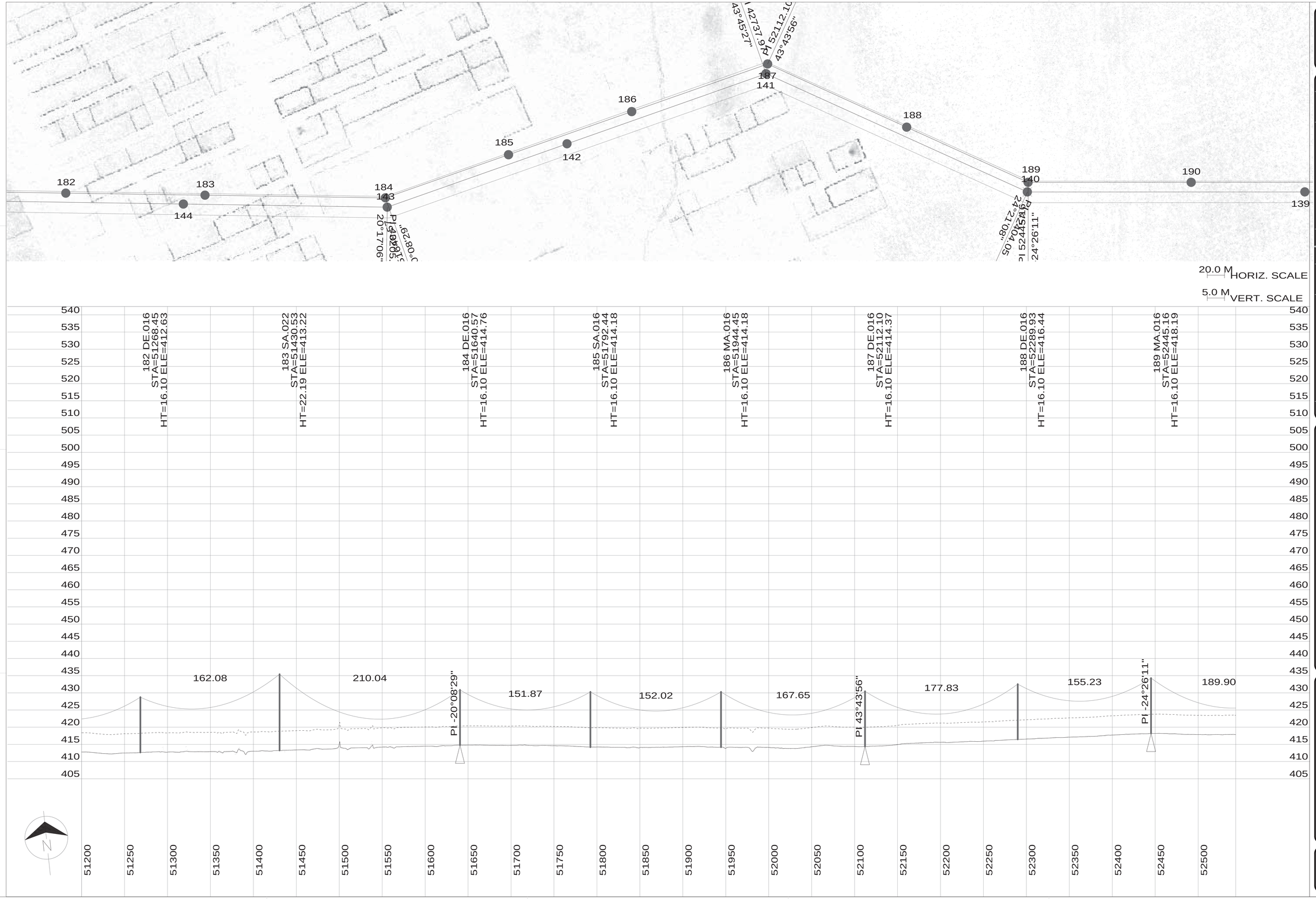
SHEET NUMBER
ES-144



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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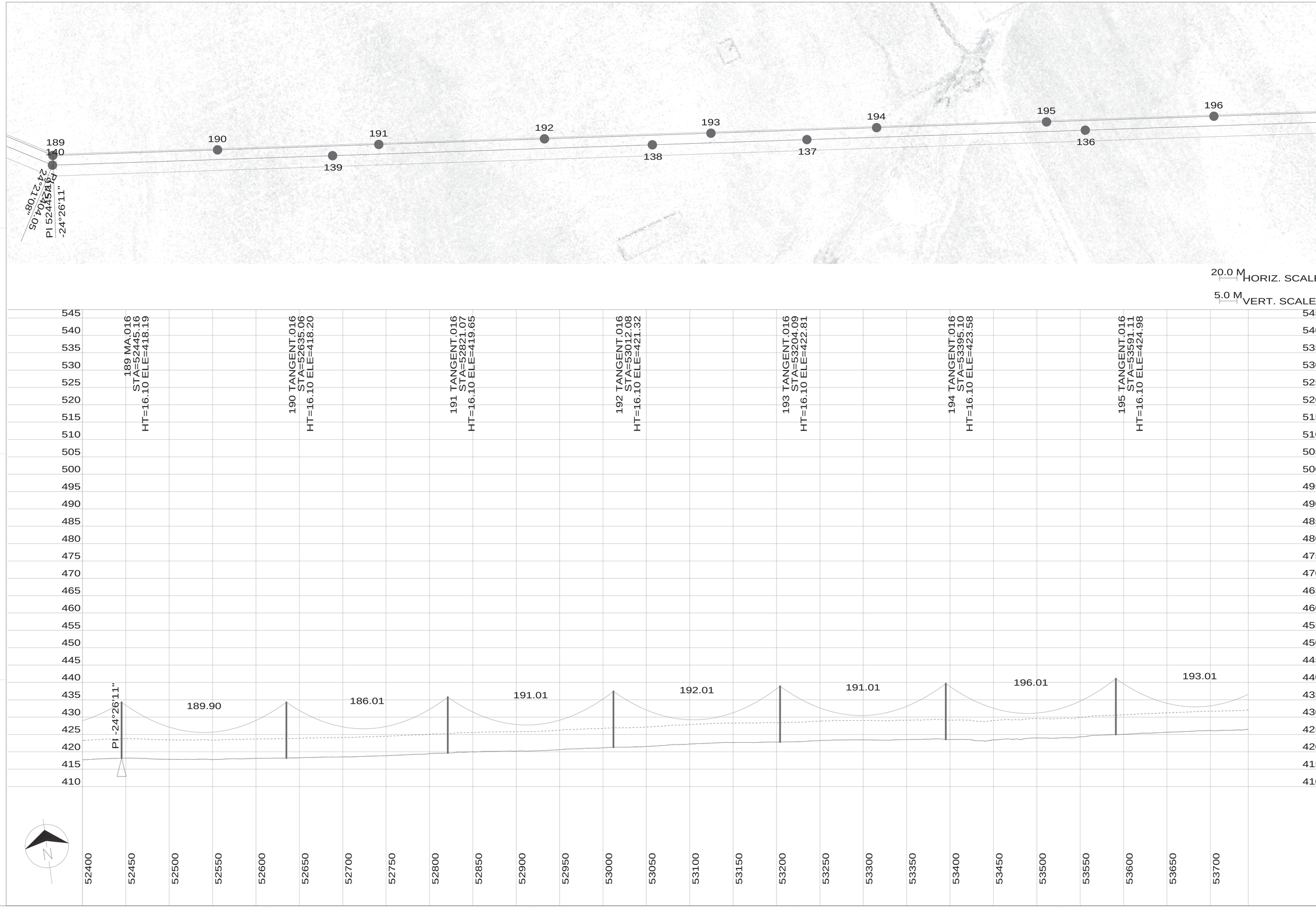
SHEET NUMBER
ES-145



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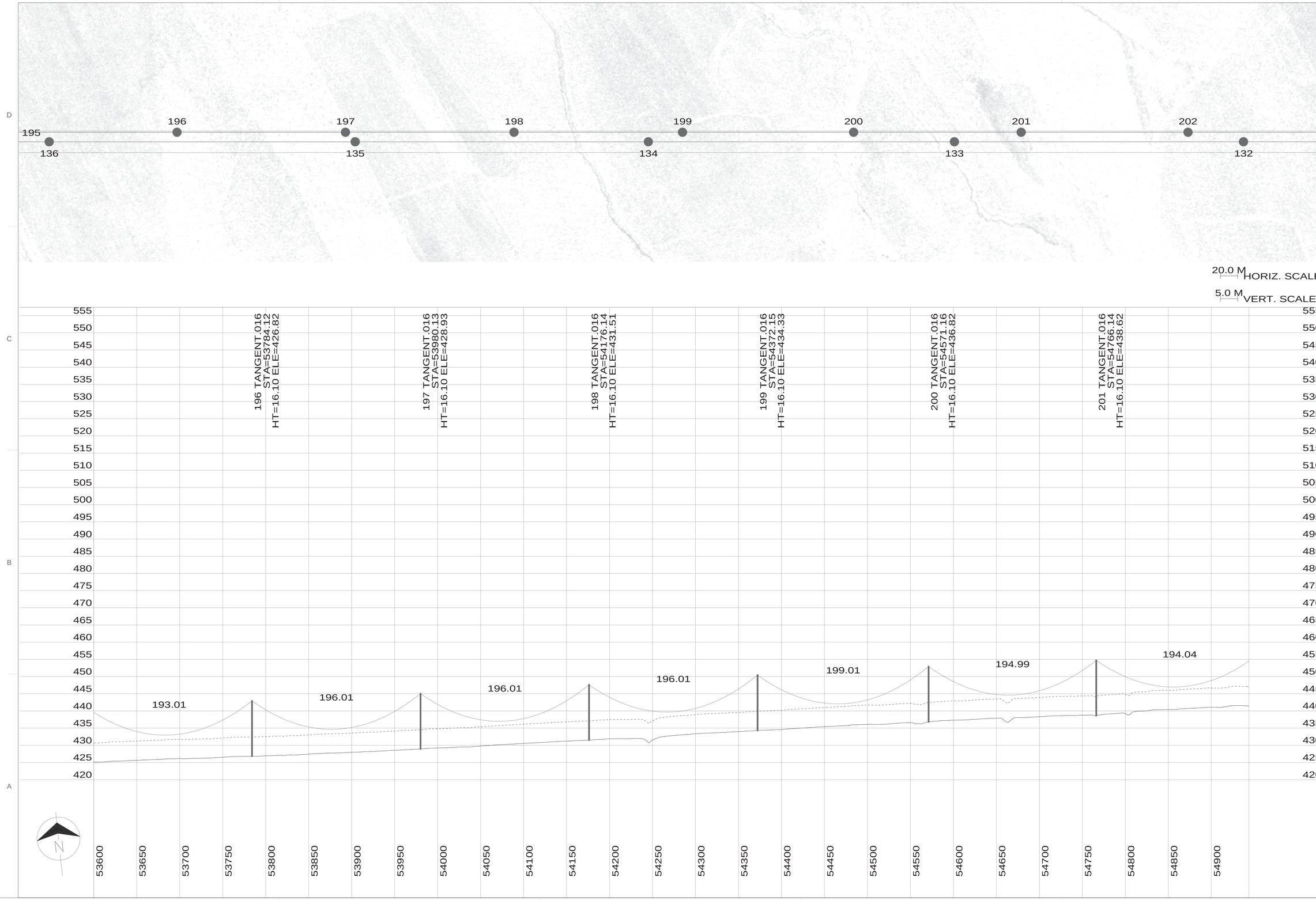

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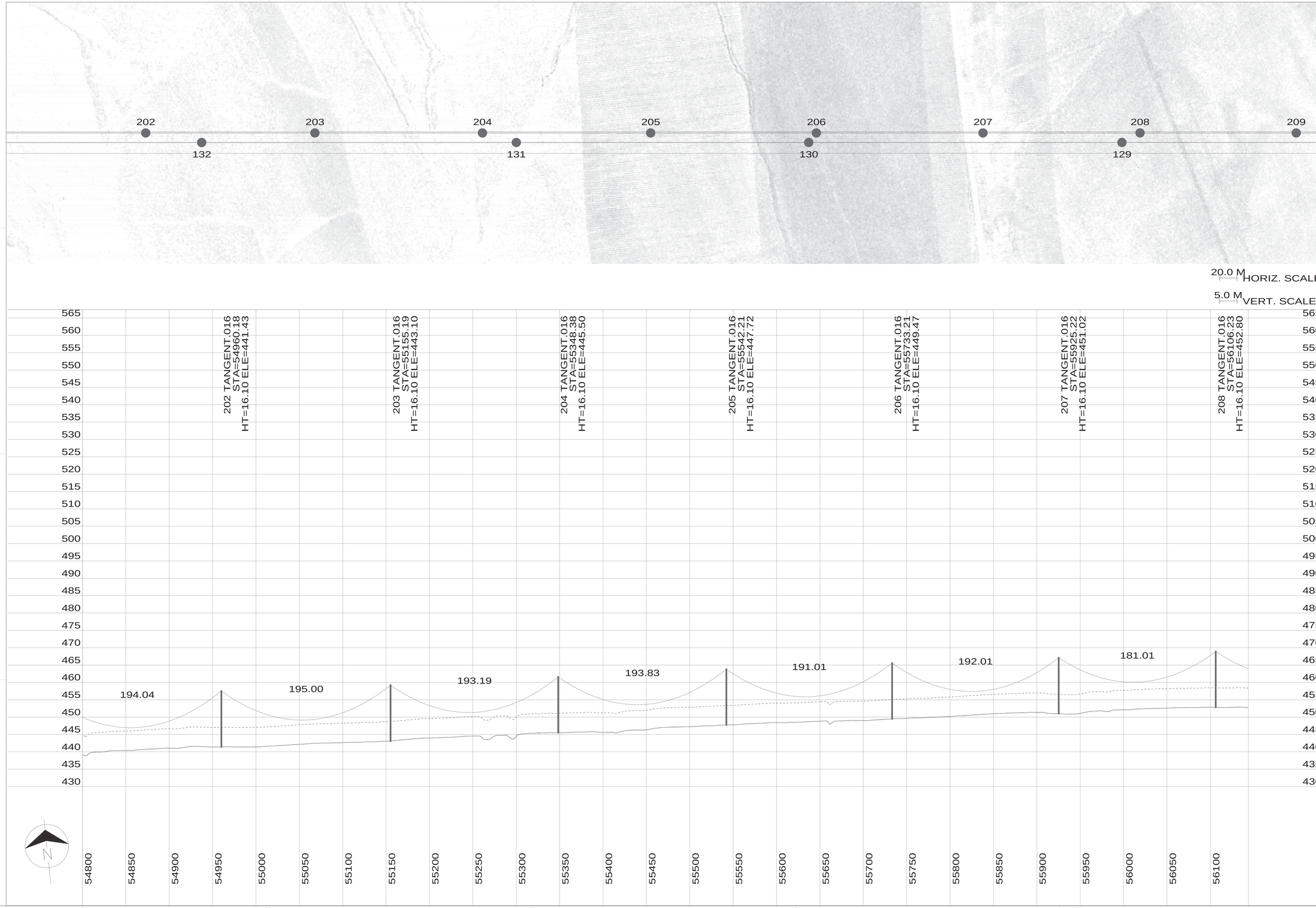

US ARMY CORPS OF ENGINEERS PHILADELPHIA DISTRICT

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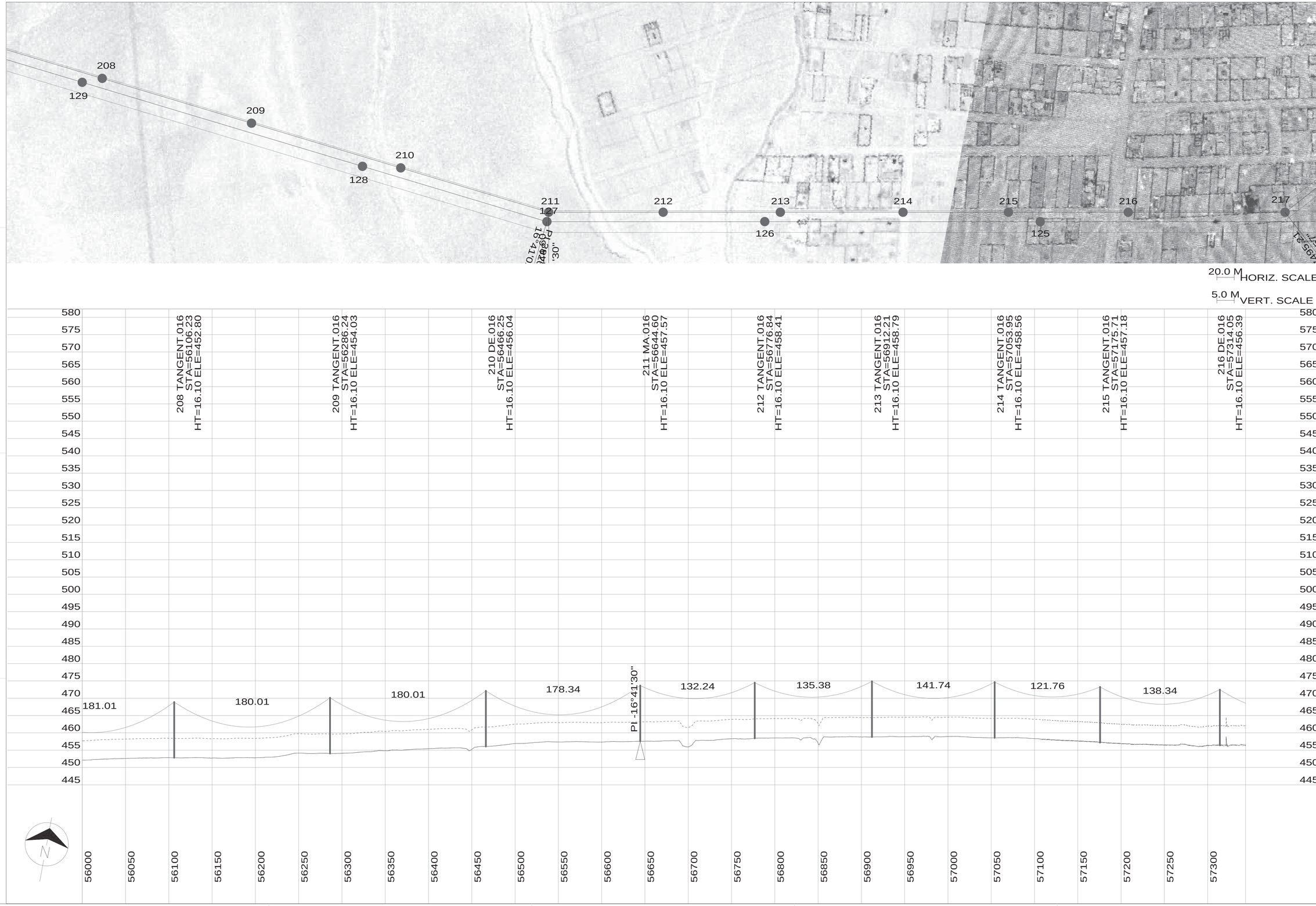

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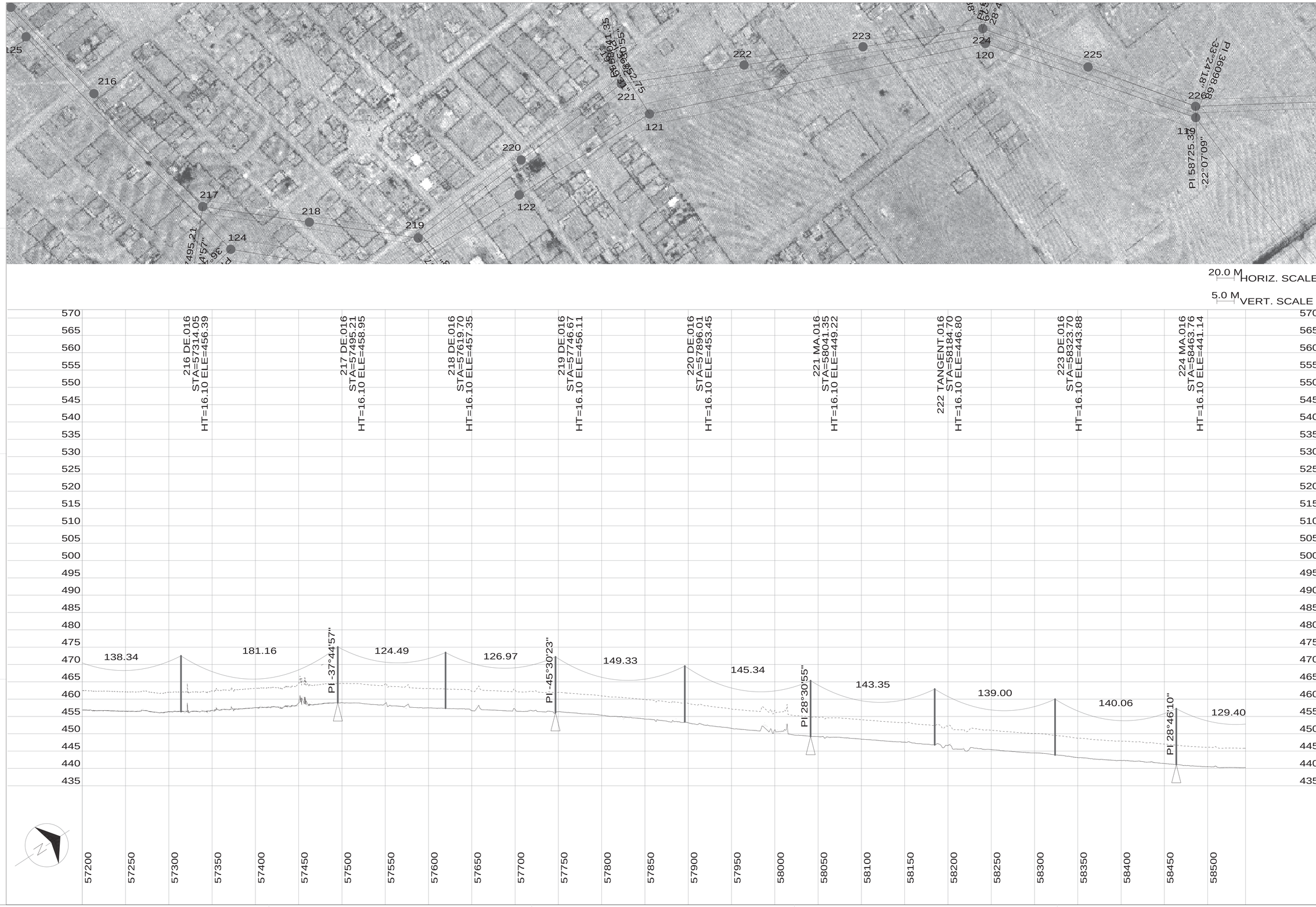
ES-149



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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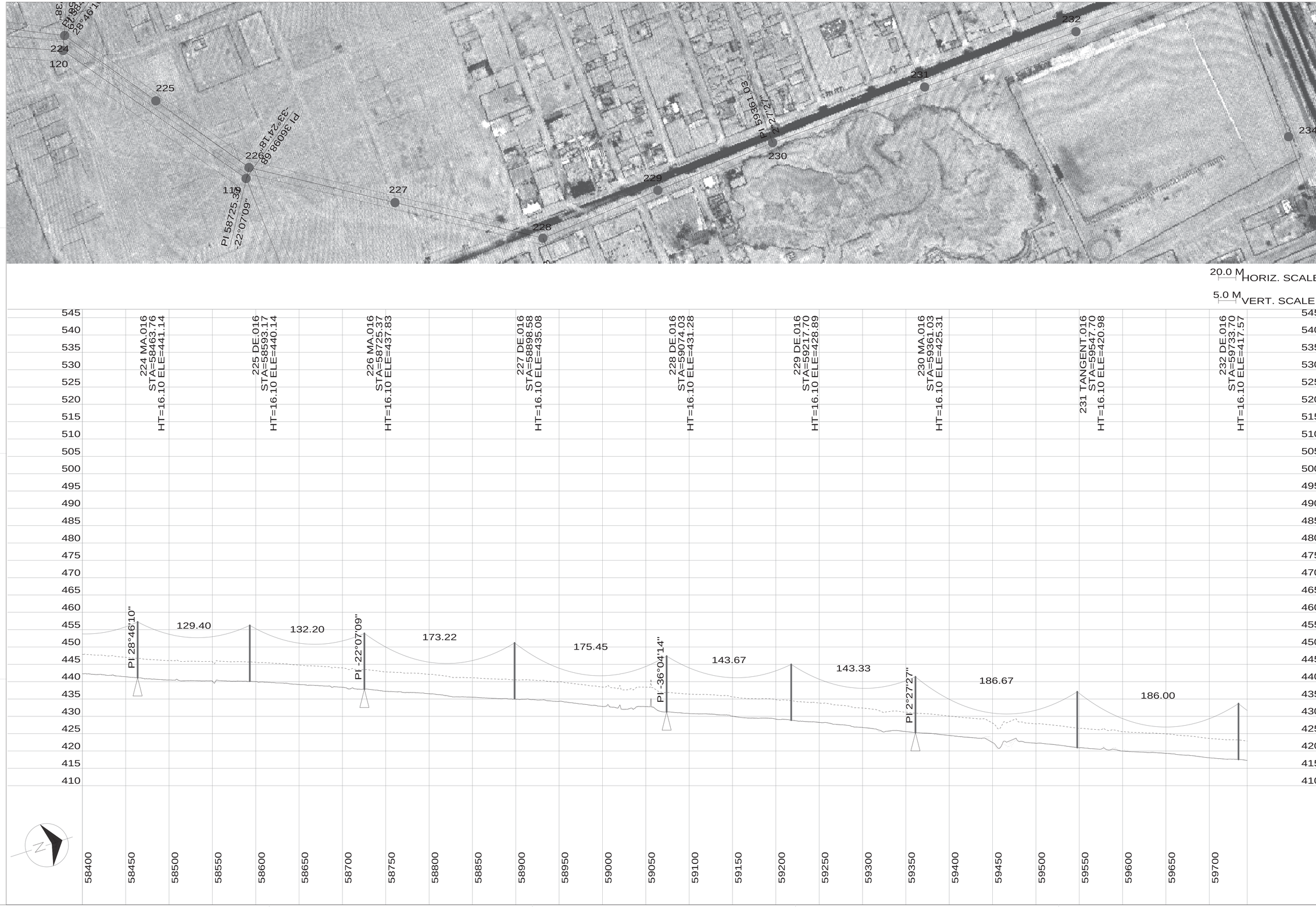
PROJECTS, AFGHANISTAN

SHAHEEN SUBSTATION TO DASHTI SHADIAN 20 KV
DISTRIBUTION LINE PLAN AND PROFILE

SHEET NUMBER
ES-150



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PHILADELPHIA DISTRICT

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DESIGNED BY: M. SOSNA
DWN BY: MRS
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PHILADELPHIA DISTRICT

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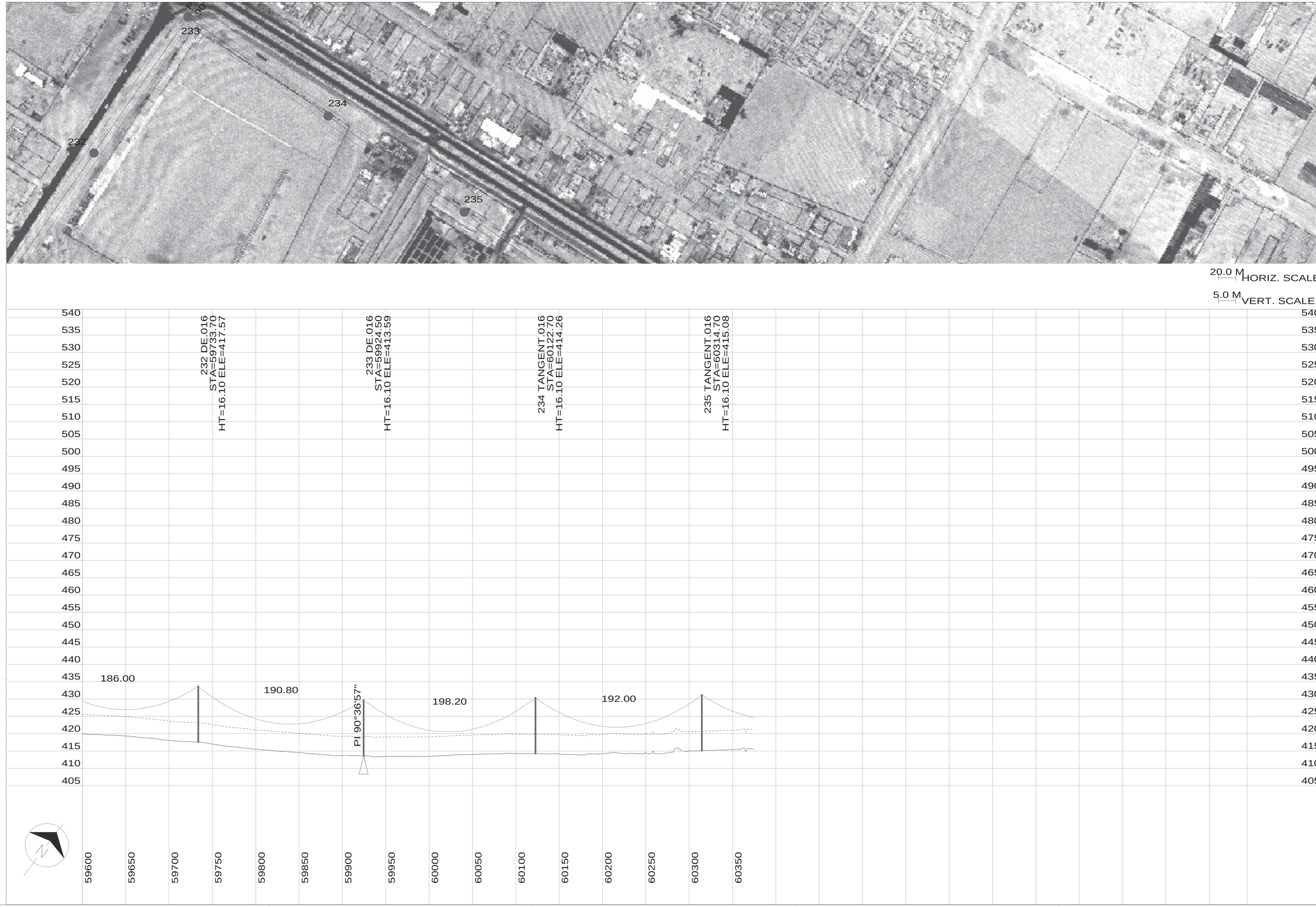
PROJECTS, AFGHANISTAN

SHAHEEN SUBSTATION TO DASHTI SHADIAN 20 KV
DISTRIBUTION LINE PLAN AND PROFILE

SHEET NUMBER
ES-151



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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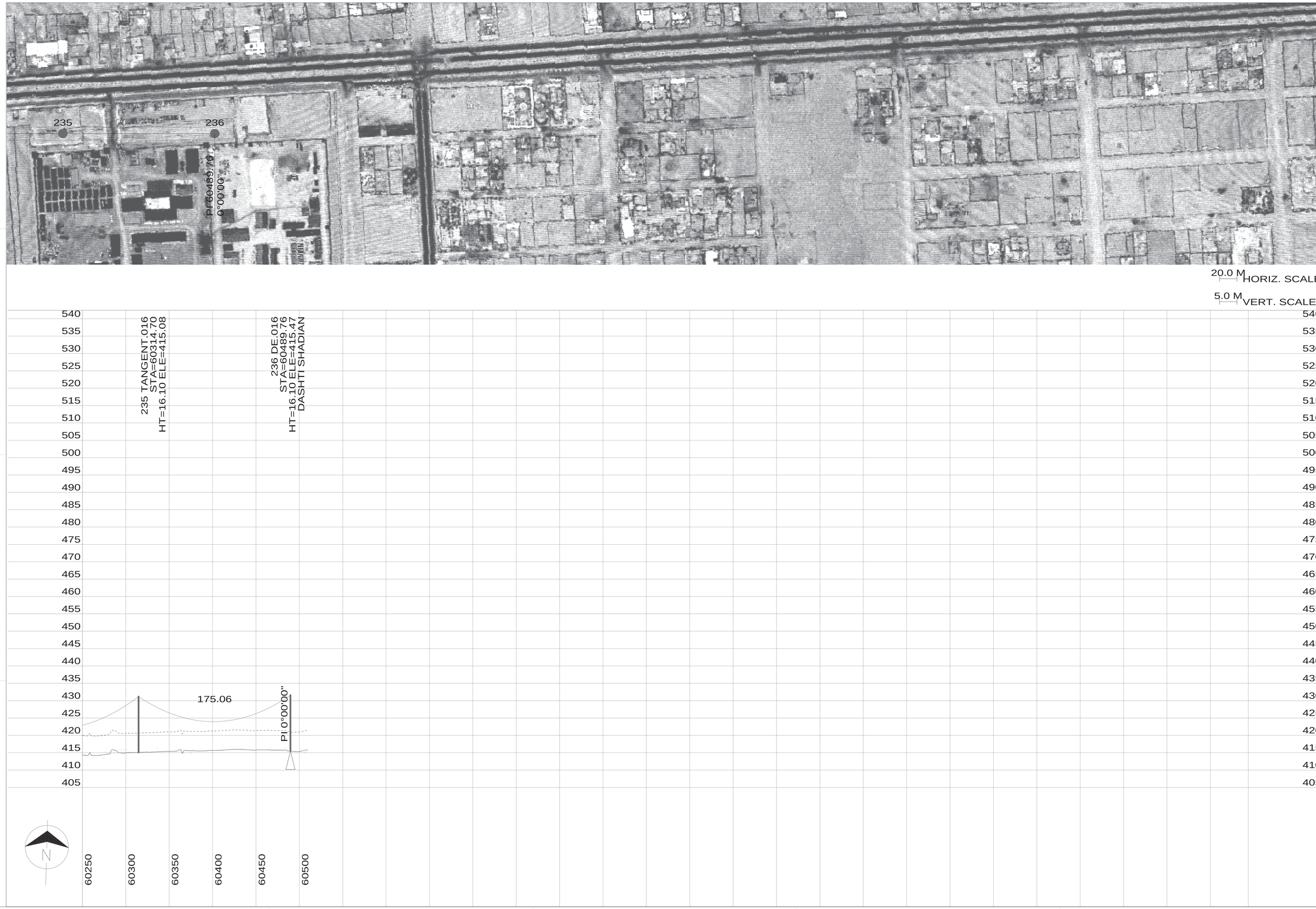
SHAHEEN SUBSTATION TO DASHTI SHADIAN 20 KV DISTRIBUTION LINE PLAN AND PROFILE

SHEET NUMBER
ES-152



US ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT

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SHAHEEN SUBSTATION TO DASHTI SHADIAN 20 KV DISTRIBUTION LINE PLAN AND PROFILE

SHEET NUMBER
ES-153

Appendix C

Structure Staking Coordinates

Note: Heights of structures provided in tables is to height of lowest conductor.

Structure Number	Station (m)	X Easting (m)	Y Northing (m)	Z Elevation (m)	Line Angle (deg)	Description	Structure Height (m)
NAIABAD SUBSTATION							
1	0	355573	4075929	350	0.00	Dead End	11.52
2	276	355656.256	4075665.86	345.261	0.00	tan.10	19.14
3	631	355763.343	4075327.39	339.165	0.00	tan.10	22.19
4	971	355865.906	4075003.23	333.327	0.00	tan.10	23.72
5	1322	355971.786	4074668.58	329.214	0.00	tan.10	22.19
6	1665	356075.253	4074341.56	328.9	0.00	Small Angle	13.05
7	2007.016	356178.424	4074015.48	328.901	0.00	tan.10	25.24
8	2361	356285.204	4073677.98	329.297	0.00	tan.10	23.72
9	2703.432	356388.5	4073351.5	336.209	37.45	Dead End	14.57
10	3020.399	356280.651	4073053.45	339.553	0.00	tan.10	28.29
11	3350.011	356168.5	4072743.5	346.999	63.78	Dead End	14.57
12	3672	355848.474	4072708	349.108	0.00	tan.10	22.19
13	3993.937	355528.5	4072672.5	346.735	-11.70	Small Angle	13.05
14	4307.327	355230.508	4072575.47	350.209	0.00	tan.10	20.67
15	4638	354916.083	4072473.1	354.07	0.00	tan.10	23.72
16	4995.139	354576.491	4072362.53	361.775	0.00	tan.10	22.19
17	5308.528	354278.5	4072265.5	372.265	-4.14	Small Angle	14.57
18	5512	354090.076	4072188.71	388.725	0.00	tan.10	16.10
19	5805	353818.744	4072078.13	384.69	0.00	tan.10	22.19
20	6171	353479.812	4071939.99	380.029	0.00	tan.10	19.14
21	6463	353209.406	4071829.79	368.771	0.00	Small Angle	20.67
22	6808.42	352889.532	4071699.42	364.048	0.00	tan.10	29.81
23	7159	352564.879	4071567.11	377.603	0.00	tan.10	19.14
24	7507.209	352242.421	4071435.69	374.115	0.00	tan.10	22.19
25	7796.527	351974.5	4071326.5	368.466	-47.68	Dead End	14.57
26	8120	351863.081	4071022.82	371.093	0.00	tan.10	17.62
27	8466	351743.902	4070698	371.236	0.00	tan.10	20.67
28	8817	351623.001	4070368.47	371.74	0.00	tan.10	22.19
29	9164.188	351503.414	4070042.53	371.811	0.00	tan.10	22.19
30	9516	351382.233	4069712.25	371.858	0.00	tan.10	22.19
31	9785.223	351289.5	4069459.5	376.068	55.91	Dead End	10.00
32	10063	351019.907	4069392.57	370.066	0.00	tan.10	19.14
33	10414.85	350678.428	4069307.79	361.063	0.00	tan.10	22.19
34	10739.36	350363.475	4069229.6	358.996	0.00	Small Angle	13.05
35	11029.92	350081.478	4069159.59	359.629	0.00	tan.10	19.14
36	11402.94	349719.449	4069069.71	359.614	0.00	tan.10	23.72
37	11719.21	349412.5	4068993.5	360.481	32.59	Dead End	13.05
38	12015	349132.237	4069088.09	359.417	0.00	tan.10	20.67
39	12366.21	348799.468	4069200.41	358.362	0.00	tan.10	22.19
40	12711.22	348472.578	4069310.73	357.119	0.00	tan.10	20.67
41	12982.54	348215.5	4069397.5	356.478	-16.13	medium angle	13.05
42	13288	347910.338	4069410.91	356.703	0.00	tan.10	22.19

Structure Number	Station (m)	X Easting (m)	Y Northing (m)	Z Elevation (m)	Line Angle (deg)	Description	Structure Height (m)
43	13643.18	347555.5	4069426.5	356.496	-17.34	medium angle	19.14
44	13976	347233.762	4069341.33	356.812	0.00	tan.10	20.67
45	14263.89	346955.456	4069267.67	357.224	0.00	tan.10	16.10
46	14381.77	346841.5	4069237.5	357.253	-1.45	tan.10	16.10
47	14634.93	346598.488	4069166.54	357.565	0.00	tan.10	20.67
48	14902.65	346341.5	4069091.5	357.662	-3.35	Small Angle	13.05
49	15138.29	346119.554	4069012.35	359.537	0.00	tan.10	16.10
50	15343.25	345926.5	4068943.5	358.032	-11.07	Small Angle	13.05
51	15597.93	345707.5	4068813.5	358.362	11.36	Small Angle	17.62
52	15936.02	345388.476	4068701.57	359.432	0.00	tan.10	20.67
53	16295	345049.74	4068582.72	358.076	0.00	tan.10	22.19
54	16605	344757.222	4068480.09	357.999	0.00	tan.10	16.10
55	16790.26	344582.409	4068418.76	358.101	0.00	tan.10	16.10
56	17090.08	344299.5	4068319.5	357.547	-29.67	medium angle	19.14
57	17323.28	344146.5	4068143.5	357.346	29.11	medium angle	11.52
58	17588	343897.57	4068053.45	356.945	0.00	tan.10	20.67
59	17933	343573.146	4067936.09	357.03	0.00	tan.10	22.19
60	18276.06	343250.542	4067819.38	357.209	0.00	tan.10	22.19
61	18607.9	342938.5	4067706.5	358.355	-27.23	medium angle	19.14
62	18798.95	342808.5	4067566.5	358.769	35.37	Dead End	17.62
63	19126.86	342487.452	4067499.73	359.31	0.00	tan.10	20.67
64	19387	342232.765	4067446.77	359.44	0.00	tan.10	16.10
65	19618.15	342006.458	4067399.7	359.754	0.00	tan.10	16.10
66	19849.96	341779.5	4067352.5	360.111	44.16	Dead End	28.29
67	20210.05	341475.5	4067545.5	358.85	-49.35	Dead End	22.19
68	20536.2	341163.5	4067450.5	358.127	23.55	medium angle	17.62
69	20718.41	340982.5	4067471.5	357.556	-27.79	medium angle	11.52
70	20917	340797.309	4067399.79	357.958	0.00	tan.10	16.10
71	21210.72	340523.41	4067293.73	360.5	0.00	tan.10	19.14
72	21581	340178.109	4067160.03	359.375	0.00	tan.10	23.72
73	21892.63	339887.5	4067047.5	359.045	-55.08	Dead End	25.24
74	22279.73	339795.5	4066671.5	361.046	19.16	medium angle	23.72
75	22529	339660.082	4066462.22	361.734	0.00	tan.10	16.10
76	22778	339524.812	4066253.16	362.72	0.00	tan.10	16.10
77	23028	339388.999	4066043.27	363.674	0.00	tan.10	20.67
78	23312.4	339234.5	4065804.5	364.388	33.99	Dead End	13.05
79	23498.33	339063.49	4065731.52	364.613	0.00	tan.10	20.67
80	23863	338728.08	4065588.39	366.04	0.00	tan.10	20.67
81	24158.27	338456.5	4065472.5	364.66	7.13	Small Angle	14.57
82	24498	338129.902	4065378.97	363.562	0.00	tan.10	25.24
83	24844.8	337796.5	4065283.5	362.565	-85.75	Dead End	14.57
84	25146	337857.749	4064988.6	364.546	0.00	tan.10	19.14
85	25458	337921.195	4064683.12	366.956	0.00	tan.10	16.10

Structure Number	Station (m)	X Easting (m)	Y Northing (m)	Z Elevation (m)	Line Angle (deg)	Description	Structure Height (m)
86	25641.45	337958.5	4064503.5	368.161	87.88	Dead End	16.10
87	25957.72	337651.43	4064427.78	367.96	0.00	tan.10	20.67
88	26284	337334.633	4064349.67	377.614	0.00	tan.10	10.00
89	26393.31	337228.5	4064323.5	367.413	-74.88	Dead End	10.00
90	26686	337222.009	4064030.88	370.522	0.00	tan.10	25.24
91	26979.46	337215.5	4063737.5	374.736	41.23	Dead End	10.00
92	27198	337067.842	4063576.38	375.461	0.00	tan.10	19.14
93	27542	336835.42	4063322.78	377.557	0.00	tan.10	20.67
94	27881	336606.376	4063072.86	378.51	0.00	tan.10	19.14
95	28132.43	336436.5	4062887.5	380.133	-53.55	Dead End	10.00
96	28309	336470.324	4062714.2	384.74	0.00	tan.10	20.67
97	28638.8	336533.5	4062390.5	395.051	19.79	medium angle	22.19
98	28967.63	336483.5	4062065.5	404.261	-13.95	Small Angle	17.62
99	29306	336514.194	4061728.52	416.451	0.00	tan.10	22.19
100	29651	336545.489	4061384.95	428.065	0.00	tan.10	25.24
101	30000	336577.146	4061037.38	441.441	0.00	tan.10	25.24
102	30346	336608.532	4060692.81	451.403	0.00	tan.10	26.76
103	30697	336640.371	4060343.26	465.945	0.00	tan.10	22.19
104	31040.17	336671.5	4060001.5	479.041	91.34	Dead End	17.62
105	31369.91	336342.515	4059979.27	477.346	0.00	tan.10	19.14
106	31719	335994.216	4059955.74	467.506	0.00	tan.10	26.76
107	32065	335649.003	4059932.42	464.648	0.00	tan.10	26.76
108	32412	335302.793	4059909.02	463.578	0.00	tan.10	23.72
109	32763	334952.591	4059885.36	463.608	0.00	tan.10	19.14
110	33111	334605.383	4059861.9	456.33	0.00	tan.10	20.67
111	33451	334266.156	4059838.98	451.219	0.00	tan.10	19.14
112	33806	333911.964	4059815.05	445.257	0.00	Small Angle	17.62
113	34145	333573.735	4059792.2	444.167	0.00	tan.10	20.67
114	34493	333226.527	4059768.74	443.421	0.00	tan.10	22.19
115	34842	332878.32	4059745.21	442.874	0.00	tan.10	22.19
116	35189.63	332531.481	4059721.78	441.142	0.00	tan.10	22.19
117	35536	332185.899	4059698.43	440.266	0.00	tan.10	20.67
118	35880.16	331842.518	4059675.23	438.627	0.00	tan.10	19.14
119	36098.68	331624.5	4059660.5	437.799	-33.40	Dead End	10.00
120	36356.29	331419.5	4059504.5	441.441	-31.28	Dead End	28.29
121	36752.75	331274.5	4059135.5	449.59	-19.99	medium angle	20.67
122	36930	331269.982	4058958.31	454.018	0.00	tan.10	16.10
123	37105.87	331265.5	4058782.5	457.491	41.14	Dead End	13.05
124	37292	331139.5	4058645.5	459.54	36.76	Dead End	17.62
125	37632.87	330804.479	4058582.61	457.533	0.00	tan.10	22.19
126	37951	330491.81	4058523.92	459.251	0.00	tan.10	19.14
127	38202.63	330244.5	4058477.5	457.807	16.68	medium angle	10.00
128	38425	330023.369	4058500.95	455.868	0.00	tan.10	19.14

Structure Number	Station (m)	X Easting (m)	Y Northing (m)	Z Elevation (m)	Line Angle (deg)	Description	Structure Height (m)
129	38763	329687.253	4058536.59	452.988	0.00	tan.10	20.67
130	39124	329328.266	4058574.65	449.582	0.00	tan.10	22.19
131	39461	328993.144	4058610.18	445.92	0.00	tan.10	22.19
132	39823.67	328632.492	4058648.42	442.025	0.00	tan.10	22.19
133	40160	328298.041	4058683.89	438.402	0.00	tan.10	22.19
134	40516	327944.025	4058721.42	433.939	0.00	tan.10	22.19
135	40857	327604.926	4058757.38	429.276	0.00	tan.10	22.19
136	41213	327250.911	4058794.92	425.633	0.00	tan.10	20.67
137	41534	326931.7	4058828.76	423.516	0.00	tan.10	16.10
138	41712.19	326754.505	4058847.55	422.771	0.00	tan.10	22.19
139	42081	326387.749	4058886.44	419.293	0.00	tan.10	20.67
140	42404.05	326066.5	4058920.5	418.387	24.35	medium angle	14.57
141	42737.97	325778.5	4059089.5	414.551	-43.76	Dead End	25.24
142	42983.68	325539.439	4059032.76	414.387	0.00	tan.10	16.10
143	43205.62	325323.5	4058981.5	414.965	20.28	medium angle	10.00
144	43443	325087.851	4059010.15	413.231	0.00	tan.10	20.67
145	43805	324728.497	4059053.84	413.289	0.00	tan.10	20.67
146	44142	324393.961	4059094.52	408.512	0.00	tan.10	23.72
147	44491	324047.517	4059136.64	403.994	0.00	tan.10	25.24
148	44841	323700.071	4059178.88	406.778	0.00	tan.10	19.14
149	45139	323404.249	4059214.85	403.015	0.00	tan.10	16.10
150	45340.7	323204.024	4059239.19	404.803	0.00	tan.10	20.67
151	45708	322839.409	4059283.52	401.286	0.00	tan.10	20.67
152	46006.09	322543.5	4059319.5	401.487	-43.20	Dead End	14.57
SHAHEEN SUBSTATION							
153	46182.8	322401.026	4059214.96	401.558	0.00	tan.10	16.10
154	46382.41	322240.088	4059096.88	402.253	0.00	tan.10	16.10
155	46587.02	322075.118	4058975.84	402.874	0.00	tan.10	16.10
156	46776.53	321922.329	4058863.73	403.39	0.00	tan.10	16.10
157	46974.74	321762.518	4058746.48	402.839	0.00	tan.10	16.10
158	47160	321613.152	4058636.88	404.179	0.00	tan.10	16.10
159	47343.86	321464.913	4058528.12	404.951	0.00	tan.10	16.10
160	47527.77	321316.632	4058419.32	405.545	0.00	tan.10	16.10
161	47710.88	321169	4058311	406.165	5.99	Small Angle	16.10
162	47887.02	321016.887	4058222.19	406.837	0.00	tan.10	16.10
163	48036.92	320887.434	4058146.61	407.681	0.00	tan.10	16.10
164	48197.8	320748.5	4058065.5	407.552	12.93	Small Angle	16.10
165	48395	320560.269	4058006.71	407.854	0.00	tan.10	16.10
166	48613.72	320351.5	4057941.5	407.565	-74.21	Dead End	16.10
167	48742.26	320355	4057813	408.52	0.00	Dead End	16.10
CAMP SHAHEEN							
SHAHEEN SUBSTATION							
168	48842.26	322543.5	4059319.5	401.487	178.16	Dead End	16.10

Structure Number	Station (m)	X Easting (m)	Y Northing (m)	Z Elevation (m)	Line Angle (deg)	Description	Structure Height (m)
169	48996.97	322697.6	4059305.78	402.264	0.00	Small Angle	16.10
170	49135.24	322835.323	4059293.52	401.23	0.00	Dead End	16.10
171	49321.76	323020.489	4059271.11	402.149	0.00	Dead End	16.10
172	49507.57	323204.953	4059248.79	404.534	0.00	Dead End	16.10
173	49694.92	323390.945	4059226.28	402.969	0.00	Dead End	16.10
174	49884.97	323579.622	4059203.44	407.178	0.00	Dead End	16.10
175	50073.85	323767.133	4059180.75	406.091	0.00	Dead End	16.10
176	50264.95	323956.844	4059157.78	404.694	0.00	Dead End	16.10
177	50453.04	324143.576	4059135.18	405.066	0.00	Dead End	16.10
178	50614.04	324303.408	4059115.84	408.017	0.00	Dead End	16.10
179	50779.2	324467.375	4059096	410.446	0.00	Dead End	16.10
180	50944.29	324631.262	4059076.16	412.467	0.00	Dead End	16.10
181	51107.37	324793.161	4059056.57	412.152	0.00	Dead End	16.10
182	51268.45	324953.075	4059037.21	412.631	0.00	Dead End	16.10
183	51430.53	325113.982	4059017.74	413.225	0.00	Small Angle	22.19
184	51640.57	325322.5	4058992.5	414.761	-20.14	Dead End	16.10
185	51792.44	325470.333	4059027.28	414.182	0.00	Small Angle	16.10
186	51944.45	325618.308	4059062.1	414.18	0.00	medium angle	16.10
187	52112.1	325781.5	4059100.5	414.365	43.73	Dead End	16.10
188	52289.93	325934.738	4059010.27	416.439	0.00	Dead End	16.10
189	52445.16	326068.5	4058931.5	418.185	-24.44	medium angle	16.10
190	52635.06	326257.337	4058911.47	418.197	0.00	tan.10	16.10
191	52821.07	326442.308	4058891.85	419.654	0.00	tan.10	16.10
192	53012.08	326632.252	4058871.7	421.318	0.00	tan.10	16.10
193	53204.09	326823.19	4058851.44	422.81	0.00	tan.10	16.10
194	53395.1	327013.134	4058831.29	423.576	0.00	tan.10	16.10
195	53591.11	327208.05	4058810.61	424.983	0.00	tan.10	16.10
196	53784.12	327399.983	4058790.25	426.825	0.00	tan.10	16.10
197	53980.13	327594.899	4058769.58	428.934	0.00	tan.10	16.10
198	54176.14	327789.815	4058748.9	431.514	0.00	tan.10	16.10
199	54372.15	327984.731	4058728.22	434.331	0.00	tan.10	16.10
200	54571.16	328182.631	4058707.23	436.816	0.00	tan.10	16.10
201	54766.14	328376.528	4058686.66	438.616	0.00	tan.10	16.10
202	54960.19	328569.488	4058666.19	441.431	0.00	tan.10	16.10
203	55155.19	328763.401	4058645.62	443.101	0.00	tan.10	16.10
204	55348.38	328955.512	4058625.24	445.501	0.00	tan.10	16.10
205	55542.21	329148.262	4058604.79	447.72	0.00	tan.10	16.10
206	55733.22	329338.205	4058584.64	449.475	0.00	tan.10	16.10
207	55925.23	329529.144	4058564.39	451.015	0.00	tan.10	16.10
208	56106.23	329709.143	4058545.29	452.803	0.00	tan.10	16.10
209	56286.24	329888.147	4058526.3	454.028	0.00	tan.10	16.10
210	56466.25	330067.152	4058507.31	456.045	0.00	Dead End	16.10
211	56644.6	330244.5	4058488.5	457.569	-16.69	medium angle	16.10

Structure Number	Station (m)	X Easting (m)	Y Northing (m)	Z Elevation (m)	Line Angle (deg)	Description	Structure Height (m)
212	56776.84	330374.471	4058512.91	458.415	0.00	tan.10	16.10
213	56912.22	330507.522	4058537.9	458.794	0.00	tan.10	16.10
214	57053.95	330646.826	4058564.06	458.564	0.00	tan.10	16.10
215	57175.71	330766.494	4058586.53	457.175	0.00	tan.10	16.10
216	57314.05	330902.453	4058612.06	456.394	0.00	Dead End	16.10
217	57495.21	331080.5	4058645.5	458.951	-37.75	Dead End	16.10
218	57619.7	331163.177	4058738.57	457.355	0.00	Dead End	16.10
219	57746.67	331247.5	4058833.5	456.111	-45.51	Dead End	16.10
220	57896.01	331237.365	4058982.49	453.45	0.00	Dead End	16.10
221	58041.35	331227.5	4059127.5	449.221	28.52	medium angle	16.10
222	58184.7	331287.228	4059257.82	446.803	0.00	tan.10	16.10
223	58323.7	331345.143	4059384.18	443.884	0.00	Dead End	16.10
224	58463.76	331403.5	4059511.5	441.137	28.77	medium angle	16.10
225	58593.17	331507.377	4059588.67	440.142	0.00	Dead End	16.10
226	58725.37	331613.5	4059667.5	437.826	-22.12	medium angle	16.10
227	58898.58	331703.421	4059815.55	435.079	0.00	Dead End	16.10
228	59074.03	331794.5	4059965.5	431.277	-36.07	Dead End	16.10
229	59217.7	331782.486	4060108.67	428.888	0.00	Dead End	16.10
230	59361.03	331770.5	4060251.5	425.305	2.46	medium angle	16.10
231	59547.7	331762.88	4060438.01	420.979	0.00	tan.10	16.10
232	59733.7	331755.288	4060623.86	417.569	0.00	Dead End	16.10
233	59924.5	331747.5	4060814.5	413.592	90.62	Dead End	16.10
234	60122.7	331945.609	4060820.46	414.259	0.00	tan.10	16.10
235	60314.7	332137.522	4060826.24	415.081	0.00	tan.10	16.10
236	60489.76	332312.503	4060831.5	415.472	0.00	Dead End	16.10
DASHTI SHADIAN							

Appendix D

Conceptual Distribution and Termination Plans at ANSF Bases

AFGHAN NATIONAL SECURITY FORCES

SITE 1/2: 209TH CORPS HQ DISTR

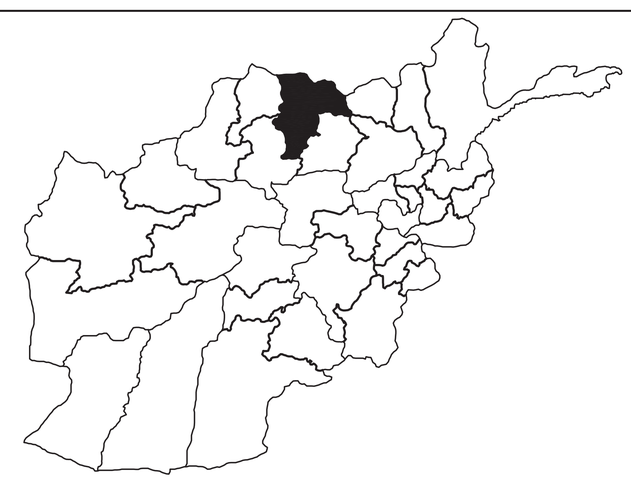
SHEET INDEX

100-G-0100	COVER SHEET
103-E-0001	MATERIAL LIST, LEGEND
103-E-0100	ALIGNMENT PLAN
103-E-0120	PLAN AND PROFILE
103-E-0121	PLAN AND PROFILE
103-E-0122	PLAN AND PROFILE
103-E-0123	PLAN AND PROFILE
103-E-0130	STAKING TABLE
104-E-0010	OPERATING SINGLE LINE DIAGRAM CAMP SHAHEEN 1
106-E-0010	OPERATING SINGLE LINE DIAGRAM CAMP SHAHEEN 2

FOR INFORMATION ONLY

AERIAL MAP

VICINITY MAP



AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27FEB2015	TDL	TDL	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 27JAN2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.# NA
SHEET FORMAT A1

DRAWN BY: DMW
CHECKED BY: TDL
APPROVED BY: MRW
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209TH CORPS HQ DISTR

COVER SHEET

100-G-0100

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PROJECT MATERIAL LIST

ASSEMBLY	QUANTITY
SINGLE CIRCUIT DEAD-END	2
DOUBLE CIRCUIT TANGENT	18
DOUBLE CIRCUIT DEAD-END	1
DOUBLE CIRCUIT HEAVY ANGLE	3
SINGLE DOWN-GUY AND ANCHOR	16
TERMINAL POLE AND CONDUIT	2
13.0 m POLES	2
15.0 m POLES	22

LEGEND

SYMBOL	DESCRIPTION
	POLE
	GUY
	CONDUCTOR
	POINT OF INFLECTION (PI)
##	BILL OF MATERIALS REFERENCE
	MANHOLE
	CULVERT
	UNDERGROUND FEEDER CABLE

MINIMUM CONDUCTOR CLEARANCES

CLEARANCE ITEM	SPECIFICATION (m)
GROUND ACCESSIBLE TO PEDESTRIANS ONLY	6.5
GROUND IN BUILT-UP AREAS, ROAD CROSSINGS AND WATER WITHOUT BOAT TRAFFIC	7.0
OVERHEAD LINES CROSSING WITH VOLTAGES UP TO 1kV	3.0
OVERHEAD LINES CROSSING WITH VOLTAGES > 1kV	4.6
TELECOMMUNICATION LINES	2.5
TREES AND VEGETATION	2.5
NAVIGABLE WATER WAYS (ABOVE MEAN WATER LEVEL)	20

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: NONE
DRAWN BY: A. BACLAAN
DATE DRAWN: 11 FEB 2015
CHECKED BY: E. MORRIS
DATE ASSESSED: JUL 2014
APPROVED BY: J. WIEDMAN
CSTC-A ENG. PROJ.# NA
CONFIRMED BY: K. SCHAEFER, PE
SHEET FORMAT A1
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209 TH CORPS HQ DISTR

MATERIAL LIST, LEGEND

103-E-0001

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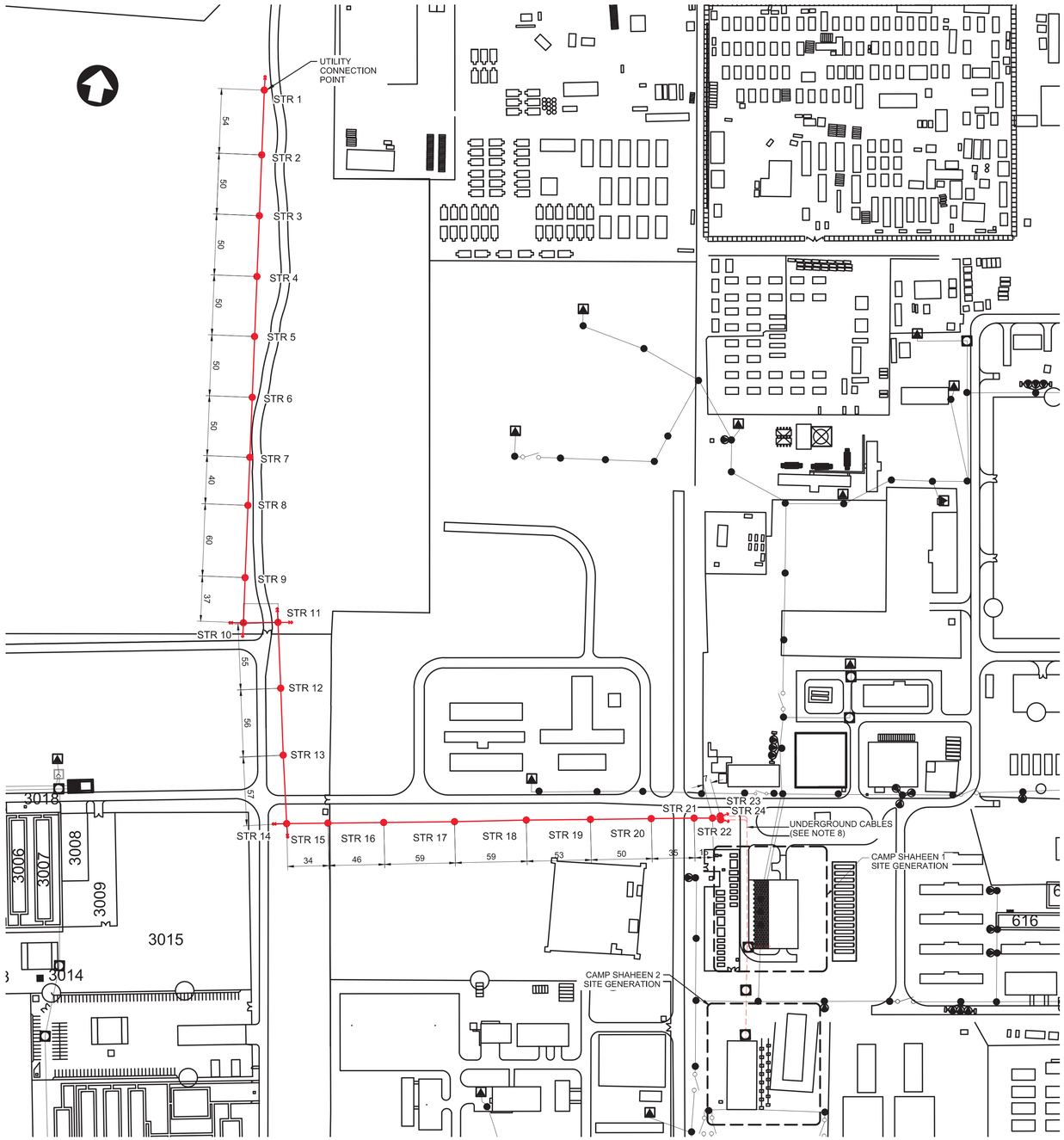
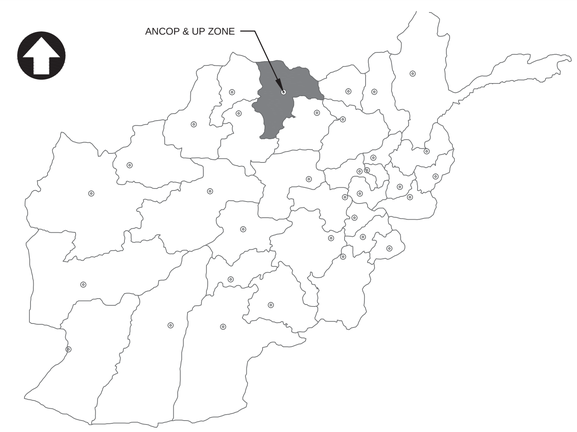


1 PROPOSED OVERHEAD LINE CAMP SHAHEEN 1 & 2

103-E-0100 REF. - SCALE: 1:2000

VICINITY MAP



AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN

DATE DRAWN: 26 JAN 2015

DATE ASSESSED: JUL 2014

C:STC-A ENG. PROJ.# NA

SHEET FORMAT A1

DRAWN BY: R. OROGO

CHECKED BY: E. MORRIS

APPROVED BY: J. WIEDMAN

CONFIRMED BY: K. SCHAEFER, PE

WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209 TH CORPS HQ DISTR

ALIGNMENT PLAN

103-E-0100

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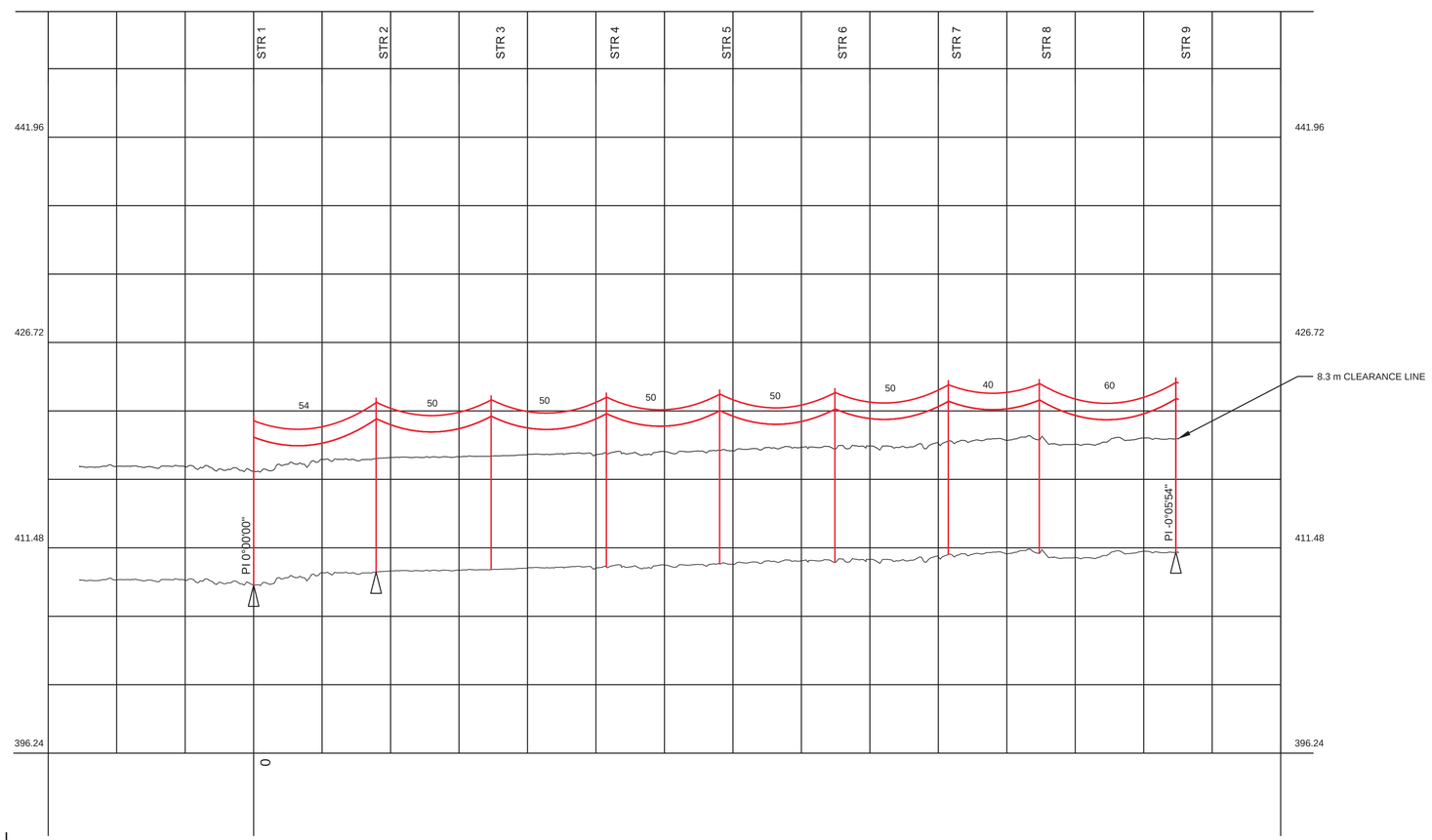
FOR INFORMATION ONLY

80 40 0 40 80 160

(1:2000 IN METRES)

30.0 m HORIZ. SCALE

5.0 m VERT. SCALE



1 PLAN AND PROFILE
103-E-0120 REF.- SCALE: NTS

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. DESIGN IS BASED ON A DIGITAL ELEVATION MODEL (DEM) WITH AN ACCURACY RANGE OF +/- 1 m.
3. CLASSIFIED LIDAR WAS NOT AVAILABLE.
4. CONTRACTOR TO VERIFY SITE CONDITIONS AND DO SITE ASSESSMENTS BEFORE STRUCTURE INSTALLATION.
5. CONDUCTOR TENSION IS LIMITED TO 13 kN UNDER MAX LOADING WHICH IS A COMBINATION OF WIND AND ICE.
6. MINIMUM DESIGN CLEARANCE OVER GROUND IS 8.3 m.
7. GUYS AND ANCHORS NOT SHOWN. REFER TO ALIGNMENT PLAN FOR THEIR LOCATIONS AND DETAILS.

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 11 FEB 2015
DATE ASSESSED: JUL 2014
DRAWN BY: R. ALCANTARA
CHECKED BY: Y. AWAN
APPROVED BY: J. WIEDMAN
CSTC-A ENG. PROJ.#: NA
CONFIRMED BY: K. SCHAEFER, PE
SHEET FORMAT A1
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209 TH CORPS HQ DISTR

PLAN AND PROFILE

103-E-0120

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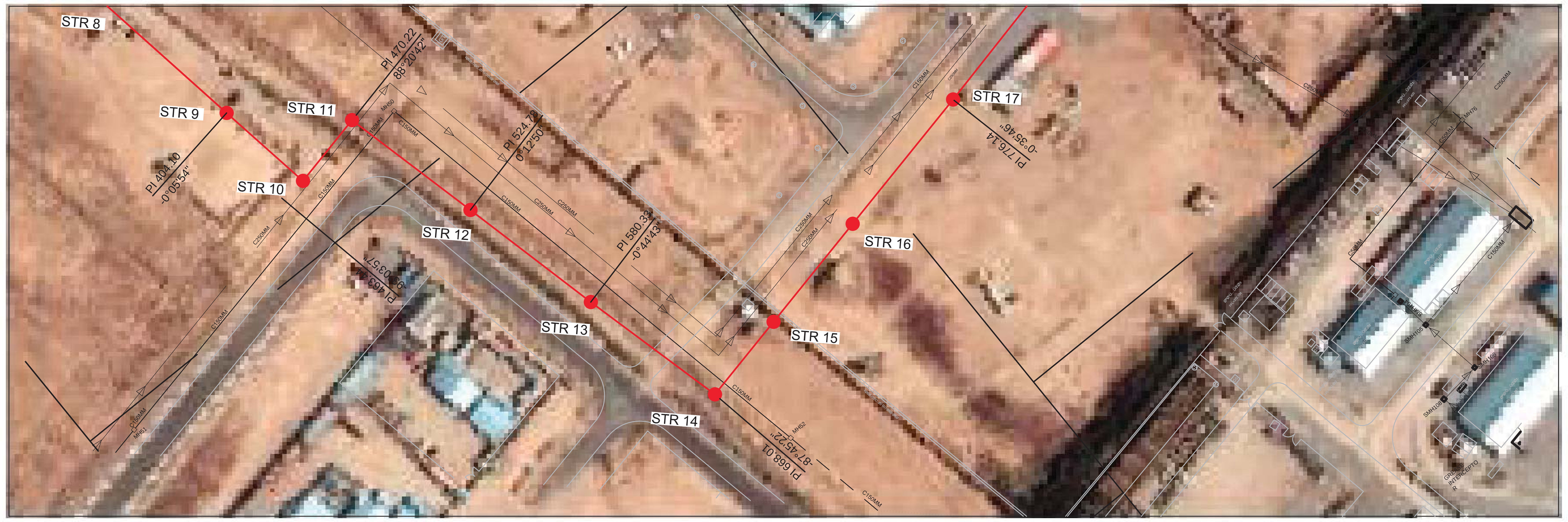
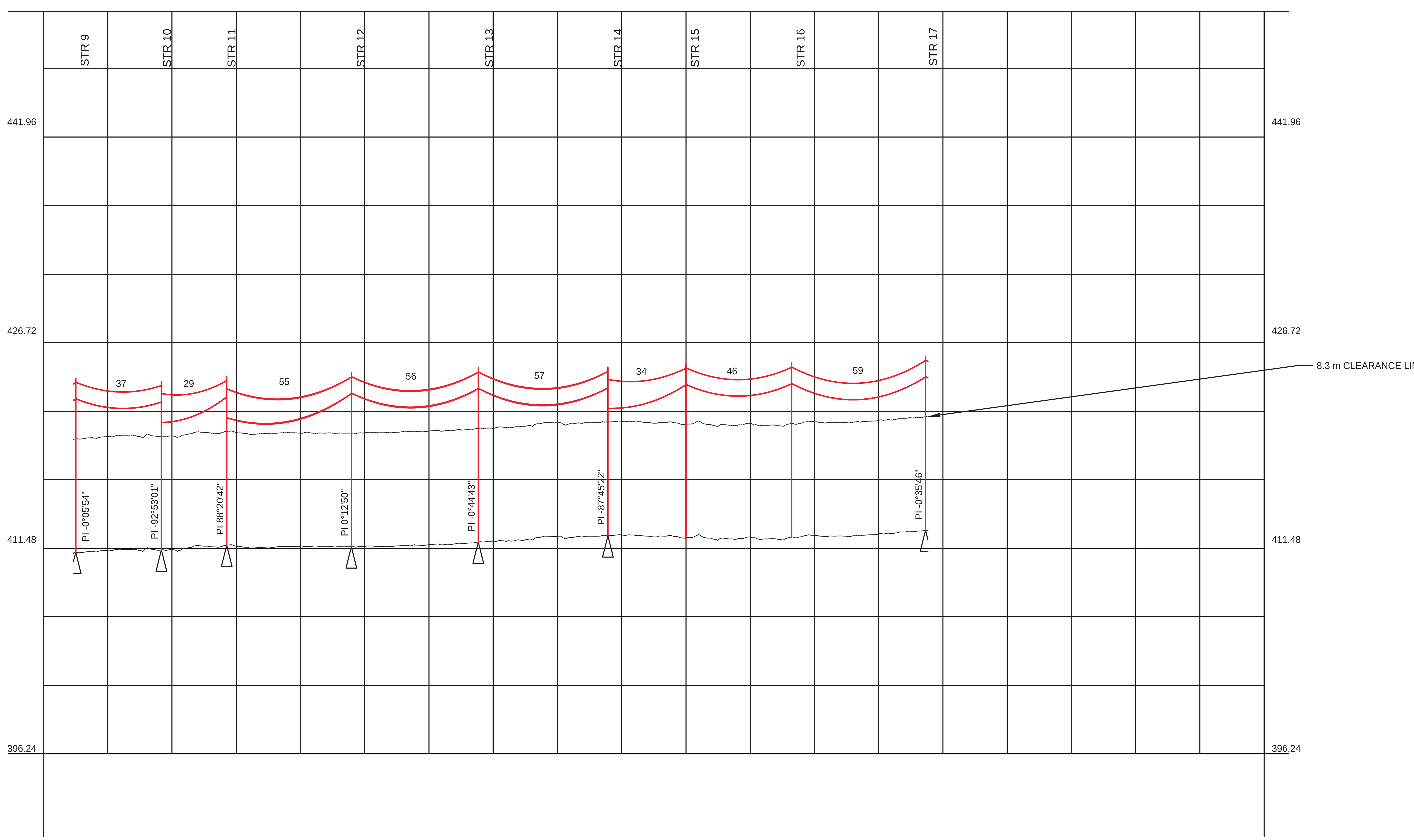
NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. DESIGN IS BASED ON A DIGITAL ELEVATION MODEL (DEM) WITH AN ACCURACY RANGE OF +/- 1 m.
3. CLASSIFIED LIDAR WAS NOT AVAILABLE.
4. CONTRACTOR TO VERIFY SITE CONDITIONS AND DO SITE ASSESSMENTS BEFORE STRUCTURE INSTALLATION.
5. CONDUCTOR TENSION IS LIMITED TO 13 kN UNDER MAX LOADING WHICH IS A COMBINATION OF WIND AND ICE.
6. MINIMUM DESIGN CLEARANCE OVER GROUND IS 8.3 m.
7. GUYS AND ANCHORS NOT SHOWN. REFER TO ALIGNMENT PLAN FOR THEIR LOCATIONS AND DETAILS.



30.0 m HORIZ. SCALE

5.0 m VERT. SCALE



1 PLAN AND PROFILE
103-E-0121 REF. – SCALE: NTS

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 11 FEB 2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.#: NA
SHEET FORMAT: A1

DRAWN BY: R. ALCANTARA
CHECKED BY: Y. AWAN
APPROVED BY: J. WIEDMAN
CONFIRMED BY: K. SCHAEFER, PE
WBS NO.: 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202
amec AMEC ENVIRONMENT & INFRASTRUCTURE, INC

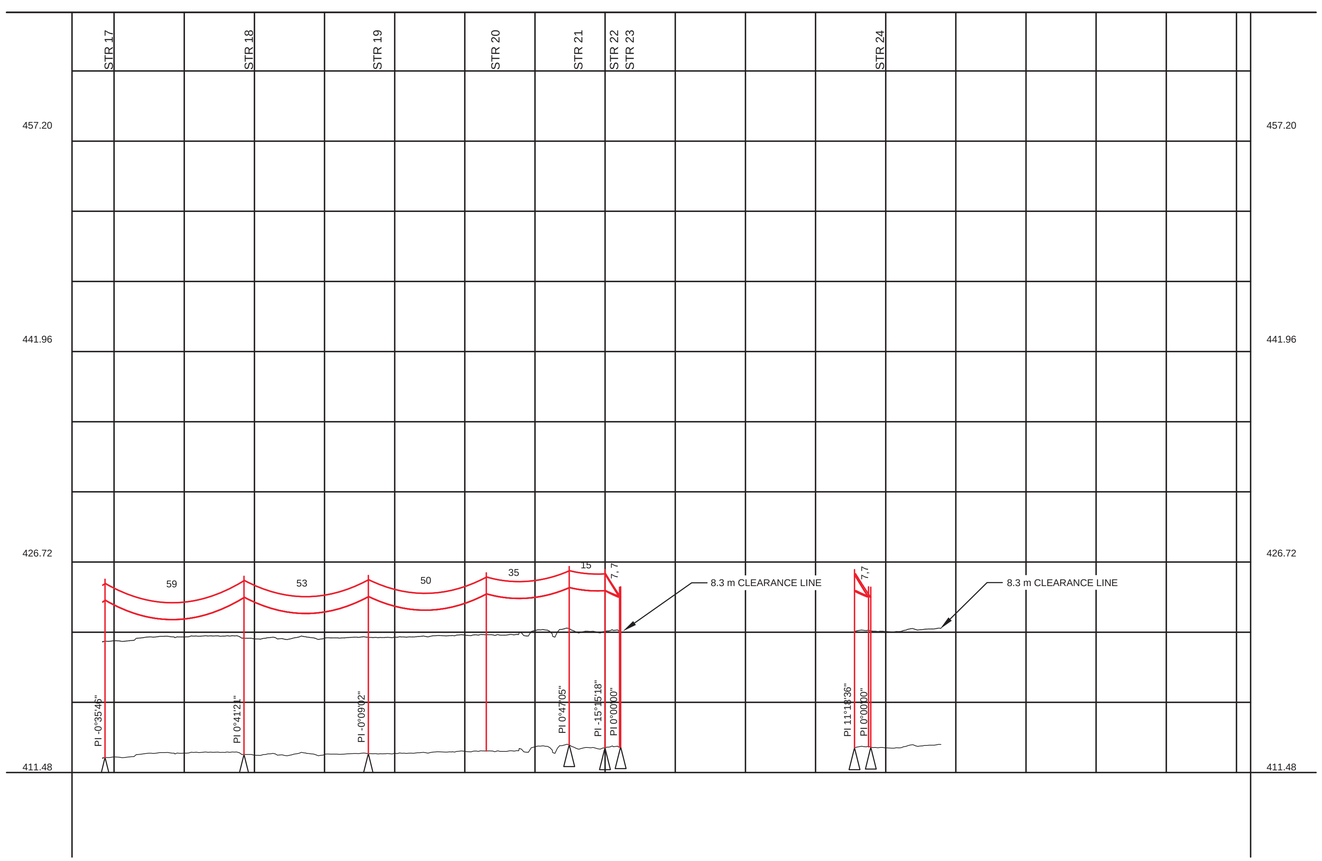
CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209 TH CORPS HQ DISTR

PLAN AND PROFILE

103-E-0121

30.0 m HORIZ. SCALE

5.0 m VERT. SCALE



1 PLAN AND PROFILE
103-E-0122 REF. – SCALE: NTS

FOR INFORMATION ONLY

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. DESIGN IS BASED ON A DIGITAL ELEVATION MODEL (DEM) WITH AN ACCURACY RANGE OF +/- 1 m.
3. CLASSIFIED LIDAR WAS NOT AVAILABLE.
4. CONTRACTOR TO VERIFY SITE CONDITIONS AND DO SITE ASSESSMENTS BEFORE STRUCTURE INSTALLATION.
5. TENSION IS LIMITED TO 13 kN UNDER MAX LOADING WHICH IS A COMBINATION OF WIND AND ICE.
6. MINIMUM DESIGN CLEARANCE OVER GROUND IS 8.3 m.
7. GUYS AND ANCHORS NOT SHOWN. REFER TO ALIGNMENT PLAN FOR THEIR LOCATIONS AND DETAILS.

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 11 FEB 2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.# NA
SHEET FORMAT A1
DRAWN BY: R. ALCANTARA
CHECKED BY: Y. AWAN
APPROVED BY: J. WIEDMAN
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209 TH CORPS HQ DISTR

PLAN AND PROFILE

103-E-0122

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STAKING TABLE

STRUCTURE NUMBER	STRUCTURE NAME	AHEAD SPAN (m)	LINE ANGLE (DEG)	STAKE DESCRIPTION	X EASTING (m)	Y NORTHING (m)	Z ELEVATION (m)	LENGTH TO STRUCTURE HUB (m)	LENGTH TO CENTRELINE HUB (m)	STRUCTURE RIGHT BISECTOR ANGLE (DEG)
STR 1	DOUBLE CIRCUIT DEAD-END	54	0	POLE	320355.06	4057813.75	408.52	0	0	0
STR 1	DOUBLE CIRCUIT DEAD-END	54	0	GUY 1	320353.38	4057824.27	408.52	10.65	10.65	90
STR 1	DOUBLE CIRCUIT DEAD-END	54	0	GUY 2	320353.19	4057825.45	408.52	11.85	11.85	90
STR 2	DOUBLE CIRCUIT TANGENT	50	0	POLE	320363.57	4057760.74	409.47	0	0	0
STR 3	DOUBLE CIRCUIT TANGENT	50	0	POLE	320371.54	4057711.01	409.65	0	0	0
STR 4	DOUBLE CIRCUIT TANGENT	50	0	POLE	320379.54	4057661.17	409.84	0	0	0
STR 5	DOUBLE CIRCUIT TANGENT	50	0	POLE	320387.40	4057612.12	410.07	0	0	0
STR 6	DOUBLE CIRCUIT TANGENT	50	0	POLE	320395.40	4057562.28	410.18	0	0	0
STR 7	DOUBLE CIRCUIT TANGENT	40	0	POLE	320403.27	4057513.24	410.75	0	0	0
STR 8	DOUBLE CIRCUIT TANGENT	60	0	POLE	320409.58	4057473.85	410.84	0	0	0
STR 9	DOUBLE CIRCUIT TANGENT	37	0	POLE	320419.06	4057414.75	410.94	0	0	0
STR 10	DOUBLE CIRCUIT HEAVY ANGLE	29	-93	POLE	320425.06	4057377.75	411.12	0	0	0
STR 10	DOUBLE CIRCUIT HEAVY ANGLE	29	-93	GUY 1	320427.03	4057367.28	411.12	10.65	10.65	315
STR 10	DOUBLE CIRCUIT HEAVY ANGLE	29	-93	GUY 2	320427.25	4057366.10	411.12	11.85	11.85	315
STR 10	DOUBLE CIRCUIT HEAVY ANGLE	29	-93	GUY 3	320416.07	4057376.06	411.12	9.15	9.15	45
STR 10	DOUBLE CIRCUIT HEAVY ANGLE	29	-93	GUY 4	320414.01	4057375.67	411.12	11.25	11.25	45
STR 11	DOUBLE CIRCUIT HEAVY ANGLE	55	88	POLE	320453.06	4057383.75	411.46	0	0	0
STR 11	DOUBLE CIRCUIT HEAVY ANGLE	55	88	GUY 1	320463.44	4057386.13	411.46	10.65	10.65	225
STR 11	DOUBLE CIRCUIT HEAVY ANGLE	55	88	GUY 2	320464.61	4057386.40	411.46	11.85	11.85	225
STR 11	DOUBLE CIRCUIT HEAVY ANGLE	55	88	GUY 3	320451.02	4057392.67	411.46	9.15	9.15	135
STR 11	DOUBLE CIRCUIT HEAVY ANGLE	55	88	GUY 4	320450.55	4057394.72	411.46	11.25	11.25	135
STR 12	DOUBLE CIRCUIT TANGENT	56	0	POLE	320466.03	4057330.75	411.34	0	0	0
STR 13	DOUBLE CIRCUIT TANGENT	57	-1	POLE	320479.03	4057276.75	411.70	0	0	0
STR 14	DOUBLE CIRCUIT HEAVY ANGLE	34	-88	POLE	320493.03	4057221.75	412.15	0	0	0
STR 14	DOUBLE CIRCUIT HEAVY ANGLE	34	-88	GUY 1	320495.46	4057211.38	412.15	10.65	10.65	315
STR 14	DOUBLE CIRCUIT HEAVY ANGLE	34	-88	GUY 2	320495.73	4057210.21	412.15	11.85	11.85	315
STR 14	DOUBLE CIRCUIT HEAVY ANGLE	34	-88	GUY 3	320484.12	4057219.67	412.15	9.15	9.15	45
STR 14	DOUBLE CIRCUIT HEAVY ANGLE	34	-88	GUY 4	320482.08	4057219.19	412.15	11.25	11.25	45
STR 15	DOUBLE CIRCUIT TANGENT	46	0	POLE	320526.48	4057228.88	411.99	0	0	0
STR 16	DOUBLE CIRCUIT TANGENT	59	0	POLE	320571.68	4057238.52	412.05	0	0	0
STR 17	DOUBLE CIRCUIT TANGENT	59	-1	POLE	320629.03	4057250.75	412.55	0	0	0
STR 18	DOUBLE CIRCUIT TANGENT	53	1	POLE	320687.03	4057263.75	412.77	0	0	0
STR 19	DOUBLE CIRCUIT TANGENT	50	0	POLE	320739.03	4057274.75	412.82	0	0	0
STR 20	DOUBLE CIRCUIT TANGENT	35	0	POLE	320788.35	4057285.32	413.01	0	0	0
STR 21	DOUBLE CIRCUIT TANGENT	15	1	POLE	320823.03	4057292.75	413.46	0	0	0
STR 22	DOUBLE CIRCUIT TANGENT	7	-15	POLE	320838.03	4057295.75	413.24	0	0	0
STR 23	TERMINAL POLE	0	0	POLE	320844.03	4057298.75	413.31	0	0	0
STR 23	TERMINAL POLE	0	0	GUY 1	320850.26	4057301.87	413.31	6.97	6.97	270
STR 24	TERMINAL POLE	0	0	POLE	320845.03	4057295.75	413.28	0	0	0
STR 24	TERMINAL POLE	0	0	GUY 1	320852.00	4057295.75	413.28	6.97	6.97	270

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 11 FEB 2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.#: NA
SHEET FORMAT: A1
DRAWN BY: A. BACLAAN
CHECKED BY: Y. AWAN
APPROVED BY: J. WIEDMAN
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209 TH CORPS HQ DISTR

STAKING TABLE

103-E-0130

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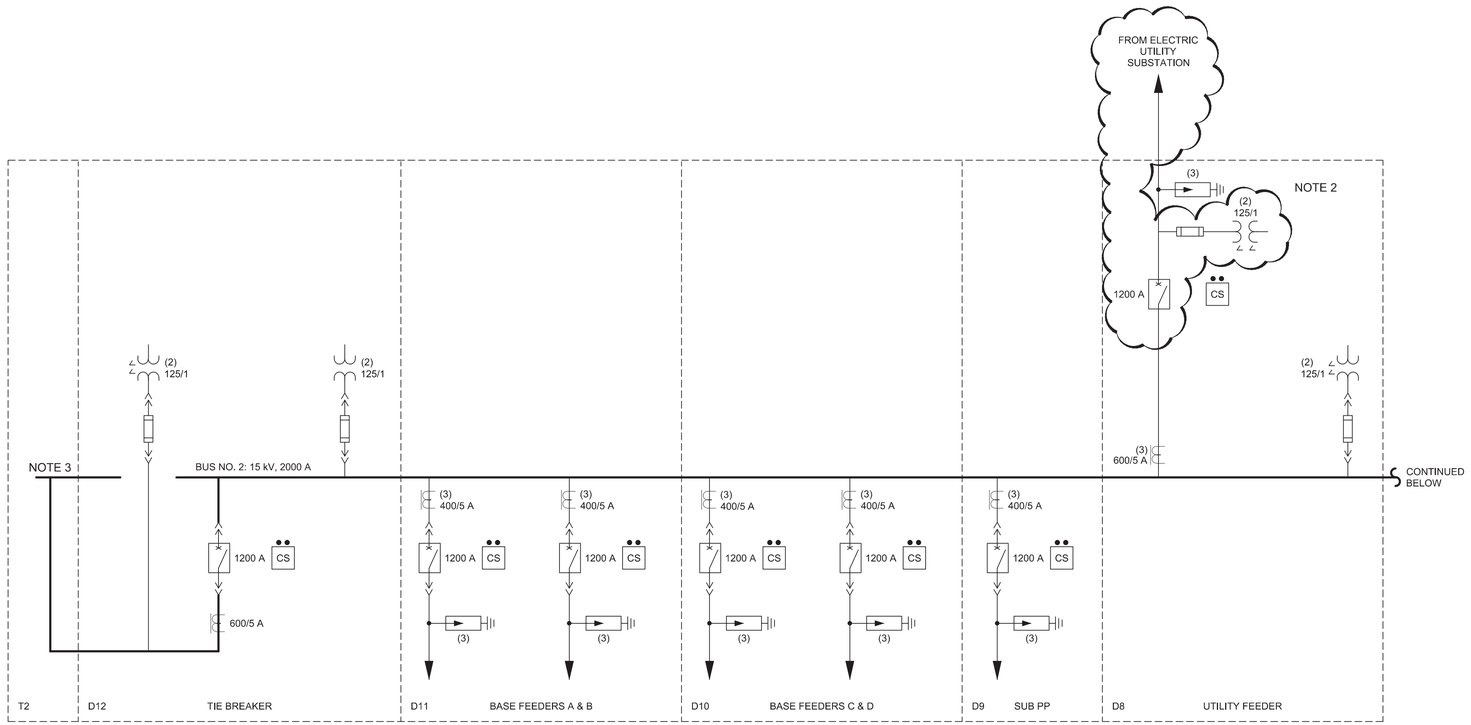

NOTES:

1. DRAWING IS TO IDENTIFY SCOPE OF WORK ONLY. DRAWING SHALL NOT BE USED FOR OPERATING OR REFERENCING ITEMS OUT OF CLOUDED SCOPE.
2. PLANT #1 UTILITY INCOMING CUBICLE HAS AN EXISTING OVERCURRENT RELAY. A CIRCUIT BREAKER, LINE SIDE PT AND SYNCHRONISING CHECK RELAY SHALL BE SUPPLIED UNDER THE SCOPE OF THIS PROJECT AS SHOWN WITHIN REVISION CLOUD.
3. BUS DRILLED FOR FUTURE EXTENSION OF SWITCHGEAR.

LEGEND:

- SURGE ARRESTER
- CIRCUIT BREAKER
- CS — CIRCUIT BREAKER CONTROL SWITCH
- POTENTIAL TRANSFORMER (PT) OPEN DELTA
- POTENTIAL TRANSFORMER (PT)
- FUSE
- CURRENT TRANSFORMER (CT)

METAL CLAD SWITCHGEAR INFORMATION	
MAKE AND MODEL	RUSS ELECTRIC RE-750 CAT B
RATED VOLTAGE	15 kV
RATED FREQUENCY	60 HZ
RATED LIGHTNING IMPULSE	95 kV
RATED POWER FREQUENCY WITHSTAND VOLTAGE	
RATED NORMAL CURRENT (BUSBAR)	1200 A
RATED NORMAL CURRENT (CIRCUIT)	1200 A
RATED SHORT-TIME WITHSTAND CURRENT	18 kA
RATED PEAK WITHSTAND CURRENT	62 kA

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27FEB2015	SL	AD	ISSUED FOR TENDER

SCALE: NONE
DATE DRAWN: 04 DEC 2014
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.# NA
SHEET FORMAT A1
DRAWN BY: R. ALCANTARA/S. LI
CHECKED BY: C. NIU
APPROVED BY: A. DAETZ
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209 TH CORPS HQ DISTR

OPERATING SINGLE LINE DIAGRAM
CAMP SHAHEEN 1

104-E-0010

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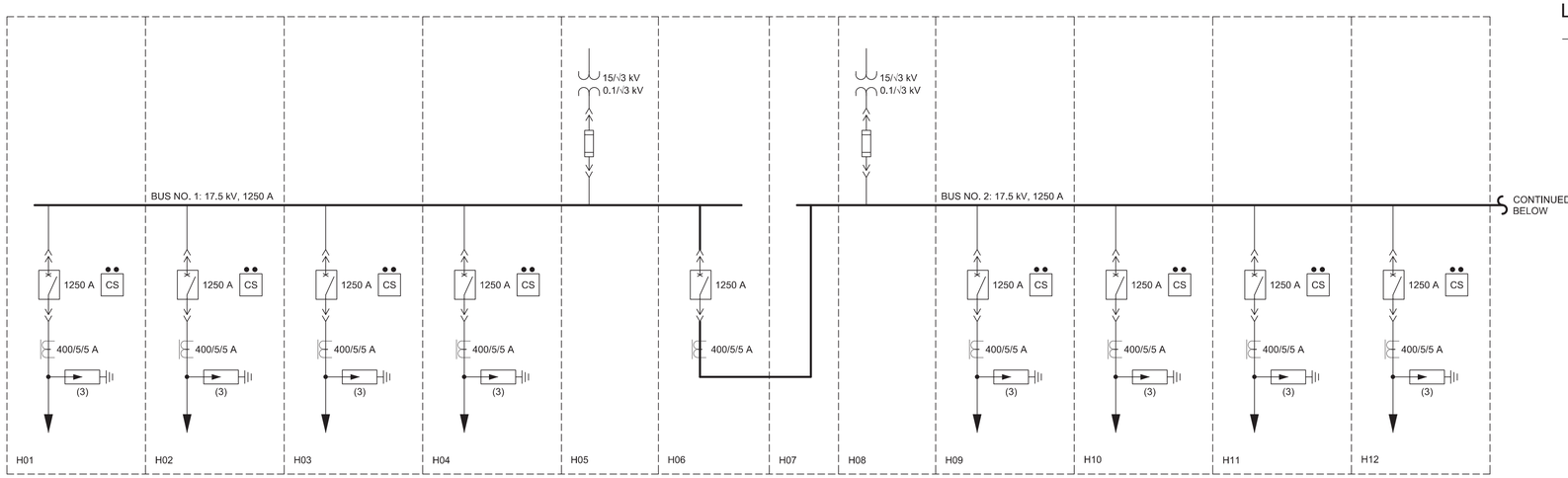

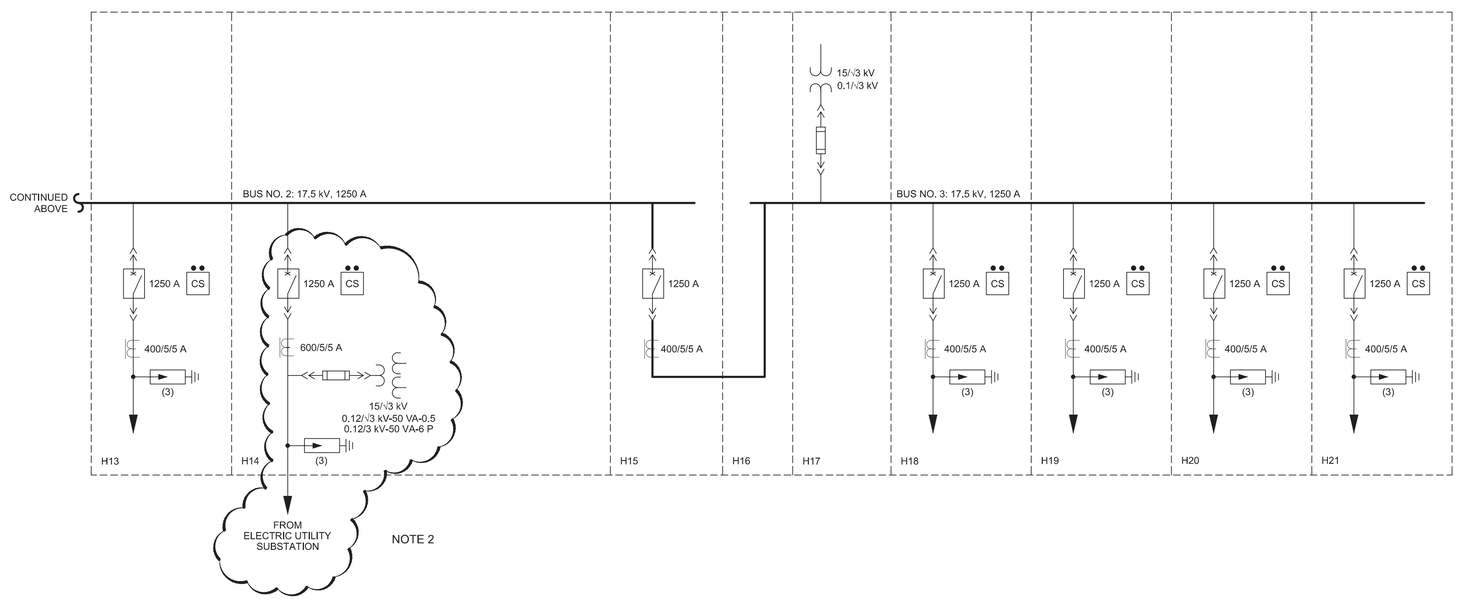

NOTES:

1. DRAWING IS TO IDENTIFY SCOPE OF WORK ONLY. DRAWING SHALL NOT BE USED FOR OPERATING OR REFERENCING ITEMS OUT OF CLOUDED SCOPE.
2. PLANT #2 UTILITY INCOMING CUBICLE IS EMPTY. AN OVERCURRENT RELAY, CIRCUIT BREAKER, SURGE ARRESTER, AND LINE SIDE PT SHALL BE SUPPLIED UNDER THE SCOPE OF THIS PROJECT AS SHOWN WITHIN REVISION CLOUD.

LEGEND:

- SURGE ARRESTER
- CIRCUIT BREAKER
- CS — CIRCUIT BREAKER CONTROL SWITCH
- POTENTIAL TRANSFORMER (PT)
- FUSE
- CURRENT TRANSFORMER (CT)
- THREE-WINDING POTENTIAL TRANSFORMER

METAL CLAD SWITCHGEAR INFORMATION	
MAKE AND MODEL	ABB UNIGEAR ZS1
RATED VOLTAGE	17.5 kV
RATED FREQUENCY	50 HZ
RATED LIGHTNING IMPULSE	95 kV
RATED POWER FREQUENCY WITHSTAND VOLTAGE	38 kV
RATED NORMAL CURRENT (BUSBAR)	1250 A
RATED NORMAL CURRENT (CIRCUIT)	1250 A
RATED SHORT-TIME WITHSTAND CURRENT	25 kA, 1 S
RATED PEAK WITHSTAND CURRENT	62.5 kA

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27FEB2015	SL	AD	ISSUED FOR TENDER

SCALE: NONE
DRAWN BY: R. ALCANTARA/S. LI
DATE DRAWN: 04 DEC 2014
CHECKED BY: C. NIU
DATE ASSESSED: JUL 2014
APPROVED BY: A. DAETZ
CSTC-A ENG. PROJ.# NA
CONFIRMED BY: K. SCHAEFER, PE
SHEET FORMAT A1
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 1/2: 209 TH CORPS HQ DISTR

OPERATING SINGLE LINE DIAGRAM
CAMP SHAHEEN 2

106-E-0010

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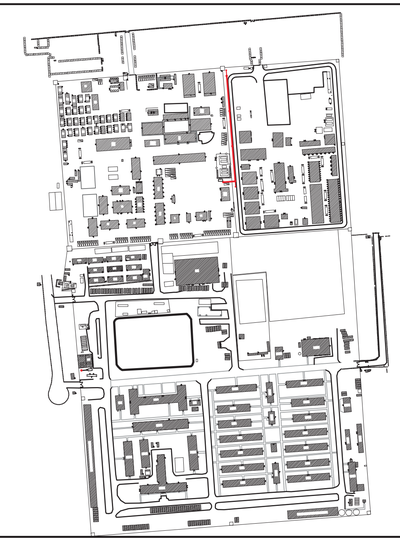
AFGHAN NATIONAL SECURITY FORCES

SITE 2/2: DASHTI SHADIAN DISTR

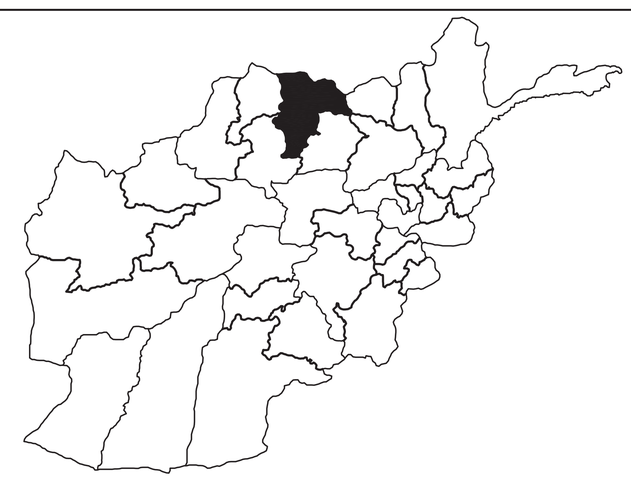
SHEET INDEX

200-G-0100	COVER SHEET
203-E-0001	MATERIAL LIST, LEGEND
203-E-0100	ALIGNMENT PLAN
203-E-0120	PLAN AND PROFILE
203-E-0130	STAKING TABLE
204-E-0010	OPERATING SINGLE LINE DIAGRAM ANCOP
206-E-0010	OPERATING SINGLE LINE DIAGRAM UP ZONE

AERIAL MAP



VICINITY MAP



FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27FEB2015	TDL	TDL	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 27JAN2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.# NA
SHEET FORMAT A1
DRAWN BY: DMW
CHECKED BY: TDL
APPROVED BY: MRW
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 2/2: DASHTI SHADIAN DISTR

COVER SHEET

200-G-0100

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PROJECT MATERIAL LIST

ASSEMBLY	QUANTITY
SINGLE CIRCUIT TANGENT	1
SINGLE CIRCUIT DEAD-END	2
SINGLE DOWN-GUY AND ANCHOR	3
TERMINAL POLE AND CONDUIT	2
13.0 m POLES	4

LEGEND

SYMBOL	DESCRIPTION
●	POLE
←	GUY
—	CONDUCTOR
Δ	POINT OF INFLECTION (PI)
##	BILL OF MATERIALS REFERENCE
- - - -	UNDERGROUND FEEDER CABLE

MINIMUM CONDUCTOR CLEARANCES

CLEARANCE ITEM	SPECIFICATION (m)
GROUND ACCESSIBLE TO PEDESTRIANS ONLY	6.5
GROUND IN BUILT-UP AREAS, ROAD CROSSINGS AND WATER WITHOUT BOAT TRAFFIC	7.0
OVERHEAD LINES CROSSING WITH VOLTAGES UP TO 1kV	3.0
OVERHEAD LINES CROSSING WITH VOLTAGES > 1kV	4.6
TELECOMMUNICATION LINES	2.5
TREES AND VEGETATION	2.5
NAVIGABLE WATER WAYS (ABOVE MEAN WATER LEVEL)	20

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 11 FEB 2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.#: NA
SHEET FORMAT A1
DRAWN BY: R. OROGO
CHECKED BY: E. MORRIS
APPROVED BY: J. WIEDMAN
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 2/2: DASHTI SHADIAN DISTR

MATERIAL LIST, LEGEND

203-E-0001

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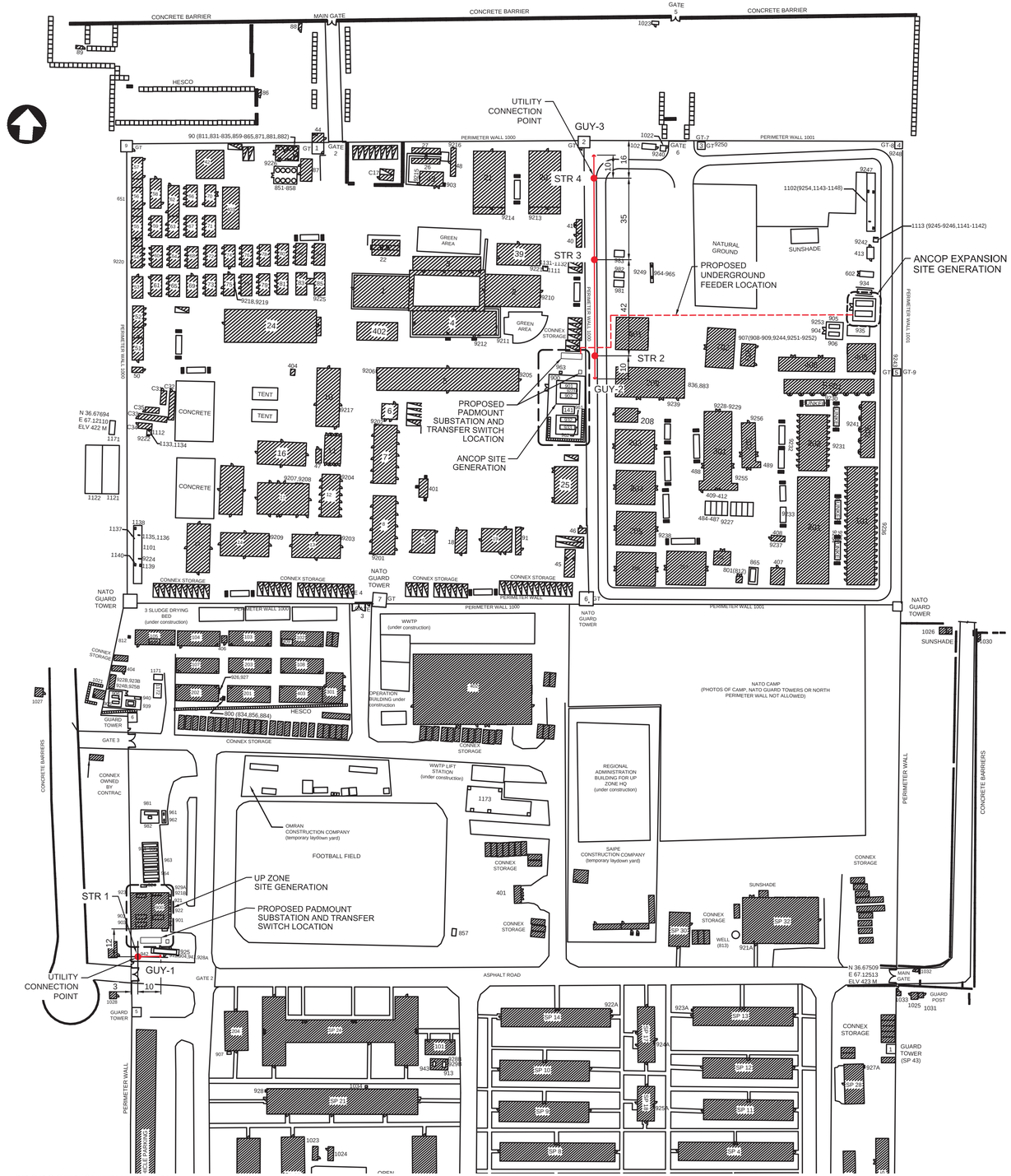
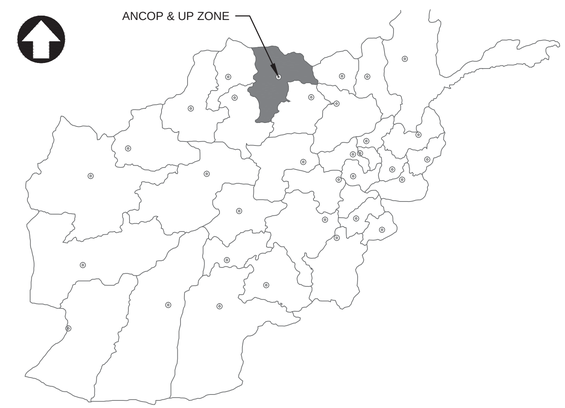


VICINITY MAP



1 PROPOSED OVERHEAD LINE ANCOP & UP ZONE

203-E-0100 REF. – SCALE: 1:1000

FOR INFORMATION ONLY

(1:1000 IN METRES)

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 26 JAN 2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.#: NA
SHEET FORMAT A1
DRAWN BY: R. OROGO
CHECKED BY: E. MORRIS
APPROVED BY: J. WIEDMAN
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 2/2: DASHTI SHADIAN DISTR

ALIGNMENT PLAN

203-E-0100

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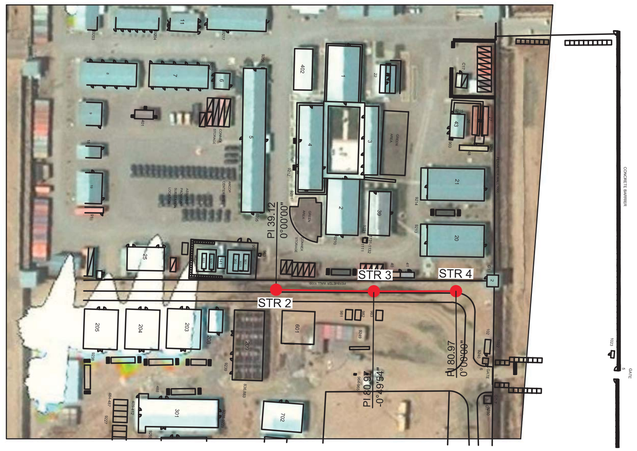
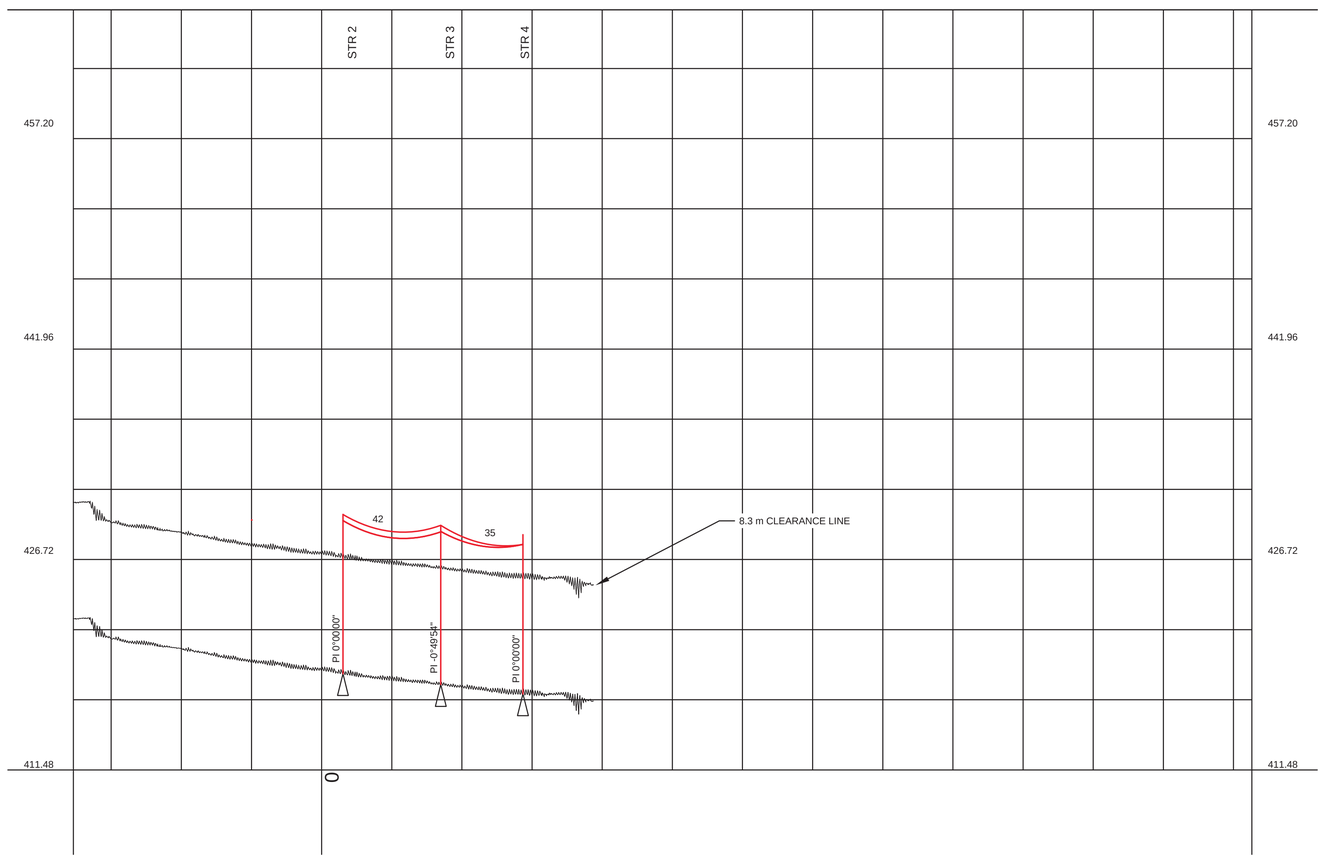


30.0 m HORIZ. SCALE

5.0 m VERT. SCALE



1 PLAN AND PROFILE
203-E-0120 REF. – SCALE: NTS

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. DESIGN IS BASED ON A DIGITAL ELEVATION MODEL (DEM) WITH AN ACCURACY RANGE OF +/- 1 m.
3. CLASSIFIED LIDAR WAS NOT AVAILABLE.
4. CONTRACTOR TO VERIFY SITE CONDITIONS AND DO SITE ASSESSMENTS BEFORE STRUCTURE INSTALLATION.
5. CONDUCTOR TENSION IS LIMITED TO 13 kN UNDER MAX LOADING WHICH IS A COMBINATION OF WIND AND ICE.
6. MINIMUM DESIGN CLEARANCE OVER GROUND IS 8.3 m.
7. GUYS AND ANCHORS NOT SHOWN. REFER TO ALIGNMENT PLAN FOR THEIR LOCATIONS AND DETAILS.

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 11 FEB 2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.# NA
SHEET FORMAT A1
DRAWN BY: R. OROGO
CHECKED BY: Y. AWAN
APPROVED BY: J. WIEDMAN
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 2/2: DASHTI SHADIAN DISTR

PLAN AND PROFILE

203-E-0120

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STAKING TABLE

STRUCTURE NUMBER	STRUCTURE NAME	AHEAD SPAN (m)	LINE ANGLE (DEG)	STAKE DESCRIPTION	X EASTING (m)	Y NORTHING (m)	Z ELEVATION (m)	LENGTH TO STRUCTURE HUB (m)	LENGTH TO CENTRELINE HUB (m)	STRUCTURE RIGHT BISECTOR ANGLE (DEG)
STR 2	TERMINAL POLE	42	0	POLE	332312.53	4060724.00	418.34	0	0	0
STR 2	TERMINAL POLE	42	0	GUY 1	332313.20	4060714.00	418.34	9.9	9.9	90
STR 3	SINGLE CIRCUIT TANGENT	35	-1	POLE	332309.56	4060765.75	417.57	0	0	0
STR 4	SINGLE CIRCUIT DEAD-END	0	0	POLE	332306.56	4060800.74	416.90	0	0	0
STR 4	SINGLE CIRCUIT DEAD-END	0	0	GUY 1	332305.67	4060811.20	416.90	10.5	10.5	270

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27 FEB 2015	GP	JW	ISSUED FOR TENDER

SCALE: AS SHOWN
DATE DRAWN: 11 FEB 2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.#: NA
SHEET FORMAT: A1
DRAWN BY: R. OROGO
CHECKED BY: E. MORRIS
APPROVED BY: J. WIEDMAN
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 2/2: DASHTI SHADIAN DISTR

STAKING TABLE

203-E-0130

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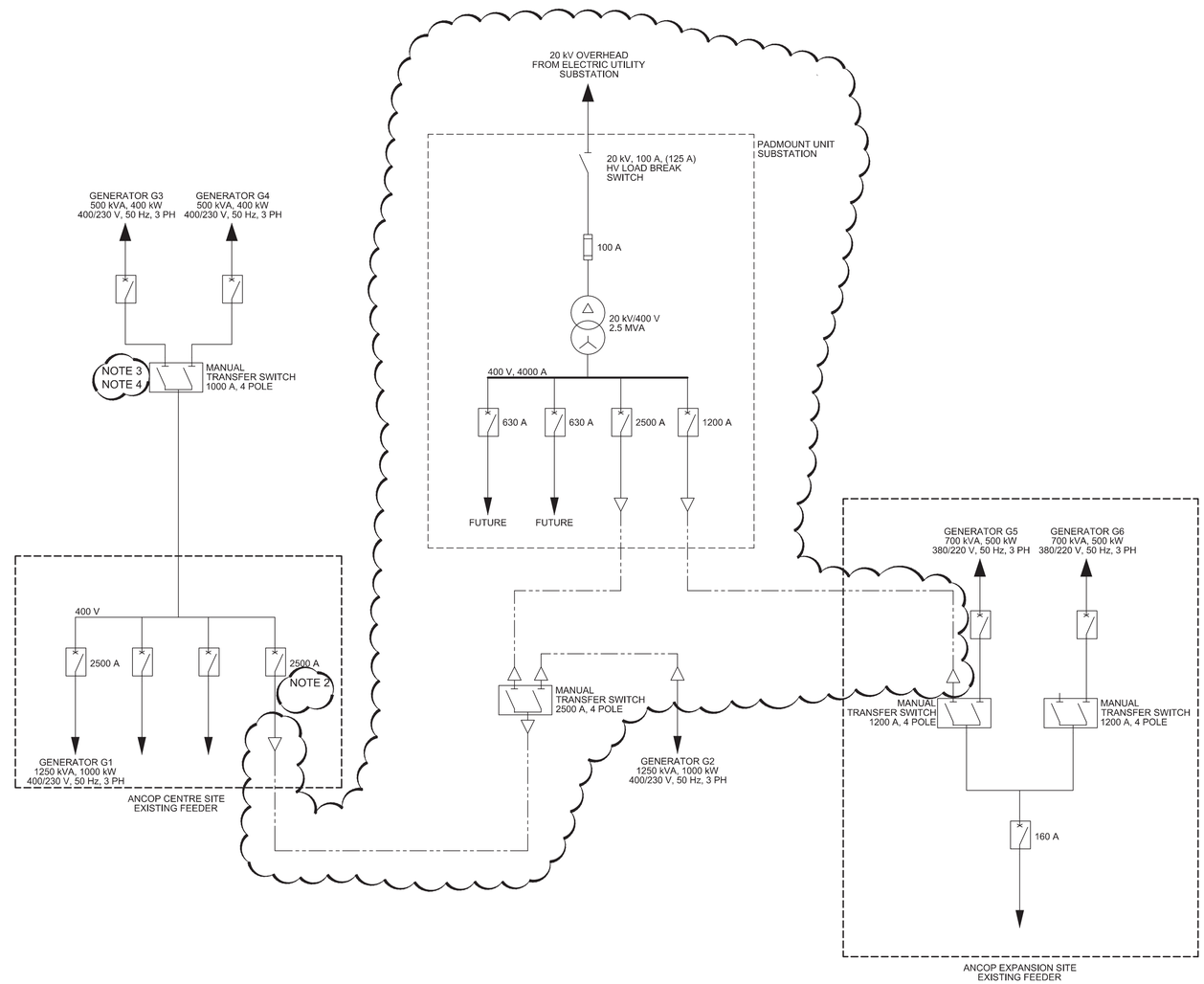

NOTES:

1. DRAWING IS TO IDENTIFY SCOPE OF WORK ONLY. DRAWING SHALL NOT BE USED FOR OPERATING OR REFERENCING ITEMS OUT OF CLOUDED SCOPE.
2. PROVIDE CIRCUIT BREAKER PLACARD: "UTILITY POWER CIRCUIT BREAKER - UCB".
3. PROVIDE TRANSFER SWITCH PLACARD: "THIS TRANSFER SWITCH SHALL REMAIN OPEN UNLESS THE UTILITY POWER CIRCUIT BREAKER - UCB IS OPEN."
4. PROVIDE PLACARDS TO INDICATE G3, G4 AND OPEN POSITIONS.
5. PLACARDS SHALL BE PROVIDED IN ENGLISH, DARI AND PASHTO.

LEGEND:

- CIRCUIT BREAKER
- DISCONNECT SWITCH (MANUAL OPERATED)
- THREE PHASE PADMOUNT TRANSFORMER TWO WINDING CONNECTION: DELTA-WYE
- MANUAL TRANSFER SWITCH
- 600V CABLE
- FUSE

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27FEB2015	SL	AD	ISSUED FOR TENDER

SCALE: NONE
DRAWN BY: I. CAMPBELL/S. LI
DATE DRAWN: 20 JAN 2015
CHECKED BY: B. MACDONALD
DATE ASSESSED: JUL 2014
APPROVED BY: A. DAETZ
CSTC-A ENG. PROJ.# NA
CONFIRMED BY: K. SCHAEFER, PE
SHEET FORMAT A1
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

amec AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 2/2: DASHTI SHADIAN DISTR

OPERATING SINGLE LINE DIAGRAM
ANCOP

204-E-0010

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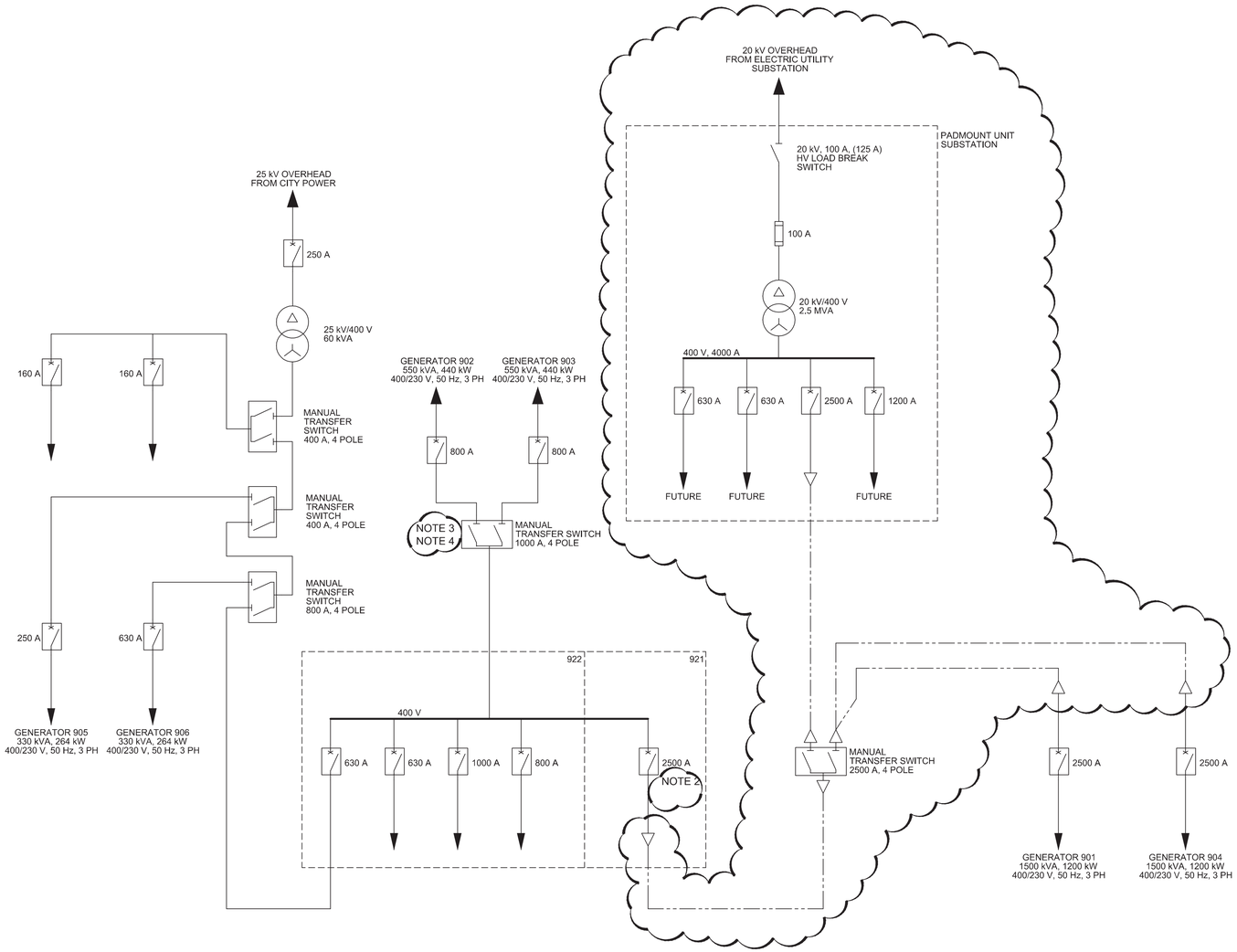


NOTES:

1. DRAWING IS TO IDENTIFY SCOPE OF WORK ONLY. DRAWING SHALL NOT BE USED FOR OPERATING OR REFERENCING ITEMS OUT OF CLOUDED SCOPE.
2. PROVIDE CIRCUIT BREAKER PLACARD: "UTILITY POWER CIRCUIT BREAKER - UCB".
3. PROVIDE TRANSFER SWITCH PLACARD: "THIS TRANSFER SWITCH SHALL REMAIN OPEN UNLESS THE UTILITY POWER CIRCUIT BREAKER - UCB IS OPEN."
4. PROVIDE PLACARDS TO INDICATE GENERATOR 902, GENERATOR 903 AND OPEN POSITIONS.
5. PLACARDS SHALL BE PROVIDED IN ENGLISH, DARI AND PASHTO.

LEGEND:

- SURGE ARRESTER
- CIRCUIT BREAKER
- DISCONNECT SWITCH (MANUAL OPERATED)
- THREE PHASE PADMOUNT TRANSFORMER TWO WINDING CONNECTION: DELTA-WYE
- MANUAL TRANSFER SWITCH
- 600V CABLE
- FUSE

FOR INFORMATION ONLY

AFGHAN NATIONAL SECURITY FORCES

ISSUED FOR TENDER

REV	DATE	BY	APP	DESCRIPTION
0	27FEB2015	SL	AD	ISSUED FOR TENDER

SCALE: NONE
DATE DRAWN: 20 JAN 2015
DATE ASSESSED: JUL 2014
CSTC-A ENG. PROJ.# NA
SHEET FORMAT A1

DRAWN BY: I. CAMPBELL/S. LI
CHECKED BY: B. MACDONALD
APPROVED BY: A. DAETZ
CONFIRMED BY: K. SCHAEFER, PE
WBS NO. 043A4N0300

AFCEC CONTRACT # FA8903-08-D-8766
AMEC PROJECT # 775290202

AMEC ENVIRONMENT & INFRASTRUCTURE, INC

CAMP SHAHEEN SUBSTATION DESIGN
SITE 2/2: DASHTI SHADIAN DISTR

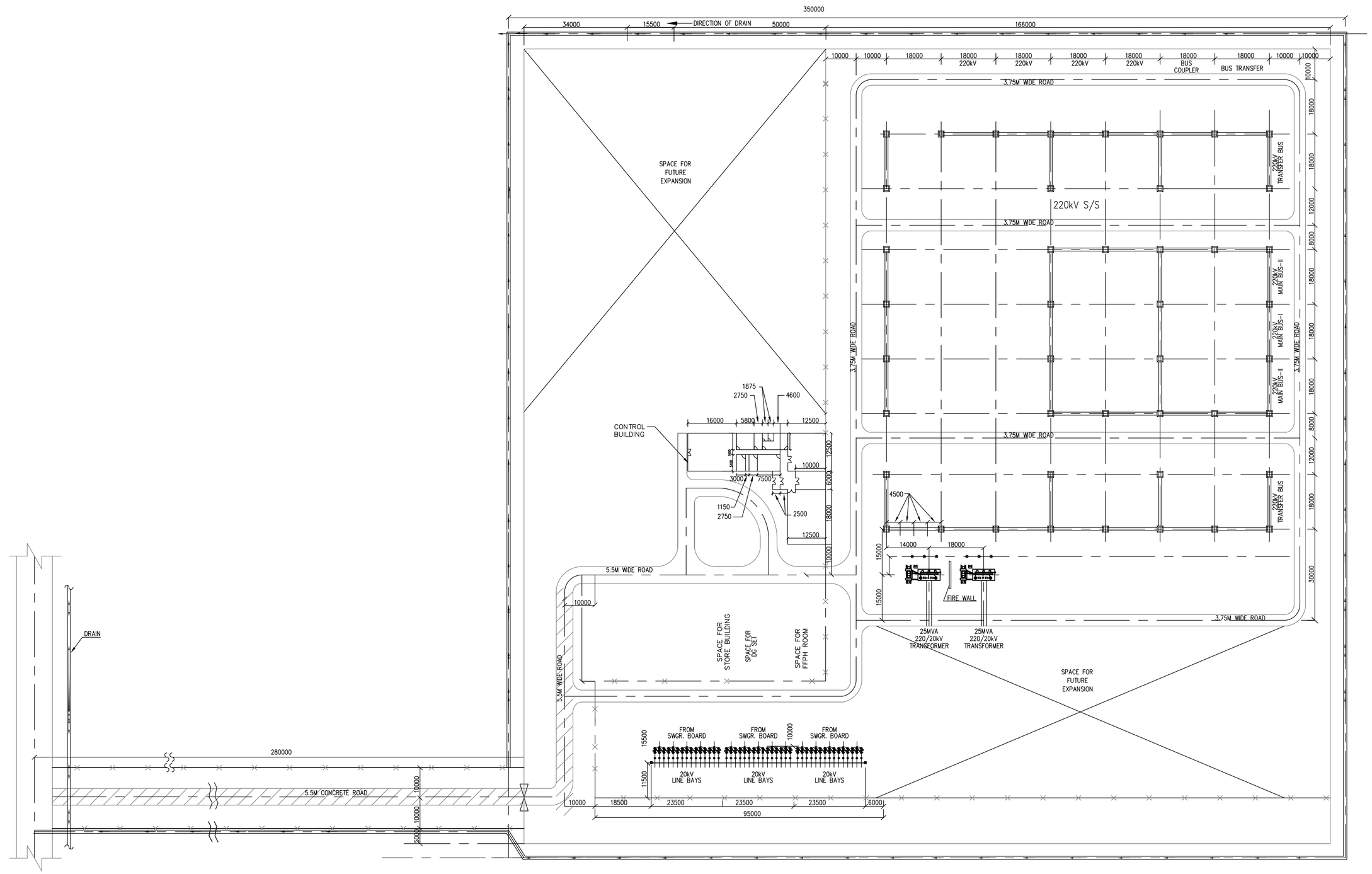
OPERATING SINGLE LINE DIAGRAM
UP ZONE

206-E-0010

P:\CAD\ELE\202-Dashti_Shadian\Electrical\206-E-0010.dwg 02/26/2015 5:30pm gl.batchplot

Appendix E

Conceptual Electrical Single Line Diagram and Substation Layout



NOTES:

1. DRAWING IS REPRESENTATIVE OF A TYPICAL SUBSTATION LAYOUT. REFER TO PROJECT SPECIFICATIONS FOR TECHNICAL REQUIREMENTS.

LEGEND:

- INDICATES 5.5 WIDE CONCRETE ROAD
- INDICATES FENCE
- INDICATES 3.75M WIDE CONCRETE ROAD
- INDICATES BOUNDARY WALL
- INDICATES DRAIN

US Army Corps of Engineers®
Philadelphia District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

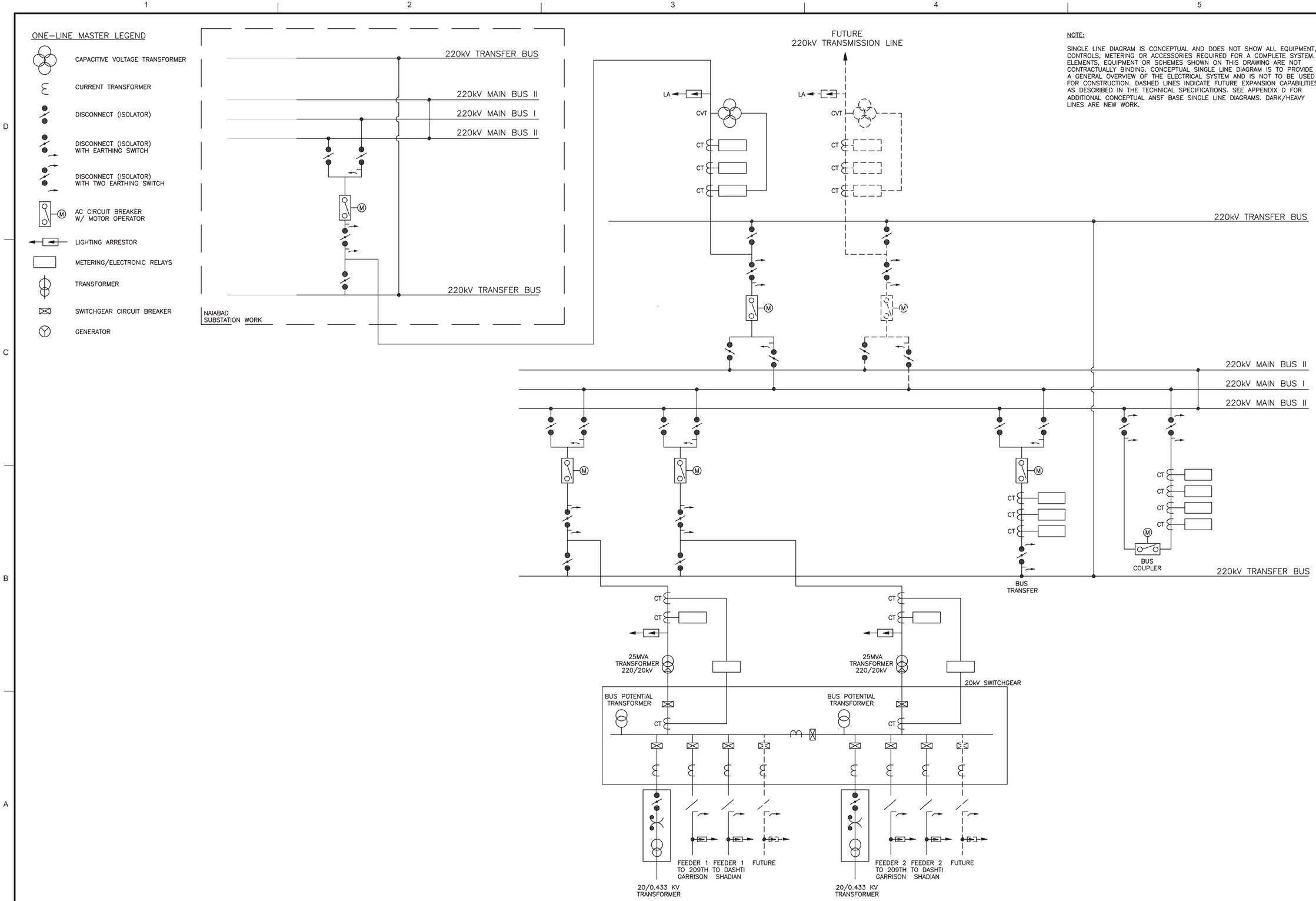
DESIGNED BY: | DATE:
DWN BY: | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
PLOT SCALE: | PLOT DATE: | FILE NUMBER:
SIZE: ANSI D | FILE NAME:

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT
PHILADELPHIA, PENNSYLVANIA

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

SUBSTATION LAYOUT PLAN
TYPICAL

SHEET IDENTIFICATION
E-100



NOTE:

SINGLE LINE DIAGRAM IS CONCEPTUAL AND DOES NOT SHOW ALL EQUIPMENT, CONTROLS, METERING OR ACCESSORIES REQUIRED FOR A COMPLETE SYSTEM. ELEMENTS, EQUIPMENT OR SCHEMES SHOWN ON THIS DRAWING ARE NOT CONTRACTUALLY BINDING. CONCEPTUAL SINGLE LINE DIAGRAM IS TO PROVIDE A GENERAL OVERVIEW OF THE ELECTRICAL SYSTEM AND IS NOT TO BE USED FOR CONSTRUCTION. DASHED LINES INDICATE FUTURE EXPANSION CAPABILITIES AS DESCRIBED IN THE TECHNICAL SPECIFICATIONS. SEE APPENDIX D FOR ADDITIONAL CONCEPTUAL ANSF BASE SINGLE LINE DIAGRAMS. DARK/HEAVY LINES ARE NEW WORK.

NOTE: FOR CONTINUATION OF FEEDERS REFER TO SINGLE LINE DIAGRAMS PROVIDED IN APPENDIX D.

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MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

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PHILADELPHIA, PA

DESIGNED BY: | DATE:
DWN BY: | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
PLOT SCALE: NONE | PLOT DATE: | FILE NUMBER:
SIZE: ANSI D | FILE NAME:

DESIGN / BUILD RFP FOR
NORTHERN ELECTRICAL INTERCONNECT
PROJECTS, AFGHANISTAN

NORTHERN ELECTRICAL INTERCONNECT
CONCEPTUAL SINGLE LINE DIAGRAM
CAMP SHAHEEN ANSF BASES

SHEET IDENTIFICATION
E-600

Appendix F

OPGW Design Data

OPGW Design

Key Design Data – Complete Cable:

Nominal Cross Sectional area	**mm²**	**61**
Center- Stainless Steel Tube –No./Dia.	**mm**	**1/3.5**
L1- Aluminum Clad Steel Wires –No./Dia.(40%)	**mm**	**2/3.6**
L1- Aluminum Clad Steel Wires –No./Dia.(27%)	**mm**	**4/3.6**
Lay Direction-Outer Layer		**LEFT HAND**

General Design Data (For Information Only)

Overall Diameter	**mm**	**10.8**
Calculated breaking Load	**kgf**	**5,500**
Approximate Total Mass	**kg/km**	**362**
Electrical Resistance at 20 ^{0}C	**Ω/km**	**0.901**
Modulus of Elasticity	**N/mm²**	**129,667**
Coefficient of Linear Expansion	**x10^{-6}/^{0}C**	**14.0**
Short Circuit Current Capacity(Ambient=20 ^{0}C)	**kA²S**	**31**
Sag at 0 ^{0}C and no wind (span=400m)	**m**	**5.06**

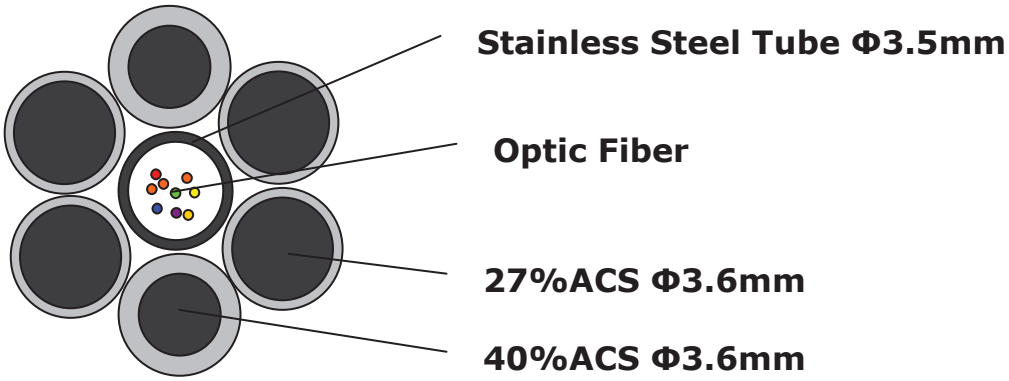
Optical Data

Optical Fiber Type	**-**	**Single Mode G.652**
Mode Field Diameter-1310nm	**μm**	**9.2±0.4**
Mode Field Diameter-1550nm	**μm**	**10.4±0.8**
Cladding Diameter	**μm**	**125.0±1.0**
Core-Clad Concentricity	**μm**	**≤ 0.5**
Cladding Non-Circularity	**%**	**≤ 1**
Coating Diameter	**μm**	**235-250**
Coating-Cladding Concentricity	**μm**	**<12**
Attenuation Coefficient-1310nm	**dB/km**	**≤0.35**
Attenuation Coefficient-1550nm	**dB/km**	**≤0.25**
Cable Cut-Off Wavelength	**nm**	**≤1260**
Zero Dispersion Wavelength	**nm**	**1300-1324**
Zero Dispersion Slope	**ps/nm².km**	**≤0.092**

FOR REFERENCE ONLY

OPGW Design

OPGW Cross section Drawing:



Color Coding:

Fiber 1 to Fiber 12: Blue, Orange Green, Brown, Slate, White, Red, Natural, Yellow, Violet, Pink and Aqua

Fiber 13 to Fiber 24: Same base color but with one black ring mark at regular intervals.

FOR REFERENCE ONLY

Appendix G

Preparatory Land Acquisition

Consultancy Services

Preparatory Land Acquisition Consultancy Services

Potential consultants who can provide Preparatory Land Acquisition Services are as follows but not limited to:

1. SMEC Industrial & Power Group IPG
   House 1, Karte-Parwan, Street 1
   Kabul, Afghanistan
   Tele: +93 797055194
   Tele: +93 707154651
   geoffrey.robinson@smec.com
   colin.laird@smec.com
   afghanistan@smec.com
   www.smec.com

2. MRA - Manasia Research and Analysis Institute
   House 13, Tamani, Street 9
   Kabul, Afghanistan
   Tele: +93 (0) 797 306 000
   Tele: +93 (0) 799 374 003
   Javed Noori
   info@mra.afghanistan.com
   mra.afghanistan@gmail.com

3. M/s Apex-2 Consulting
   House 199 Tamani, Between Street 4 and 5
   Kabul, Afghanistan
   Tele: +93 (0) 20 220 4914
   Tele: +93 (0) 77 100 1311
   info@apex2consulting.com
   ANosher@apex2consulting.com

4. Abdulhai Gardezi Construction Firm (ACF)
   House 120, Shashdarak, Street 2
   Kabul, Afghanistan
   Tele: +93 (0) 0700224888
   Tele: +93 (0) 0794700152
   info@acf.af
   sayed.waheedullah@acf.af
   A.khalid@acf.af

5. Wassil Law Offices
   malalai.wassil@wassillaw.com
   Tele: +93(0)795 980 231