Part B

General Design Requirements

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CHAPTER 1 – GEOTECHNICAL

A site specific Soil and Foundation Report was conducted by the Corps of Engineers Kansas City District. The report provides site-specific soils and geologic conditions, site preparation recommendations, compaction criteria, seismic design criteria, foundation recommendations and bearing capacity, and pavement subgrade recommendations. A drawing indicating Subsurface Explorations and Geologic Profiles for the proposed site is also provided. A copy of the complete SOIL REPORT will be furnished to the Contractor after the Award of the Contract.

1.1 SUBSURFACE CONDITIONS

Borings ADU-01-47 through AD-01-51, drilled for the proposed MRFR, indicated a subsurface profile consisting primarily of stiff to very stiff, high plastic residual clay overlying weathered limestone at a depth of 2.4 to 2.8 meters below ground surface. The residual soil had a natural water content of 8 to 21 percent and a dry unit weight of 95 to 101 pound per cubic foot (pcf). The liquid limit of two samples was 43 and 52 and the plastic limit of two samples was 19 and 21. Unconfined compression tests on three samples had results of 2.0, 3.5, and 6.0 kips per square foot (ksf). Fill was encountered at AD-01-51 from the ground surface to a depth of 0.9 meters. It is believed that this fill was placed to build the existing pavement subgrade.

Borings ADU-01-52 through ADU-01-54, drilled for the proposed CPR, indicated a subsurface profile that consisted of stiff to very stiff, high plastic residual clay from the ground surface to a depth of 2.1 to 3 meters below the ground surface where stiff to very stiff, low plastic residual clay was encountered. The low plastic clay extended to the bottom of the borings at depths of 4.6 to 6.1 meters below ground surface. The natural water content of the high plastic clay was 15 to 19 percent and the dry unit weight was 97 to 98. One unconfined compression test of the high plastic clay had a result of 7.6 ksf. A sample of the low plastic clay had a natural water content of 20 and 24 percent and a dry unit weight of 101 pcf. The liquid limit of the sample was 48 and the plastic limit was 22. An unconfined compression test on the sample had a result of 6.0 ksf.

Borings ADU-01-68 and ADU-01-69 were drilled for the proposed ZR prior to knowing on which side of the MRFR the ZR would be located. Therefore, ADU-01-68 is the boring that is located closest to the proposed ZR location. ADU-01-68 and ADU-01-69 were drilled through the earth berm that was constructed for the firing line at the existing firing range. A similar subsurface profile was encountered at both boring locations. ADU-01-68 and ADU-01-69 encountered stiff to very stiff, high plastic clay fill from the ground surface to a depth of 0.9 to 2.1 meters, respectively. The natural water content of the fill was 19 percent. High plastic residual clay was encountered beneath the fill at both boring locations. The residual clay extended to depths of 2.9 to 4.6 meters below ground surface. The natural water content of the residuum was 15 to 23 percent and the dry unit weight was 92 pcf. Unconfined compression tests conducted on two samples were 6.8 and 2.6 ksf. Interbedded shale and limestone was encountered beneath the

residuum at depths of 2.9 and 4.6 meters below ground surface. Although fill was encountered at ADU-01-68 and ADU-01-69, fill is not expected to be encountered at the locations of the proposed structures for the ZR since the locations of the proposed structures are not near the existing firing berm.

Groundwater was not detected at the time of drilling at any of the boring locations.

1.2 SEISMIC CONDITIONS

In reference to data published by the US Army Corps of Engineers TI 809-04, SEISMIC DESIGN FOR BUILDINGS, dated December 1998, the proposed project should be design using a Site Class "D". The short period spectral acceleration coefficient, S_s, is 0.2. The one-second period spectral acceleration coefficient, S_1, is 0.06.

1.3 SITE PREPARATION

Site preparation shall include the demolition and removal of the existing structures, floor slabs, foundations, vegetation, stumps, roots, pavements, base course materials, underground utilities, and other deleterious materials to at least five feet outside of the building pad limits. Any voids created by the removal of these materials shall be filled with compacted fill. All existing topsoil should be removed and stored in a designated area until the completion of the project. Prior to placement of the first lift of fill, native soils should be scarified to a depth of 150 mm and compacted to the proper moisture and density. Sloped surfaces greater than one vertical to four horizontal shall be benched or stepped prior to the placement of any new fill.

Satisfactory and unsatisfactory materials will be classified according the Unified Soils Classification (USC) criteria. Satisfactory materials will include the classifications GW, GP, GM, GC, SW, SM, SC, ML, CL, and CH material. Unsatisfactory materials include SP, MH, Pt, OH, and OL. Unsatisfactory materials also include debris, refuse, roots, organic matter, frozen material, and stones larger than 75-mm in diameter. Soil like materials obtained from the excavation, e.g. intensely weathered sedimentary rock such as sandstone, shale, and underclay, will not be considered satisfactory for use as borrow. Borrow material for the construction of engineered fill will need to be obtained from an approved source off the limits of government property.

Select materials shall be used within 0.6 meters of the bottom of slabs-on-grade. Select material should consist of natural sand and gravel, crushed rock, manufactured sand, or quarry fines that have a maximum particle size of 25-mm and 15 to 20 percent passing the #200 sieve. The portion of the material passing the #40 sieve shall either be non-plastic or have a plasticity index equal to or less than 12. Select materials should be compacted to at least 95 percent of the maximum density based on ASTM D-1557.

Materials placed as backfill should be placed in uncompacted lifts not to exceed 200-mm in thickness. Compaction should be accomplished by approved equipment well suited to the material being compacted. Prior to compaction, the moisture content of the cohesive materials should be adjusted to a range 0 to +4 percent of optimum moisture either by moistening or aerating as required. It should be noted that the use of a drying agent; i.e., type-C fly ash, shall be allowed: however, use of a drying agent should be considered a means of aeration chosen by the Contractor to allow him to meet construction schedules at no additional cost to the Government.

Expansive soils with a plasticity index equal to or greater than 18 shall be compacted to a density of not less than 90 percent or more than 93 percent of the maximum density with a water content between +3 and +6 percent of optimum as determined by ASTM D-1557. Non-expansive cohesive fill shall be compacted to not less than 90 percent of the maximum density as determined by ASTM D-1557. Non-cohesive fill materials shall be compacted to not less than 95 percent of the maximum density as determined by ASTM D-1557. In-place densities of engineered fill should be determined using ASTM D-1556, ASTM D-2937, or ASTM D-2922 in conjunction with ASTM D-3017. If ASTM D-2922 is used for field density control, there should be at least one test performed according to ASTM D-1556 per every 10 tests performed according to ASTM D-2922 for verification of results. Field density tests of the site grading operation should be performed at a frequency not less than one test per lift per every 2000 m^2 of every lift. Field density tests of material placed beneath the building foundation should be performed at a frequency not less than one test per 1000 m^2 of every lift. Wall and/or footing backfill shall be tested at a rate of one test per lift per 12 linear meters.

Working surfaces should be sloped to prevent the ponding of water during construction. Excessively wet material will either need to be aerated or removed from the fill area prior to the placement of any subsequent lifts. Frozen material will not be allowed in the fill. Approved compacted fill should be maintained at the proper moisture and density condition until the slab-on-grade, foundation, or pavement is completed. Areas disturbed due to construction activity should be recompacted to the specified moisture and density. Fill within the building area should be constructed to the finished grade elevation before the foundations are constructed.

1.4 FOUNDATION RECOMMENDATIONS

Footings may be founded on native clay. Footing excavations should not be made until immediately prior to placement of concrete to prevent any drying out or accumulation of water. Excavations should be kept dry until footing excavations are approved and concrete placed. Foundation excavations should be observed prior to placement of concrete to confirm that the assumed bearing materials are present and that the excavation is free of soft and loose material and water. Footings may be constructed either as conventional stem footings, or as trench footings, eliminating the need for

backfilling the footing excavations. Refer to TI 809-01 "Load Assumptions for Buildings" for the minimum footing depth to prevent possible heaving due to freeze-thaw effects.

Foundation Design Recommendations

Value	Recommendation	
Allowable Bearing Pressure	Strip Footings	142 kPa (3000 psf)
	Spread Footings	166 kPa (3500 psf)
Backfill Unit Weight	Native Clay	1922 kg/m^3 (120 pcf)
	Granular Sand	1760 kg/m^3 (110 pcf)
Coefficient of Sliding for Concrete on Foundation Material	0.57	
Coefficient of Subgrade Reaction for Slab on Grade	2070 g/cm^3	

The structural loads were not available at the time of this report. Based on experience with similar structures, it is anticipated that the structures should be designed to accommodate total and differential settlements of 25-mm and 13-mm, respectively.

A 6-mil thick vapor barrier should underlie all slab-on-grade floors over a minimum of 150-mm of open graded crushed rock (capillary water barrier). The material used for the capillary water barrier shall have a maximum particle size of 37.5-mm and a maximum of 2% passing the #4 sieve. All interior slabs-on-grade should be isolated from all load bearing walls and columns using a 13.6 kg felt. Slabs-on-grade should be designed using a coefficient of subgrade reaction of 2070 grams/cubic centimeter.

Heavy equipment for spreading and compacting backfill should not be operated closer to foundation walls, or retaining walls, than a distance equal to the height of the backfill, above the back of the wall, or wall footings. Excavations for utility trenches can be made vertically unsupported to a depth of 1.2 meters. Excavation made below a depth of 1.2 meters will need to be braced, shored, sloped, or made with a trench box as required to protect workers, equipment, and adjacent structures. Excavated material should be stockpiled in an orderly manner from the top of the excavation, no closer than a distance equal to the depth of the excavation. Adequate drainage should be provided to keep surface water from flowing into excavations. The seepage of groundwater into trench excavation should not influence the sidewall stability unless excavations are made subsequent to periods of prolonged precipitation.

1.5 EXCAVATION, SUBGRADE, AND EMBANKMENT RECOMMENDATIONS

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Excavation for roads, parking lots, and other surfaced areas shall conform to state specification section 204. Excavation for structures shall conform to state specification section 207.

Subgrades: A modulus of subgrade reaction of 27.1 kPa/mm was determined from previous exploration in adjacent areas. The subgrade soil support value based on correlation to the modulus of subgrade reaction of 27.1 kPa/mm would indicate a subgrade CBR = 3.

Embankments and fills: Embankments and fills shall be constructed and tested in accordance with the Kansas State Department of Transportation "STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION", referred to herein as state specification. The latest edition and revisions of the state specification shall be used for all work.

In-place field density testing and frequency of testing shall conform to state specifications. Field density tests should be taken at a frequency not less than one test every 1,000 square meters per lift of embankment or subgrade. Laboratory density and moisture testing should be performed at a rate of one test per 500 cubic meters of material placed or when there is a change of material. During construction of embankments or fills, the working surface should be sloped to prevent the ponding of water. After completion, newly graded areas should be protected from traffic and erosion.

1.6 SUBGRADE PREPARATION AND DRAINAGE RECOMMENDATIONS

Subgrades: Subgrades for roads, parking lots and other surfaced areas shall be cleared of obstructions, organic soils shall be excavated and replace with suitable select structural backfill. Backfill shall be placed in compacted lifts in accordance with state specifications. Subgrades shall conform to the state specification requirements for subgrades for primary roads. Lime modification of subgrades is used at Ft Riley due to the presence of moisture sensitive and expansive clays. The subgrade for all roads, parking lots, and other surfaced areas shall be lime modified and compacted to a depth of at least 153 mm. lime-modification of all subgrade areas shall be accomplished in accordance with state specification section 305 Lime Treated Subgrade. Previous projects at Ft Riley have used a minimum of 5 percent hydrated lime by weight (based on oven-dry weight of the soil) or a minimum 3.8 percent granular quicklime by weight (based on oven-dry weight of the soil).

Drainage: Roads, parking lots, and other surfaced areas shall be provided with a drainage channel at the perimeter of the surfaced areas and edges of the roads. The compacted subgrade surface shall be graded and sloped to readily drain to the drainage channel. The drainage channel invert shall be graded and sloped to drain quickly without surface erosion, and shall be free of ponding areas, and shall be located at an elevation

below the subgrade surface to ensure adequate drainage. The finished surface of roads, parking lots, and other surfaced areas shall have a longitudinal grade and transverse surface slope conforming to state specifications to ensure adequate surface drainage without ponding or erosion of the finished surface. Grades and slopes shall be designed to provide adequate surface drainage for the site, and shall provide safe vehicle and pedestrian traffic surfaces.

1.7 TRAFFIC AND LOAD ANALYSIS

The design requirement is for aggregate surfaced traffic areas. This project involves four traffic area design requirements. (1) The Range access road is required to support traffic composed of passenger cars, panel and pickup trucks, and two axle trucks. (2) A parking lot for two axle trucks. (3) A parking lot for passenger cars, panel and pickup trucks. (4) small light service vehicle traffic at perimeter of the ranges.

Primary traffic includes approximately 30 to 50 passenger cars, panel and pickup trucks passes per week, approximately Three to five 5-ton trucks passes per week, approximately three to five 6-ton trucks passes per week, approximately 1 large garbage truck pass per week, and approximately One pass per year of a 600 gallon water tank towed to the range and parked on site during range operation.

According to TM 5-822-12 paragraph 4, the traffic consists of Group 1, 2, and 3 vehicles. Due to daily variations in traffic at the ranges the design traffic Category would be approximately Category IV. The estimated daily traffic would be approximately 12 vehicle passes on average (adjusted DHV = 1). According to Table 1 in TM 5-822-12 the surfaced traffic areas would conform to a Class G road. The primary vehicle trafficked areas at the ranges according to Table 2 in TM 5-822-12 for a Class G and Category IV requires a section design index = 2. TM 5-822-12 paragraph 7. Frost design requirements for aggregate surfaced areas refers to TM 5-818-2, which has been replaced by TM 5-822-5 Chapter 18. TM 5-822-5 Chapter 18 Paragraph 18-8 specifies that for roads and parking lots with a design index less than 4, state highway requirements for design and materials may be used, subject to demonstrated satisfactory performance of similar roads and parking lots in the state as determined by observation and experience.

1.8 AGGREGATE SURFACED ROADS, PARKING LOTS, AND OTHER AREAS

Based on a design index less than 4, the thickness design for aggregate surfaced road, parking lots, and other surfaced areas shall conform to the latest recommended design procedures of the Kansas State Department of Transportation, based on the above specified traffic and site conditions. A complete and detailed copy of the thickness design procedure shall be submitted with the section design analysis. The design

procedure and analysis shall be submitted for review prior to construction of the roads, parking lots, and other surfaced areas.

Materials and procedures used in the design and construction of the aggregate surfaced areas shall conform to the requirements in the Kansas State Department of Transportation "STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION", referred to herein as state specification. The latest edition and revisions of the state specification shall be used for all work.

The wearing course and base course shall be designed and constructed to minimize overstresses in the subgrade, rutting of the finished surface, lateral displacement of the surface materials under traffic action, and shall be resistant to erosion due to surface drainage water movements. The design shall ensure a safe and stable finished surface under the traffic and loading conditions during wet and dry weather conditions. The finished surface shall not exhibit loose or unstable surface gravel materials, which may be displaced under traffic, or result in vehicle sliding on the finished surface. The aggregate surfaced areas shall durable under the design traffic and loading conditions during wet and dry weather conditions, and shall not exhibit excessive rutting or potholing. Therefore, the finished surface of aggregate surfaced areas shall include a stable moisture resistant wearing course. Depending on availability, asphalt concrete pavement millings placed and compacted to maximum density is recommended for use as an aggregate wearing course for roads, parking lots, and other surfaced areas. However, the aggregate surfaced areas shall consist of at least a compacted wearing course, on a compacted aggregate base course, on a compacted lime modified subgrade. Base course aggregates used for roads, parking lots, and other surfaced areas shall be crushed aggregate conforming to state specification subsection 1105, Type AB-1 or AB-2.

1.9 ASPHALT CONCRETE PAVEMENT

Asphalt concrete (plant mixed bituminous concrete mixtures): The project may include limited areas to be paved with asphalt concrete (plant mixed bituminous concrete mixtures). Based on a design index less than 4, the thickness design for asphalt concrete surfaced areas shall conform to the latest recommended design procedures of the Kansas State Department of Transportation. The thickness of the asphalt concrete pavement and base course shall be designed for the traffic and loading conditions. A complete and detailed copy of the thickness design procedure shall be submitted with the section design analysis. The design procedure and analysis shall be submitted for review prior to construction of the roads, parking lots, and other surfaced areas.

The section shall consist of a compacted asphalt concrete surface course on a compacted crushed aggregate base course, on a compacted lime modified subgrade. Materials and procedures used in the design and construction of asphalt concrete surfaced roads, parking lots, and other areas shall conform to state specification and the requirements

herein. Construction of asphalt concrete pavement shall conform to the state specification section 601, 602, and 603. The latest edition and revisions of the state specification shall be used for all work.

Asphalt concrete shall conform to state specification section 605, PLANT MIX BITUMINOUS MIXTURE – COMMERCIAL GRADE. Asphalt cement shall conform to state. Aggregates for asphalt concrete (bituminous mixtures) shall conform to state specification section 1103. The total aggregate (coarse, fine, and material passing the No. 200 sieve) shall contain not less than 85 percent crushed aggregate. Asphalt concrete mix design shall conform to Asphalt Institute MS-2, Sixth Edition, Marshall mix design 75 blow criteria. The mix design shall use the materials proposed for use in the work. The mix design shall be accomplished by a commercial testing laboratory conforming to the requirements of ASTM D 3666-96a. The mixture shall be tested in accordance with AASHTO T 283-89 and shall have an index of retained strength greater than 80 percent. An anti-stripping agent may be used in accordance with the state specifications.

Base course aggregates: Base course aggregates used for roads, parking lots, and other surfaced areas shall be crushed aggregate conforming to state specification subsection 1105, Type AB-1 or AB-2.

2.0 PORTLAND CEMENT CONCRETE

Portland Cement Concrete: Portland cement concrete shall conform to state specification section 402, and the requirements herein. All concrete shall be air entrained, and shall have a compressive strength of at least 27.5 MPa at 28 days age. Concrete for pavements and slabs on grade shall conform to section 402 paragraph 402.04 Table 2, except that the maximum water-cement ratio shall not exceed 0.45 by weight. Concrete for structures and foundations, and other construction shall conform to section 402 paragraph 402.04 Table 4, Class selected as appropriate for the application, except that the maximum water-cement ratio shall not exceed 0.44 by weight. Portland cement, Fly Ash, mixing water, admixtures and other ingredients used in concrete shall conform to state specifications. Air-entraining Portland cement shall not be used. Air-entrainment shall be achieved by the use of admixtures.

Aggregates: Coarse and fine aggregate for concrete shall conform to state specification subsection 1102, durability Class I. All aggregates used in concrete shall be produced from a Kansas Department of Transportation approved Class I concrete aggregate source. Coarse Aggregate gradations shall be based on the application, and shall conform to Table 1. Limits on deleterious substances are specified in paragraph 1102.02 (a)(2.2). Fine aggregates shall conform to the specified requirements in paragraph 1102.02 (c).

Portland cement concrete construction: Concrete pavement construction shall conform to state specification section 502. Concrete construction for structures, foundations, and

other work shall conform to state specification section 701. All concrete shall be cured and protected in accordance with state specification.
Joints in Portland cement concrete pavements and structures shall be provided to control cracking, allow adequate freedom of movement of the pavement or structure, and to facilitate construction. Joints for pavements shall be constructed and sealed in accordance with state specification section 502. Joints in structures shall be constructed and sealed in accordance with state specification section 701. Joint sealant for pavements shall conform to state specifications for pavement joint sealants or to ASTM C 920-01, Type S or M, Grade P, Class 25 or 50 selected as required for the application, Use T. Joint sealant for structures shall conform to state specifications for joint sealants for structures, or to ASTM C 920-01, Type S or M, Grade P or NS (Grade selected as required for the application, Class 25 or 50 selected as required for the application, Use selected as appropriate for the application. A full depth expansion joint shall be provided between horizontal and vertical surfaces in concrete construction, i.e. between pavements and structures. The design analysis shall show the jointing plans and joint details proposed for use in concrete pavements and structures.

Steel Reinforcement for use in pavements and structures shall conform to state specifications, and to the requirements specified in other sections.

Portland cement concrete pavements: This project may require limited surface areas to be paved with Portland cement concrete, and construction of small concrete slabs on grade. The concrete shall conform to the requirements specified above. Based on a design index less than 4, the thickness design for concrete surfaced areas shall conform to the latest recommended design procedures of the Kansas State Department of Transportation. The thickness of the concrete pavement and base course shall be designed for the traffic and loading conditions. A complete and detailed copy of the thickness design procedure shall be submitted with the section design analysis. The design procedure and analysis shall be submitted for review prior to construction of the roads, parking lots, and other surfaced areas.

The pavement section shall consist of a concrete surface course on a compacted crushed aggregate base course, on a compacted lime modified subgrade. Base course aggregates used for roads, parking lots, and other surfaced areas shall be crushed aggregate conforming to state specification subsection 1105, Type AB-1 or AB-2.

2.1 TESTING AND SURVEYING

Pre-construction testing requirements: All mix designs, and materials proposed for use in the work shall be tested initially for conformance to state specification requirements prior to delivering the materials to the project site. Certified copies of laboratory test reports shall verify that mix designs conform to state specification and the requirements specified herein. Certified copies of laboratory test reports shall verify that aggregate gradations,

composition, and quality requirements, and other materials proposed for use in the work conform to state specification. A certified copy of each mix design and materials test reports, shall be submitted to: U.S. Army Corps of Engineers, CENWK-EC-GL for review. The above mix design and materials test report submittals shall be submitted during the project design. The mix design, and materials test report submittals, shall include names of companies and contractor's performing the mix design and testing, with a listing of all sources of materials and aggregates proposed for use in the work. The listing shall include a point of contact and telephone number for each material type and source.

Construction testing: Portland cement concrete, asphalt concrete mixtures shall be tested during construction in accordance with state specification, and certified laboratory reports shall be submitted to the Contracting Officer within 24 hours following completion of the test. In place density, compacted thickness, and gradation testing for each course shall be accomplished in accordance with the requirements and testing frequency specified in the state specification. Where the state specification testing frequency for subgrade, aggregate courses, and surface courses is not defined or is greater than 1,000 square meters, a minimum testing requirement of 1,000 square meters for each course or lift shall be used. All testing required on each course or lift shall be accomplished prior to commencing construction of the next course or lift. A certified copy of each test report for all testing, shall be submitted to the contracting officer within 24 hours following completion of the test. The materials testing laboratory shall conform to the state requirements for testing laboratories.

Surveys: The subgrade surface and the finished surface of the road, parking lot and other areas to be surfaced shall be surveyed. Structure locations, corners, and other important features of structures shall be surveyed. Drainage channels shall be surveyed to show exact plan dimensions, surface slopes, grades, and elevations. The surveys for roads, parking lots, and other surfaced areas shall be accomplished at least at 6.1 m intervals or less to demonstrate that the finished surfaces are properly sloped, free draining, and free of low areas which may tend to pond or trap water. A certified copy of each survey report, including plotted data and maps, shall be submitted to the contracting officer within 7 days following completion of the survey.

2.2 TECHNICAL REFERENCES

Recommended technical references include:

Kansas Department of Transportation, "STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION".

ASTM C 920 –01 Standard Specification for Elastomeric Joint Sealants.

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ASTM D 3666-96a	Standard Practice for Evaluation of Inspection and Testing Agencies for Bituminous Paving Materials
MS-2	Asphalt Institute, Mix Design Methods, Sixth Edition.
T 283-89	American Association of State Highway and Transportation Officials (AASHTO), Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.

BORING LOG NOMENCLATURE SHEET

TERM		IDENTIFICATION AND DESCRIPTION
SPT		Split-Spoon Sample (Standard Penetration Test): A 2-inch O.D., 1.5-inch I.D., split-barrel, 18 to 30-inch long sampler is driven by blows from a 140-pound hammer falling 30-inches. The number of blows required to advance the sampler three 6-inch increments are counted (See Sampling resistance below).
C		California Sample: Thick-wall sampler containing four nominal 2-inch diameter, 4-inch long brass liners. The sampler is hydraulically pushed a maximum of 12 inches.
ST		Shelby Tube sample: Hydraulically-pushed, 3-inch diameter, thin-walled tube used for obtaining undisturbed soil samples.
CME		CME 3-inch diameter continuous soil sampling system.
PS		Nominal 3-inch diameter Shelby tube piston sampler.
D		Disturbed sample or auger cuttings
NX		NX-size (2.155-inch diameter) rock core sample obtained using a diamond bit and recirculating water (See RQD below).
PP		Pocket Penetrometer measurement indicative of soil unconfined compressive strength (ksf).
TV		Torvane measurement of soil shear strength (tsf).
W %		As-received water content (percent)
LL, PL		Liquid Limit, Plastic Limit
PI		Plasticity Index
USC		Unified Soil Classification
Qu		Unconfined compressive strength (ksf).
RQD		Rock Quality Designation: The sum of the lengths of intact core pieces 4 or more inches (10 cm) in length, measured along the center line of the core, and expressed as a percentage of the length cored.
REC		Recovery: The length of recovered soil or rock sample expressed as a percentage of the sample length or depth cored.
		Point of groundwater entry.
		Stabilized groundwater level at some time after drilling.

SAMPLING RESISTANCE	
P	Sampler pushed by hydraulic system.
3 6 9	Numbers indicate the number of blows from a 140-pound hammer falling freely for 30 inches required to drive the SPT sampler 6 inches. The SPT test result, N-value, or blow count, is the number of blows required to drive the sampler the last 12 inches. The N value for this example is 15.
50/2"	The split-spoon sampler was driven 2 inches by 50 blows; the Standard Penetration Resistance, or N-value, is set at 100.

ABBREVIATIONS USED	
HSA	Hollow-Stem Auger
SSA	Solid-Stem Auger
ATD	At the time of drilling
AD	After Drilling
DWL	Drill Water Loss
DWR	Drill Water Return
ND	Not Determined

The relative density of coarse-grained soils (sands and gravels having less than 50 percent passing the number 200 sieve) is indicated by the uncorrected SPT test result (N-Value or blow count) in accordance with the relationships given below:

RELATIVE DENSITY	BLOW COUNT (N-VALUE)
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Greater than 50

The shear strengths of silts and clays (fine-grained soils having more than 50 percent passing the #200 sieve) are directly related to the torvane reading (TV) and my be taken to be equal to one half of the unconfined compressive strength (Qu) of the soil. Furthermore, the pocket penetrometer reading (PP) approximates Qu which is related to consistency and manual methods as indicated in the following table:

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (ksf)	MANUAL PROCEDURE
Very Soft	< 0.5	Extrudes between fingers
Soft	> 0.5 to 1	Molded by slight pressure
Medium Stiff	> 1 to 2	Molded by strong pressure
Stiff	>2 to 4	Indented by thumb
Very Stiff	> 4 to 8	Indented by thumbnail
Hard	> 8	Difficult to indent

Minor Soil Constituant Terms and Definitions	
Trace	Less than 5 percent
Few	Between 5 and 10 percent
Little	Between 10 and 25 percent
Some	Between 25 and 50 percent

Coarse Grain Descriptors	
Boulder	> 12 inches
Cobble	3 inches to 12 inches
Coarse Gravel	3 inches to 3/4 inches
Fine Gravel	3/4 inches to #4 sieve

The Graphical Key to Boring Logs shows the graphical symbols used on boring logs and generalized, geologic cross-sections of selected boring logs. The basic Unified Soil Classification System (USCS) designations are used for soils. The basic letter types are as follows: G - Gravels, S - Sands, M - Silts (M comes from the Swedish word mo for rock flour), W - Well graded, P - Poorly graded, C - Clay, H - High Plastic (fat), and L - Low Plastic (lean). Dual classification designations show the primary soil type throughout the graphic column, and the secondary soil type appears in the right half of the column. CL-CH, SP-GP, and GP-SP are examples.

TERM	MOISTURE CONDITION
Dry	Water content is less than the plastic limit; dry to the touch
Moist	Water content is greater than the plastic limit, but the soil may be damp but no visible water
Wet	Soil exhibits free water or is obviously saturated.

BORING LOG NOMENCLATURE SHEET FOR ROCK

Scale of Relative Rock Hardness:

Term	Field Identification	Approx. Unconfined Compressive Strength
Very Soft	Can be pealed by a pocket knife	5 to 100 ksf
Soft	Small thin pieces can be broken by finger	100 to 500 ksf
Medium Hard	Can be groved by firm pressure of knife	500 to 1000 ksf
Moderately Hard	Requires one hammer blow to fracture	1000 to 2000 ksf
Hard	Hard hammer blow required to break; Can be scratched with knife only with difficulty	2000 to 5000 ksf
Very Hard	Cannot be scratched by knife; Several hard blows of a hammer required to break	> 5000 ksf

Bedding thickness:

Term	Thickness Range
Massive	> 5'
Very Thick	3' to 5'
Thick	1' to 3'
Medium	4" to 1'
Thin	1" to 4"
Very Thin	½" to 1"
Unit	Single bed

Weathering Descriptions:

Term	Description
Fresh	No visible signs of material weathering
Slightly Weathered	Some discoloration of rock and discontinuity surfaces
Moderately Weathered	Up to half of rock is decomposed; Discoloration is apparent in portion of rock mass
Highly (very) Weathered	Rock mass is more that 50% decomposed; Discoloration throughout rock mass

Rock Quality Designation (RQD):

RQD	Rock Mass Description
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
Less than 15	Very Poor

URS GRAPHIC BORING LOG

ADU-01-47

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-10-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Very stiff, dry, medium brown, High Plastic CLAY (CL) (residuum)			
	SPT			67	4 8 14								
	ST			100	P								
5	SPT			67	6 8 11								
	ST			100	P	21 19	101		3.5				
										8.7			
	SPT			70	12 50					SHALE: Soft, highly weathered, yellow to yellowish brown			
										9.3			
10										INTERBEDDED LIMESTONE AND SHALE: Soft to hard, thinly bedded, yellow shale, gray limestone			
										9.9			
										BOTTOM OF BORING ADU-01-47 AT 9.9 FEET			
15													
20													
25													

OVP3 FTRILMRF.GPJ OVP1.GDT 10/17/01

URS GRAPHIC BORING LOG

ADU-01-48

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-10-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Stiff, damp, reddish brown, High Plastic CLAY (CH) (residuum)			
	SPT			80	2 4 5								
	ST			100	P	21 18	95		2.0				
5	SPT			100	4 6 7								
	ST			100	P								
										9.1			
	SPT			100	50/1.2"					INTERBEDDED LIMESTONE AND SHALE: Soft to hard, thinly bedded, yellow shale, gray limestone			
10										10.0 BOTTOM OF BORING ADU-01-48 AT 10.0 FEET			
15													
20													
25													

OVP3 FTRILMRF.GPJ OVP1.GDT 10/17/01

URS GRAPHIC BORING LOG

ADU-01-49

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-11-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Stiff, damp, medium brown, High Plastic CLAY (CH) with roots (residuum)			
	SPT			67	2 3 7								
	ST			100	P	20 17	96		6.0				
5													
	SPT			100	7 50								
										7.8			
										LIMESTONE: Hard, light gray to yellowish gray, thinly bedded 8.3			
										INTERBEDDED LIMESTONE AND SHALE: Soft to hard, thinly bedded, yellow shale, gray limestone			
10	SPT			100	20 50/3.6"								
										11.2			
										BOTTOM OF BORING ADU-01-49 AT 11.2 FEET			
15													
20													
25													

OVP3 FTRILMRF.GPJ OVP1.GDT 10/17/01

URS GRAPHIC BORING LOG

AD-01-50

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-10-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE/COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Stiff, dry to damp, dark brown, High Plastic CLAY (CH) with gravel and roots (residuum)			
	SPT			60	2 5 5	8							
	SPT			67	6 6 6								
5										5.0 BOTTOM OF BORING AD-01-50 AT 5.0 FEET			
10													
15													
20													
25													

OVP3 FTRILMRF.GPJ OVP1.GDT 10/17/01

URS GRAPHIC BORING LOG

AD-01-51

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-11-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Soft, damp, dark grayish brown, High Plastic CLAY (CH) with roots (fill)			
	SPT			53	0 1 2	21				**LL = 52; PL = 21**			
3.0													
	SPT			100	3 8 9	17				Stiff, damp, medium brown, Low Plastic CLAY (CL) (residuum) **LL = 43; PL = 19**			
5										5.0			
										BOTTOM OF BORING AD-01-51 AT 5.0 FEET			
10													
15													
20													
25													

OVP3_FTRILMRF.GPJ OVP1.GDT 10/17/01

URS GRAPHIC BORING LOG

ADU-01-52

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-12-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Stiff, damp, dark brown, High Plastic CLAY (CH) with roots (residuum)			
	SPT			93	3 5 8								
5	ST			100	P								
	SPT			87	4 5 5								
10	ST			100	P	24 20	101		6.0	10.0 Stiff to very stiff, moist, yellowish brown to brownish gray, Low Plastic CLAY (CL) with thin limestone stringers **LL = 48; PL = 22**			
	SPT			100	5 6 10								
15	ST			100	P								
	SPT			100	4 6 6					20.0			
20										BOTTOM OF BORING ADU-01-52 AT 20.0 FEET			
25													

OVP3 FTRILMRF.GPJ OVP1.GDT 10/17/01

URS GRAPHIC BORING LOG

ADU-01-53

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-13-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Stiff, damp, medium to dark brown, High Plastic CLAY (CH) with roots			
	SPT			67	3 5 8								
	ST			100	P	19 16	98		7.6				
5													
										7.0			
	SPT				4 6 8					Stiff to very stiff, moist, yellow to reddish brown, Low Plastic CLAY (CL) (residuum)			
10													
	ST			100	P					Becomes yellowish gray and reddish brown			
	SPT			100	8 10 14								
15										15.0			
										BOTTOM OF BORING ADU-01-53 AT 15.0 FEET			
20													
25													

OVP3_FTRILMRF.GPJ_OVP1.GDT 10/17/01

URS GRAPHIC BORING LOG

ADU-01-54

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-12-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Stiff, damp, dark brown, High Plastic CLAY (CH) with roots (residuum)			
	SPT			67	4 6 7								
	ST			65	P	18 15	97						
5													
										7.0			
	SPT			87	6 7 10					Stiff, damp, yellowish brown, Low Plastic CLAY (CL) with gray limestone stringers			
10													
	ST			100	P								
	SPT												
15										15.0			
										BOTTOM OF BORING ADU-01-54 AT 15.0 FEET			
20													
25													

URS GRAPHIC BORING LOG

ADU-01-68

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-11-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Stiff, damp, dark brown, High Plastic CLAY (CH) with roots (fill)			
	SPT			67	3 4 7								
										3.0			
										Stiff, damp, medium to dark brown, High Plastic CLAY (CH) (residuum)			
5	ST			100	P	17 15	92		6.8				
	SPT			67	6 8 9								
										9.5			
10	SPT			100	50/2.4"					INTERBEDDED LIMESTONE AND SHALE: Soft to hard, thinly bedded, yellow and reddish brown shale, gray limestone			
										10.2			
										BOTTOM OF BORING ADU-01-68 AT 10.2 FEET			
15													
20													
25													

OVP3 FTRILMRF.GPJ OVP1.GDT 10/17/01

URS GRAPHIC BORING LOG

ADU-01-69

PROJECT NAME: Modified Record Fire & Combat Pistol Ranges
SHEET 1 OF 1
PROJECT LOCATION: Fort Riley, KS
PROJECT NO:
LOGGED BY: R. Parker
DRILLING CO: USACE
RIG: CME-55
SURFACE ELEVATION:
ELEVATION DATUM:
DATE: 9-12-01
GROUNDWATER ENTRY:
DELAYED GROUNDWATER:
NORTH:
OBSERVATIONS: No water detected ATD
EAST:

DEPTH (feet)	SAMPLE DATA: TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	γ_d (pcf)	PP (KSF)	Q_u (ksf)	DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
0										Stiff, damp, dark grayish brown, High Plastic CLAY (CH) with roots (fill)			
	SPT			67	3 4 4	19							
	ST			100	P	19							
5													
	SPT			100	4 6 8								
						19							
10	ST			100	P	23	92		2.6				
	SPT			100	5 7 9								
15										7.0 Stiff, damp, medium brown to reddish brown, High Plastic CLAY (CH) (residuum) 15.0			
	SPT			100	50/2.4"					INTERBEDDED SHALE AND LIMESTONE: Soft to hard, thinly bedded, yellow shale and gray limestone 17.6			
20										BOTTOM OF BORING ADU-01-69 AT 17.6 FEET			
25													

OVP3 FTRILMRF.GPJ OVP1.GDT 10/17/01

PART B

GENERAL DESIGN REQUIREMENTS

CHAPTER 2

FUNCTIONAL AND AREA REQUIREMENTS

NOT APPLICABLE

(Refer to Individual Range Requirements)

PART B

GENERAL DESIGN REQUIREMENTS

CHAPTER 3

SITE PLANNING AND DESIGN

CHAPTER 3

GENERAL SITE PLANNING AND DESIGN

3. **Scope of work.** This project includes 3 ranges, which are, the modified record fire range, 25 Meter firing zero range, and combat pistol range. Site layout of these ranges and their support facilities are on Sheet C3.1. Site is located east of First Division road, approximately 3.4 kilometers north of Custer Hill.

The designer will be required to prepare all specifications and drawings related to civil and sitework. Included are ranges, roads, parking areas, concrete pads, target emplacements, lighting emplacements, range markers, horsejumps, flagpoles, foxholes and associated features. Drawings shall include cover sheet, location map, vicinity map, legend/symbols, index, Demolition, site plans, haul routes, habitat areas, firewood areas. The project scope also includes performing an engineering and topographic survey on which to base the design as provided for in chapter 4. Electricity and telephone service are required as part of the scope.

Also required is a design analysis to include storm drainage calculations, line of sight calculations and other pertinent civil design requirements. Applicable profiles and sections should also be provided.

3.1. **Existing conditions.** Existing contours and road locations may vary due to general mapping industry standards, maintenance grading operations, and erosion. Buildings, foxholes, target emplacements, and target utilities, aren't shown on the existing conditions sheets.

3.2. **Utility Maps.** The locations of existing utilities shown on the site survey and utility maps are approximate only. Utility locates should be performed by appropriate parties (see Chapter 4, surveying) in order to be surveyed in their correct location.

3.3. **Site Development.**

3.3.1. **Project Boundaries.** The Contractor shall confine all proposed development to be within the project boundaries indicated on the drawings. Under no circumstances shall the Contractor contemplate any work outside the project boundaries except as authorized in the RFP or in writing by the CO. Required utility connections are an exception to this requirement.

3.3.2. **Excavation permits**. The contractor shall obtain approved excavation permits immediately prior to digging.

3.3.3. **Orientation.** The orientation of the ranges are as shown on the drawings. Coordinates of the range corners are also provided on the drawings. The coordinates were located with respect to firing range fans. See Specification 1130, paragraph 1b for additional information.

The coordinate systems of those points are English NAD 27. However, the survey shall be in Metric NAD 83 coordinate system. It will also be necessary to convert the range corner coordinates to metric NAD 83. The access/perimeter roads and buildings may need to be

modified in order to locate ranges as provided by the range corners coordinate points as shown on the drawings.

3.3.4. **Landscaping.** Landscaping is required in the form of berms, rocks, etc. to prevent access to non trafficked areas, such as abandoned roads, perimeter roads, etc. This needs to be considered when creating site layout and abandoning roads. Traffic should be channeled to main roads. Landscaping should also be used to keep unauthorized people off the ranges, such as access to perimeter roads from other than at the towers and main roads. Two locations that need be addressed are 1) the u-loop southwest of Modified Record Firing Range that is to be abandoned and 2) southeast of the 25 M firing range, there should not be access to the 25 M range from the existing roads.

3.3.5. **Grading and Drainage.** The grading should maintain existing topography as much as possible while providing for smooth drainage off the site. Water transported off site shall be by culverts under the perimeter roads.

3.3.5.1. Culvert pipes shall be designed to withstand earth loads as well as H-20 highway live loads. The location of culverts shall be based on design grading.

3.3.5.2. Use 10 year design storm for design with I=2.5 inches/hour (rationale method shall be used.)

3.3.5.3. Final grading/drainage plan shall be provided at the same scale as the site plan. New contours shall be .25-meter intervals. Plans shall show layout of culverts, grade arrows if at uniform slope. Provide spot elevations at building corners, parking area corners, finish floor elevations.

3.3.5.4. Provide a section through the firing line to include foxholes in order to ensure proper drainage away from the foxholes.

Each range has different drainage/grading requirements as listed below:

25 M zero firing range: Firers must walk from the firing line to the targets to place the paper targets manually. As such the range shall be graded relatively flat without ponding. This would prevent soldiers having to walk through ponding water.

Combat pistol range: A move out path (gravel) shall be constructed in each lane in accordance with the RETS standard design. This path shall extend for the first 20 meters downlane. As such, flow shall not be across the move out paths, but parallel downlane so as to minimize flow on move out paths.

Modified record firing range: There is an additional nighttime firing line. As such, flow shall not be across the walking line but should be downlane similar to the combat pistol range. Soldiers fire from the foxhole/nighttime firing line and don't approach targets.

3.3.6. **Restoration:** All disturbed areas not paved within the project boundaries shall be restored to their original condition. See guide specification section for types of grass.

3.3.7. **Seeding:** Seeding is required in all areas not covered by asphalt, gravel, or concrete.

3.3.8. **Contractor Storage material**. The site for staging and storing material during construction shall be approved by the Contracting Officer.

3.3.9. **Borrow Material.** Borrow material can be obtained from the area surrounding the ranges. The Contracting Officer should approve actual location. The borrow source shall be regraded as needed to match surrounding and provide uniform drainage.

3.3.10. **Erosion and Sediment Control Facilities.** NPDES permit shall be required in accordance with Kansas Department of Health & Environment. Permit is required as area disturbed is over 5 acres. Permit can be obtained from industrial programs, stormwater program at (785) 296-5547. The stormwater/erosion control plan shall be stamped by a Kansas registered professional engineer. The internet web site address is http://www.kdhe.state.ks.us/nps/resources/notes_ww/eroscons.pdf.

3.3.11. **Demolition.** Demolition is anticipated on the Modified Record Fire Range. The Ft. Riley Demolition specification is located in the guide specification section of this chapter.

3.4. **General Site Design Criteria.**

3.4.1. **Parking.** Parking areas as shown on the drawings shall be asphalt. Amount of parking area shall be scaled of RFP drawings. Striping for parking stalls is not required.

3.4.2. **Force Protection.** Buildings shall not have any obscure zones within 10 M of the building. Obscure zone requires all object heights be less than 150 mm high.

3.4.3. **Horse jumps/flagpoles.** Two horsejumps and two flagpoles shall be located as shown on the drawings. The flag poles shall be of the screw in base support and shall have a light on it. Flagpoles shall be 18 meters high.

3.4.4. **Line of Sight Analysis.** All targets and firing positions must be site adapted, and a graphical and/or numerical line-of-sight analysis must be performed for all targets and firing positions. The line-of-sight shots should be taken from the height of the gun barrel at the firing position to a point 300-millimeters above the front wall of the target emplacement. A line-of-sight analysis must be completed at the final design stage. The line-of-sight analysis must be based on contour intervals of the site.

Combat pistol range: Targets beyond the move out path can be elevated to achieve the line of site requirements.

Modified record firing range: Targets can be elevated beyond the night firing position to achieve the line of site requirements.

25 meter firing range: For calculation purposes, assume the paper targets are at same elevations as the targets on the Modified Record Firing Range.

3.4.5. **Liquefied Petroleum (LP) Gas storage and distribution.** Tanks will be approximately located as shown. Accessibility to the LP tanks should be a design consideration. Tank should be as close to the crushed rock surfacing while maintaining minimum distances away from classrooms. Bollards around the tanks are required where possibility of vehicle damage exist.

3.4.6. The maximum grade within 10 feet of the building is 10 percent. The minimum grade within 10 feet of the buildings shall be 5%. Grade for drainage away from buildings.

3.4.7. The perimeter road between the firing line and Observation tower shall be uniform cross slope draining away from the range. This road is shown on Contract Drawing sheet C3.3, but shall be applied to all three ranges. This is to prevent ponding of water near/around the foxholes/firing positions.

3.4.8. Observation Tower shall have a concrete stoop at base of stairs.

3.4.9. Concrete stoops are required at all building exits. Stoops shall be 1.25 x 1.25 m. Provide step down so heaving isn't a problem with door swing. Provide ground mounted door stops.

3.4.10. Concrete pads are required under the training area bleachers.

3.4.11. Concrete shall be jointed in accordance with TM 5-822-5, "PAVEMENT DESIGN FOR ROADS, STREETS, WALKS, AND OPEN STORAGE AREAS."

3.4.12. Bollards shall be located at structures near asphalt parking areas.

3.4.13. Grades for parking areas will be between 2 and 4 percent.

3.4.14. Splashblocks are required at downspouts.

3.4.15. Minimum grade is 2 percent for turfed areas other than ranges. Ranges should between 2% and 5%.

3.4.16. Minimum ditch grade is 0.3 percent.

3.4.17. Buildings shall have a minimum of 3 M of gravel surfacing between building and grass area.

3.4.18. Perimeter gravel roads around ranges should be 2 M wide. Access gravel roads shall be 7 M wide.

Technical Specifications

Section 02050	Demolition (Ft. Riley Specification)
Section 02080	Asbestos containing materials (Ft. Riley Specification)
Section 02230	Clearing and grubbing
Section 02300	Earthwork
Section 02316	Excavation, trenching and backfilling for utilities.
Section 02364	Termite treatment measures for subterranean termite control
Section 02630	Storm Drainage
Section 02921	Seeding

The guide specifications and Ft. Riley specifications shall be edited for specific criteria of the ranges. Certain portions of the specifications will not apply to the ranges and therefore can be deleted. However, the quality criteria should not be deleted.

SPECIFIC FEATURES:

SECTION 02050 – DEMOLITION

PART 1 GENERAL

1.1 SCOPE: Work covered by this section includes furnishing all plant, labor, equipment, materials, and transportation necessary for demolition and disposal required in this project.

1.2 APPLICABLE PUBLICATIONS: Publications listed below form a part of this section to the extent referenced. Publications are referred to in the text by basic designation only. Assume publications to be the most current edition in effect at the time a contract is awarded.

1.2.1 Defense Reutilization and Marketing Office Standard Operating Procedures (DRMO SOP):

DRMO Riley and FRA McConnell Customer Assistance Handbook
DRMO Customer assistance Guildelines and regulations for Hazardous Material/Hazardous Waste Turn in.

1.2.2 Kansas Department of Health and Environment (KDHE) Regulations:

KAR 28-50-1 thru 28-50-14	Asbestos Control Regulation.

1.2.3 National Institute of Building Sciences (NIBS) Publication:

Lead-Based Paint, Operations and Maintenance Work Practices Manual for Homes and Buildings.

1.2.4 U.S. Department of Housing and Urban Development (HUD Guidelines) Publication:

Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.

1.2.5 U.S. Department of Labor Occupational Safety and Health Administration (OSHA) Regulations:

29 CFR 1926.62	Lead in Construction.
29 CFR 1926.1101	Asbestos.

PART 3 EXECUTION

3.1 DEMOLITION AND DISPOSAL: Demolish or remove from the work site all items designated to be demolished or removed as part of the replacement process, and any other items necessary to accomplish the required work. The plans and specifications may not designate all demolition and removal items existing at the work site. Therefore, prior to beginning demolition or removal work, verify with the COR all items to be demolished or removed and all items to remain. The Contractor is responsible for loading, hauling, and unloading salvage items and debris.

3.1.1 Removal: Carefully remove salvage items to prevent unnecessary damage to items to be salvaged or portions of components and structures to remain. Salvable items shall be removed and protected to prevent unnecessary damage. Items, embedded in concrete or masonry, or which are otherwise nonremovable, shall be neatly cut off at or beneath the surrounding surface. Open piping or conduit shall be capped or plugged, and the surrounding surface repaired as specified.

3.1.2 Disposition of Salvable: Construction materials, which have salvage value, or which can be dismantled or removed without damage, shall be turned in at the PW Materials Yard; the DES Recycle Center, Bldg. 1980; or the DRMO Yard, Bldg. 1950;

3.1.3 Recyclable Materials: Turn in recyclable material at the DES Recycle Center.

3.1.4 Disposition of Nonsalvable and Nonrecyclable Items: Construction materials and debris, which will have no salvage or recycling value because of the type of material or the procedures required for dismantling or demolition, shall be disposed of at the Riley County Transfer Station or other off-post landfill; the DES Compost Area, vicinity of Bldg. 1980; or the PW Demolition and Construction Debris Landfill (PWDCDL) located in the Campbell Hill Quarry 2 miles north of Camp Funston; as indicated below or as directed by the COR.

3.1.5 Location and Hours of Operation: Bldg. 1950, Camp Funston, Hours 7:30-3:00 p.m.,

Monday thru Thursday except Federal Holidays.

3.2 ASBESTOS CONTAINING MATERIALS (ACM): Immediately notify the Contracting Officer should materials (other than vinyl asbestos floor tile) suspected to contain asbestos be encountered.

Building materials used on buildings constructed prior to 1982 should be assumed to contain asbestos unless testing proves otherwise. Contractor personnel involved in maintenance or construction activities which may disturb or come in close proximity with ACM shall be trained in the dangers inherent in handling ACM and breathing ACM dust; proper work procedures; and personal and area protective measures in accordance with 29 CFR 1926.1101. Contractor personnel shall not disturb ACM without proper protection. Protection includes, but is not limited to, medical surveillance, respiratory protection, personal protection, hygiene facilities, and personal air monitoring. The Contractor shall be required to remove and dispose of ACM when necessary to accomplish the required work and as indicated. ACM shall be removed and disposed of in accordance with 29 CFR 1926.1101 and KAR 28-50. Refer to SECTION 02080, ASBESTOS CONTAINING MATERIALS REMOVAL AND DISPOSAL.

3.3 LEAD-BASED PAINT (LBP): Lead-based paint may be encountered in the building(s) in this project. All painted surfaces will be treated as though they have been coated with lead-based paint and compliance with OSHA regulations for handling is required. If cutting or any other operation is necessary which could cause particles to become airborne, paint shall be removed by acceptable methods prior to the operation. No sanding of existing painted surfaces will be allowed. Immediately notify the Contracting Officer should materials suspected to contain lead be encountered.

Exterior painted surfaces on buildings constructed prior to 1978 should be assumed to contain lead unless testing proves otherwise. Contractor personnel involved in maintenance and construction activities which may disturb lead-containing surfaces shall be trained in the dangers inherent in handling lead and breathing or ingesting lead dust; proper work procedures; and personal and area protective measures in accordance with 29 CFR 1926.62. Contractor personnel shall not disturb lead-containing surfaces without proper protection. Protection includes, but is not limited to, medical surveillance, respiratory protection, personal protection, hygiene facilities, and personal air monitoring. The Contractor shall be required to reduce LBP hazards through interim controls and remove and dispose of LBP when necessary to accomplish the required work and when indicated on delivery orders. LBP shall be removed and disposed of in accordance with 29 CFR 1926.62; HUD Guidelines; NIBS Lead-Based Paint, Operations and Maintenance Work Practices Manual for Homes and Buildings; and KDHE regulations (when published).

3.4 CLEANUP: Remove debris and perform general cleanup of the work site at the end of each workday and upon completion of the required work. Ensure that waste and debris at the work site does not blow off the site. Be responsible for immediate cleanup of spillage wherever it might occur.

SECTION 02080

ASBESTOS CONTAINING MATERIALS REMOVAL AND DISPOSAL

PART 1 GENERAL

1.1 SCOPE: Work includes furnishing all plant, labor, equipment, materials, and transportation necessary for removal and disposal of asbestos containing materials (ACM) or presumed asbestos containing materials (PACM) required in this contract. Removal and disposal shall be in accordance with state and federal regulations.

1.2 APPLICABLE PUBLICATIONS: Publications shall be assumed to be the most current edition in effect at the time a contract is awarded.

American National Standards Institute (ANSI) Standards:

Z88.2 Practices for Respiratory Protection.

American Society for Testing and Materials (ASTM) Publication:

D4397 Polyethylene Sheeting for Construction, Industrial and Agricultural Applications.

State of Kansas Publications (KAR):

28-31 Hazardous Waste Management.

28-50 Asbestos Control Regulation.

U.S. Army Corps of Engineers Manual (EM):

385-1-1 General Safety and Health Requirements.

U.S. Department of Labor Occupational Safety and Health Administration (OSHA) Regulations:

29 CFR 1910.133 Eye and Face Protection.

29 CFR 1910.134 Respiratory Protection.

29 CFR 1910.1001 Asbestos, Tremolite, Anthophylite, and Actinolite.

29 CFR 1926.59 Hazard Communication.

29 CFR 1926.1101 Asbestos.

U.S. Department of Transportation (DOT) Regulations:

49 CFR 171 Hazardous Substances.

49 CFR 172 Subparts B & C Hazardous Materials Tables and Hazardous Materials Communications Regulations.

49 CFR 173 Subpart M	Shippers - General Requirements for Shipments and Packaging.

U.S. Environmental Protection Agency (EPA) Regulations:

40 CFR 61 Subpart A	National Emission Standards for Hazardous Pollutants-General Provisions.
40 CFR 61 Subpart M	National Emission Standards for Hazardous Air Pollutants-National Emission Standard for Asbestos.

1.3 SUBMITTALS:

1.3.1 Removal and Disposal Plan: Submit an ACM Removal and Disposal Plan.

1.4 WORKER SAFETY AND PROTECTION:

1.4.1 Worker Training: The Contractor shall ensure that all of his employees who perform ACM removal and disposal have received training required by 29 CFR 1926.1101 and KAR 28-50 and that training records are on file in his office and available for review and/or submittal, and are maintained for 1 year beyond the last date of employment. Specific training requirements for the four Classes of asbestos work include: Class IV work requires 2 hours of Asbestos General Awareness Training; Class III work requires 16 hours of Asbestos Operations and Maintenance Training; Class I and II work requires 32 hours of Asbestos Worker Training and must be supervised by a Competent Person who has received 40 hours of Asbestos Contractor/Supervisor Training.

PART 2 PRODUCTS

2.1 MATERIALS: Materials furnished shall be standard products of manufacturers regularly engaged in the production of the items, and the most current design which conforms to the requirements specified.

2.2 ACM HANDLING MATERIALS AND EQUIPMENT: Materials and equipment used to remove, handle, and dispose of ACM shall conform to 29 CFR 1926.1101, 40 CFR 61 Subpart M, KAR 28-31, and KAR 28-50.

2.3 WORKER PROTECTIVE CLOTHING AND EQUIPMENT: Worker protective clothing and equipment shall conform to 29 CFR 1910.133, 29 CFR 1910.134, 29 CFR 1926.1101, and EM 385-1-1. All personnel engaged in ACM removal work shall wear approved disposable protective clothing constructed of spun-bonded olefin or polypropylene fabrics, or other material of equivalent resistance to penetration by ACM. A full body suit is recommended in lieu of a separate set of coveralls, head covers, and shoe covers. Disposable whole body clothing including head covers, gloves, and shoe coverings shall be provided to and worn by all persons in the ACM control area. If elastic sleeve enclosures are not provided, sleeves shall be secured with duct tape to gloves. Footwear having a non-skid tracking surface shall be provided and used by all personnel within the ACM control area. Contaminated clothing shall be treated as ACM and undergo the same disposal procedures. All disposable clothing shall be flame-retardant. All openings in clothing shall be immediately taped to exclude penetration by asbestos fibers.

2.4 Respirator Use: Respirators shall be worn at all times in the ACM control area while the activities are being performed.

2.5 WARNING LABELS AND SIGNS: Warning labels and signs shall conform to 29 CFR 1926.1101.

2.5.1 Signs: The Contractor shall post warning signs at the perimeter of the ACM control area prior to ACM removal in accordance with 29 CFR 1926.1101. The signs shall display the legend indicated below.

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

SECTION 02230 - CLEARING AND GRUBBING

Edit paragraph 3.4.2 to disallow burning.

SECTION 02300 - EARTHWORK

SECTION 02316 - EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES.

Plastic warning tape is required to be used.

SECTION 02364 - TERMITICIDE TREATMENT MEASURES FOR SUBTERRANEAN TERMITE CONTROL

SECTION 02370 - SOIL SURFACE EROSION CONTROL

SECTION 02556 - GAS DISTRIBUTION SYSTEM

LP gas tanks shall comply with requirements of NFPA 58 and the ASME Code, Section VII, Pressure Vessels. Tanks shall be pad mounted, and shall not be located inside any building. Tanks shall be provided with all required gauges, shut off valves, safety devices, and suction connections. Shut off valves shall be installed at each tank, and at each heating unit. No shut off valve shall be installed between a safety device and tank. LP gas pressure shall be reduced to a minimum service pressure of 3.5 kPa prior to the building entrance. LP gas pipe connectors shall be in accordance with UL 567.

SECTION 02630 - STORM DRAINAGE

Culverts are needed to remove storm run-off from the site. Contractor may elect to edit this specification or provide own specification/notes on drawings. Contractor shall provide inlet/outlet structures to facilitate grading at structure and permanent erosion control.

SECTION 02921 - SEEDING

Seed shall be installed from 1 March to 15 June for spring establishment. Seed shall be installed from 1 Sep to 1 Oct for fall establishment.

Seed shall be K-31 Tall Fescue, seeded at 20 pound per acre of pure live seed. Use certified seed that is free of all noxious weeds, especially musk thistle and serecia lespedeza.

PART B

GENERAL DESIGN REQUIREMENTS

CHAPTER 4

SURVEY REQUIREMENTS

CHAPTER 4

SURVEY REQUIREMENTS

4. **Scope of work.** Contract Drawing Sheets c2.1 and c3.1 shows an existing survey, however, the project scope includes performing an engineering and topographic survey on which to base the design. The original surveys and field notes shall become district property and shall be furnished to the district survey section. The following are minimum survey requirements for this project.

4.1. **Flagging.** Surveyor shall be responsible for contacting 1-800-344-7233 and Ft. Riley Public Works (Building 337, 913-239-8187) for utility flagging.

4.2. **Benchmarks.** Record and confirm the locations of any permanent benchmarks located inside and outside the project limits. Control points descriptions are at presented later in the chapter starting on page 48. Survey shall have at least three monument points.

4.3. **Contours.** The survey shall be provided in metric units with a .25-meter contour interval. Provide spot elevations at high and low points and abrupt changes in grade along centerline and at top of bank of drainage courses, at structures, physical appurtenances, roadways and adjacent walkways if any exist.

4.4. **Spot Elevations.** Provide ground spot elevations at corners of each building and as shown on attached drawing. Ground spot elevations shall also be obtained on obvious eroded surfaces (i.e., eroding drainage paths from downspout outlets, culvert outlets, etc.).

4.5. **Features.** Locate all existing road centerlines, edges of pavement, type of pavement, sidewalks, retaining walls, fences, buildings, piers, abutments, structures, curbs, utilities, etc.

4.6. **Trees.** Identify the major trees (100 mm) and indicate trunk size at a height of 1 M above the existing ground line at the base of the tree and the type of tree. Locate shrubbery and indicate accordingly.

4.7. **Water Lines:** N/A

4.8. **Sanitary Sewers:**N/A

4.9. **Storm Drainage:** Locate manholes and all other storm drainage structures such as culverts, pipe outfalls, headwalls, catch basins, gate structures and cleanouts. Provide type of manhole (i.e. concrete, brick, etc.), manhole diameter, top of manhole or top of catch basin elevation along with an invert elevation of all pipes connected to a manhole or catch basin. Identify type, size, and direction of each pipe. Provide type, size, and invert elevations for all culverts. Provide information on existing pipe closures (i.e. flap gates, sluice gates, etc.) such as: size, type of material, controls, etc.

4.10. **Electrical:** Locate all power poles, guy wires, vaults, manholes, meters, transformers, electrical boxes, and substations. Obtain type and height of poles, number and size of transformers, number of cross arms, number of wires (electrical and communication), direction and low wire elevation at each pole. Identify the number and anchor points of any guy wires. Provide top of rim or top of vault elevation, top of wire or conduit elevation, direction and bottom elevation of manholes and vaults. Provide size for all electrical vaults and boxes.

4.11. **Gas:** N/A

4.12. **Telephone:** Locate all poles, manholes, boxes, etc. Provide top of rim elevation, top of wire or conduit elevation, direction and bottom of manhole elevation. Obtain type and height of poles; number of cross arms; number of wires and low wire elevation at each pole.

4.13. **Street Light:** Locate all poles and provide type and height of poles. Identify number and type of lights on poles. If connected by wires, show direction and low wire elevation.

4.14. **Equipment and Use.** Vertical control shall be established with spirit or self-leveling instruments. Trigonometric leveling or "total stations" shall not be used in setting vertical control or in determining the elevation of critical items such as floors, foundations, runways or taxiway, drainage structures, and utility lines. Horizontal control shall be established with equipment capable of producing the accuracies specified below.

4.15. **Accuracy.** The project survey shall meet or exceed the horizontal and vertical accuracy described herein. The survey shall be third order class I. Horizontal closing error shall not exceed 1:10,000 for distance and 10 times the square root of N where N is the number of angle stations. Vertical closing error shall not exceed 12mm times the square root K where K is the length in kilometers.

4.16. **Control.** Establish horizontal and vertical control points outside the areas of construction. Use NAD83. Use NAVD88.

4.17. **Format.** Final product shall be a Bentley Microstation version J 3d file. The survey file shall have the following data included:

4.17.1. The levels which items are placed shall be done in accordance with Tri-Service CADD standards:

- 4.17.1.1. Table 1 lists the level attributes.
- 4.17.1.2. Table 2 lists the north arrow, scale marker, existing legend to be used.
- 4.17.1.3. Table 3 lists the format of existing manhole labeling.
- 4.17.1.4. Scale shall be 1:500.
- 4.17.1.5. Text size shall be 1.2 meter.
- 4.17.1.6. Font shall be 1.

4.17.2. Control point descriptions
4.17.3. Survey crew names
4.17.4. Date of survey
4.17.5. Combination factor used in the reduction to state plane system
4.17.6. The file shall have north arrow, bar scale, state plan coordinate system grid (with coordinate labels).
4.17.7. Provide a table of Sanitary Sewer information.
4.17.8. Provide a table of Storm Sewer information.
4.17.9. Provide a table of survey control and TBM information.
4.17.10. Provide a 100 M x 100 M grid with coordinate values

GENERAL DESIGN REQUIREMENTS

NAD-27
CORPS OF ENGINEERS, U.S. ARMY — PROJECT: Ft. Riley Mapping
CONTROL STATION DESCRIPTION — STATE: KANSAS
PROJECTION: LAMBERT — ERROR OF CLOSURE: 1:33,000
STATE PLAN COORDINATE SYSTEM: KANSAS, NORTH ZONE

CITY, TOWN, COUNTRY	NAME OF STATION	YEAR
FT. RILEY KANSAS	SCP-11	1977
N=288597.512	VERTICLE DATUM	ELEVATION
	MSL	1305
E=2345777.944	ESTABLISHED BY	YEAR
	DIVISION ARTILLERY	?

DISTANCES AND DIRECTION TO TRAVERSE STATIONS AND AZIMUTH MARKS

	STATION OR AZIMUTH MARK	DISTANCE	GRID AZIMUTH
T	SCP-13	4349.939’	100 31’54.5”
T	JUNCTION	6423.993	133 03’02.9”
T	SCP-10	11762.523’	265 00’56.2

DETAILED DESCRIPTION: On Ft. Riley, near Carpenter Hill. About 3500’ S and 6600’ E. of junction of old Vinton Road and First Division Road. A 12” by 12” concrete monument projecting 12” above the ground with a 150mm shell casing imbedded in the top stamped “SCP-11 DIVARTY S/C”. Monument set by others. It is 18’ W. of center of tank trail and 30’ N. of center of trail SW. Steel posts with SURVEY MARK sign 2’ N. and S.

TO REACH: From SCP-13, follow main tank road easterly for about 6000’ to “Y” intersection and station on the left.

REFERENCES: 7.67’ NE to RR. Tie projecting 15” above the ground.

* T = TRAVERSE STATION and A = AZIMUTH MARK

NAD-27
CORPS OF ENGINEERS, U.S. ARMY — PROJECT: Ft. Riley Mapping
CONTROL STATION DESCRIPTION — STATE: KANSAS
PROJECTION: LAMBERT — ERROR OF CLOSURE: 1:33,000
STATE PLAN COORDINATE SYSTEM: KANSAS, NORTH ZONE

CITY, TOWN, COUNTRY	NAME OF STATION	YEAR
FT. RILEY KANSAS	SCP-13	1977
N=289392.599	VERTICLE DATUM	ELEVATION
	MSL	1310
E=2341501.286	ESTABLISHED BY	YEAR
	30TH ENG. BATTALION	1972

DISTANCES AND DIRECTION TO TRAVERSE STATIONS AND AZIMUTH MARKS

*	STATION OR AZIMUTH MARK	DISTANCE	GRID AZIMUTH
T	MORRIS HILL	9473.050’	358 47’51.1”
T	JUNCTION	3614.442’	173 21’51.7”
T	SCP-11	4349.939’	280 31’54.5”

DETAILED DESCRIPTION: On Ft. Riley, about 3700’ S. of junction of First Division Road and Vinton School Road. Center of the top of a 105 mm shell casing (set by others), driven into the ground and projecting .1’ above the ground. It is stamped SCP-13-30TH Engr. Bn. –1972”. It is 57’ E. of center of First Division Road and 81’ N. of center of tank trail E. Steel posts with “SURVEY MARK” sign 2’ NW and SE. 4” x 4” wooden posts 4.5’ SW and SE.

TO REACH: N/A

REFERENCES: None available.

* T = TRAVERSE STATION and A = AZIMUTH MARK

GENERAL DESIGN REQUIREMENTS

NAD-27
CORPS OF ENGINEERS, U.S. ARMY — PROJECT: Ft. Riley Mapping
CONTROL STATION DESCRIPTION — STATE: KANSAS
PROJECTION: LAMBERT — ERROR OF CLOSURE: 1:98,000
STATE PLAN COORDINATE SYSTEM: KANSAS, NORTH ZONE

CITY, TOWN, COUNTRY	NAME OF STATION	YEAR
FT. RILEY KANSAS	INDIA	1978
N=305014.396	VERTICLE DATUM	ELEVATION
E=2340345.423	ESTABLISHED BY	YEAR
	USCE	1978

DISTANCES AND DIRECTION TO TRAVERSE STATIONS AND AZIMUTH MARKS

*	STATION OR AZIMUTH MARK	DISTANCE	GRID AZIMUTH
T	HOTEL	11862.557’	175 06’29.2”
T	JUNCTION	12054.193’	356 29’20.5”

DETAILED DESCRIPTION: Near the center of the SE ¼SEC. 19, T10S, R6E, Riley Co., Ks. At Trainfire Range #2 170’ E. of centerline of 1st Division Road, 12’ S. of SW. corner of parking area, 160’ W. of SW corner of bldg. T9145, ILW E-W power line & 39.7’ W. of 2nd power pole E. of 1st. Division Road. A C of E brass cap stamped “INDIA-1978”, flush.

TO REACH: N/A

REFERENCES: 39.65’ E. to shiner in power pole.
2.70’ S. to steel post and sign.
113.93’ W. to shinerin power pole.

* T = TRAVERSE STATION and A = AZIMUTH MARK

FORT RILEY KANSAS
TBMS VICINITY OF FORT
LEVELS BY DODSON 1977

TBM FR-10

U.S.C.E. Junction – By Dodson 1977 – top of aluminum monument. On Fort Riley, about 1 mile south of Custor Hill Troop housing area at junction of First Division Road and old Vinton School Road. A Corps of Engineers aluminun monument stampted "JUNCTION-1977" and set flush with the ground. A ¾inch rebar has been driven beside the monument to facilitate easy recovery with a magnetic locator. Concrete has been poured from the base to about 6 inches below the ground level and the rest of the hole filled with dirt. It is about 43 feet W. of the center of First Division Road and 85 feet S. of the center of Old Vinton School Road. Steel posts with sign set 2 feet east and west.

Elev.1281.192

TBM FR-11

Approximately 3300 feet S. of junction of Vinton School Road and 1st Division Road. 400 feet N.W. of SCP-13. A railroad spike 1 foot above the ground in the W. side of 12 inc cotton wood tree. 40 feet W. of centerline of 1st Division Road. 33 feet E. of centerline of tank trail. Marked by a 5" x 5" Corps of Engineers yellow sign.

Elev.1311.521

TBM FR-12

On Fort Riley, Approximately 1500 feet North of junction of 1st Division Road & Appenines Road. A chiseled square on the N. end of E. headwall of new 15' x 18' concrete box culvert under 1st Division Road.

Elev.1276.197

TBM FR-13

Near most S.E. corner of Custer Hill Troop Housing Area, at N.E. corner of junction of 1st Division Road and Appenines Road. A chiseled square on top and center of concrete curb at S. W. corner of N.E. triangle shaped median. 18 feet N. of centerline of 1st Division Road and 18 feet E. of centerline of Appenines Road.

Elev.1311.887

TBM FR-14

Approximately .6 mile N. of new fire station on Custer Hill and 250 feet E.N.E. of junction of 1st Division Road and a gravel road E. to a sewage treatment plant. 33 feet West of building # 8129. 50 feet N. of centerline of gravel road. 15 feet west of in line with a N-S power line. A chiseled square in center along W. edge of 11' x 12' concrete manhole.

Elev.1277.713

TBM FR-95

Near the corner of sections 29, 30, 31, and 32. T-10-S, R-6-E Riley Co. Ks. On Morris Hill Road. A chiseled square on top and center of E. end of 30 inch C.R.P. About 100 feet S. of intersection of two trail roads.

Elev.1248.413

TBM FR-96

About 1500 feet west of southeast corner of section 19. T-10-S R-6-E Riley Co. Ks. On the West side of Morris Hill Road at curve north and southeast. A railroad spike .5' above the ground on the east side of power pole. About 85 feet north of tanktrail W.

Elev.1313.429

TBM FR-97

Near the center of the N. ½section 19. T-10-S R-6-E Riley Co. Ks. On Morris Hill Road about 350 feet south of curve W. A chiseled square on top and center of east headwall of concrete box culvert.

Elev.1263.150

TBM FR-98

About 1200 feet south and 1000 feet west of north. ¼corner of section 18. T10S R6E Riley Co. Ks. About 300 feet south and 85 feet east of drive to target detection range #19, on Morris Hill Road. A railroad spike .2 feet above the ground in the west side of power pole.

Elev.1322.031

TBM FR-99

Near the corner of sections 5, 6, 7, and 8. T10S R6E Riley Co. Ks. On Morris Hill Road, about 100 feet North and 45 feet east of crossroads intersection to 'train fire zeroing range' # 7. A railroad spike .3' above the ground in the west side of power pole.

Elev.1341.942

4.17.11.

JOB TITLE: WORKING UNITS:
FILE NAME: PLOT SCALE: 1in=50in
CONTACT: LAST REV. DATE: 4/1/1999

	WT	CO	LT	FT	TH	LV	ACAD LAYER	TRI-SERVICE STANDARDS A/E/C CADD/GIS CADD STANDARDS REFERENCE PAGE A-6.7.EE 25-1-243.6/98 RESCINDS EM 1110-1-1807
GENERAL	X	X	X	X	X	1	V-ANNODIP	DIMENSIONS, ALINEMENT MARKINGS, STATIONING, NORTH ARROW, PLOT SCALE
	X	X	X	X	X	2	V-ANNOKEP	KEYNOTES, LEGEND
	X	X	X	X	X	3	V-ANNONPP	CONSTRUCTION LINES,REFERENCE TARGETS, AREA CALCULATIONS,COMMENTS
	X	X	X	X	X	4	V-ANNOPAP	MISC. PATTERNING, CROSS HATCHING, POCHÉ
	X	X	X	X	X	5	V-ANNONOP	GENERAL NOTES & REMARKS
	X	X	X	X	X	6	V-ANNOSYP	MISC. SYMBOLS
	X	X	X	X	X	7	V-ANNOTEP	MISC. TEXT AND CALLOUTS WITH LEADERLINES
GRID	0	3	0	X	X	8	V-GRIDTIM	COORDINATE GRID AND ANNOTATION
	2	0	0	X	X	9	V-SURVLIM	SURVEY & CONTROL LINE
	½	1/0	0	X	X	10	V-SURVIDM	SURVEY CONTROL ANNOTATION
BLDGS.	X	7	X	X	X	11	V-BLDGIDM	BUILDING ANNOTATION
	X	7	X	X	X	12	V-BLDGOTM	BUILDING, & PRIMARY STRUCTURES, OUTBUILDINGS
	X	7	X	X	X	13	V-BLDGOTF	OTHER BLDG. FEATURES
SITE	X	7	X	X	X	14	V-SITEFEM	FENCES, SIGNS, OTHER SITE GROUND FEATURES
	X	X	X	X	X	15	X	X
	X	7	X	X	X	16	V-SITEIDM	FENCE ANNOTATION
TREES	X	2	X	X	X	17	V-SITEVEG	VEGETATION,TREES, SHRUBS, DRIPLINES,CROP EDGES
	X	2	X	X	X	18	V-SITEVEGIDM	VEGETATION ANNOTATION
CONC.	X	0	X	X	X	19	V-SITECON	CONCRETE FEATURES ex. PAVEMENT JOINTS
	X	0	X	X	X	20	V-SITECONIDM	CONCRETE ANNOTATION ex. PAVEMENT ANNOTATION
UTILITIES TEXT	X	6	X	X	X	21	V-GASIDM	GAS LINES & FEATURE ANNOTATION
	X	0	X	X	X	22	V-UTILIDM	OTHER UTILITIES ANNOTATION
	X	3	X	X	X	23	V-ELECIDM	POWER & COMMUNICATIONS ANNOTATION
	X	1	X	X	X	24	V-WATERIDM	WATER LINES & WATER FEATURES ANNOTATION
BOUND	X	0	X	X	X	25	V-PROPESM	BOUNDARY LINES & MONUMENTATION
	X	0	X	X	X	26	V-PROPLIM	BOUNDARY, MONUMENTATION BEARING DISTANCE ANNOTATION
	X	X	7	X	X	27	V-PROPRIM	CONSTRUCTION LIMITS, RIGHT OF WAYS
WATER & EMBANKMENTS	X	X	X	X	X	28	X	Levees, Dikes
	X	2	4	X	X	29	V-EMBKCNM	EMBANKMENT CENTERLINE
	X	1	1	X	X	30	V-EMBKEDM	EMBANKMENT EDGES AND OBJECT LINES,HIGH & LOW BANKS,
	X	3	X	X	X	31	V-EMBKIDM	EMBANKMENT, LEVEES & DIKES ANNOTATION
ROADS	X	3	X	X	X	32	V-PAVEROM	ROADS, CURBS, PARKING LOT EDGES, RAILROADS, AIRFIELD PAVEMENT, SIDEWALKS
	X	0	X	X	X	33	V-PAVIDM	ROAD, PARKING LOT, RAILROADS, AIRFIELDS, ANNOTATION
	X	5	X	X	X	34	V-GEOM	MONITORING WELLS & SOIL BORE HOLES
	X	X	X	X	X	35	V-GEOIDM	MONITORING WELLS & SOIL BORINGS ANNOTATION
STORM DRAINAGE & SEWER	X	5	X	X	X	36	V-STRMRM	STORM DRAINAGE, HEADWALLS, RCP,CMPS, VCPS, ICPS, INLETS, MANHOLES, DRAINAGE STRUCTURES,
	X	5	X	X	X	37	V-STRMDTM	DITCHES, CREEKS, RIVERS,PONDS, LAKES
	X	5	X	X	X	38	V-STRMDM	ANNOTATION FOR STORM DRAINAGE, HEADWALLS, RCPS, CMPS, VCPS, ICPS, INLETS, MANHOLES, DRAINAGE STRUCTURES
	X	2	X	X	X	39	V-SANISEWM	SANITARY SEWER LINES, MANHOLES,
	X	2	X	X	X	40	V-SANISEWDM	SANITARY SEWER LINES & MANHOLE ANNOTATION
TOPOGRAPHY	X	7	X	X	X	41	V-TOPOMAM	MAJOR CONTOURS- ANNOTATION
	X	7	X	X	X	42	V-TOPOMJM	MAJOR CONTOURS
	X	3	X	X	X	43	V-TOPOMIM	MINOR CONTOURS- ANNOTATION
	X	3	X	X	X	44	V-TOPOMNM	MINOR CONTOURS
TOPOGRAPHIC DATA	X	3	X	X	X	45	V-SHOTNUM	SURVEY SHOT NUMBER OR CROSS HAIR
	X	5	X	X	X	46	V-FEATNUM	SURVEY CODES
	X	2	X	X	X	47	V-TRIADTM	TRIANGLES FROM DTM
	X	7	X	X	X	48	V-TOPOSPM	SPOT ELEVATIONS
	X	2	X	X	X	49	V-BRKLNS	BREAKS AND TOES FOR CONTOURING
STATUS LAYERS	X	X	X	X	X	50	V-STATDEM	DEMOLITION TO BE REMOVED WITH ANNOTATION
	X	X	X	X	X	51	V-STATEXM	EXISTING TO REMAIN
	X	X	5	X	X	52	V-STATFUM	FUTURE WORK
	X	X	X	X	X	53	V-STATMOM	ITEMS TO BE MOVED
	X	X	X	X	X	54	V-STATNEM	NEW WORK
	X	X	X	X	X	55	V-STATNIM	NOT IN CONTRACT
	X	X	X	X	X	56	V-STATPHM	PHASE NUMBER (*=1-9)
	X	X	X	X	X	57	V-STATREM	RELOCATED ITEMS
	X	X	X	X	X	58	V-STATTEM	TEMPORARY WORK, EROSION CONTROL W ANNOTATION
UTILITIES	X	6	X	X	X	59	V-UTILGAM	GAS LINE PIPING AND GAS FEATURES
	X	X	X	X	X	60	V-UTILPIM	OTHER PIPING EX. STEAM, COMMUNICATIONS, INDUSTRIAL WASTE ETC.
	X	3	X	X	X	61	V-UTILPOM	POWER LINES, LIGHTS, TELEPHONE LINES, UNDERGROUND POWER & COMMUNICATIONS, POLES AND MARKERS
	X	1	X	X	X	62	V-UTILWAM	WATER LINES, HYDRANTS, VALVES, TANKS, METERS, SPRINKLERS, ETC.
	X	X	X	X	X	63	X	X

NOTES:
X DENOTES NOT DETERMINED OR VARIES

WORKING UNITS:

	MU	SU	SU/PU
	MP. FT	TH	100/10
	MET. M	MM	1000/1

CO-0.0,2147483.648

Table 1: Tri-Services Standards Level Attributes

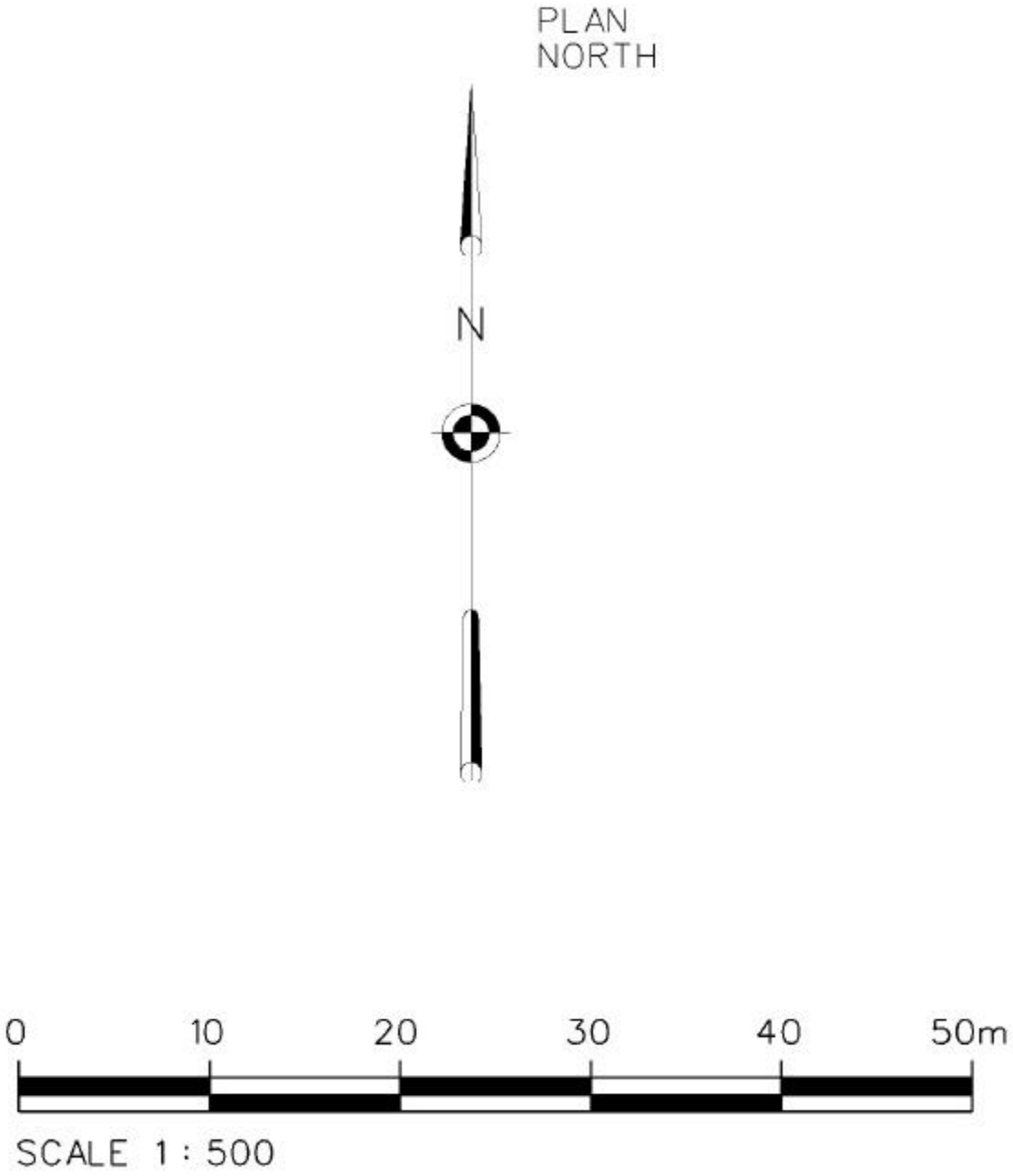

Table 2: Survey Arrowhead , Scale

STORM CI00-1
(SURVEYED 12/00)
TOP EL. 779.103
THROAT EL 778.124
12" PVC SE. F/L OUT EL. 775.30
2 MANHOLE COVERS

STORM CI00-2
(SURVEYED 12/00)
TOP EL. 779.12
THROAT EL 778.09
12" RCP S. F/L OUT EL. 774.77

STORM CI00-3
(SURVEYED 12/00)
TOP EL. 778.98
THROAT EL 778.14
12" PVC NW. F/L IN EL. 772.42
12" PVC SSW F/L OUT EL. 771.88

STORM CI00-4
(SURVEYED 12/00)
TOP EL. 778.32
THROAT EL 777.41
12" CMP SW. F/L OUT EL. 774.55

STORM CI00-5
(SURVEYED 12/00)
TOP EL. 778.54
THROAT EL 777.54
12" PVC NE F/L IN
24" PVC SW F/L OUT
INVERT EL. 770.78

STORM CI00-7
(SURVEYED 12/00)
TOP EL. 780.23
THROAT F/L 779.33
NO INVERTS
BOLTED SHUT

STORM CI00-6
(SURVEYED 12/00)
TOP EL. 780.14
THROAT EL 779.55
NO INVERTS
BOLTED SHUT

STORM DI #7
(RESURVEYED 12/00)
TOP EL. 778.60
24" CMP S F/L OUT
INVERT EL. 776.59

STORM CI00-8
(SURVEYED 12/00)
TOP EL. 789.26
THROAT EL 788.46
12" RCP SE. F/L OUT EL. 785.50

STORM CI00-9
(SURVEYED 12/00)
TOP EL. 788.82
THROAT EL 788.33
12" RCP SW. F/L OUT
BOLTED SHUT
NO INVERT SURVEYED

STORM DI00-10
(SURVEYED 12/00)
TOP EL. 788.33
12" RCP NW F/L IN
12" RCP NE F/L IN
24" RCP E F/L IN
24" RCP W F/L OUT
INVERT EL. 783.33

STORM CI00-11
(SURVEYED 12/00)
TOP EL. 789.81
THROAT EL. 789.16
24" RCP E F/L IN UNCERTAIN
INLET BOLTED
24" RCP W F/L OUT
INVERT EL. 785.32

STORM CI00-12
(SURVEYED 12/00)
TOP EL. 786.02
THROAT EL. 785.26
12" RCP NW F/L IN
UNCERTAIN OF F/L OUT
POSSIBLY SOUTH UNDER
HEADWALL
INVERT EL. 778.74

STORM CI00-13
(SURVEYED 12/00)
TOP EL. 786.08
THROAT EL. 785.43
12" RCP SE F/L OUT
INVERT EL. 781.18

STORM CI00-14
(SURVEYED 12/00)
TOP EL. 784.34
THROAT EL. 783.74
BOLTED NO ACCESS
FLOWS TO 1999 SURVEY
OF STORM MH #2

STORM CI00-15
(SURVEYED 12/00)
TOP EL. 784.67
24" RCP S F/L OUT
INVERT EL. 771.22
FLOWS TO STORM
SEWER MH #2

STORM CI00-16
(SURVEYED 12/00)
TOP EL. 785.14
THROAT INV. EL. 784.52
12" CMP SE F/L OUT
EL. 781.98

STORM CI00-17
(SURVEYED 12/00)
TOP EL. 783.31
THROAT INV EL. 782.48
12" CMP NW F/L IN EL. 777.86
30" CMP S F/L OUT EL. 769.96
FLOWS TO STORM MH #1

STORM CI00-18
(SURVEYED 12/00)
TOP EL. 783.00
THROAT 782.30
12" CMP S F/L OUT
INVERT EL. 778.88
BOLTED SHUT

STORM MH 00-19
TOP EL. 800.90
SURVEYED 12/00
48" RCP SW F/L IN EL. 794.36
48" RCP NE F/L OUT EL. 789.30

Table 3: Tri-Services Standards Labeling (typical).

1. Survey. Contract Drawing Sheets c2.1 and c3.1 shows an existing survey, however, the project scope includes performing an engineering and topographic survey on which to base the design. The original surveys and field notes are district property and shall be furnished to the district survey section. The following are minimum survey requirements for this project.

1.1. Surveyor shall be responsible for contacting 1-800-344-7233 and Ft. Riley Public Works (Building 337, 913-239-8187) for utility flagging.

1.2. Record and confirm the locations of any permanent benchmarks located inside and outside the project limits. Survey shall have at least three monument points.

1.3. The levels which items are placed shall be done in accordance with Tri-Service CADD standards:

1.3.1. Table 1 lists the level attributes.

1.3.2. Table 2 lists the north arrow, scale marker, existing legend to be used.

1.3.3. Scale shall be 1:500.

1.3.4. Text size shall be 1.2 meter.

1.3.5. Font shall be 1.

1.4. The survey shall be provided in metric units with a .25-meter contour interval. Provide spot elevations at high and low points and abrupt changes in grade along centerline and at top of bank of drainage courses, at structures, physical appurtenances, roadways and adjacent walkways if any exist.

1.5. Provide ground spot elevations at corners of each building and as shown on attached drawing. Ground spot elevations shall also be obtained on obvious eroded surfaces (i.e., eroding drainage paths from downspout outlets, culvert outlets, etc.).

1.6. Locate all existing street centerlines, edges of pavement, type of pavement, sidewalks, retaining walls, fences, buildings, piers, abutments, structures, curbs, utilities, etc.

1.7. Identify the major trees (100 mm) and indicate trunk size at a height of 1 M above the existing ground line at the base of the tree and the type of tree. Locate shrubbery and indicate accordingly.

1.8. Water Lines: Locate all valves, standpipes, regulators, etc. Locate all fire hydrants. Provide an elevation on top of valve case and top of valve. Provide size of pipe, material, and distance above ground for standpipes.

1.9. Sanitary Sewers: Locate all manholes/cleanouts and provide type of manhole (i.e., concrete, brick), manhole diameter, and top of rim elevation along with invert elevation of all pipes connected to the manhole. Identify type, size, and direction of each pipe. Locate and identify force mains, lift stations, gate structures, etc.

1.10. Storm Drainage: Locate manholes and all other storm drainage structures such as culverts, pipe outfalls, headwalls, catch basins, gate structures and cleanouts. Provide type of manhole (i.e. concrete, brick, etc.), manhole diameter, top of manhole or top of catch basin elevation along with an invert elevation of all pipes connected to a manhole or catch basin. Identify type, size, and direction of each pipe. Provide type, size, and invert elevations for all culverts. Provide information on existing pipe closures (i.e. flap gates, sluice gates, etc.) such as: size, type of material, controls, etc.

1.11. Electrical: Locate all power poles, guy wires, vaults, manholes, meters, transformers, electrical boxes, and substations. Obtain type and height of poles, number and size of transformers, number of cross arms, number of wires (electrical and communication), direction and low wire elevation at each pole. Identify the number and anchor points of any guy wires. Provide top of rim or top of vault elevation, top of wire or conduit elevation, direction and bottom elevation of manholes and vaults. Provide size for all electrical vaults and boxes.

1.12. Gas: Locate all valves, meters, and gas line markers. Provide elevation on top valve case and on top of valve.

1.13. Telephone: Locate all poles, manholes, boxes, etc. Provide top of rim elevation, top of wire or conduit elevation, direction and bottom of manhole elevation. Obtain type and height of poles; number of cross arms; number of wires and low wire elevation at each pole.

1.14. Street Light: Locate all poles and provide type and height of poles. Identify number and type of lights on poles. If connected by wires, show direction and low wire elevation.

1.15. Equipment and Use. Vertical control shall be established with spirit or self-leveling instruments. Trigonometric leveling or "total stations" shall not be used in setting vertical control or in determining the elevation of critical items such as floors, foundations, runways or taxiway, drainage structures, and utility lines. Horizontal control shall be established with equipment capable of producing the accuracies specified below.

1.16. Accuracy. The project survey shall meet or exceed the horizontal and vertical accuracy described herein. The survey shall be third order class I.

Horizontal closing error shall not exceed 1:10,000 for distance and 10 times the square root of N where N is the number of angle stations. Vertical closing error shall not exceed 12mm times the square root K where K is the length in kilometers.

1.17. Establish horizontal and vertical control points outside the areas of construction. Use NAD83. Use NAVD88.

1.18. Final product shall be a Bentley Microstation 3d file. The survey file shall have the following data included:

1.18.1. Control point descriptions
1.18.2. Survey crew names
1.18.3. Date of survey
1.18.4. Combination factor used in the reduction to state plane system
1.18.5. The file shall have north arrow, bar scale, state plan coordinate system grid (with coordinate labels).
1.18.6. Provide a table of Sanitary Sewer information.
1.18.7. Provide a table of Storm Sewer information.
1.18.8. Provide a table of survey control and TBM information.
1.18.9. Provide a 100 M x 100 M grid with coordinate values

JOB TITLE:
FILE NAME:
CONTACT:
WORKING UNITS:
PLOT SCALE:
LAST REV. DATE: 4/1/1999

	WT	CO	LC	FT	TX	LV	MCAD LAYER	TRI-SERVICE STANDARDS A/E/C CADD/GIS CADD STANDARDS REFERENCE PAGE A-6.1.CC.25-1-203.6/96 RESCINDS EM 1110-1-1807
GENERAL	X	X	X	0	X	1	X-ANNODIM	DIMENSIONS, ALIGNMENT MARKINGS, STATIONING, NORTH ARROW, PLOT SCALE
	X	X	X	0	X	2	X-ANNOKEY	KEYNOTES, LEGEND
	X	X	X	0	X	3	X-ANNONPP	CONSTRUCTION LINES,REFERENCE TARGETS, AREA CALCULATIONS,COMMENTS
	X	X	X	0	X	4	X-ANNOPAT	MISC. PATTERNING, CROSS HATCHING, POCHE
	X	X	X	0	X	5	X-ANNONOT	GENERAL NOTES & REMARKS
	X	X	X	0	X	6	X-ANNOSYM	MISC. SYMBOLS
	X	X	X	0	X	7	X-ANNOTXT	MISC. TEXT AND CALLOUTS WITH LEADERLINES
GRID	0	1	0	0	X	8	X-GRIDTIM	COORDINATE GRID AND ANNOTATION
	2	0	0	0	X	9	X-SURVLIN	SURVEY & CONTROL LINE
	½	3/8	0	0	X	10	X-SURVTXM	SURVEY CONTROL ANNOTATION
BLDGS.	X	7	X	0	X	11	X-BLDGDIM	BUILDING ANNOTATION
	X	7	X	0	X	12	X-BLDGTIM	BUILDING & PRIMARY STRUCTURES, OUTBUILDINGS
	X	7	X	0	X	13	X-BLDGTIF	OTHER BLDG. FEATURES
SITE	X	7	X	0	X	14	X-SITEFEM	FENCES, SIGNS, OTHER SITE GROUND FEATURES
	X	X	X	0	X	15	X	X
	X	7	X	0	X	16	X-SITEDIM	FENCE ANNOTATION
TREES	X	E	X	0	X	17	X-SITEVEG	VEGETATION,TREES, SHRUBS, DRIPLINES,CROP EDGES
	X	E	X	0	X	18	X-SITEVEGDIM	VEGETATION ANNOTATION
CONC.	X	0	X	0	X	19	X-SITECON	CONCRETE FEATURES ex. PAVEMENT JOINTS
	X	0	X	0	X	20	X-SITECONDIM	CONCRETE ANNOTATION ex. PAVEMENT ANNOTATION
UTILITIES TEXT	X	5	X	0	X	21	X-DATDIM	GAS LINES & FEATURE ANNOTATION
	X	0	X	0	X	22	X-UTLDIM	OTHER UTILITIES ANNOTATION
	X	3	X	0	X	23	X-ELECDIM	POWER & COMMUNICATIONS ANNOTATION
	X	1	X	0	X	24	X-WATERDIM	WATER LINES & WATER FEATURES ANNOTATION
BOUND.	X	0	X	0	X	25	X-PROPESM	BOUNDARY LINES & MONUMENTATION
	X	0	X	0	X	26	X-PROPLIM	BOUNDARY, MONUMENTATION BEARING DISTANCE ANNOTATION
	X	X	7	0	X	27	X-PROPRAW	CONSTRUCTION LIMITS, RIGHT OF WAYS
WATER & EMBANKMENTS	X	X	X	0	X	28	X	Levees, Dikes
	X	E	4	0	X	29	X-EMBKCNM	EMBANKMENT CENTERLINE
	X	1	1	0	X	30	X-EMBKEDM	EMBANKMENT EDGES AND OBJECT LINES,HIGH & LOW BANKS,
	X	1	X	0	X	31	X-EMBK.DIM	EMBANKMENT, LEVEES & DIKES ANNOTATION
ROADS	X	3	X	0	X	32	X-PAVEDIM	ROADS, CURBS, PARKING LOT EDGES, RAILROADS, AIRFIELD PAVEMENT, SIDEWALKS
	X	0	X	0	X	33	X-PAVIDM	ROAD, PARKING LOT, RAILROADS, AIRFIELDS, ANNOTATION
	X	5	X	0	X	34	X-GEOM	MONITORING WELLS & SOIL BORE HOLES
	X	4	X	0	X	35	X-GEODIM	MONITORING WELLS & SOIL BORINGS ANNOTATION
STORM DRAINAGE & SEWER	X	5	X	0	X	36	X-STRMPM	STORM DRAINAGE, HEADWALLS, RCP,CMPS, VCPS, ICPS, INLETS, MANHOLES, DRAINAGE STRUCTURES,
	X	6	X	0	X	37	X-STRMDTM	DITCHES, CREEKS, RIVERS,PONDS, LAKES
	X	5	X	0	X	38	X-STRMDM	ANNOTATION FOR STORM DRAINAGE, HEADWALLS, RCPS, CMPS, VCPS, ICPS, INLETS, MANHOLES, DRAINAGE STRUCTURES
	X	2	X	0	X	39	X-SANSEWM	SANITARY SEWER LINES, MANHOLES,
	X	2	X	0	X	40	X-SANSEWDM	SANITARY SEWER LINES & MANHOLE ANNOTATION
TOPOGRAPHY	X	7	X	0	X	41	X-TOPOMAM	MAJOR CONTOURS-- ANNOTATION
	X	7	X	0	X	42	X-TOPOMJM	MAJOR CONTOURS
	X	1	X	0	X	43	X-TOPOMIM	MINOR CONTOURS-- ANNOTATION
	X	1	X	0	X	44	X-TOPOMAM	MINOR CONTOURS
TOPOGRAPHIC DATA	X	1	X	0	X	45	X-SHOTNUM	SURVEY SHOT NUMBER OR CROSS HAIR
	X	5	X	0	X	46	X-FEATNUM	SURVEY CODES
	X	2	X	0	X	47	X-TRIaDTM	TRIANGLES FROM DTM
	X	7	X	0	X	48	X-TOPOSPM	SPOT ELEVATIONS
	X	2	X	0	X	49	X-BRKLNS	BREAKS AND TOES FOR CONTOURING
STATUS LAYERS	X	X	X	0	X	50	X-STATDEM	DEMOLITION TO BE REMOVED WITH ANNOTATION
	X	X	X	0	X	51	X-STATEXM	EXISTING TO REMAIN
	X	X	5	0	X	52	X-STATFUM	FUTURE WORK
	X	X	X	0	X	53	X-STATMOM	ITEMS TO BE MOVED
	X	X	X	0	X	54	X-STATNEM	NEW WORK
	X	X	X	0	X	55	X-STATNIM	NOT IN CONTRACT
	X	X	X	0	X	56	X-STATPHM	PHASE NUMBER (*=1-9)
	X	X	X	0	X	57	X-STATREM	RELOCATED ITEMS
	X	X	X	0	X	58	X-STATTEM	TEMPORARY WORK, EROSION CONTROL & ANNOTATION
UTILITIES	X	6	X	0	X	59	X-UTLGAM	GAS LINE PIPING AND GAS FEATURES
	X	X	X	0	X	60	X-UTLPIM	OTHER PIPING EX. STEAM, COMMUNICATIONS, INDUSTRIAL WASTE ETC.
	X	3	X	0	X	61	X-UTLPOM	POWER LINES, LIGHTS, TELEPHONE LINES, UNDERGROUND POWER & COMMUNICATIONS, POLES AND MARKERS
	X	1	X	0	X	62	X-UTLWAM	WATER LINES, HYDRANTS, VALVES, TANKS, METERS, SPRINKLERS, ETC.
	X	X	X	0	X	63	X	X

NOTES:
X DENOTES NOT DETERMINED OR VARIES

WORKING UNITS:

MU	SU	SU/PU
IMP. FT.	TH	100/10
MET. M	MM	1000/1

GO=0.0,2147483.648

Table 1: Tri-Services Standards Level Attributes

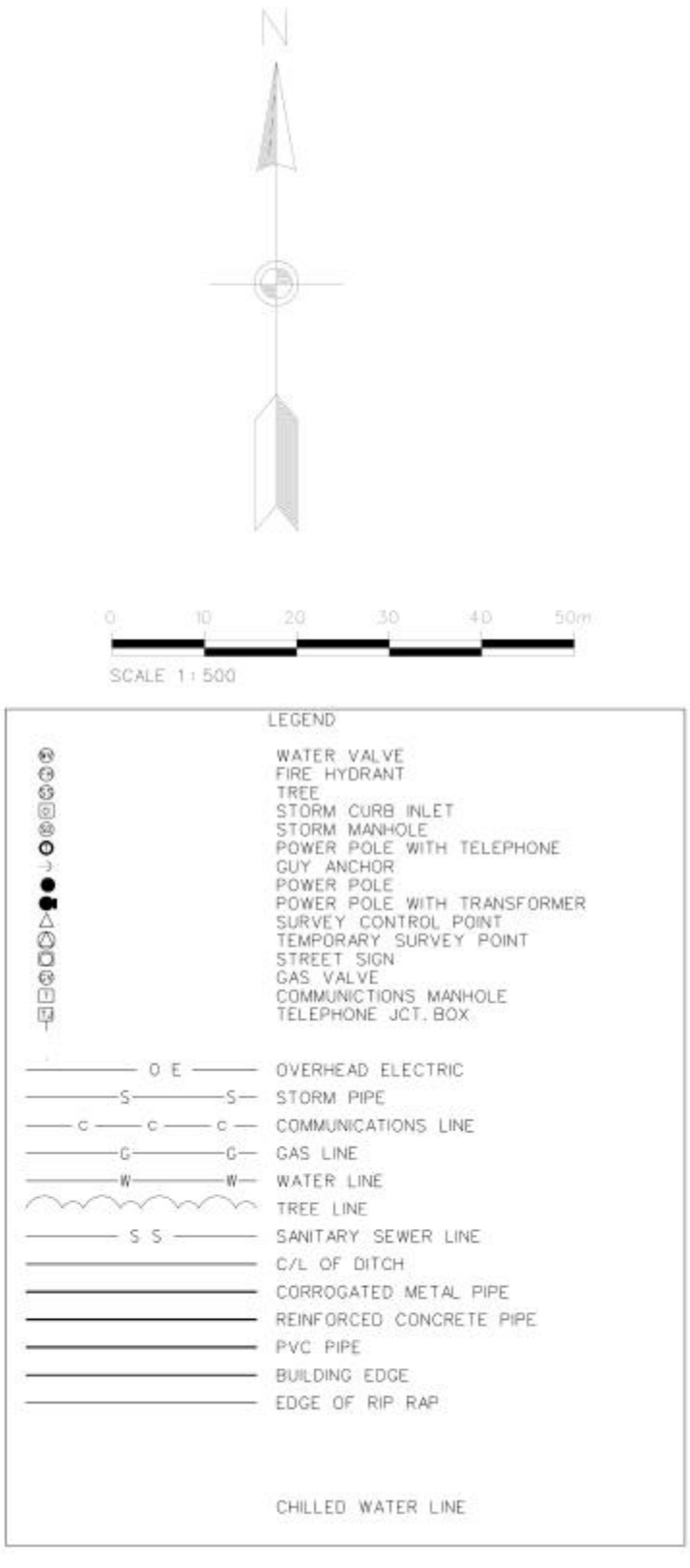

Table 2: Survey Legend

PI-TROOPER
86241.805N 711862.412E
A STD. C. OF. E. MON.
BURIED 0.5' 45.8' E OF E EDGE
OF PAVEMENT. TROOPER AVE. &
150'± N. OF NORMANDY DR.
NO REFS.

PI BRP-1
86203.988N 711754.576E
A⅝" REBAR FLUSH
W/GR @ SW COR. OF INTERSECTION
APPENNINES & TROOPER RDS
77.47'NW TO METAL LIGHT POLE
7.05' NE TO EDGE CONC. WALK
103' S OF ℄ APPENNINES RD.

PI BRP-2
86076.558 711591.134E
A⅝" REBAR FLUSH
W/GR ON N SIDE OF DESERT STORM
RD., 250± W. OF TROOPER DR.
25.0' N OF DESERT STORM RD.
38.64' W TO N&S IN POWER/POLE
82.8T' E TO N&S IN POWER/POLE

PI BRP-3
86076.973 711370.933E
A¾" ALUM SHAFT FLUSH
W/GR IN OPEN FIELD, NE OF MAINT. FACILITY
97.01' NW TO N&S IN POWER/POLE
97.59 WSW TO N&S IN 8" COTTONWOOD
120' W OF ℄ DESERT STORM RD.

PI BRP-4
85884.228N 711343.994E
A⅝" REBAR FLUSH
W/GR ~65' SSW OF END OF
PAVEMENT DESERT STORM RD.
NO REFS

PI BRP-5
85898.626N 711511.636E
A⅝" REBAR FLUSH
W/GR @ CREST OF HILL 500'± W
OF TROOPER DR. & 500'± S. OF
DESERT STORM RD.
27.15' E TO N&S IN 8" HACKBERRY
33.97' NW TO N&S IN 8" MULBERRY
47.46 NNW TO N&S IN 8" CEDAR

PI BRP-9
86699.348N 712341.760E
A⅝" REBAR FLUSH W/CR
NEAR NE COR OF EAST BASEBALL FIELD
12' SW OF R.H.B. SMALL DITCH
23.00' NNE TO N&S IN 5" COTTONWOOD
36.37' ESE TO COR FE POST
49.88' NW TO N&S IN 6" COTTONWOOD

PI BRP-10
86697.865N 712224.164E
A⅝" REBAR FLUSH W/CR
NEAR WEST MOST OF 2 BASEBALL FIELDS
ON N SIDE OF GRAVEL DRIVE
BASEBALL FIELD IS MARKED "#7"
67.41' SSE TO W COR. POST OF BACKSTOP
42.74' S TO N&S IN POWER POLE
74.36' SSW TO END POST OF BACKSTOP

PI BRP-11
86843.368N 712219.598E
A⅝" REBAR FLUSH
W/GR S

PI BRP-12
86884.888 712053.917E
A⅝" REBAR FLUSH W/GR
NEAR NE COR OF ASPHALT PARKING LOT
S. OF SWIMMING POOL ON NORMANDY DR.
BETWEEN PARKER & BAMFORD ST.'S
13.9' S OF N EDGE & 3.5' E OF E EDGE
OF PARKING LOT
48.60'WNW TO METAL SERVICE POLE
74.24' NW TO N&S IN 18" BL. LOCUST
26.32' NNW TO N&S IN POWER POLE

PI BRP-13
86771.716N 712035.854E
A⅝" REBAR FLUSH W/GR
4.4' E OF E EDGE OF ASPHALT PARKING LOT, BETWEEN
OLD THEATER BLDG & LIBRARY BLDG. ON NORMANDY
DR. 37.5' N OF CONC DRAIN
56.50' SE TO N&S IN 8" REDBUD
83.99' SSE TO N&S IN 16" COTTONWOOD
48.98' SW TO N&S IN POWER POLE

Table XXX: Tri-Services Standards requirements

PART B

GENERAL DESIGN REQUIREMENTS

CHAPTER 5

ARCHITECTURAL

STATEMENT OF WORK CONTENTS

Page

CHAPTER 5 ARCHITECTURAL DESIGN

CHAPTER 5

ARCHITECTURAL DESIGN

5-0 **GENERAL.** The design of the building for the three project sites shall be in accordance with the U. S. Army Corps of Engineers Design Manual For Remoted Target System (RETS) Ranges except as noted. For the remainder of this document the U. S. Army Corps of Engineers Design Manual For Remoted Target System (RETS) Ranges shall be referred to as the RETS Standard Design.

5-0a **GENERAL DESIGN.**

COVERED TRAINING AREA (BLEACHERS) FUNCTIONAL AND AREA REQUIREMENTS.

IMPROVEMENTS: The Covered Training Area shall be designed in accordance with the standard Design. Use the enclosed concept drawing. The walls shall be un-insulated metal panels with the building manufacturers standard panel liners. The structural system shall be a steel frame as provided by the metal building manufacturer. The roof shall be standing seam metal roofing. The Covered Training Area shall be designed to accommodate 120 soldiers in bleachers. The bleachers shall be included in the construction project and therefore shall be permanently anchored to the concrete slab. Total net building area shall be a minimum of 54.20 square meters.

5-1 **APPLICABLE CODES AND STANDARDS**. Except as specified otherwise in the RFP, design and construction of facilities shall comply with the latest editions (as of the date of the RFP) of the following. Major criteria references for building design are listed below; additional requirements are included throughout the RFP. Refer to Chapter 9 General Design Requirements for a list of criteria references, and sources of availability.

5-1.1 National Fire Codes, published by the National Fire Protection Association (NFPA), including NFPA 101 Life Safety Code.

5-1.2 Uniform Building Code, 1997 edition.

5-1.3 Interim Department of Defense Antiterrorism / Force Protection Standards.

5-1.4 The Ft. Riley Installation Design Guide (IDG), excerpts of which are included in an appendix to the Statement of Work.

5-1.5 U.S. Army Corps of Engineers Design Manual for Remoted Target System (RETS) Ranges. Include excerpts of the document in an appendix to the SOW, or include source of availability in Appendix A References.

5-2 **UBC OCCUPANCY AND BUILDING TYPE CLASSIFICATIONS**.

5-2.1 **General**. Occupancy classifications, construction types, allowable areas, maximum building heights, and fire separation requirements shall comply with the requirements of the International Building Code.

5-2.2 **Observation Tower**. Occupancy classification: Group B.

5-2.3 **Ammo Breakdown Building**. Occupancy classification: High-Hazard Group H-1

5-2.4 **Covered Training Area**. Occupancy classification: Group B.

5-3 **Finish Requirements**. Room finishes stated in the following paragraphs are preferred minimums; finish selections are not limited to those listed.

Floors: Concrete with sealer.
Walls: Manufacturers standard liner panel.
Ceilings: Simple Saver System or approved equal.

5-3.1 **Material and Product Selection Criteria**. Materials shall meet the requirements of the SOW. The SOW includes a range of specificity: some material requirements are specific (no option); other material requirements allow a range of options. The SOW requirements establish a minimum quality level. Higher quality materials will be judged more favorably. The offeror's proposal shall identify the quality level of all major materials to be provided.

5-4 **EXTERIOR DESIGN**.

5-4.1 **Acceptable Materials and Colors**. Exterior elements of the facilities shall comply with the Installation Design Guide (IDG) unless required otherwise by applicable codes or this Statement of Work.

5-4.2 **Exterior Walls**. The wall panels shall be a metal/foam sandwich panel. See the RETS Standard Design. The color shall be FSC 0313 (Tan).

5-4.3 **Roofs.** Sloped roofs with a minimum pitch of 16% or 2 in12 shall be used on all buildings. Roofing material and color shall comply with the Ft. Riley IDG. Roofing system shall have Underwriters Laboratory (UL) Class A rating for fire resistance, UL 90 wind resistance rating, and Factory Mutual (FM) 1-90 fire and wind resistance rating.

5-4.4 **Trim and Flashing**. Materials and colors shall comply with the Ft. Riley IDG. Gutters, downspouts, and fascias shall be factory finished metal; comply with SMACNA Architectural Sheet Metal Manual. Provide a 20 year manufacturers finish warranty.

5-4.5 **Miscellaneous Exterior Elements**. Comply with the Ft. Riley IDG.

5-4.6 **Signage**. Provide exterior building number signs. Comply with Ft. Riley IDG. Coordinate with installation facilities engineer (DPW); provide criteria for quantity, type, size and location of building identification signs.

5.5 **INTERIOR DESIGN**.

5-5.1 **Floors**. Comply with requirements of applicable codes. Floor slabs shall be concrete slab on grade construction with a 225 mm high by 150 mm wide concrete curbs all around with the exception of the Observation Tower. For the Observation Tower see the enclosed concept drawing. Floor finish materials shall be as specified in functional and area

requirements listed in Chapter 2 of the Statement of Work.

5-5.2 **Interior Walls and Partitions**. Comply with requirements of applicable codes. Non-combustible construction is preferable, even where combustible materials are allowed by code. Wall finish materials shall be as specified in functional and area requirements listed in Chapter 2 of the Statement of Work.

Range Classroom – The office shall be constructed of standard drywall and metal or wood stud construction. The building shall have the manufacturers standard liner panels for the walls.
Ammo Breakdown Building – The ammo issue room shall have the standard metal building manufacturers liner panel. The “Gator” storage room shall have a one (1) hour fire rated wall separating it from the ammo issue room. The “Gator” storage room shall have the manufacturers liner panels plus a 1200mm high 20mm thick plywood wainscot on three sides to protect the walls from accidental damage when placing the “Gator” inside.
Field Latrine - The building shall have the manufacturers standard liner panel for the walls.

5-5.3 **Metal Support Systems**. Non-load bearing metal studs and furring shall comply with ASTM C 645; stud gauge shall be as required by height and loading, but shall not be less than 25 gauge. Maximum stud spacing: 406 mm on center. Provide galvanized finish.

5-5.4 **Ceilings**.

Observation Tower – Simple Saver System or approved equal.
Ammo Breakdown Building – Simple Saver System or approved equal.
Range Classroom Building – Simple Saver System or approved equal.
Field Latrine - Simple Saver System or approved equal.

5-5.5 **Casework**.

5-5.5.1 **Observation Tower**. Provide a worktable per the standard design manual with a high pressure decorative laminate finish, meeting NEMA LD3 standards. Horizontal laminate: nominal .050” thick; vertical laminate: nominal .028” thick.

5-5.5.2 **Ammo Breakdown Building**. Provide a worktable per the RETS Standard Design manual with a smooth finished working surface.

5-5.5.3 **Window Treatments**. Provide exterior side hinged metal shutters and wire mesh caging over the windows for security on the Range Classroom building.

5-6 **PHYSICAL SECURITY REQUIREMENTS.**

5-6.1 **Anti Terrorism / Force Protection.** No requirements.

TECHNICAL SPECIFICATIONS

GUIDE SPECIFICATIONS FOR THE DESIGN-BUILD CONSTRUCTION CONTRACTS:

Section 05500	Miscellaneous Metal
Section 06100	Rough Carpentry
Section 07416	Structural Standing Seam Metal Roof (SSSMR) System
Section 07600	Sheet Metalwork, General
Section 08110	Steel Doors And Frames
Section 08810	Glass And Glazing
Section 08520	Aluminum And Environmental Control Aluminum Windows
Section 08700	Builders' Hardware
Section 09250	Gypsum Wallboard
Section 09900	Painting General
Section 13120	Standard Metal Building Systems

SPECIFIC FEATURES:

Section 05500 – Miscellaneous Metals.

2.5 Pipe Guard Door Stop (Bollards)
Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53/A 53M, Type E or S, weight STD, black finish.
2.11 Floor grating shall be galvanized after fabrication.
2.14.1 Steel handrails shall be hot-dip galvanized.
2.26 Steel Stairs shall have grating treads. Steel stairs and accessories shall be galvanized.
2.31 WINDOW GUARDS, DIAMOND MESH TYPE
Diamond mesh window guards shall be constructed of woven steel wire or expanded metal frames with hot-rolled or cold-formed steel shapes. Expanded metal conforming to ASTM F 1267 shall be of 38 mm, No. 10 mesh, welded to 25 by 25 by 3 mm angle frame. Woven-wire panels shall be of 10 gauge, 38 mm mesh secured through weaving bar to 10 mm round or 25 mm channel frame. Corners of frames shall be mitered and welded or mortised and tenoned. One tamperproof hasp and padlock, with access from the interior, shall be provided for each butt used.

3.5 INSTALLATION OF PIPE GUARD DOOR STOPS (BOLLARDS)
Pipe guard door stops shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of pipe filled with, concrete specified in SECTION 03300A CAST-IN-PLACE STRUCTURAL CONCRETE

3.18 DIAMOND MESH WINDOW GUARDS Diamond mesh window guards shall be mounted on exterior of window frame with not less than two tamperproof hinged butts mounted on 25 by 300 by 3 mm jamb channel attached as indicated to 50 by 6 mm plate anchored to wood jamb with 6 mm lag bolt. One additional butt shall be provided for each 900 mm internal length of guard over 1500 mm. Hasp and padlock shall be installed on the jamb opposite to that hinged.

Section 06100 – Rough Carpentry.

2.3 Insulation, thermal resistance for roof insulation shall be R-30.
2.3.1.2 Glass fiber batts and rolls shall have a10 mil thick, white, puncture resistant woven-glass cloth with vinyl facing on one side.

Section 0714 – Structural Standing Seam Metal (SSSMR)

2.7 Insulation

Use a dual layer of full thickness batt insulation R-30 with a vapor barrier applied below the purlins, like the Simple Saver Insulation for Pre-Engineered Metal Buildings as manufactured by Thermal Design, Inc., 600 N. Main St., Madison, NE. 68748, (800) 255-776, www.thermaldesign.com or approved equal.

Section 07600 – Sheet Metalwork, General.

See Standard Metal Building Systems – Section 13120

Section 08110 – Steel Doors and Frames.

2.1 Doors and frames shall be factory fabricated in accordance with ANSI A250.8 and the additional requirements specified herein. Door grade shall be heavy duty (Grade II) unless otherwise indicated on the door and door frame schedules. Exterior doors and frames shall be designation A40 galvanized. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section 08700 BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type located as shown on the Door and Frame Schedule. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 1.2 mm (18 gauge) steel or 4.5 mm (7 gauge) diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory pre-drilled holes in door frames; adhesively applied silencers are not acceptable. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with A250.8 and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top edges closed flush and sealed against water penetration.

Section 08510 – Steel Windows.

See Standard Metal Building Systems, Section 13120

Section 08520 – Aluminum Windows.

See Standard Metal Building Systems, Section 13120

Exterior Windows. Provide aluminum windows complying with American Architectural

Manufacturers Association AAMA/NWWDA 101 / I.S. 2. Minimum performance class shall be Heavy Commercial (HC). Minimum wind load, and resulting design pressure and performance grade shall be determined in accordance with the International Building Code (IBC). Provide windows with laminated insulating glazing and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 45. Finish shall be Architectural Class I anodic coating or AAMA 2605 organic coating.

Section 08700 – Builders' Hardware.

Exterior Door Finish Hardware.

2.3 Hinges. ANSI/BHMA A156.1; template, full mortise, heavy duty, ball bearing, minimum size 4"½x 4 ½three pair per door, brass, non -removable pins. A1111

2.4 Locksets on Exterior Hollow Metal Doors. ANSI/BHMA A156.2; series 4000, Grade 1, brass, removable core. Use BEST brand hardware with 7 pin interchangeable cores.

2.5 Exit (Panic) Devices. ANSI/BHMA 156.3; heavy-duty touch-pad type, through-bolted mounting. Listed and labeled for panic protection based on UL 305.

2.8 Closing Devices. ANSI/BHMA A156.4; series C02000, Grade 1, hydraulic, factory-sized, adjustable to meet field conditions. Provide for all exterior doors as required by codes.

2.12 Architectural Door Trim.

2.12.1.2 Kick Plates. ANSI/BHMA A156.6; Stainless Steel. Provide at all doors with closers.

2.13 Auxiliary Hardware. ANSI/BHMA A156.16. Due to high wind conditions at Fort Riley, KS, provide a substantial door stop, such as an inverted "U" shaped pipe bollard for doors that open to the outside and are subject to wind damage. Provide wall mounted stops for all exterior doors that are subject to damage from contact with the concrete "wind walls". Provide other hardware as necessary for a complete installation.

2.14 Miscellaneous.

2.14.2 Metal Thresholds. Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping.

3.16 Thresholds. 3.1.6 Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of 300 mm. Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 19 mm thread engagement into the floor or anchoring device used.

Weather-stripping. ANSI/BHMA A156.22. Provide at all exterior doors.

Section 09250 – Gypsum Wallboard.

2.3.2 Fire-Rated Gypsum Wallboard.
Fire-rated gypsum board shall conform to ASTM C 36/C 36M, and shall be Type X or Type C as required, 1200 mm

Section 13120 – Standard Metal Building Systems.

All factory color finishes shall be a factory applied polyvinylidene fluoride, Kynar 500 finish.

2.3.5 Factory Insulated Panels.

Walls – R-19

2.3.6 Factory Color Finish.

Roof Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall be FSC0061 (Red/Brown). The exterior coating shall be a nominal 0.025 mm thickness consisting of a topcoat of not less than .018 mm dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm thickness. The interior color finish shall consist of a backer coat with a dry film thickness of 0.013 mm . The exterior color finish shall meet the test requirements specified as stated in the Standard Metal Building System Specification Section 13120.

Walls – FSC 0313 (Tan)

2.3.7 Accessories.

Roof – FSC0061 (Red/Brown)

Walls – FSC 0313 (Tan)

2.6 Gutters and Downspouts. – FSC0061 (Red/Brown)

2.7 Louvers. – FSC0061 (Red/Brown)

Louver Screen Provide a 1/2" removable expanded aluminum bird screen, Type III aluminum alloy to ISWA IWS 089.

Metal Louvers shall be fabricated of aluminum to the dimensions indicated and in accordance with the details shown in SMACNA-02. Blades shall be accurately fitted and firmly secured to the frame. The edges of the louver blades shall be drainable type, folded or beaded for rigidity and baffled to exclude driving rain. Louvers shall be provided with screens as indicated. Louvers shall have a factory applied finish of Kynar 500. No field painting of louvers shall be allowed. Finish color shall be as shown in the Exterior Finish and Color Schedule. Louvers shall bear the AMCA Certified Ratings Seal for air performance and water penetration ratings as described in AMCA 500. Louvers shall have a beginning point of water penetration of 0.0275 millimeters per square meter at a free area velocity of not less than 3.80 meters per second, with a maximum pressure drop of 25 Pa.

3.1 GENERAL REQUIREMENTS

GUTTERS AND DOWNSPOUTS Gutters and downspouts shall be designed and fabricated in conformance with SMACNA Arch. Manual, louvers shall be fabricated in conformance with SMACNA Arch. Manual and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing. 12.0 meter 9.6 meter 3.6 meter Gutters and downspouts shall be installed as indicated. Gutters shall be supported by cleats spaced not less than 915 mm apart. Downspouts shall be rigidly attached to the building.

Supports for downspouts shall be spaced according to manufacturer's recommendations.

PART B

GENERAL DESIGN REQUIREMENTS

CHAPTER 6

STRUCTURAL

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CHAPTER 6 STRUCTURAL DESIGN

CHAPTER 6 - STRUCTURAL DESIGN

6.1 **GENERAL** The structural criteria established herein shall be used for structural loading, design and installation of all structural systems and foundations, including manufacturing, erection, supervision, testing, and quality assurance of the completed installation of the buildings. All structural calculations shall be checked and initialed as such by a registered engineer other than the original design engineer. Construction Documents (drawings and specifications) shall be sealed and signed by a Professional Engineer registered and licensed to perform work in the jurisdiction.

6.2 **STRUCTURAL WORK**. The structural design shall fully comply with the provisions provided in the Kansas City District Structural Design Controlling Criteria (SDCC), included in Appendix A, located at the end of this chapter. The SDCC shall control if criteria discrepancies are found to exist between the SDCC and any other criteria, including the RETC standard design. The RETC standard design shall be for conceptual use only; all structural design shall be based on actual design loads. The structures to be analyzed, designed and detailed include the following:

6.2.1 **Observation Tower**: A Observation Tower shall be located at all three ranges; Modified Record Firing Range, Combat Pistol Range and the 25-meter Firing Zero Range. The Observation Towers will be designed as shown in the RETC standard design. The Observation Towers as designed are to be changed to reflect characteristics as specified herein. The observation Tower located at the Modified Record Firing Range shall be a two-story structure with an observation deck at the first story. The Combat Pistol Range and the 25-meter Firing Zero Range shall be a one-story structure without an observation deck. See the architectural section of this report for the finish floor height requirements for each observation tower.

6.2.1.1 Structural System: The structural system shall include a structural steel columns and beams. X bracing shall be provided as shown in RETC standard. Additional X bracing shall be provided at the Control Room level. A roof diaphragm shall be provided for the Control Room. All exposed structural steel shall be galvanized or painted. The steel member sizes shall be based on actual design loads.

6.2.1.2 Foundation: The foundation shall consist of four concrete pedestals supported by spread footing located at each corner of the structure. The pedestals shall be tied to the adjacent corner pedestals with a grade beam. The footings shall meet the minimum frost penetration depth requirements per Kansas City District Structural Controlling Criteria. Refer to chapter 1 for allowable bearing pressures and other soils information.

6.2.2 **Ammo Breakdown Building**: An Ammo Breakdown Building shall be located at all three ranges; Modified Record Firing Range, Combat Pistol Range and the 25-meter Firing Zero Range. The Ammo Breakdown Building will be a pre-engineered/metal building as shown in the RETS standard design. The Ammo Breakdown Buildings as designed are to be changed to reflect characteristics as specified herein. The building located on the Modified Record Firing Range

and the Combat Pistol Range shall be sized according to the Concept Design drawings provided.

6.2.2.1 Structural System: The structure shall be a pre-engineered type metal building with a metal roof.

6.2.2.1 Foundation: Foundations system shall consist of continuous footings with isolated slab. The slab on grade shall be a reinforced slab having a minimum design thickness of 100-mm with the actual thickness based on design loads. The slab on grade shall be underlain by a 6-mil vapor barrier over 150-mm capillary water barrier over suitable material. The slab on grade shall have turndowns meeting the minimum frost penetration depth requirements. The footings shall meet the minimum depth requirements per Kansas City District Structural Controlling Criteria. The concrete pad in front of the entrance door shall have a turn down on the front of the pad to meet frost depth requirements and the side turndowns shall be a minimum of 305-mm below bottom of pad. Refer to chapter 1 for allowable bearing pressures and other soils information.

6.2.3 Covered Training Area (Bleachers): A Covered Training Area structure shall be located at all three ranges; Modified Record Firing Range, Combat Pistol Range and the 25-meter Firing Zero Range. The covered training area will be a pre-engineered /metal building canopy structure with an exterior back wall, used to shelter the bleachers. The structure shall be designed using the conceptual drawings provided.

6.2.3.1 Structural System: The structure shall be a pre-engineered/metal building that will consist primarily of a structural steel metal roof system with structural steel support columns. Provide redundant lateral load carrying system to resist all lateral design loads. All exposed structural steel shall be galvanized or painted

6.2.3.2 Foundation: Foundations system shall consist of pedestals at column locations with isolated slab. The slab on grade shall be a reinforced slab having a minimum design thickness of 100-mm with the actual thickness based on design loads. The slab on grades shall be underlain by a 6-mil vapor barrier over 150-mm capillary water barrier over suitable material. The pedestals shall meet the minimum frost penetration depth requirements per Kansas City District Structural Controlling Criteria. The edge of slap shall be over thicken to extend a minimum of 305-mm below the bottom of the slab for a minimum width of 200-mm. The floor slab transition into the thickened slab shall be no greater then 45-degrees. Refer to chapter 1 for allowable bearing pressures and other soils information.

6.2.4 **Classroom Range Building**: A classroom building shall be located at the Modified Record Firing Range and another classroom building shall be located at the Combat Pistol Range. The classroom buildings will be a pre-engineered/metal buildings as shown in the RETS standard design. The structures as designed are to be changed to reflect the additions of wind walls located at the entrances to the building.

6.2.4.1 Structural System: The pre-engineered/metal building will consist primarily of a structural steel metal roof system with structural steel support columns. A

redundant lateral load resisting system shall be provided to resist lateral design loads.

6.2.4.2 Foundation: The building foundation is to be constructed of reinforced, cast -in-place concrete. Isolated column footings and concrete pedestals of suitable size are required to resist the forces imparted upon them from the metal building. The floor of the building shall be designed as slab-on-grade. The slab-on-grade shall be a reinforced slab having a minimum thickness of 100-mm. All slabs-on-grade shall be underlain by a 6-mil vapor barrier over 150-mm capillary water barrier above suitable subgrade material. The design of the slab on grade shall be based on the actual design loads. The slab on grade shall have turndowns that meeting the minimum frost penetration depth requirements. The foundations shall meet the minimum depth requirements per Kansas City District Structural Controlling Criteria. Refer to chapter 1 for allowable bearing pressures and other soils information.

6.2.4.3 Wind Walls: Wind walls shall be constructed to provide protection from the wind as the entrance doors are utilized. The wind walls shall be reinforced concrete with a minimum thickness of 200-mm. Each wind wall shall consist of two panels that form an integral “L” shape as shown in the concept drawings provided.

6.2.5 Field Latrine: A Field Latrine shall be located at the Modified Record Firing Range and another latrine shall be located at the Combat Pistol Range. The Field Latrines will be a pre-engineered/metal building as shown in the conceptual drawings provided.

6.2.5.1 Structural System: The pre-engineered/metal building will consist primarily of a structural steel metal roof system with structural steel support columns.

6.2.5.2 Foundation: Foundations system shall consist of continuous footings with isolated slab. The slab on grade shall be a reinforced slab having a minimum design thickness of 100-mm with the actual thickness based on design loads. All slab-on-grade shall be underlain by a 6-mil vapor barrier over 150-mm capillary water barrier over suitable material. The footings shall meet the minimum depth requirements per Kansas City District Structural Controlling Criteria. Refer to Chapter 1 for allowable bearing pressures and other soils information.

6.2.5.3 Wind Walls: Wind walls shall be constructed to provide protection from the wind as the entrance doors are utilized. The wind walls shall be reinforced concrete with a minimum thickness of 200-mm. Each wind wall shall consist of two panels that form an integral “L” shape as shown in the concept drawings provided.

6.3 **DESIGN CRITERIA**. The structures shall be designed for self-weight of all buildings/structure components. The structures will also be designed for the following minimum live loads (other applicable dead and live loads per ASCE 7-98 shall also be accounted for). The following minimum loads are for all structures unless indicated otherwise.

6.3.1 **Floor Live Load Requirements**

Control Tower Floor	5 kPa
Control Tower Stairs and Platforms	5 kPa

6.3.2 **Roof Live Load Requirements**

Control Tower Roof	1 kPa

6.3.3 **Snow Load Requirements** (ASCE 7-98)

Ground Snow Load	0.96 Kpa
Exposure Category	C

6.3.4 **Wind Load Requirements** (ASCE 7-98)

Velocity	40 m/s
Exposure Category	C
Building Classification	
Control Tower	II
All structures (except Control Tower)	I

6.3.5 **Seismic Load Requirements** (per TI 809-04)

Site Classification	Class D
Use Group	I
Site Seismicity	S_s=0.20
	S_1=0.06

6.4 SERVICEABILITY CRITERIA

6.4.1 Deflections of structural members shall not be greater than allowed by the applicable material standard (ACI, AISC, etc.), or the limits set forth below. Deflection limits are needed to restrict damage to ceilings, partitions, and other fragile non-structural elements. Member deflections shall not exceed that permitted by TI 809-04 or MBMA Low Rise Building Systems Manual.

6.5 TECHNICAL SPECIFICATIONS

6.5.1 The DESIGNER will be required to provide a fully edited Corps of Engineers Guide Specification for all applicable structural components where a Corps of Engineers Guide Specification exists. If a Corps of Engineers Guide Specification does not exist for the component than the DESIGNER will be required to create the technical specification. All requirements contained in the RFP document must be incorporated into the edited specifications and/or drawings.

6.5.2 The following specifications shall be edited from the Corps of Engineers Guide Specification and provided (other Corps of Engineers Guide Specs may be required)

Section	Title
03100	Structural Concrete Formwork
03150	Expansion Joints, Contraction Joints, and Waterstops
03200	Concrete Reinforcement
03300	Cast in Place Structural Concrete (For Building Construction)
05090	Welding, Structural
05120	Structural Steel
05500	Miscellaneous Metals
07416	Structural Standing Seam Metal Roof (SSSMR) System
13120	Standard Metal Building Systems

Division 3

- Minimum Compressive Design Strength = 27.5 Mpa
- All Concrete shall be air entrained.
- Comply with design requirements of the American Concrete Institute "Building Code Requirements for Structural Concrete (ACI 318-99) and Commentary (ACI 318R-99)
- Reinforcing Steel: ASTM A615M Grade 420 Steel
- Welded Wire Fabric: ASTM A185
- Incorporate items from the Kansas City District Structural Design Guidance Controlling Criteria

Division 5

- Structural Steel, Shapes, Plates and Bars: ASTM A36M (minimum)
- Structural Tubing: ASTM A500, Grade B
- Steel Pipe: ASTM A53 Type s Grade B
- High Strength Bolts: ASTM A325M
- Anchor Bolts: ASTM A307
- Welds: E70XX per AWS
- Incorporate items from the Kansas City District Structural Design Guidance Controlling Criteria

Division 7

- Incorporate items from the Kansas City District Structural Design Guidance Controlling Criteria

Division 13

- Incorporate items from the Kansas City District Structural Design Guidance Controlling Criteria

6.6 **REFERENCES.** Refer to the Kansas City District Structural Design Controlling Criteria in Appendix A of chapter 6 for References.

Structural Design

Appendix A

APPENDIX A

KANSAS CITY DISTRICT STRUCTURAL DESIGN CONTROLLING CRITERIA (SDCC)

TABLE OF CONTENTS

1. GENERAL.

1.1 *Purpose and Scope*.
Design will be completed in accordance with the criteria and instruction documents furnished for this project. A structural controlling criteria listing is provided below, however, the design engineer shall be responsible for incorporation of all applicable information.

1.2 *Minimum Requirements*.
The criteria established herein will be used as the minimum standards for structural loading and design. If a local code, which also must be followed for design of the building, is more stringent for a particular criterion, the local code may be used as the minimum requirement for that criterion.

1.3 *Applicability*.
This structural design controlling criteria is applicable to all projects within the Kansas City District military jurisdiction, or as stated otherwise.

2. REFERENCES.

The following are referenced documents within this controlling criteria and does not constitute a complete list of required design reference material.
Note that US Army Corps of Engineers TI publications, Unified Facilities Guide Specifications (UFGS), and other select Corps of Engineers publications are available in electronic format via the TECHINFO internet site **http://www.hnd.usace.army.mil/techinfo/**.
Information on other US Army Corps of Engineers publications that are not available in electronic format can be found at **http://www.usace.army.mil/inet/usace-docs/**.

- U.S. Army Corps of Engineers Technical Instructions

UFC 3-310-01	Load Assumptions for Buildings (Jun 2000)
TI 809-02	Structural Design Criteria for Buildings (Sep 1999)
TI 809-04	Seismic Design For Buildings (Jan 1999)
TI 809-07	Design of Cold-Formed Load Bearing Steel Systems and Masonry Veneer/Steel Stud Walls (Nov 1998)
TI 809-29	Structural Considerations for Metal Roofing (Aug 1999)
TI 809-30	Metal Building Systems (Aug 1998)
TI 818-02	Design of Deep Foundations (Aug 1998)

- U.S. Army Technical Manuals/Air Force Manuals

TM 5-809-3/AFM 88-3, Ch.3/NAVFAC DM-2.9	Masonry Structural Design for uildings (Oct 1992)
TM 5-809-6/AFM 88-3, Ch.6	Structural Design Criteria for Structures Other than Buildings (Dec 1991)

TM 5-809-12/AFM 88-3, Ch.12	Concrete Floor Slabs on Grade Subjected to Heavy Loads (Aug 1987)
TM 5-818-1/AFM 88-3, Ch.7	Soils and Geology Procedures for Foundation Design of Buildings and Other Structures (Except Hydraulic Structures)(Oct 1983)
TM 5-822-5/AFM 88-7, Ch.1	Pavement Design for Roads, Streets, Walks and Open Storage Areas(Incl C1) (Jun 1992)

- Antiterrorism/ Force protection criteria

  Interim Department of Defense Antiterrorism/ Force Protection Construction Standards. (December 16, 1999)
  Department of Defense interim Antiterrorism/ Force Protection Construction Standards – Progressive collapse Design Guidance ()

- Unified Facilities Guide Specifications (UFGS)

UFGS 03300	Cast-In-Place Structural Concrete
UFGS 04200	Masonry
UFGS 07416	Structural Standing Seam Metal Roof (SSSMR) System
UFGS 07530	Elastomeric Roofing (EPDM)
UFGS 13120	Standard Metal Building Systems
UFGS 13121	Metal Building Systems (Minor Requirements)

- U.S. Army Corps of Engineers Design Guide

DG 1110-3-107	Design Guide for U.S. Army Reserve Facilities (Sep 1984)

- U.S. Army Corps of Engineers Engineer Regulations

ER 1110-345-700	Design Analysis, Drawings, and Specifications (May 1997)

- U.S. Army Corps of Engineers Engineer Manual

EM 1110-2-2502	Retaining and Flood Walls (Sep 1989)

- American Concrete Institute Building Code

ACI 318-99	Requirements for Structural Concrete and Commentary (ACI 318R-99)

- American Forest & Paper Association

ANSI/AF&PANDS-1997	“National Design Specification For Wood Construction”(1997 Edition)

- American Institute of Steel Construction

AISC	"Manual of Steel Construction –Allowable Stress Design" (Latest Edition)

AISC	"Manual of Steel Construction –Load & Resistance Factor Design" (Latest Edition)

- American Iron & Steel Institute

AISI	“Cold Formed Steel Design Manual” (Latest Edition) American Iron & Steel Institute

- American Society of Civil Engineers Standard

ASCE 7-98	ASCE Standard, Minimum Design Loads for Buildings and Other Structures

- Federal Emergency Management Agency

FEMA 302	NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures

- International Conference of Building Officials

UBC	”Uniform Building Code”(Latest Edition)
IBC	“International Building Code” (Latest Edition)

- National Concrete Masonry Association

TEK Publication 12-2	“The Structural Role of Joint Reinforcement in Concrete Masonry”.

- Steel Deck Institute

SDI	Steel Roof Deck Design Manual (Steel Deck Institute Publication, current edition)

- Steel Joist Institute

SJI	Standard Specification, Load Tables and Weight Tables

3. SELECTION OF STRUCTURAL SYSTEM.

3.1 *Overall*.

The overall structural system to be used will be based on the cost effectiveness of the system and will take into account both the superstructure and foundation. The comparison of competitive systems will also consider the cost factors related to the architectural, mechanical, electrical and other features that comprise the total building. The goals in the selection of a load resisting system are simplicity in the structural framing layout and symmetry in the structural system reaction to design loadings. The selections must consider the need for economy, function, and reliability. Structural systems selected must have deformation characteristics that are compatible with the architectural and other nonstructural building elements and features. Regular structure configuration, continuous and redundant load paths, and system ductility are attributes encouraged. These attributes are required of buildings constructed in high seismic areas.

3.2 *Coordination*.
The structural engineer shall coordinate with the architect at the inception of the design, and throughout, so that the structural system layout can be properly coordinated with the building architecture to provide the most effective and efficient overall plan.

3.3 *Minimum*.
The minimum structural system will be selected from TI 809-02 for wind loads and TI 809-04 for seismic loads. Conform to all applicable requirements, general and specific, found in TI 809-02 and TI 809-04 for the structural system selected.

4. LOADING CRITERIA.

4.1 *General Requirements*.

4.1.1 For dead and live loads use the latest version of ASCE 7, but no earlier than ASCE 7-98.

4.1.2 For snow and wind loads use the latest version of ASCE 7, but no earlier than ASCE 7-98, except as modified by UFC 3-310-01. Use Category [___] to determine the importance factors and use wind exposure [___].

4.1.3 For seismic design use TI 809-04. Use seismic group [___]. Use site class and site characteristic information as recommended in the geotechnical subsurface investigation report. Use the following spectral response coefficients for the locations listed below in Table 4-1. Otherwise, use the zip code for the project location and the USGS Zip Code earthquake ground motion hazard look-up page, which can be found on the internet world wide web address **http://geohazards.cr.usgs.gov/eq/**.

Table 4-1

Location	S_s	S_1
Ft. Leavenworth, KS	0.13	0.06
Ft. Riley, KS	0.20	0.06
McConnell AFB, KS	0.14	0.06
Ft. LeonardWood, MO	0.27	0.13
Whiteman AFB, MO	0.13	0.08

4.1.4 For combined loads use the latest version of ASCE 7, but no earlier than ASCE 7-98, and TI 809-04 for load combinations that include seismic loads.

4.2 *Specific Requirements*.

4.2.1 If wind loading on the main lateral force resisting system and/or the components and cladding members are greater than seismic loadings and thus are the controlling forces that are used for structural design, the structural seismic detailing requirements given in TI 809-04 must also be used. Both wind and seismic loading for components and cladding must be investigated to determine controlling forces regardless of controlling loads on the main force resisting system.

4.2.2 The tributary area "A" to be used in determining the exterior wind pressure coefficients for components and cladding shall be the actual loaded area of the structural element under consideration and not the entire area of the loading region in which the member resides. However, for rectangular tributary areas, the width need not be assumed to be less than 1/3 of the length of the area.

4.2.3 When determining the internal wind pressure coefficients for buildings, doors and windows shall be assumed opened or closed as required to produce the coefficients that will produce the greatest wind loadings, both inward and outward.

4.2.4 For roof slopes less than ½ inch per foot(1:24), include in the de sign snow load a rain-on-snow surcharge load of 5 psf (0.24 kPa).

4.2.5 When the design roof snow or snow plus rain-on-snow loading is less than 20 pounds per square foot (0.96 kPa), a roof live loading for construction and maintenance of 20 pounds per square foot (0.96 kPa)shall be used for design of the structure. The minimum roof live load of 20 psf (0.96 kPa)is used in lieu of and not in addition to the snow or rain plus snow loading.

4.2.6 The maximum net inward and outward loads used in the design shall be indicated on the Contract Drawings. The design engineer is responsible for calculating the wind loads based on the applicable paragraph Loading Criteria, Specific Requirements. However, in calculating component and cladding loading, whether or not the SSSMR is applied over a substrate, the smallest acceptable internal pressure coefficient shall be as defined in ASCE7-98. The component and cladding loads shall be calculated based on the tributary area of a clip; maximum tributary area of 10 square feet (1 square meter).

4.2.7 For loading on railings, use the latest edition of ASCE 7 (ASCE 7-98), except that the minimum load for one- and two-family dwellings shall be 50 lb/ft (0.29 kN/m).

4.2.8 For electrically driven cranes, a design check shall be made assuming the live loading on the crane is 2.75 times the rated loading. For this loading case, the allowable material stresses may be 90% of the yield stresses. In lieu of this design check, an electric limit switch may be used.

4.2.9 For electrically driven permanently installed cranes support use the impact percentages, horizontal force percentages, and fatigue requirements in the Manual of Steel Construction (AISC publication, current edition).

5. DESIGN CRITERIA.

5.1 *Foundations*.

5.1.1 Comply with the applicable recommendations in the geotechnical subsurface investigation report provided by CENWK-EC-GL.

5.1.2 Minimum footing depth for frost consideration shall be determined using TI 809-01, but not less than 3 feet (915mm). The bottom of all exterior footings shall also meet the recommendations in the geotechnical subsurface investigation report provided by CENWK-EC-

GL.

5.1.3 Where control joints are required in concrete foundation walls, they shall be located where control joints are required in CMU walls above the foundations. Control joints in concrete foundations are not required at all control joints in CMU.

5.1.4 In all concrete foundation walls that directly support CMU walls, provide one additional reinforcing bar longitudinally at the top of the concrete wall that is one size greater than the other longitudinal reinforcement. This added bar shall be continuous through all control and construction joints. In all concrete walls with vertical mats of reinforcing in each face, provide two additional bars at the top, one in each face.

5.1.5 When masonry veneer is used, the foundation stem wall shall be stepped to form a brick ledge at least 8 inches (200mm) lower than the finished floor.

5.1.6 Basement walls (walls mostly below grade that are supported laterally by diaphragms at or near the top and bottom) shall be designed using loadings based on at rest soil pressures. A design check of basement walls shall be made using submerged earth pressure, the free water surface at grade and surcharge loading if present. For this design check, the allowable stresses for the wall materials may be increased to be 90% of the yield stresses or for strength design, a overall load factor of 1.1 may be used.

5.1.7 Retaining walls subjected to hydraulic loadings such as flowing water, submergence, wave action, and spray, exposure to chemically contaminated atmosphere, and/or severe climatic conditions, shall be designed using EM 1110-2-2502. Earth retaining walls not subjected to the above mentioned conditions may be designed using TM 5-818-1. A design check of retaining walls shall be made using assumed submerged active earth pressures, free water pressures all around and surcharge loading if present. For this design check, factors of safety for overturning and sliding shall be at least 1.2 and the allowable stresses for all wall materials may be increased to be 90% of the yield stresses or for strength design, a overall load factor of 1.1 may be used.

5.1.8 For deep foundations, including concrete drilled pier foundations and, use TM 5-818-1, and TI 818-02.

5.1.9 Loading docks, if present shall be designed as retaining walls using at-rest soil values.

5.1.10 Structural stoops shall be provided at exterior doorways directly adjacent to exterior concrete slabs. Stoops should have foundations to frost depth and should be rigidly attached to foundation walls.

5.2 *Concrete*.

5.2.1 For concrete design, except for slabs on grade subjected to heavy loads, use TI 809-02, TI 809-04, and ACI 318-99 with the TI's controlling over ACI in cases of conflict. TI 809-04 controls over TI 809-02 in cases of conflict.

5.2.2 Do not use keys in horizontal and vertical concrete construction joints. Specify the use of joints roughened to 1/4 inch (6mm) amplitude per ACI 318.

5.2.3 For concrete floor slabs-on-grade subjected to heavy moving loads, use TM 5-809-12.

5.2.4 For concrete floor slabs-on-grade subjected to post/rack loads, use Designing Floor Slabs on Grade by Boyd C. Ringo and Robert B. Anderson, 1992, chapters 4 and 6 and "Slab Thickness Design for Industrial Concrete Floors on Grade" by Robert C. Packard, Portland Cement Association, 1976 with the latter controlling in cases of conflict.

5.2.5 For exterior concrete slabs-on-grade subject to heavy moving loads, use TM 5-822-5.

5.2.6 All walls or slabs greater than 9 inches (230mm) thick shall have two or more layers of reinforcing steel.

5.3 *Masonry*.

5.3.1 For masonry design (CMU and/or brick), use TM 5-809-3, and TI 809-04 with TI 809-04 controlling in case of conflict.

5.3.2 All masonry design will be reinforced masonry. These walls shall be designed as reinforced masonry assuming simply supported vertical spans between diaphragms.

5.3.3 If exterior walls have a CMU wythe available due to economic or architectural reasons, the CMU will be used as the vertical and main lateral force resisting systems in lieu of providing steel frames along these walls.

5.3.4 Brick veneer with steel stud backup exterior wall systems shall strictly adhere to the criteria and detailing requirements of TI 809-07.

5.3.5 In buildings with CMU structural and partition walls, all horizontal and vertical block layout dimensions shall be based on coursing using an 8 inch module when using IP units for design and a 200mm module when using hard metric design. This includes all dimensions for openings as well as the total wall.

5.3.6 Steel columns shall not be embedded over all or part of their height in CMU or concrete walls.

5.3.7 Single wythe CMU walls permanently exposed to weather shall be fully grouted.

5.3.8 The preferred method of construction of double wythe walls is that the wythes be brought up together. The specification, section 04200 shall be edited to prohibit the use of adjustable ties, to prohibit the construction of one wythe independent of the other, and to require that the wythes be brought up together.

5.3.9 For double wythe walls, the maximum cavity width shall be 3.5 inches (89 mm) for ladder type joint reinforcement at 16 inches (400 mm) vertical spacing. The maximum cavity width shall be 5 inches (127 mm) for joint reinforcement vertical spacing of 8 inches (200 mm). Reference National Concrete Masonry Association TEK Publication 12-2 “The Structural Role of Joint Reinforcement in Concrete Masonry”.

5.3.10 In structural reinforced load bearing CMU walls, vertical reinforcing bars shall be hooked into the top horizontal bond beam at the roof level with a standard ACI 90 degree hook for

resistance to roof uplift loads.

5.3.11 Structural CMU walls shall be placed in running bond pattern only. Stacked bond pattern for structural walls is not permitted.

5.3.12 The use of thin brick veneer is not permitted.

5.4 *Structural Steel*.

5.4.1 For structural steel design, use TI 809-04, TI 809-02, and the AISC Manual of Steel Construction, current edition, with the TI's controlling over AISC in cases of conflict. TI 809-04 controls over TI 809-02 in cases of conflict.

5.4.2 In buildings or other structures where the main vertical or lateral force resisting systems are structural steel, the main force member connections shall not be made by field welding; ie, there shall be no field welded moment connections, no field welded shear tabs, no field welded bracing connections, etc.

5.4.3 Structural steel columns or beams will not be given lateral support by the bottom chords or the bottom chords of extended open web or long span steel joists or joist girders.

5.4.4 In buildings where braced frames are used as all or part of the main lateral force resisting system, the stability of the structural system shall not depend on any single member or connection. Redundancy shall be provided either by using multiple bays of tension only X-bracing members or by using bracing members that are capable of both tension and compression if bracing is placed in a single bay. The lateral load resisting system shall comply with the redundancy requirements of TI 809-04.

5.5 *Metal Building Systems*.

5.5.1 Metal Building Systems. For metal building systems, previously referred to as pre-engineered metal buildings (PEMB), follow the guidance given in TI 809-30 and the criteria presented in UFGS 13120 and/or UFGS 13121 as applicable. The minimum size in plan of the building along with the required clear distance to the bottom of the structural steel should be shown on the contract plans along with any additional minimum clearance requirements. The minimum sizes of all foundation members, including thickness and reinforcing steel sizes and spacings, should be shown along with the minimum footing depth. The Contract Drawings shall show the vertical, horizontal, and moment loading used to compute the minimum footing sizes in a tabular form with the corresponding resultant footing sizes. The Contractor will be required by the specifications to provide the final design of the foundation, if the loading exceeds that shown on the drawings. All concrete floor slabs on grade will be designed using the applicable criteria contained in the section Design Criteria, Concrete above.

5.5.2 If the eave height of the metal building system exceeds 20 feet(6 meters), or the rigid frame span exceeds 60 feet(18 meters), or other considerations require, then hairpins shall not be used. Other methods, such as foundation tie beams or at-rest pressures acting on the foundation elements, shall be used to provide resistance to the horizontal loads acting at the base of the metal building system columns. Passive soil pressures will not be used to resist column thrusts unless sufficient supporting justification (including consideration of soil disturbance, moisture conditions, freezing and thawing, and deflection) is provided. Not more

than one-half the full passive soil pressure will be used to resist horizontal thrust from columns.

5.5.3 The metal building system shall be structurally isolated from other structures (e.g. masonry buildings or arms vaults) located therein.

5.5.4 To determine the minimum sizes of the foundation members, the loads of the metal building system columns shall be determined using the different loading combinations of the latest version of ASCE 7 and a suitable computer program. The resultant footing sizes shall be presented in tabular form in a footing schedule with the corresponding design loads on the contract drawings.

5.5.5 Where the metal building system will be used to support lateral loads from non-structural elements, such as the top of CMU firewalls, these loads shall be provided on the contract drawings.

5.5.6 The allowable methods for resisting lateral loads shall be cross-bracing, rigid frames, or wind columns. All braces used in roofs and walls to transfer or resist load, such as wind loads, seismic loads, and crane thrusts, shall be either standard hot rolled sections or rods. Adjustable rods must be permanently locked in place after final adjustment. Cable bracing is not permitted except for erection purposes.

5.5.7 The minimum required lateral force resisting system shall be shown on the roof framing plan, to include the minimum number and location of cross braced bays.

5.5.8 Provide a typical base plate detail on the drawings and edit the specifications to assure compliance with the following minimum base plate requirements:

- At least two anchor bolts are required for base plates with least dimension equal to or less than 12 inches (305mm) and at least four anchor bolts (one near each corner) are required when the least dimension of the base plate is greater than 12 inches (305mm).

- Show the minimum edge distances from the bolt centerline to the edge of the base plate.

- The base plate shall not bear on the slab-on-grade;

- The base plate shall be grouted with non-shrink grout.

- Show the minimum edge distance from the anchor bolts to the concrete pedestal face. Anchor bolts shall not be less than 3/4 inch (M20) in diameter and shall be confined by at least one #4 (#13) reinforcing bar.

5.5.9 When SSSMR is a component of a metal building system, the Unified Facilities Guide Specification (UFGS) section 07416 must be used and coordinated with CEGS section 13120 or 13121 as applicable.

5.6 *Steel Joists*.

5.6.1 For steel joist design, use Standard Specification, Load Tables and Weight Tables (Steel

Joist Institute, current edition).

5.6.2 Open web and long span steel joists are designed as laterally supported simple beams under vertical uniform gravity loading. For any other condition, the joist manufacturer must be required to provide the certified design of the joist. The building designer will provide the desired joist depth and spacing along with the required loading diagrams for both upward and downward loadings. The designer will require the manufacturer to select and certify the joist design for the loads specified on the drawings.

5.6.3 Open web steel joists used on sloping roofs or floors that exceed a slope of 1/2 inch vertical on 12 inches horizontal (1:24) shall be designed by the manufacturer for that slope. The design shall include the effects of axial loads that result from load components acting parallel to the slope.

5.6.4 The bottom chord of open web steel joists shall not be extended to supporting members except as specifically shown on manufacturer's shop or erection drawings.

5.6.5 The bottom chord of open web steel joists shall not be used to support suspended loads.

5.6.6 Field welding to the bottom chord of open web steel joist is not permitted, except as expressly permitted in writing by the joist manufacturer.

5.7 Decks, Diaphragms, and Light Gage Steel Members.

5.7.1 For the general requirements for the design and detailing of diaphragms use TI 809-04.

5.7.2 Diaphragms shall have continuous chord members on all edges and shall have direct positive connection for transferring shear load to all members of the main lateral force resisting system.

5.7.3 For steel roof and floor deck design, use Steel Roof Deck Design Manual (Steel Deck Institute Publication, current edition), TI 809-02 and TI 809-04 with TI's controlling the diaphragm design over SDI and TI 809-04 controlling over TI 809-02 in cases of conflict.

5.7.4 All screw connections for diaphragms shall be No. 12 or larger. Weld connections of steel deck shall use E60 electrodes.

5.7.5 For cold formed structural steel sheet members, strictly adhere to the design guidance provisions of TI 809-07.

5.8 *Wood*.

5.8.1 For wood design and construction, excluding plywood, use National Design Specification for Wood Construction and Design Values for Wood, TI 809-04, and TI 809-02 with the TI 809-02 controlling over NFPA and TI 809-04 controlling over TI 809-02 in cases of conflict.

5.8.2 For plywood properties and design criteria, use current American Plywood Association published brochures, TI 809-04 and TI 809-02 with the TI controlling for diaphragm flexibility determination along with minimum nailing requirements for diaphragms.

5.8.3 Fire-retardant treated wood shall not be used for structural applications. This includes, but is not limited to wood trusses, wood framing, and APA rated structural use panels (including plywood). Reference UFGS 06100 for additional information.

5.8.4 The use of Oriented Strand Board (OSB) for non-vertical applications is not permitted. For floor and roof sheathing, APA structural rated plywood sheathing only shall be used. Specifically, for floors, use as a minimum, 23/32 inch (18mm) thickness APA rated STURD-I-FLOOR, 24 inch (600mm) on center span rating, Exposure 1, Tongue and Groove, glued and nailed. In addition, all of the requirements of the APA “Code Plus Floor” shall be met. Ring- or screw-shank nails shall be used.

5.9 *Roofing*.

5.9.1 Metal Roofing. Metal roofing systems shall conform to the guidance in TI 809-29, with exceptions and revision contained herein.

5.9.1.1 Structural Standing Seam Metal Roof (SSSMR)System

5.9.1.1.1 Since there is a wide variety in roof system configurations, fastening systems, and accessories, excessive detailing of the roof system will be avoided. For conventionally engineered buildings, the designer will provide details to include all members below the hold-down clip, including subpurlins and their connections, attachment of wood blocking (if used), and restrictions on the use of thermal barriers or blocks as required.

5.9.1.1.2 For conventionally engineered buildings, TI 809-02 requires the design engineer to provide loading diagrams on the Contract Documents, including the dimensions of edge, eave, ridge and corner zones. Loads are to be calculated in accordance with ASCE 7 using a maximum tributary area of 10 square feet (1 square meter). The tributary is based on a maximum panel width and maximum clip spacing. All tributary areas of 10 square feet (1 square meter) or less have the same external pressure coefficient according to ASCE 7 and MBMA-01. The internal pressure coefficient for conventionally engineered buildings and Metal Building Systems shall be determined based on the combination of opened and closed doors and windows which produce the greatest wind loadings. The internal pressure coefficient shall be determined considering large openings, such as aircraft hanger doors, open, unless special provisions are made to assure the openings will be closed at the time of high winds. The minimum internal pressure coefficient per ASCE 7 for installations over open or solid substrates shall be used to account for air infiltration and leakage at the eaves. For Metal Building Systems, select the basic wind speed value from TI 809-01. The importance factor and exposure factors will be obtained from ASCE 7. Loading diagrams for metal buildings systems are required to be submitted with the shop drawings.

5.9.1.1.3 For conventionally engineered buildings both purlin and subpurlin design are the responsibility of the designer. The designer will incorporate the criteria in the specifications including the changes in the SPECIFICATIONS paragraph in the design of the framing members. Typical roof sections showing the purlins or subpurlins, including minimum gauge, minimum section properties, minimum connection requirements, bracing provisions for the flanges under both positive and negative bending, and maximum allowable purlin or subpurlin spacing shall be shown on the contract drawings.

5.9.1.1.4 For buildings utilizing a steel deck as a roof diaphragm, inverting the steel deck to

accommodate the subpurlins is not permitted.

5.9.1.1.5 Roof slopes less than 1½ inch on 12 (1:8) require mechanical seaming and the specifications must be revised to indicate this requirement.

5.9.1.1.6 When the SSSMR is a component of a metal building system, the UFGS section 07416 must be used and coordinated with UFGS section 13120 or 13121 as applicable.

5.9.1.2 Non-structural applications. A non-structural standing seam metal roof shall be applied over a solid substrate. The designer is responsible for the design of the substrate. Subpurlins are required if insulation is to be placed above the substrate and shall be shown on the Contract Drawings. Attachment of clips through rigid insulation to structure is prohibited. If the substrate is plywood, the design shall include a nailing pattern shown on the Contract Drawings. If the substrate is a metal deck, the deck must be designed for the full wind load in accordance with the provisions of Load Criteria, Specific Requirements. The metal deck shall be designed for concentrated loads and line loads in addition to the appropriate uniformly distributed load. Clips or subpurlins shall be attached through the metal deck to the structure below with bolts or screws. If the clips or subpurlins are attached to the metal deck alone, then bolts (not less than ¼ inch (6mm) diameter with locking washers and nuts), blind screw -type expandable fasteners (FAB-LOK fasteners as manufactured by Fabco Fastening Systems, or approved equal), or blind (pop) rivets (9/32 inch (7mm) diameter, BULB-TITE, as manufactured by Olympic Fastening Systems, Inc., or approved equal) must be used.

5.9.2 Elastomeric Roofing (EPDM)

5.9.2.1 EPDM roofing shall comply with the criteria UFGS 07530, ELASTOMERIC ROOFING (EPDM). Only the adhesive bonded system will be used. The ballasted system is not permitted. The adhesive bonded system will be used with the following additional requirements

5.9.2.2 Require the manufacturer to provide a standard warranty for 10 years.

5.9.2.3 According to the guide specifications, insulation under adhered membrane must be attached to the substrate with mechanical fasteners or steep (Type III) insulation. The guide specifications also require that on steel decks, or any slope exceeding 1/2 inch per foot, the first layer of insulation shall be mechanically fastened. For multiple layers of insulation, the preferred practice is to mechanically fasten the bottom board and then adhere the upper boards to lower boards with steep asphalt or an approved adhesive. Mechanical fasteners must be capable of resisting the uplift roof pressures shown on the contract drawings, with appropriate factors of safety for the fasteners and substrate provided. The minimum factor of safety for fasteners is three.

5.9.2.4 Require the roofing manufacturer to furnish a certified wind uplift test, Factory Mutual, I-90 rating, for the roofing assembly. An I-90 rating -presently the highest Factory Mutual rating - is given when a load of 90 psf is reached and maintained for 1 minute. The minimum factor of safety for this system is two. This means that the membrane is considered suitable to sustain a maximum design load of 45 psf with a safety factor of two. There will be many cases where the uplift pressures shown on the wind uplift load diagram on the contract drawings will exceed 45 psf at corners and edges. If the design uplift values exceed 45 psf for the adhesive bonded system, the shortcomings of this type of roofing system shall be reported to the customer. If the customer considers it reasonable to accept the risk of failure and will be responsible to repair the

damage as it occurs, then this roofing system may be used where design uplift exceeds 45 psf. If the customer decides that full resistance to design uplift above 45 psf must be provided, another roofing system shall be .

5.9.2.5 The contract drawings must include a wind uplift diagram based on criteria from TM 5-809-1/AFM 88-3, Chap. 1, for the entire roof, including the high pressure areas along the edges and corners. A load tributary area of 10 square feet or less should be used in determining wind load coefficients.

5.9.2.6 Special attention must be given to the shop approval and evaluation of material to assure that unacceptable materials and systems are not installed. The system shall comply in all respects with the roof assemblies as described in the Factory Mutual Approval Guide. This includes insulation type, fastener types and quantities, and adhesives.

5.9.3 Flat roofs shall have a secondary drainage system.

5.10 *Architectural, Mechanical, and Electrical Equipment*.

5.10.1 For anchorage and/or isolation requirements for architectural, mechanical and electrical elements, use TI 809-04.

5.10.2 For underground storage tanks, the anchorage slabs and tank restraints shall be designed assuming the tanks are empty and the free water surface is at the finished earth grade. The factor of safety of the gravity loads over the buoyant forces shall be at least 1.5.

5.11 *Special Structures and Conditions*.

5.11.1 For structures other than buildings, use TM 5-809-6.

5.11.2 For Arms Vaults, use DOD 5100.76-M, Chapter 3, except for Arms Vaults located in USARC projects use Design Guide 1110-3-107 dated Sep 84.

5.11.3 For Tornado Shelters, use TR-83, Wind-Resistant Design Concepts for Residences, Defense Civil Preparedness Agency, July 1975, including TR-83A, Interim Guidelines for Building Occupant Protection from Tornadoes and Extreme Winds. Also use Local Effects of Tornado-Generated Missiles, Anil K. Kar, Journal of the Structural Division, ASCE, ST5, May 1978.

5.11.4 The use of expansion bolt anchors for connections between the elements of the main lateral force resisting structural system is not permitted.

5.11.5 Rack storage design

5.11.5.1 The racks shall be designed in accordance with the latest version of the Uniform Building Code. The design and construction of the racks and rack components shall meet requirements to resist vertical and lateral seismic forces.

5.11.5.2 Minimum rack requirements for each different storage rack configuration shall be shown on the Contract Drawings. This includes the minimum post base plate size and the anchorage requirements. The A-E is responsible for assuring that the post load assumptions

made in designing the slab are not exceeded by the post loads of the actual rack configuration.

5.11.5.3 The specifications shall include the minimum acceptable material requirements, load capacity, factor of safety, and submittal requirements for each type of rack storage unit required.
1-1

6. DESIGN ANALYSIS.

The Design Analysis Structural Chapter shall be prepared in accordance with ER-1110-345-700 and shall include, as a minimum, the following:

6.1 Structural System. The structural system shall be selected from the approved systems listed in TI 809-02. A general description of the structural system for the building and/or truck loading docks including seismic considerations should be given with reasons for selection of the system used and including cost comparisons. Structural system examples include: (1) a building frame system with load bearing and shear walls and interior steel columns supporting steel girders and joists; (2) a moment resisting steel rigid frame system supporting steel beams and joists; (3) a moment resisting concrete frame system with reinforced concrete beams, columns and pan joists; (4) a bearing wall system with reinforced masonry exterior and interior vertical and lateral load bearing walls with steel joists spanning between walls and supporting a flexible steel deck diaphragm.

6.2 Roof and Floor System. General method of framing and type of deck including options. Cost comparisons shall be furnished to justify system selected. Address the type, span to depth ratios and classification of the diaphragm. Address features which impact the layout of the structural framing, such as standing seam metal roofing.

6.3 Walls and Partitions. Describe composition and general range of thicknesses, seismic design when used, method of providing lateral support for the partitions, and location of load bearing and shear walls.

6.4 Foundation System. Foundation design data or assumptions and description of type of foundation system to be used for the buildings and truck loading docks.

6.5 Design Loads. Roof and floor live loads, wind and seismic lateral loads, and unusual dead loads should be given. Truck loads for the design of the truck loading docks.

6.6 Design Data. A listing of material properties for all materials to be used in the project, including allowable soil properties (with source notation).

6.7 Unusual Design Features. Those which might be controversial should be clearly presented in such a manner that definite approval can be given.

6.8 Site Adaptation. When site adapting standard working drawings or designs used at other locations, the data required herein should be limited to design changes resulting from loading, climatic and soil conditions at the new site and/or updating for conformance to current criteria.

6.9 List criteria needed to complete final design.

6.10 Calculations done using computer programs or spreadsheets shall include sufficient documentation to verify input and output, accuracy of theory, and accuracy of computations.

7. CONTRACT DRAWINGS.

7.1 The drawings shall contain in the General Notes a list of the design loading criteria, a list of the strengths of the engineering materials used, the design soil values and any other data that would be pertinent to remodeling and/or future additions. Also, a description of the building structural system shall be given so that the construction contractor will know when the building is self supporting.

7.2 The detailing of structural steel framing, including connections, shall be complete. All weld types, weld sizes, bolting layouts, bolt sizes, connection plates and members sizes and locations and stiffener plates sizes and locations shall be shown. Elevations of steel frames used in the lateral load resisting system shall be shown on the contact drawings.

7.3 Elevations of all masonry walls showing all openings, lintels, bond beams, horizontal and vertical reinforcement and control joints shall be shown on the structural drawings, including horizontal and vertical dimensions of wall panels, openings, etc. Elevations shall indicate all portions of the masonry wall that are piers or columns as defined in TI 809-04, and indicate the required details. The minimum scale for masonry wall elevations shall be ¼" = 1' -0" (1:50 for metric jobs).

7.4 All members, elements and connections that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

7.5 Show locations of control joints for slab-on-grade floors. Show locations of brick expansion joints.

7.6 The required joist loading diagrams for both upward and downward loading, computed in accordance with the Loading Criteria General Requirements and Specific Requirements paragraphs, must be shown on the Contract Drawings.

7.7 See Section Design Criteria, Roofing in this appendix for standing seam metal roofing loading diagram requirements and minimum detailing requirements.

8. SPECIFICATIONS.

8.1 Proprietary materials, fabricated products or construction methods cannot be used. At least three manufacturers must be known before any product can be shown or specified.

8.2 Replace paragraph 1.2 Submittals, SD-02 Shop drawings given in the Corps of Engineer's Guide Specification (UFGS) Section 03200, Concrete Reinforcement, with the following:

> "Complete shop drawings shall be submitted. The shop drawings shall be prepared under the direct supervision of a licensed professional engineer. The shop drawings shall contain his seal and a statement certifying that they are in compliance with the specifications and contract drawings. The shop drawing shall include details of the bending and placing schedule of the steel reinforcement, together with bar schedules indicating the number, size, dimensions, and total length of various bars required. Bar lists

and bending diagrams shall be checked for accuracy and completeness before the bars are fabricated. Details of typical supports for reinforcing steel shall be approved prior to placing any concrete. Shop drawings shall show all concrete dimensions, location of all reinforcement, elevations, reinforcing steel clearances, and the location of all construction joints shown on the drawings or proposed by the Contractor. The drawings shall show support details including types, sizes and spacing. Spacing between vertical reinforcing steel shall be shown on the wall elevations. The minimum scale used in the shop drawings shall be 3/8-inch to the foot (1:50). Reinforcement bending details shall conform to the requirements of ACI SP-66."

8.3 Concrete for buildings shall comply with the UFGS-03300 including changes through Notice 3 (February 1999) with the exception of subparagraph 1.3.4 Slump and paragraphs 1.4 PROPORTIONS OF MIX, 2.1 ADMIXTURES, 2.2 CEMENTITIOUS MATERIAL, 2.3 AGGREGATE, 3.3 BATCHING, MIXING AND TRANSPORTING CONCRETE, and 3.4 SAMPLING AND TESTING. Specific information for these paragraphs shall be obtained from CENWK-EC-GL for incorporation into the CEGS-03300 format. A Government mix design is required for the concrete used in all projects. Any project specific requirements which would necessitate changes in the mix design, examples of which include, but are not limited to drilled piers, industrial and other special application floor slabs, multicubical munition structures, and high strength concrete applications, shall be discussed with CENWK-EC-GL. It is the designer's responsibility to bring the need for required changes in the mix design to the attention of both CENWK-EC-GL and CENWK-EC-DS. The results of these discussions, including any deviations from the preceding requirements shall be documented and included in the design analysis.

8.4 Masonry shall comply with current version of UFGS-04200, but dated no earlier than July 1992 including changes through Notice 12 (Jun 1999). This specification includes mortar proportion requirements to reduce efflorescence. The specification, section 04200 shall be edited to prohibit the use of adjustable ties, to prohibit the construction of one wythe independent of the other, and to require that the wythes be brought up together in all seismic zones.

8.5 The standing seam roofing system shall comply with the current version of CEGS section 07416, but dated no earlier than October 1998 including changes through Notice 2 (Sep 1999), with the exceptions noted below. Earlier versions of the specification are not to be used, if the version of the specification you are editing does not match this number, notify CENWK.

8.5.1 Add the subparagraph 1.2.4 Manufacturer's Representative to read "A representative of the SSSMR manufacturer, who is familiar with the design of the roof system supplied and experienced in the erection of roof systems similar in size to the one required under this contract, shall be present at the job site during installation of the SSSMR to assure that the roof system meets specified requirements. The manufacturer's representative shall be either an employee of the manufacturer with at least two years experience in installing the roof system or an employee of an independent installer that is certified by the SSSMR manufacturer to have two years of experience in installing similar roof systems."

8.5.3 Revise first sentence in subparagraph 1.3.5 Wind Loads to read, "The design uplift pressures for the roof system shall be [as indicated on the contract drawings.] [computed and applied using a basic wind speed of _____ miles per hour (fastest mile), and importance factor of _____, and exposure factor of _____, an internal pressure coefficient of _____, and a

tributary area of 10 square feet.]."
The uplift pressures shall be computed by the design engineer and shown on the drawings for conventional designed structures. For metal building systems, the manufacturer must compute the uplift pressures using the parameters provided by the design engineer.

8.5.4 Change the subparagraph 1.3.7 Framing Members Supporting the SSSMR System to read, "[Structural cold-formed steel framing members and their connections, including minimum required connection capacity shall be as shown on the contract drawings.] [Structural cold-formed steel framing members and their connections shall be designed in accordance with AISI SG-673. Maximum deflections under applied dead and live load and/or wind load for subpurlins shall not exceed 1/180 times the span length and shall be based on constraint conditions at the supports. Subpurlins shall be designed to span from structural member to structural member. Attachment to a metal deck, if present, is permitted for lateral stability only. Subpurlins must be adequately braced for both positive and negative bending. Subpurlins are required at all clip locations in installations above a metal deck. Attaching clips through rigid insulation to structure is prohibited.]"

8.5.5 From the subparagraph 1.3.8 Roof Panels Design, revise next to last sentence to read "Deflections shall be based on panels being continuous across three or more supports, fastener spacing, and the ability of the panel to rotate freely on the support."

8.5.6 Add the following to the end of subparagraph 1.3.9 Accessories and Their Fasteners, "The design uplift force for the accessory connections and the factors of safety, shall be as required in subparagraph 1.3.5 Wind Loads."

8.5.7 Add paragraph 1.4.1 to read as follows:
"1.4.1 Concealed Anchor Clip Connection to Building Structure
The tested capacity of fasteners used to connect the concealed anchor clips to [subpurlins] [structural purlins] [metal roof deck] [plywood sheathing] shall be determined from tests supplied by the fastener manufacturer or an independent testing laboratory. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation. The maximum uplift loading used in the test shall be the design uplift force multiplied by the factor of safety. The design uplift force and the factors of safety shall be as required in subparagraph 1.3.5 Wind Loads."

8.5.8 Add paragraph 1.4.2 to read as follows:
"[1.4.2 Subpurlin Connection to Building Structure
The tested capacity of fasteners used to connect the subpurlins [to structural purlins] [through metal roof deck to building structure] [to plywood sheathing] shall be determined from tests supplied by the fastener manufacturer or an independent testing laboratory. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation. The maximum uplift loading used in the test shall be the design uplift force [given on the drawings for the roof area under consideration] multiplied by the factor of safety. The factors of safety [and the design uplift force] shall be as required in subparagraph 1.3.5 Wind Loads.]"

8.5.9 Change sub paragraph SD-03 ProductData to read,
"Design Analysis; [_____].

Design analysis signed by a Registered Professional Engineer, and submitted for approval prior to beginning of manufacture. The design analysis shall include, but not be limited to the following information:

a. A list of the design loads.

b. Thermal movements that will result from the specified temperature range. The calculations shall be accompanied by details from the manufacturer that demonstrate how installed concealed anchor clips and other roof system devices will accommodate the required thermal movement.

c. Concentrated load and roof live load analysis.

[d. Subpurlin catalog cuts, section property information and sketches to indicate that the subpurlin geometry has been coordinated with the metal deck configuration and that the subpurlins will nest properly in the metal deck flutes.]

****

NOTE: The following submittal requirements apply to metal building systems only.

****

[d. Complete calculations of the support system [,including purlins and/or subpurlins designed in accordance with subparagraph: Framing Members].]

[e. Wind forces on various parts of the roof. Both positive and negative pressures shall be calculated based on the criteria in subparagraph: Design Conditions and parameters in subparagraph: Wind Uplift Loads. The resultant wind uplift forces and dimensions of the edge and corner zones will be shown on an isometric view of the roof.]"

8.5.10 Add the following to the end of paragraph SD-04, Drawings to the end of the paragraph: "The shop drawings shall also include the SSSMR component details that resulted from the design calculations and the wind uplift testing required herein. The shop drawings also shall show the locations and configuration of any thermal spacer blocks or barriers. Subpurlin layouts shall be shown [and the spacing must be coordinated with the metal deck configuration, lap locations, and sidelap configurations]."

8.5.11 Add the following items to the end of paragraph SD-06 Reports to read,

i. Fastener Test Report (Additional Requirement)- Manufacturer's test report or independent test laboratory report. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation.

j. Panel Finish Color (Additional Requirement)- Test results shall be submitted for all roofing panels showing the results of testing in accordance with the color finish tests specified in paragraphs 2.6.1 through 2.6.8.

8.5.12 Change paragraph SD-04 Samples to include submittal of external clamps or clips used by the manufacturer to increase the load capacity of the roof system. This paragraph must be coordinated with the user of the facility to assure that there is no architectural requirement to limit the use of external clamps.

> "External attachments; [_____].
>
> External attachment- two samples of every type of permanent external attachment either, clips or clamps, used in the tested system to increase the rated capacity of the roofing system."

8.5.13 Revise the second sentence of subparagraph 2.1.1 Steel Panels to read, "Uncoated panels shall be 0.024-inch (0.61 mm) thick minimum, except that areas of the roof subject to design wind uplift pressures of 60 psf (2.87 kPa) or greater shall have a minimum panel thickness of 0.030-inch (0.76 mm)."

8.5.14 Add the following to the end of subparagraph 2.3 ACCESSORIES "Thermal spacer blocks and other thermal barriers shall be submitted for approval."

8.5.15 Change the first sentence of subparagraph 2.4.1 Screws to read, "Screws for attaching anchor devices shall be not less than No. 14 self-tapping type and not less than No. 12 if self-drilling and self-tapping type."

8.5.16 Replace the first sentence of 2.5 SUBPURLINS to read, " Cold formed subpurlins [, when required by the system design,] shall be formed from steel sheet as standard with the manufacturer. The uncoated thickness [shall be as shown on the contract drawings. The subpurlins shall meet the minimum properties shown on the contract drawings [, with the flange configuration designed and coordinated to nest properly in the flutes of the metal deck.]] [may be a minimum of 0.059-inches (1.50 mm) if bolts or structural blind fasteners are used for attachment of the concealed anchor clips to the subpurlins and attachment of the subpurlins to the structure. If screws are used for either attachment, then the minimum uncoated thickness of the subpurlin shall be 0.074-inches (1.85 mm).] Cold formed subpurlins shall have a minimum tensile yield strength of 50,000 psi (345 MPa)."

8.5.17 Add to end of subparagraph 3.1.2 Subpurlins "Closer spacing may be required by the roofing manufacturer to meet the roof uplift loads [shown on the contract drawings] [calculated and submitted with the shop drawings.]"

8.5.18 Replace the first sentence of subparagraph 3.1.4 Concealed Anchor Clips to read, "Roof panels shall be fastened to framing members with concealed fastening clips or other concealed devices. Clips shall be attached directly to the building structural system or to the subpurlins with bolts or screws."

8.5.19 Add to the end of subparagraph 3.1.4 Concealed Anchor Clips to read, "Closer spacing may be required by the roofing manufacturer to meet the roof uplift pressures [shown on the contract drawings] [calculated and submitted with the shop drawings.] Attachment of clips through rigid insulation to structure is prohibited."

8.5.20 Add the following to the end of subparagraph 3.2.1 Board Insulation with Blanket Insulation and to subparagraph Blanket Insulation 3.2.2, “Thermal blocks shall not be placed in between the concealed anchor clips and the subpurlins or supporting structure.”

--End--

PART B

GENERAL DESIGN REQUIREMENTS

CHAPTER 7

MECHANICAL

CHAPTER 7

MECHANICAL SYSTEMS

GENERAL DESIGN REQUIREMENTS

NOTE: Any reference made to the “standard design” document in this chapter is referring to the U.S. Army Corps of Engineers Design Manual for Remote Target System (RETS) Ranges.

7-1 **SCOPE.** The Project shall consists of three ranges i.e., Modified Record Range, Pistol Range & Zero Range. Buildings in each range are as follows:

Modified Record Range:	Tower, Classroom, Latrines and Ammo
Pistol Range:	Tower, Classroom, Latrines and Ammo
Zero Range:	Tower and Ammo

(Note: The towers of the Pistol & Zero Ranges are one level shorter than the tower of Modified Range.)

7-2 **DESIGN CRITERIA**

Room	**Outdoor Temp**		**Indoor Temp**	
	Winter Degrees C	**Summer Degrees C**	**Winter Degrees C**	**Summer Degrees C**
Tower	16	37 db, 24 wb	10	26
Classroom	16	37 db, 24 wb	16	30
Ammo	16	37 db, 24 wb	10	32
Latrine	16	37 db, 24 wb	10	32
Vault	N/A	N/A	N/A	N/A

Room	**Vent/Exhaust**	**Remarks**
Tower	2 people	2 units at a minimum 3 tons each
Classroom	20 air changes per hour	20 ACH summer; 6 ACH winter
Ammo	6 air changes per hour	No A/C required
Latrine	2.0 cfm per square foot	No A/C required
Vault	Vault exhaust at 120% of supply	Min ½hp air compressor for aeration Vault closet shall be stainless steel designed to fit through a six inch concrete slab

7-3 **ASHRAE Standard 62 Ventilation Requirements**

Ventilation for the instructional buildings, control towers, ammo buildings, and latrines including the vault portion of the latrine shall ensure proper ventilation rates. The classrooms shall not be occupied in excess of 3 hours at a time so a reduction for intermittent occupancy will be allowed.

7-4 **Propane Gas Systems**

Propane gas shall be used to heat the instructional buildings and latrine. The propane tank will be a minimum 500-gallon capacity.

Classroom

The classroom shall have a propane fired forced air heater. Make-up air to the heater shall be zero (0) percent. Note: 6 ACH shall be used for ventilation when required based on number of occupants.

7-5 **Heat Pumps**

Heat Pumps will be used to heat the towers.

7-6 **Infrared Heat**

Infrared heat will be used to heat the towers and latrines. The infrared heat for the towers will be used as supplemental heat to a heat pump, which serve as the primary heat. The infrared heater for the tower and the latrines will be electric.

7-7 **Electric heater**

Provide an electric heater to heat the ammo building of each range.

7-8 **Ventilation**

Classroom

The instructional buildings will be provided with two modulating intake louvers approximately one foot from the ground level. These intake louvers will be located on one side of the room and two roof mounted exhaust fans will be on the opposite end of the room. Both summer and winter exhaust fans shall operate at such a noise level to produce no more than 25 NC. Maximum RPM of both exhaust fans shall be 1000 and the maximum sones shall be 8. The intake air will be unheated. In addition, both intake louvers will be interlocked with their summer and winter exhaust fan as described below.

There shall be two separate exhaust fans: one for summer operation and one for winter operation. The exhaust fan for summer operation shall be thermostatically controlled and interlocked with the wide-open position of the two modulating intake louvers. The exhaust fan for winter operation shall be interlocked with the minimum position of the two modulating intake louvers. The winter exhaust fan shall operate only when a wall mounted switch is engaged. The minimum position of the intake louver shall be sized for six air changes per hour and the wide-open position shall be sized for 20 air changes per hour.

Tower

Ventilation air will be provided through the heat pump, which will serve the tower.

Ammo
Natural ventilation will be provided through louvers, which will be located approximately one foot from the ground.

Latrine
There is a holding tank directing below the latrines to gather the waste. Twenty (20) per cent of the vault exhaust shall originate from the latrine above to provide a negative pressure of the vault with respect to the latrine.There will be a separate exhaust fan for the men's latrine, the women's latrine, and the vault below both latrines. The air compressor room for the vault will be provided with natural ventilation to maintain a 27 degree C space temperature. Reference "miscellaneous items" below for air compressor room.

7-9 Air Conditioning

Tower
The tower will be served by two separate 50 % heat pumps.

7-10 Miscellaneous Items

The stainless steel vault closet will be aerated through a minimum ½hp air compressor located above the vault in a separate closet. In the aerated vault, the water level must be maintained at least 150 millimeters (6 inches) above the aerators. The size of the vault shall be a minimum 2500-gallon capacity. A six inch diameter vent pipe shall extend from the holding tank to a PRV exhaust fan. The holding tank exhaust fan shall be a minimum 1/20 hp.

7-11 Plumbing

There is no water available on site. Latrines will be heated only, ventilated, and aerated as stated above. Toilets shall be capable of supporting 300 lbs.

7-12 TECHNICAL SPECIFICATIONS

Section	Title
13290	Aerated Vault Toilet
15250	Thermal Insulation for Mechanical Systems
15566	Warm-Air-Heating Systems
15563	Air-Conditioning Systems

7-13 REFERENCES.

The mechanical design for all facilities shall be in accordance with the following:

a. TM 5-810-1, Mechanical Design: Heating, Ventilating, and Air-Conditioning

b. ASHRAE Handbook, Fundamentals

c. ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

d. CEGS13290, Aerated Vault Toilet (used for ranges that have no water available)

e. CEGS 15250, Thermal Insulation for Mechanical Systems

f. CEGS 15566, Warm-Air-Heating Systems

g. CEGS 15563, Air-Conditioning Systems

h. MIL-HDBK- 1008 C, Fire Protection For Facilities

I. HQUSACE Architectural and Engineering Instructions - Design Criteria

j. 13A Installation Information Infrastructure Implementation Guide Version 2

k. Standard design criteria, CEHNC 1110-1-23

L. Air Conditioning and Refrigeration Institute (ARI) Standards

m. American National Standards Institute, Inc. (ANSI) Standards

n. American Society of Mechanical Engineers (ASME) Codes

o. Architectural and Engineering Instructions (AEI)

p. Life Safety Code

q. Manufacturers Standardization Society of the Valve and fitting Industry, Inc. (MSS) Standards.

r. National Fire Protection Association (NFPA) Codes

s. National Standard Plumbing Code, latest edition

t. TM 5-809-10, Chapter 13, Seismic Design for Buildings

u. TM 5-810-4, Noise Control for Mechanical Equipment

v. TM 5-810-5, Plumbing

w. TM 5-810-6, Non-industrial Gas Piping Systems

x. Sheet Metal & Air-Conditioning Contractors National Association (SMACNA) Standards

y. Uniform Building Code, latest edition

PART B

GENERAL DESIGN REQUIREMENTS

CHAPTER 8

ELECTRICAL

CHAPTER 8

ELECTRICAL

GENERAL DESIGN REQUIREMENTS

NOTE: Any reference made to the “standard design” document in this chapter is referring to the U.S. Army Corps of Engineers Design Manual for Remoted Target System (RETS) Ranges.

8-1 **DESIGN CALCULATIONS**. Provide calculations for the following:

8-1.1 Interior lighting. Provide calculations for each room or area.

8-1.2 Exterior lighting. Provide calculation for area.

8-1.3 Load Analysis for each building to include connected and estimated demand. Separate loads by categories such as lighting, receptacles, HVAC, special equipment, etc.

8-1.4 Voltage drop – Provide calculations to verify voltage drops. Do not exceed limits as given in the National Electric code (NEC).

8-1.5 Coordination – provide data to verify proper protection and coordination is provided for the equipment/system(s).

8-1.6 PA system. Design and size the PA system components.

8-1.7 Range Power Cables. Provide calculations to verify voltage drops.

8-2 **MATERIALS AND EQUIPMENT**. All materials and equipment shall be the standard catalogued products of manufacturers regularly engaged in the production of such equipment and material, and shall be the manufacturer’s latest design. All equipment and material shall conform to the requirements of American National Standards Institute (ANSI), American Society of Testing and Materials (ASTM), National Electrical Manufacturer’s Association (NEMA), National Fire Protection Association (NFPA) or other national trade association as applicable. Where standards exist, materials and equipment shall bear the label and be listed by Underwriters Laboratories, Inc. (UL) or other recognized testing organization.

8-2.1 Space requirements. Electrical space shall be provided for all electrical equipment. Space shall provide clearances and working areas as required by codes. Coordinate location to consider factors such as ease of maintenance, vicinity to loads being served and accessibility.

8-2.2 Wiring. Shall be copper and shall be run in conduit unless otherwise indicated. Use solid copper wire for sizes No. 8 AWG and smaller diameter, and Class B, stranded copper wire for sizes No. 6 AWG and larger diameter.

8-2.3 Motors. Motors shall be high energy efficient type. Motors 1/2 horse power and larger shall be 208 volt. Motors smaller than 1/2 horsepower shall be 120 volt. Motor starters for mechanical and special equipment will be furnished as an integral part of the mechanical or special systems.

8-2.3.1 Motor Efficiencies. Minimum motor efficiencies shall be either Energy Star or in accordance with DOE Buying Energy Efficient Products Recommendations (refer to www.eren.doe.gov/femp/procurement for recommended efficiencies). Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

8-3 SITE ELECTRICAL

8-3.1 Power Distribution. Power distribution to the facilities shall originate from existing overhead distribution system and be routed underground to each of the facility as indicated on sheet C10.1 and described in the specific requirements chapters for each range.

8-4 LIGHTING.

8-4.1 Interior. Lighting shall conform to Illumination Engineering Society (IES) recommended levels and in general shall be energy efficient T-8 fluorescent lamps with electronic ballast. Lighting in occupied areas shall be color corrected with a Color Rendering Index (CRI) of 85 or better. All lighting control for fixtures with clear lenses shall be by key switch. Control for fixtures with red lenses shall be by wall switch. Light fixture types indicated are described in the standard design.

Room	Fixture Type	Illum Stand. Type	Illum Level Clear	Illum Level Red
Observation Tower	Industrial Fluorescent, Industrial Fluorescent with red lens	Type A	320 Lux	10 Lux
Observation Tower Exterior	Incandescent with red lens	Type D	N/A	*
Classrooms	Industrial Fluorescent, Industrial Fluorescent with red lens	Type A	320 Lux	10 Lux
Ammo Breakdown Building	Incandescent with clear lens (Ammuniton Breakdown Portion Only) Incandescent with red lens-Qty 2 (Ammunition Breakdown Portion Only)	Type B	320 Lux	10 Lux
Field Latrines	Incandescent with clear lens Red Lenses Incandescent (Qty 2)	Type B	215 Lux	10 Lux

* Provide one fixture at the base, each landing, and the top level of the observation tower.

8-4.2 Exterior. In addition, exterior incandescent light fixtures (Type D) with a red lens shall be located on the exterior of each building as indicated on the architectural elevations.

8-4.3 Emergency Lighting. Emergency lighting shall be as required by the standard design and NFPA 101.

8-4.4 Flood lights. Lighting for the range consists of two quartz flood lights and two red lens fixtures mounted on wood poles and the observation tower. Fixture types,

wattages, and mounting shall be per the standard design with the exception that the red lens floodlights shall be 500 watts each. The illumination level for the quartz flood lights shall be 110 lux at the firing positions. Fixtures shall be controlled by light switches mounted in the observation tower. Light switch for quartz lights shall be the key type. Flood lights shall be installed behind the firing lines for all three ranges.

8-4.5 Range Limit Sign Lighting. Each range has two Range Limit Signs that will require illumination. Circuit for lighting shall originate in the observation tower panelboard. Circuit shall be in conduit from tower panel to grade. Circuit shall be direct buried from this point to the signs. See the specific civil narrative for each range for the location of the signs and lighting detail on sheet C6.2 Lighting control shall be located in the observation tower.

8-4.6 Flag poles at the Modified and Combat Pistol Ranges will require illumination with L-810 obstruction lights as indicated on sheet C10.1. Lighting control shall be located in the observation tower.

8-4.7 All lighting control located in the observation tower shall be grouped together and clearly labeled.

8-5 **RECEPTACLES** Convenience receptacles shall be 120V, 20 amps. The spacing shall be in accordance with the standard design but shall meet the following minimum requirements.

A. Observation Tower Four convenience outlets (one on each wall) plus to 20 amp receptacles on dedicated circuits for targetry computers.
B. Classroom Provide receptacle every 3 meters
C. Classroom Office one on each wall
D. Field latrines Receptacles shall be GFCI.

8-6 **TELECOMMUNICATIONS**. Define general requirements by reference to the I3A and EIA/TIA standards. Cable and jacks shall be Category 5E per EIA/TIA 568A, Commercial Building Telecommunications Cabling Standard. Provide wiring from outlet jack to termination on type 110 block.

8-6.1 Telecommunication outlet locations. Tower shall be supported with one duplex telecommunication outlet inside the cab and a telephone mounted in a weather tight enclosure at the base of the tower. The exact location to be coordinated with user during final design. The classroom shall have a simplex computer outlet and the office shall have one duplex telecommunication outlet. Locations to be coordinated with the user during final design.

8-7 **PUBLIC ADDRESS SYSTEM.** PA system (paging only) shall be provided at each range. The system shall consist of a desk type mixer-amplifier located in the tower. Microphone shall also be desk type. Horn speakers shall be outdoor weatherproof type tapped at 3.8 - 15 watts. Each flood light pole shall be equipped with two horn speakers. Two additional speakers shall be located on the tower. Installation details on mounting are included in the standard design documents.

8-8 **PADMOUNTED TRANSFORMERS.** Transformers shall be single phase 7.2KV primary, 120/240V secondary oil filled installed on a concrete pad.

8-9 **SECONDARY DISTRIBUTION.** Secondary service conductors shall be low voltage 600V cables with USE type insulation. Conductors shall be installed underground in schedule 40 pvc conduit from pad mounted transformer to the main distribution panel. Secondary services to various building from the transformers shall be as follows;

Transformer T1: Modified record firing range tower.
Transformer T2: Modified record fire range classroom, field latrine & ammo breakdown building.
Transformer T3: 25 meter firing zero range tower.
Transformer T4: Combat pistol range classroom, field latrine & ammo breakdown building.
Transformer T5: Combat pistol range tower.

Each transformer will require a power meter mounted at the transformer.

Each transformer and panelboard shall be sized for the existing load plus 20% spare capacity.

8-10 **RANGE POWER & DATA CABLES (Modified and Combat Pistol Ranges Only).** Cable junction box (CJB) NEMA 3R shall be provided at each emplacement structure. Power shall originate from the down range power panel located at the tower base (See standard design) and shall run underground in min 26mm conduit. All CJB's of each lane shall be connected together with conduit. Pig tails of 600 mm duly labeled shall be provided at each CJB for others to terminate. Similarly the data cables from the tower junction box (TJB) shall run underground in 26mm conduit (parallel with power cables) and connected to all CJBs of each lane. Pig tails of 600 mm duly labeled shall be provided at each CJB for others to terminate. Termination of cables in CJB to electronics i.e. remote modems etc., and in signal distribution assembly (SDA) including its electronics i.e. modems etc. shall be performed under a separate contract. Data & power cables type, burial depth and separation shall be as defined in the standard design.

8-10.1 Cable Junction Box (CJB). Construction and installation of CJB shall be as specified in the design manual. Furnishing and installation of electronics in CJBs is not part of this project.

8-10.2 Signal Distribution Assembly (SDA). Furnishing and installation of SDA is not part of this project. However space for the installation of the SDA shall be provided for. Space requirements are as indicated in the standard design.

8-10 **LIGHTNING PROTECTION.**
Lightning protection shall be provided for the following buildings of each range:

8-10.1 Observation Tower
8-10.2 Ammo Breakdown Building
8-10.3 Covered Training Area

Lightning protection shall be in conformance with the RETS Standard Design, and NFPA 780.

8-11 **CATHODIC PROTECTION.** Cathodic protection shall be provided for all metal underground pressurized piping systems and any metal underground structures. If plastic piping systems are utilized then ferrous valves and fittings shall be cathodically protected.

8.12 TECHNICAL SPECIFICATIONS

Section	Title
16370	Electrical Distribution System, Overhead
16375	Electrical Distribution System, Underground
16415	Electrical Work, Interior
16640	Cathodic Protection System (Sacrificial Anode)
16670	Radio and Public Address System
16710	Premises Distribution System
16711	Telephone Outside Plant

16375 Electrical Distribution System, Underground

Secondary feeders from transformer to facility shall be copper, 600V, type USE service entrance cable.

Medium voltage cables shall be multiconductor copper with shield and insulating jacket. Cables shall be provided with 133 percent insulation level. Cable insulation shall be EPR & minimum conductor size shall be #2.

Neutral conductors, cable shields, and all other non-current carrying metallic parts of equipment shall be grounded. Ground resistance of not greater than 25 ohms shall be provided.

Label all cables, where they come from and where they go, with metal embossed tags.

All Primary and HV connections shall be load break type

All pad mounted equipment shall have standard manufacturers finish.

Pad mounted transformers shall be new and labeled PCB free. Each transformer shall have the following requirements: 1 phase, dead front, loop feed, oil immersed type, load break group operated switch, surge arresters, and oil immersed current limiting fuses.

16415 Electrical Work, Interior

Wall mounted sealed lamps and batteries shall be used for emergency lighting.

Panelboards shall be bolt on circuit breaker type and shall have copper bus bars for the Observation tower and Down Range Panelboards. Plug-in breakers are approved for other buildings. The service entrance panelboard for each transformer shall have Transient Voltage Surge Suppression installed at the panel main.

All exterior underground conduit shall be schedule 40 pvc.

All exterior above ground conduit shall be galvanized rigid steel.

All interior conduit shall be EMT.

REFERENCES. The electrical design for all facilities shall be in accordance with the following:

a. NFPA 70, National Electrical Code

b. NFPA 101, Life Safety Code

c. TM 5-811-1, Electric Power Supply and Distribution

d. TM 5-811-2, Interior Electrical System

e. IES, Lighting Handbook

f. ANSI C2, National Electrical Safety Code

g. MIL-HDBK- 1008 C, Fire Protection For Facilities

h. HQUSACE Architectural and Engineering Instructions - Design Criteria

i. I3A Installation Information Infrastructure Implementation Guide Version 2

j. Standard design criteria, CEHNC 1110-1-23.

k. MIL-HDBK-1004/6, Lightning Protection

l. DOD 6055.9-STD, DOD Ammunition & Explosives Safety Standards

PART B

GENERAL DESIGN REQUIREMENTS

CHAPTER 9

SUSTAINABLE DESIGN

CHAPTER 9
SUSTAINABLE DESIGN

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SUSTAINABLE DESIGN

9-1 **SUSTAINABLE DESIGN GOALS**. The goals for improving the sustainability of facilities include: (a) use resources efficiently and minimize raw material resource consumption, including energy, water, land and materials, both during the construction process and throughout the life of the facility, (b) maximize resource reuse, while maintaining financial stewardship, (c) move away from fossil fuels towards renewable energy sources, (d) create a healthy and productive work environment for all who use the facility, (e) build facilities of long-term value, and (f) protect and, where appropriate, restore the natural environment.

9-2 **PROJECT REQUIREMENTS**. Sustainable design techniques shall be considered as they relate to site and building design, construction, and operation. Techniques which conserve energy, improve livability, and can be justified by life cycle cost analysis as cost effective are encouraged.

9-2.1 Sustainable design is a proposal evaluation factor. The level of incorporation of sustainable design principles will be measured through use of the Sustainable Project Rating Tool (SPiRiT), available from the following website: http://www.cecer.army.mil/SustDesign/SPiRiT.cfm SPiRiT is the government version of the LEED Green Building Rating System™, developed by the U.S. Green Building Council.

9-2.2 Each offeror will complete and submit the SPiRiT Facility Points Summary with the proposal; the total point score will determine the SPiRiT Sustainable Project Certification Level: SPiRiT Bronze, Silver, Gold, or Platinum. The certification level will be used as a proposal evaluation factor as defined in RFP Section 00120 – Proposal Evaluation and Contract Award.

9-2.3 Proposals that do not achieve a SPiRiT Bronze certification level will be considered non-conforming.

9-2.4 Proposals that do not comply with the “Required” criteria listed in the SPiRiT document will be considered non-conforming. For example: SPiRiT category *3.R3 CFC Reduction in HVAC&R Equipment* requires zero use of CFC-based refrigerants in new mechanical systems. Although no credit points are available, the requirement must be met to achieve the minimum certification level.

Some SPiRiT categories award potential points (credits) for strategies or decisions that are not within the control of the Offeror. These areas may include installation master planning, site selection, or involving facility users in the programming process. The Offeror will receive points in the following credit categories for criteria met by the government: Installation Base Redevelopment, Facility Impact. Other than the credits stated in this paragraph, the Offeror shall not receive points for any SPiRiT criteria that cannot be substantiated by information contained in the proposal.

REFERENCES

GOVERNMENT PUBLICATIONS:

Department of the Navy Standardization Documents Order Desk 700 Robbins Avenue, Bldg. 4D Philadelphia, PA 19111-5094	MIL-HDBK-1008, Fire Protection for Facilities Engineering, Design, and Construction
U.S. Army Corps of Engineers Engineering and Support Center, Huntsville, Alabama http://www.hnd.usace.army.mil/rtlp/index.htm	U. S. Army Corps of Engineers Design Manual For Remoted Target System (RETS) Ranges
U.S. Government Printing Office Superintendent of Documents U.S. Government Printing Office Washington, DC 20402	U.S. Government Printing Office (GPO) Style Manual

NON-GOVERNMENT PUBLICATIONS:

American Architectural Manufacturers Association (AAMA) 1827 Walden Office Square, Suite 104 Schaumburg, IL 60173-4268	AAMA 101 Voluntary Specifications for Aluminum, Vinyl and Wood Windows and Glass Doors AAMA 605 Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels AAMA 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections
American National Standards Institute 11 West 42 Street New York, NY 10036	ANSI C2 (1997) National Electrical Safety Code ANSI 70 (1996) National Electrical Code
Architectural Woodwork Institute 1952 Isaac Newton Square W. Reston, VA 20190	AWI Quality Standards (1999) 7th Edition, Version 1.2
Builders Hardware Manufacturers Association 355 Lexington Ave, Suite 1700 New York, NY 10017-6603	ANSI/BHMA A156.4 (2000) American National Standards for Door Controls - Closers…
Council of American Building Officials 5203 Leesburg Pike, Suite 708 Falls Church, VA 22041	CABO A117.1 (1992; Errata Jun 1993) Accessible and Usable Buildings and Facilities
International Conference of Building Officials 5360 Workman Mill Road Whittier, CA 90601-2298	ICBO (1997) Uniform Building Code

National Electrical Manufacturers Association 1300 N 17th Street, Suite 1847 Rosslyn, VA 22209	NEMA LD3 High Pressure Decorative Laminates
National Fire Protection Association One Batterymarch Park Quincy, MA 02269-9101	NFPA 101 (2000) Life Safety Code
Steel Door Institute (SDI) 30200 Detroit Road Cleveland, OH 44145-1967	ANSI A250.8/SDI 100 Standard Steel Doors and Frames