



**US Army Corps  
of Engineers**  
Fort Worth District

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**SUPPLY SUPPORT ACTIVITY**  
**DESIGN ANALYSIS**

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## 1. Site Analysis.

Existing Site Description. N/A.

- 1.2 New Site Development Supply Support Activity. This portion of the project consists of the construction of the site work for a Supply Support Activity (SSA). Support facilities include utilities, fire protection, sidewalks, curb & gutter, POV parking, concrete hardstand, detention pond (if needed), storm drainage, dumpster pads, and site improvements. Six-foot wide concrete sidewalks will be included adjacent to the POV parking. This facility will be accessible to persons with disabilities.

Access to the SSA facility will be provided from two 24-foot wide access drives. These access drives will be placed to allow tractor-trailer traffic easy access to the loading dock on the front side of the SSA building and to the access gates to the Open Storage area and flatbed load/unload area in the rear of the SSA warehouse building. The POV parking area is placed in front of the SSA compound and will be accessed from the 24-access drives. The loading dock on the front side of the SSA warehouse will provide for four trucks to load or unload at the same time. The loading dock will have a 48-inch high dock which is standard truckload dock height. Retaining walls will provide the grade transition from the loading dock pit to the pavement just below the finished grade of the building. To allow for proper tractor-trailer truck access and backup to the loading dock a minimum of 142-feet of hardstand will be provided from the front of the SSA warehouse to the edge of the pavement in front of the loading docks.

The SSA facility compound will be separated from the front side of the facility and the rear of the facility by a 7-foot high security fence. The area in the rear of the facility will be a secure Open Storage area providing storage for containers and equipment that do not need to be stored in the warehouse or under covered storage. The area adjacent to the rear of the warehouse building will be provided for flatbed tractor-trailer or container truck loading and unloading. The load/unload area will be 64-foot wide to allow for 2 tractor trailer trucks to park in the area and provide forklift access around the trucks as well as into the 2 doors on the rear of the warehouse. The Open Storage area behind the load/unload area will be a minimum of 66-feet wide for the full length of the building. Hardstand on either side of the SSA warehouse building will provide for proper access and turning clearances for tractor-trailer truck access to the load/unload area. 24' wide double swing gates will be provided in the security fence on either side of the warehouse to allow access into and out of the Open Storage and Load/Unload areas.

The service drives to the SSA facility and hardstand surrounding the SSA warehouse will provide Emergency Vehicle Access to the facility and will allow access for fire truck and emergency medical vehicles around the SSA in accordance with NFPA. The emergency access drives shall have a minimum turning radii to accommodate fire vehicles.

- 1.3 Security. This site will be located to adhere to AT/FP requirements. According to UFC 4-010-01 (8 OCT 03), the SSA building will qualify as an inhabited building (routinely occupied by 11 or more personnel). Therefore, in order to provide force protection requirements, the building will have a minimum clear zone of 33 feet around it. This includes minimum setback from any parking or roads of at least 33 feet. If the facility is adjacent to the installation perimeter, perimeter roads and clear zones shall be included in accordance with FM 3-19.30, Physical Security, Para 4-37 and 4-38.
- 1.4 Other Site Considerations.
- 1.4.1 SSA Components. In addition to the primary SSA building, a covered area inside the Open Storage area will be provided for Serviceable and Unserviceable storage. This area will be 60-foot by 110-foot and will be placed at the back corner edge of the Open Storage area hardstand.
- 1.4.2 Temporary Storage Area: Another area inside the Open Storage area will be provided for POL storage, and Hazmat storage. This area will be approximately 20-foot by 75-foot.

- 1.4.3 **POV Parking.** Parking required for the SSA facility is based on an assessment of the actual number of personnel occupying SSA facilities and analysis of TOE assigned strength, the average occupancy is 37 personnel. 60 percent of the average occupancy and the habitual number of customers using the SSA was used to determine the number of POV parking spaces and was approved by the Facility Design Team chair to be 24 spaces.
- 1.4.4 **Military Vehicle Parking.** Parking for military vehicles is provided near the warehouse for easy access to the turn-in bay, customer issue bay and customer service area. These parking spaces are required to be 33-feet from the building to meet AT/FP requirements in UFC 4-010-01.
- 1.4.5 **Dumpster Pad.** A dumpster pad and screen wall will be provided inside the fence of the SSA compound to provide for trash and recycling dumpsters. The Facility Design Team determined that it was necessary to place the dumpsters inside the SSA compound fence because of the amount of packaging waste generated by the facility. To meet AF/FP requirements in UFC 4-010-01 the dumpsters must be placed more than 85-feet from the building. Dumpsters will be placed at the edge of the hardstand on the right or left in the front access area of the SSA compound.
2. **Grading.** Site grading and drainage shall adhere to the principles of Low Impact Development as outlined in UFC 3-210-10.
3. **Pavements.** The POV parking area will be paved with asphalt. The hardstand around the facility as well as the dumpster pad shall be constructed of portland cement concrete.
4. **Storm Drainage.** Drainage design shall be in accordance with UFC 3-230-17FA Drainage in Areas Other Than Airfields. Drainage from the hardstand should be directed to surface inlets interior to the hardstand or curb inlets along the edge of the hardstand to avoid erosion of soil adjacent to the hardstand.
5. **Utilities.** Utilities are site specific and will be addressed by the Geographic District.
6. **Fencing.** A 7' high security fence shall be installed around the concrete hardstand. A security fence will also separate the Open Storage area in the rear of the facility from the hardstand area in front of the SSA warehouse. The fence will abut the warehouse building on both sides and connect to the exterior security fence. 24-foot wide double swing gates will be provided at the 2 access drives to the facility. 24-foot wide double swing gates will also be provided through the fence to the Open Storage area on both sides of the SSA warehouse. A 4-foot wide personnel gate will be provided in the security fence leading from the POV parking area.
7. **Turf and Landscaping.** Solid sod will be placed in turfed areas adjacent to the building. Remaining turfed areas will be seeded.
8. **Railroads.** N/A
9. **Economic Justification.** N/A
10. **Calculations.** N/A

1. **General Description:** The Tables of Organization and Equipment (TOE) Supply Support Activity (SSA) Facility is a specified application of general purpose warehouse space for organizational supply storage and provides enclosed, covered, and open storage space to accomplish materiel receiving, turn-in, shipping, distribution, and storage of Class II, III(P), IV, & IX supplies in brigade sets and authorized for Brigade Support Battalion or equivalent units (separate Battalions when authorized SSA).
2. **Criteria References:** Applicable design and construction criteria references are listed in below. Unless a specific document version or date is indicated, criteria shall be taken from the most current references as of the date of issue of the contract. This list is not intended to include all criteria that may apply or to restrict design and construction to only those references listed.
  - American Architectural Manufacturers Association (AAMA)  
AAMA 605 Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels  
AAMA 607.1 Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum  
AAMA 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections
  - Architectural Woodwork Institute (AWI)  
Version 1.2 AWI Quality Standards 7th Edition
  - Builders Hardware Manufacturers Association (BHMA)  
ANSI/BHMA A156.4 American National Standards for Door Controls – Closers
  - International Code Council (ICC)  
IBC International Building Code  
Note: All references in the International Building Code to the International Electrical Code shall be considered to be references to NFPA 70.  
All references in the International Building Code to the International Fuel Gas Code shall be considered to be references to NFPA 54 and NFPA 58.  
All references in the International Building Code to the International Fire Code shall be considered to be references to Unified Facilities Criteria (UFC) 3-600-01.
  - National Fire Protection Association (NFPA)  
NFPA 10 Standard for Portable Fire Extinguishers  
NFPA 13 Installation of Sprinkler Systems  
NFPA 72 National Fire Alarm Code  
NFPA 80 Standard for Fire Doors and Fire Windows  
NFPA 101 Life Safety Code  
NFPA 780 Standard for the Installation of Lightning Protection Systems
  - National Roofing Contractor's Association (NRCA)  
Roofing and Waterproofing Manual
  - Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)  
SMACNA Architectural Manual Architectural Sheet Metal Manual
  - Steel Door Institute (SDI)  
ANSI A250.8/SDI 100 Standard Steel Doors and Frames
  - American with Disabilities Act Accessibility Guidelines (ADAAG)
  - Energy Policy Act 2005 (EPACT05)
  - Executive Order 13423 (E.O. 13423), Strengthening Federal Environmental Energy and Transportation Management
  - Army SDD LEED NC Silver Policy
  - Army Standards for keyless access locks and Waterfree Urinals.
  - AR 405-70, Utilization of Real Property
  - AR 420-1, Army Facilities Management
  - DA PAM 415-28, Facility Guide To Army Real Property Category Codes
  - UFC 1-200-01, Design: General Building Requirements
  - UFC 3-600-01, Design: Fire Protection Engineering for Facilities
  - UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings

- UFC 4-023-03, Security Engineering: Design to Resist Progressive Collapse
  - UFC 4-214-02, Standard Definitive Design for Tactical Equipment Maintenance Facilities
  - ETL 1110-3-491, Sustainable Design for Military Facilities
  - ER 1110-3-113, Engineering and Design, Department of the Army Facilities Standardization Program
3. **Design Criteria:** The primary facility is composed of a Warehouse Module and an Administrative Core Module. SSA facility will ONLY be provided in one size as determined by Facility Planning System (FPS).
- 3.1. Space Allocation: Functional areas in the SSA are allocated as follows:
- SSA – 20,640 GSF – Measured to the exterior face of the building envelope.
- 3.1.1. Warehouse Module: 17,597 GSF  
This area includes the Warehouse Operation Area, Turn-in Area, Receiving/Issue Area, Customer Issue Area and Secure Storage. This whole area requires an unobstructed ceiling height of 16 feet throughout. A total of six high-lift sectional overhead doors shall be furnished for the warehouse module. All overhead doors shall have a clear opening 14 feet high. One overhead door shall have a clear opening 18 feet wide and the remaining five doors shall each have a clear opening 10 feet wide. Warehouse module floor area shall be free of intermediate support columns and shall be designed to support the operation of 10,000-pound capacity rough terrain forklifts.
- 3.1.1.1. Warehouse Operations Area: 11,438 NSF  
Warehouse Operations Area shall be furnished with one 18 feet wide x 14 feet high overhead door and one 10 feet wide x 14 feet high high-lift sectional overhead doors. High-lift sectional overhead door operation shall not intrude into the required clear ceiling area. Doors shall be electrically operated with manual over-ride. Provide a 64 feet x 200 feet Load/Unload Apron on the Warehouse Operations side of the facility. Provide a forklift charging station along one of the enclosure walls of the facility close to the electrical room and in a location that does not impede container operations. Provide a loading/unloading apron on the warehouse side of the facility.
- 3.1.1.1.1 Forklift Charging Station: Provide an enclosed forklift charging station within the warehouse operations area. Location of forklift charging station shall not impede warehouse operations. Forklift charging station shall be approximately 13-feet wide by 14-feet deep, with a 10 feet wide x 10 feet high overhead door for access. Overhead door shall be electrically operated with manual over-ride. Provide a dedicated exhaust system for the forklift charging station.
- 3.1.1.2. Receiving/Issue Bay: 3,600 NSF  
Provide a separate Receiving/Issue area furnished with a loading dock for both commercial and/or military vehicle deliveries. Receiving/Issue bay shall be 40 feet deep x 90 feet wide. Provide four separate loading bays. Each bay shall be furnished with a 9 feet wide x 10 feet high overhead door for Receiving/Issuing operations. Locate overhead doors at 25 feet on center. Door shall be electrically operated with manual over-ride. Loading dock shall be furnished with all necessary dock accessories, including electrical operated dock levelers – with vehicle restraint and lights communication package, dock seals, dock bumpers, removable safety railing, access stairs, etc.
- 3.1.1.3. Secure Storage: 150 NSF  
This is a Non-Sensitive Secure Storage area, and shall be provided with the appropriate access and physical security measures. Walls, ceiling and doors of secure storage shall be minimum 6 gage expanded metal diamond wire mesh with a maximum 2-inch mesh opening, on minimum 1 ½ inch x ¾ inch x 1/8 inch steel channel frame, spaced at 24 inches on center maximum, with minimum 1 ¾ inch x 1 ¾ inch x 1/8 inch steel angle corner posts.
- 3.1.1.4. Turn-in Bay: 625 NSF  
Provide a separate Turn-in bay on adjacent to the Receiving/Issue Bay. Turn-in area shall be 25 feet deep x 25 feet wide and shall be furnished with one 6 feet wide exterior double door.

- 3.1.1.5. Customer Issue Bay: 1,788 NSF  
Provide a separate Customer Issue bay adjacent to the Administrative Module and the Receiving/Issue Bay. Customer Issue area shall be 25 feet deep x 50 feet wide and shall be furnished with one 6 feet wide exterior double door.
- 3.1.2. Administrative Module: 2,706 GSF  
The Administrative Module consolidates all administrative functions for the SSA Facility, and includes enclosed offices, open workspaces, production, stock control, and support space (e.g. multipurpose conference/training room, restrooms, janitorial space, and administrative storage space), Contractor Logistics Support spaces, mechanical, electrical and telecommunication spaces.
- 3.1.2.1. Administrative Spaces: 1,506 NSF  
Provide administrative spaces consisting of four enclosed offices, a stock control office (open plan), copier space, a customer service area with a service counter and general circulation space.
- 3.1.2.2. Contractor Logistics Support: 217 NSF  
Provide a Contractor Logistics Support (CLS) office space.
- 3.1.2.3. Multipurpose Room: 238 NSF  
Provide a consolidated meeting, conference, and training room.
- 3.1.2.4. Men's and Women's Toilets: 280 NSF  
Provide handicapped accessible toilet facilities for staff and guest use. Provide a janitor's closet furnished with shelving for storage of janitorial supplies.
- 3.1.2.5. Janitor's Closet: 20 SF  
Provide a janitors closet furnished with a utility sink, mop racks and built-in stainless shelving for storing janitorial supplies.
- 3.1.2.6. Mechanical, Electrical and Telecommunication: 259 NSF  
Mechanical/Electrical room shall be sized to accommodate space for equipment maintenance/repair access without having to remove other equipment. First floor exterior access is required for mechanical and electrical room. Telecommunications room shall be conditioned space.
- 3.1.3. External Covered Hardstand: 4050 NSF  
Provide a rigid-paved covered hardstand located immediately adjacent to the Turn-in and Shipping Area. Hardstand shall be fence enclosed and shall be provided with a vehicle access gate. Clear ceiling height in the covered hardstand shall be 16 feet. Provide external lighting to facilitate night operations. Lateral clearances and ground pressure loading of the External Covered Hardstand shall be designed to support the unimpeded operation of 10,000-pound capacity rough terrain forklifts.
- 3.1.4. Loading/Unloading Apron: 12,800 NSF  
Provide a rigid-paved Loading/Unloading Apron on the warehouse side of the facility, furnished with exterior lighting to support night operations, and an external public address system. Loading/Unloading apron shall be a minimum 60 feet deep, measured from the face of the facility exterior wall. Loading and unloading operations shall not prevent access to the Receiving and Issue Bay. The Loading and Unloading Apron is a contiguous area sized for commercial container or flatbed vehicles. The area is composed of two components – an offload area and a static load area, with the former being temporary space for deliveries using commercial or military flatbed trailers or containers as the largest requirement to be met. The latter is based on military flatrack assemblies and provides a pre-loaded deployment configuration for movement by organic battalion assets.

4. **Basic analysis.** Design and construct SSA complex in accordance with Army SSA Standard. Supporting facilities include the utilities, electric service, exterior lighting, fire protection and alarm systems, paving, walks, curbs and gutters, storm drainage, information systems, and site improvements.
- 4.1. Installation Master Plan: The facility will be sited as requested by Department of Public Works (DPW) – Master Planning and Installation Design Guidelines (IDG) requirements and shall comply with AT/FP criteria.
- 4.1.2. Visual Features: The facility to comply with the IDG or relevant Area Design Guide (ADG) with reference to visual external features.
- 4.1.3. Spatial Composition: Optimum land use, massing, proportioning and balance between facilities, paving, and open space is required.
- 4.1.4. Accessibility: The facility is required to comply with the Americans with Disabilities Act/Architectural Barriers Act (ADA/ABA) Accessibility Guidelines.
- 4.1.5. Energy Conservation: Facilities shall be designed in compliance with requirements for federal facilities IAW EPACT 05 and E.O. 13423.
- 4.1.6. Life Safety: Facility design shall comply with all relevant life safety codes and criteria.
- 4.1.7. Security: All locks will be master keyed to Installation’s standards. A “Knox box” if required shall be located at the main building entrance in a visible and accessible location.
- 4.1.8. Acoustical Design: There are no special acoustical requirements identified for this project, except the design shall control sound attenuation in the Core Administrative area. Acoustical ceiling tile shall to have an STC range of 40-44.
5. **Building Systems, Materials & Equipment:** The Design-Build Contractor is ultimately responsible for the choice of building systems, material and equipment within the limits of the relevant IDG/ADG criteria, except where stated otherwise.
- 5.1. Exterior Material: Provide durable and easily maintainable materials. Do not use exterior materials that require periodic repainting or similar refinishing processes. Material exposed to weather shall be factory pre-finished, integrally colored or provided with intrinsic weathering finish

The most cost effective building system for this facility type is a pre-engineered metal building system, with metal sandwich panels for the walls and standing seam metal roof sandwich panel system with a minimum slope of 1:12 for the roof. The standard facility exterior closure will be based on 4-inch sandwich wall and roof panels. Exterior doors shall be thermally insulated and fully weatherstripped. All equipment doors shall be high-lift sectional overhead doors, electrically operated, and furnished with backup manual operating systems. Each equipment door shall be furnished with a canopy on the exterior side. Canopy shall have a minimum depth of 4-feet. Provide a continuous canopy covering all four equipment doors on the Receiving/Issue Bay side. Each equipment door shall be furnished with a “headache bar” on the interior and exterior side of the facility. Set bottom of each “headache bar” 6-inches below bottom of door head height and 4-feet from face of door. Windows shall be insulated high efficiency windows and shall comply with relevant criteria. Exterior louvers shall have bird screens and shall be designed to exclude wind-driven rain. Exterior louvers shall be made to withstand wind loads in accordance with the applicable codes.

- 5.1.1. Building Envelope Sealing Performance Requirement: Design and construction of the admin portion of the facility shall incorporate a continuous air barrier system to control air leakage in and out of the conditioned space. Air barrier material shall have an air permeance not to exceed 0.004 cfm/sf @ 0.3” wg (0.02 L/s.m<sup>2</sup> @ 75 Pa) when tested in accordance with ASTM E 2178. Seal all penetrations of the air barrier system. Refer to Mechanical Section for additional requirements.

- 5.1.2. Interior Material: Provide sustainable materials and furnishings that are easily maintained and replaced. Maximize use of daylighting within the limits allowable for the facility type. Provide interior surfaces that are easy to clean and light in color.

Wall, ceiling and floor finishes shall conform to the requirements of the IBC, NFPA and UFC 3-600-01 Fire Protection Engineering for Facilities. Where code requirements conflict, the most stringent code requirement shall apply.

Provide a 22-gage metal panel wall in-board of the sandwich panel exterior wall to protect the sandwich panels. Extend this metal panel wall to a height of 8-feet in the warehouse area, and to a height of 10-feet in the administrative area.

All gypsum wallboard shall be impact resistant. All gypsum board walls and ceilings shall have a painted finish. Gypsum wallboard shall not be used as a final interior finish material below 8 feet in the warehouse operations area; and carpet shall not be used as a floor finish material in this facility. The warehouse side of all gypsum wallboard partitions shall have a minimum 20-gage sheet metal finish up to a height of 8 feet from the floor finish. Vinyl composition tile (VCT) shall be minimum 1/8 inch thick, conforming to ASTM F 1066, Class 2, through pattern tile, Composition 1, asbestos free, with color and pattern uniformly distributed throughout the thickness of the tile.

Provide cabinets complying with AWI Quality Standards. Countertops shall have waterfall front edge and integral covered backsplash. Bathroom vanity countertop shall be minimum ½-inch thick cast 100 percent acrylic polymer solid surfacing material with waterfall front edge and integral covered backsplash.

All interior finish materials shall be classified as containing low volatile organic compounds (VOCs) in accordance with MPI criteria.

6. **Sustainable Design:** The facility design shall comply with Leadership in Energy Environmental Design (LEED) requirements. Facility/Site shall be design to be certifiable at the LEED “Silver” rating level.

## 1. References.

The most recent versions of references shall be used.

- 1.1. International Building Code (IBC)
- 1.2. American Concrete Institute. Building Code Requirements for Structural Concrete.
- 1.3. American Institute of Steel Construction. Manual of Steel Construction
- 1.4. American Iron and Steel Institute. North American Specification for the Design of Cold-Formed Steel Structural Members
- 1.5. Steel Deck Institute. SDI Diaphragm Design Manual
- 1.6. Metal Building Manufacturers Association (MBMA). Metal Systems Building Manual
- 1.7. United Facilities Criteria (UFC) 4-010-01 DoD Minimum Antiterrorism Standards for Buildings
- 1.8. UFC 4-023-03 Design of Buildings to Resist Progressive Collapse.

## 2. Description of structural system.

- 2.1 Framing System. The single story TOE Supply Support Activity Facility (SSA) is a pre-engineered, rectangular metal building. The building is approximately 21,000 square feet in floor area. The clear height for the building shall be 17 feet. The pre-engineered steel framing system carries vertical loads and lateral loads and consists of moment resisting steel frames without center support columns. "Z" purlins span between moment frames and support the roof structure. At selected locations between exterior columns, vertical 'X' bracing and roof bracing are provided to transfer lateral loads from roof or columns to foundation. Where required tilt-up concrete walls may be used as the exterior surface and behave as shear walls transferring lateral loads to the foundation.
  - 2.2 Foundation System. Pre-engineered metal building foundation system is generally a conventionally reinforced, continuous and spot footing foundation. Concrete encased ties below the slab-on-grade and spaced at each moment frame may be required to provide restraint to the lateral load thrust of the moment frames. The final foundation design will be based on the recommendations of the Geotechnical report. All slab-on-grade to receive a coating (e.g. epoxy) or to receive an overlaying finish (e.g. carpet, tile, VCT) shall be underlain by a vapor barrier system with a minimum 20-mil polyethylene membrane over compacted subgrade.
  - 2.3 Roof and Floor System. The ground floor consists of an approximately 6" thick, conventionally reinforced concrete slab-on-grade. The final foundation design shall be based on the recommendations of the Geotechnical report. The roof of the pre-engineered metal building consists of structural standing seam metal roofing supported by purlins or joists spanning between rigid frames, as designed by the building manufacturer.
  - 2.4 Walls and Partitions. All exterior walls are composed of either non-load bearing metal panels supported by metal girts in turn supported by frames and columns or non-load bearing tilt-up concrete walls bearing directly on the perimeter footings. Interior walls consist of non-load bearing metal studs and gypsum board.
3. **Design Loads.** Site-specific design loads; wind, seismic, ground snow load, and frost penetration; are based on Fort Bliss, Texas. Modification to design loads is required for actual project location.
- 3.1. Occupancy category II

- 3.2. Dead loads Actual weights
- 3.3. Roof live loads
  - 3.3.1. Uniform load 20 pounds per square foot (psf)
  - 3.3.2. Concentrated load at primary roof members, exposed to work floor 2,000-pound load single panel point at lower chord of roof trusses or at any point along primary structural members supporting roofs
- 3.4. Floor live loads
  - 3.4.1. All at grade floors 250 psf  
(excluding Admin) 10 kip fork lifting capacity
- 3.5. Wind loads Design wind pressures per IBC, Exposure C, Basic wind speed 90 miles per hour
- 3.6. Seismic design parameters for site class B
  - 3.6.1. Importance factor  $I=1.0$
  - 3.6.2. Mapped spectral response accelerations  $SS=31\% g, S1=10\% g$
  - 3.6.3. Seismic Design Category C
- 3.7. Ground snow load 5 psf
- 3.8. Frost penetration depth 0 inches
- 4. **Design Basis.**
  - 4.1. Concrete-----f'c = 4 ksi minimum
  - 4.2. Concrete Reinforcing-----Fy = 60 ksi minimum
- 5. **Lateral Load Analysis.** The pre-engineered steel framing system carries the lateral wind and seismic loads from horizontal roof X bracing or roof diaphragm to locations where either moment or braced frames transfer lateral loads to foundation. Tilt-up concrete walls may also be used to transfer lateral loads to the foundation.
- 6. **Security Analysis.** This project is designed for antiterrorism/force protection, low threat requirements. The minimum setback is assumed to be provided.
- 7. **Economic Justification.** Pre-engineered buildings were chosen for economy, and concrete tilt-up walls were chosen for durability.
  - 7.1 Costs comparisons were made for a similar type warehouse facility but for two, larger sizes.
  - 7.2 Comparisons were made between the following building types.
    - 7.2.1 Standard pre-engineered metal building with metal panel wall from \$168 to \$172 per square foot
    - 7.2.2 Standard pre-engineered metal building with metal panel wall and split-face CMU wainscot from \$170 to \$173 per square foot
    - 7.2.3 Standard pre-engineered metal building with tilt-up concrete wall from \$177 to \$182 per square foot

- 7.2.4 Standard stick, beam, and column building with metal panel wall and split-face CMU wainscot from \$174 to \$178 per square foot
- 7.2.5 Standard stick, beam, and column building with tilt-up concrete wall from \$181 to \$186 per square foot.

## 1. Heating, Ventilating, Refrigeration and Air-Conditioning:

### 1.1 Criteria and Reference Sources:

- a. Advanced Energy Design Guide for Small Warehouses, ASHRAE 2008
- b. Mechanical Design – Heating, Ventilating and Air-Conditioning, UFC 3-410-01FA, 2003
- c. DDC for HVAC & Building Level Controls, UFC 3-401-02, 2005
- d. Engineering Weather Data, UFC 3-400-02, 2003
- e. ASHRAE Handbook of Fundamentals, 2009
- f. ASHRAE Refrigeration Handbook, 2006
- g. ASHRAE HVAC Applications Handbook, 2007
- h. ASHRAE HVAC Systems and Equipment Handbook, 2008
- i. Thermal Environmental Conditions for Human Occupancy, ASHRAE Standard 55-2004.
- i. Ventilation for Acceptable Indoor Air Quality, ASHRAE Standard 62.1-2007.
- j. Energy Standard for Buildings Except Low-Rise Residential Buildings, ASHRAE Standard 90.1-2007
- k. The HVAC Commissioning Process, ASHRAE Guideline 1-2007.
- l. International Mechanical Code, IMC-2006.
- m. Energy Policy Act of 2005 (EPACT-2005)
- n. HVAC Controls, UFC 3-410-02a, 2003
- o. Energy Conservation, UFC 3-400-01, 2002
- p. 29 CFR 1910, Occupational Safety and Health Standards
- q. 29 CFR 1926, Safety and Health Regulations for Construction
- r. IMC 2006
- s. ATEP, UFC4-010, 2007

### 1.2 Functional and Technical Requirements:

#### 1.2.1 User Requirements:

Typical office comfort level for admin area.

Comfortable/functional customer service area.

Warehouse area safe for work with proper clothing depending on weather conditions.

Modern, safe dock area with dock seals, combination full pit dock levelers/truck locks with inside/outside indicator lights. Dock bumpers and bollards outside with bollards inside. Trailer cooling fans with lights mounted on adjustable goosenecks.

#### 1.2.2 Available Energy Systems: Electricity and natural gas.

#### 1.2.3 Outdoor Design Temperatures:

Summer: 98F db, 69F wb  
 Winter: 25F db

#### 1.2.4 Indoor Design Conditions:

Summer: 75°F db /50%RH (max)  
 Winter: 70°F db

Mechanical and electrical rooms:

Summer: 103°F db  
 Winter: 40 F db (min)

Communications rooms:

Summer: 75°F

Warehouse:

Winter, Occupied: 55°F

Winter, Un-occupied: 40°F

- 1.2.5 U-Values: 4" thick structural urethane foam panels with metal cladding on both sides are planned for the building shell. Tested R value for Metl-Span panels (without air film allowance) is 28.57. (Tested value with air film allowance is 29.42.) Drift over time is supposed to be nil. Select R=28 ft<sup>2</sup>·°F·h/Btu

- 1.2.6 Mechanical Ventilation, Exhaust and Filtration:

Fumes from the charging of fork lift storage batteries will need to be captured at the source and exhausted from the building so that hydrogen cannot accumulate and form an explosive mixture. A charging room (with rollup door) plus the necessary exhaust fan and associated connecting duct will be required to discharge the fumes harmlessly high above the roof. It is expected that two 5,000# capacity, conventional, pneumatic tire, electric forklifts will be on site. Based on contractor operation of the SSA the batteries will be charged and allowed to cool (8 hr + 8 hr) during the night. Usage (8hr) will occur during the day. Typical battery would be 24 cell, 1,085 AH. Assuming a charging room size of 12'w X 15'd X 14'h and with a 4% LEL (1% max allowable hydrogen) then the required ventilation rate would be 63.97 cfm. However, required continuous ventilation (min) of at least 1 cfm/sq ft of floor area = 180 cfm. Select 250 cfm (net) upblast centrifugal roof fan. Interlock fan (by means of pressure or sail switch) to the battery charger power feed to shut off chargers in the event of fan failure. Provide non-plugging makeup air grilles at least 1' above the floor on both sides of the door and exhaust high diagonally across the room. Size for 100 fpm based on net free area. Slope the ceiling about 1' up away from the roll up door to two fume capture openings in the ceiling.

Exhaust toilets at the rate of 50 cfm/unit. Utilize exhaust for energy recovery if possible.

Exhaust janitor closet at the rate of 1.0 cfm/sq ft.

Exhaust interstitial space above office hard ceiling (13' AFF) at a rate of 2 air changes per hour. Based on an office area footprint of 2,965 sq ft 909 cfm will be required. Select 1,000 cfm wall mount fan. Install fan high up on warehouse/office dividing wall blowing into the warehouse. Center the fan along the N/S axis. Install 2 intake louvers (in the same wall) with insect screens about 1' above the 13' ceiling. Size louvers for 50 fpm based on net free area. Locate the louvers as far away from the centered fan as possible.

When occupied the warehouse must be ventilated at the rate .06 cfm/sq ft. With a warehouse floor area of 17,675 sq ft this results in a ventilation rate of 1,061 cfm. Select 1,200 cfm (net) centrifugal fan. It may be advisable to ventilate continuously. Utilize an energy recovery device if possible.

People loading for small offices is believed to be 1 per office with 2 people in the large corner office. The work area behind customer reception is believed to have 4 workers. The reception area has unknown density as does the conference room. Admin space (except for com room) shall be ventilated at 5 cfm/person or .06/sq ft. Using ASHRAE 62.1 compare default ventilation rates with known density rates and use the worst case values for the ventilation design. Utilize exhaust for energy recovery if possible.

Filtration of intake air is advisable due to chronic blowing dust problems in the Ft Bliss area. Maintenance of filters must be practical and cost effective.

- 1.3 Design Objectives and Provisions:

### 1.3.1 Heating and Air-Conditioning Systems:

#### 1.3.1.1 Office/Admin area:

Walled offices are mixed in with open workspaces and waiting areas. Multiple openings to the exterior and the warehouse are present which will increase infiltration and draftiness in those areas. A main entrance vestibule is required. There is a multi-purpose room present. The office area has a mix of interior and exterior exposures. Four zones (multi-purpose room, interior exposure, exterior exposure and communication room) will be required in order to provide a reasonable level of comfort and to keep zones small enough to provide effective control. Individual thermostats for each work area may be necessary. Thermofusers should be considered.

Exterior equipment such as condensing units may be sited adjacent to the mechanical room for ease of maintenance. Condensing units should be placed on stands to prevent damage from dirt and/or vehicles.

The building will have a pitched metal roof, which makes the servicing of roof-mounted equipment challenging. Anchorages for personal fall protection must be provided. A caged roof ladder (located in the warehouse) with a locking roof hatch will be installed to provide access for service of rooftop exhaust fans. Air handlers will be installed in a dedicated mechanical room with exterior access for maintenance.

#### 1.3.1.2 Warehouse

##### 1.3.1.2.1 Heat:

Low intensity, infrared, vented gas-fired heaters will be suspended (around the perimeter) from the ceiling above the 16' line to provide heat to the workers as well as product stored in the warehouse. A gas-heated fresh air makeup air unit with stainless steel heat exchanger and burners will be installed.

Freeze protection for the fire riser room will be provided by an electric space heater with thermostat.

##### 1.3.1.2.2 Cooling ventilation for comfort, productivity and safety:

Summer comfort ventilation will be provided to the warehouse by means of roof-mounted up-blast exhaust fans. The hot, stale, air, which stratifies under the roof on a sunny day, will be drawn off first making room for fresh makeup air that will take its place at the floor level (where the people are). The system should limit daytime heat buildup dramatically. During the day rollup doors will serve as fresh air inlets. At night low-wall rain-resistant intake louvers with motorized dampers will permit a somewhat reduced airflow to cool the building off using cool night air. This will result in a reduced initial sunrise temperature so that the warehouse temperature throughout the day is comparatively lower even as daytime heating takes place. Note that building height (above the occupant level) provides a place for hot air to accumulate until it is drawn out by the exhaust fans. The 16' clear height specified for the structure is just adequate to all but eliminate direct radiant loading of stored items and/or personnel.

Since 60" purlin spacing is common for metal buildings selection of fans with a similar footprint is desirable. This can be accomplished by selecting 48" diameter commercially available up-blast fans with integral wind-band butterfly-damper assemblies. Fans will be placed down slope from the ridge over the first full 60" opening. By using a fairly deep fan curb and cutting out the roof panels fully under the curb, placement directly over the structural building frames should not reduce fan airflow unless a great deal of insulation is hung beneath the roof purlins. If the installed insulation intrudes into the airflow opening then the fans will need to be offset from the moment frames. If a floating metal roof (standing seam) is used it will be necessary to frame

across three purlins. Fan selection will remain unchanged as it is the most cost effective size per cfm. Larger sizes are much heavier.

Based on an under-roof warehouse floor area of 80' X (258'-30') and a 3 minute air change X 12' high the required exhaust flow is 72,960 cfm. For three fans 24,320 cfm each at 1/8" s.p. is required. Select 2 hp (48" dia, adjustable belt drive) fan with rated airflow of 23,995 cfm.  $23,995/29 = 827$  which exceeds the 800 cfm/sone baseline so noise criteria is met.

For night cooling a 20 minute air change is required for the warehouse under-roof volume. With an average interior roof deck height of 21.7' the required airflow is  $395,808 / 20 = 19,790$  cfm. This can be accomplished with a single fan and low wall intake louvers that open when any of the fans operate. Free area should be based on a max velocity of 500 fpm so  $23,995/500 = 47.99$  sq ft of opening. Louvers are typically 50% open free area so 96 sq ft gross area is required. Select four 60" X 60" Ruskin ELC6375DAX Drainable Combination Louvers with 110 vac damper motors. (Energize motor to open louver. Utilize auxiliary contacts on fan motor starters such that any contact closure will energize all four damper motors. Provide signage to explain system operation next to starters.) Group motor starters in on a protected warehouse wall in the vicinity of the roof access ladder. Use non-metallic butterfly dampers if possible to reduce chance of sweating and extend damper life. Provide shallow drip pans underneath fans to catch occasional condensate.

### 1.3.3 HVAC Piping Systems: NA

### 1.3.4 System Expansion and Feasibility: NA

### 1.3.5 Vibration and Noise Isolation criteria : Chapter 47 of the ASHRAE HVAC Applications Handbook, 2007.

### 1.3.6 Controls:

Admin area, Local DDC, connected to main DDC system.

Warehouse area, manually operated motor starters for exhaust fans/dampers or DDC control by UMCS depending on site. Use magnetic starters to facilitate future connection to UMCS if

### 1.3.7 Enhancements for Operation and Maintenance: Building will be commissioned to ensure proper operation of the systems prior to turnover. Commissioning also ensures that the building maintenance staff has seen all parts of the system in operation and has had a chance to ask any questions they may have about operation or maintenance prior to acceptance.

## 2. **Energy Budget Analysis:**

### 2.1 Criteria and Reference Sources: ASHRAE 90.1, 2004 EPA 2005

### 2.2 Functional and Technical Requirements

#### 2.2.1 Energy Use Budget Analysis is site specific.

#### 2.2.2 Energy Use Budget Target is site specific.

## 3. **Plumbing:**

### 3.1 Criteria and Reference Sources:

- a. UFC 3-420-01, Design, Plumbing Systems, October 2004.

- b. TM-5-810-6, Non-Industrial Gas Piping Systems, 1990.
  - c. International Plumbing Code (IPC), 2006.
  - d. National Fuel Gas Code, NFPA 54, 2006.
- 3.2 Functional and Technical Requirements
- 3.2.1 User Requirements:
- Restrooms for permanent staff plus customers/visitors.  
Plumbed eyewash station with mixing valve and drain.  
Floor drains in fire riser and mechanical rooms.
- 3.2.2 Fixture Allocation: Fixture count exceeds IPC requirements for future flexibility.
- 3.2.3 Domestic Cold Water System: Water for domestic consumption.
- 3.2.4 Domestic Hot Water System: 110 F hot water supply for all areas including janitor sink. Use under counter mounted point of use electric water heater for supply.
- 3.3 Design Objectives and Provisions
- 3.3.1 Piping Systems:
- a. Natural gas supply required capacity is site specific.
  - b. Domestic water
  - c. Sanitary sewer
4. **Anti-Terrorism/Force Protection Requirements**
- 4.1 Criteria and Reference Sources: DoD Min. Antiterrorism Stds. for Buildings UFC 4- 010-01, 2003.
- 4.2 Functional and Technical Requirements:
- 4.2.1 User Requirements: No specific requirements.
- 4.3 Design Objectives and Provisions
- 4.3.1 All air handler and fan coil unit outside air intakes will be located minimum 10-ft above the ground.
- 4.3.2 Emergency shutoff switch for air handling units to be located for easy access by building occupants.
- 4.3.3 Equipment and piping will be braced per Anti-Terrorism/Force Protection Measures.
5. **Environmental Considerations:** N/A
6. **Fire Protection**
- 6.1 Criteria and Reference Sources:
- a. National Fire Protection Association Publications - Standard for the Installation of Air-Conditioning and Ventilating Systems, NFPA 90A-2009.
  - b. NFPA 13 – Installation of Sprinkler Systems, 2007
  - c. NFPA 101 – Life Safety Code, 2009
  - d. NFPA 20 – Fire Pumps, 2010
  - e. UFC 3-600-01 – Fire Protection for Facilities, 2006

**6.2 Functional and Technical Requirements:**

The building must be fully sprinklered. ESFR will be used in the warehouse as it is effective for that use and will function properly (no matter what the warehouse space is used for in the future) so long as it remains open space.

**6.2.1 User Requirements: No specific requirements.****6.3 Design Objectives and Provisions:**

ESFR type sprinklers in warehouse area.

Post indicator Valve to be located at least 40 feet away from the building.  
In accordance with NFPA 24. PIV shall be supervised by the building fire alarm system.

Fire Hydrant must be freestanding and located at least 40 feet away from the building and located at a curb next to fire department access lane.

Fire pump riser will be placed in dedicated fire pump room (whether a pump is required or not).  
Wet pipe system will serve all areas of the building.

**7.0 Equipment to Coordinate and/or Specify:**

- 10'h X 9'w roll up dock doors
- Wedge type dock seals on the sides plus a top curtain at each dock
- Combination full pit dock levelers and truck locks with indoor and outdoor indicator lights.  
Dock leveler shall operate at 48" (above grade) plus/minus 12" and have suitable gradability for use by conventional electric lift trucks. Dock leveler plate width shall be 7'.
- Suitable bumpers and bollards outside and bollards inside at each dock
- Eyebrow above each dock opening
- Bollard-mounted combination truck cooler fan/light at each dock

1. **Requirements, criteria sources, and references:**

- a. Type of occupancies: Supply Support Activity (SSA) Facility is to be utilized for storing receiving, shipping and distributing of Class II, III(P), V & IX supplies.
- b. Specialized functions/equipment: No requirement.
- c. Communications support: A prewired raceway system will be provided for telephone and LAN systems in accordance with project criteria.

2. **Interior Electrical Distribution System.**

a. Functional and technical requirements.

(1) Illumination levels will be in accordance with IES Lighting Handbook (9<sup>th</sup> Edition), ASHRAE 90.1 standard and UFC 3-530-01.

(2) Installation and equipment standards: No special requirements.

(3) System voltage: No special requirements.

(4) Emergency lighting and standby generation: Emergency and exit lighting will be in accordance with NFPA 101. Standby generation is not required.

(5) Communications: Telephone, wireless access point, LAN systems requirements will be in accordance with project criteria.

(6) Electronic clock systems: No requirement.

(7) Electronic security, and intrusion detection systems: No requirement.

(8) Audio/visual systems (TV, PA, Intercom, etc.): Required.

(9) Fire alarm system will conform to UFC-3-600-01, and project criteria.

(10) Mass notification system will be installed and conform to UFC-4-021-01.

(11) Lightning protection system: Will be determined by risk analysis as approach final design.

(12) Static grounding system: No Requirement.

(13) Energy conservation and energy monitoring: Energy monitoring provisions will be in accordance with project criteria.

(14) Cable TV: Required.

b. Design objectives and provisions.

(1) Electrical characteristics: Distribution system will be 277/480 volt, 3-phase, 4-wire to serve main electrical loads for the building. General receptacles and computer loads will be supplied power through a dry type transformer that steps 277/480 volt to 120/208 volt.

(2) General illumination and task lighting.

Lighting fixtures for the building are utilized 277V in maximum extend. Details of the lighting

fixtures are listed on drawing E801 and E802. Intensities will be as per the IES. and project criteria. Illumination will be provided as listed in Table I in Calculation, Illumination section.

(a) Warehouse storage area. Lighting fixtures are utilized 277V and T5 high base high output fluorescent lighting will be utilized. For the processing area that includes Customer Issue Bay, Receiving and Issue Bay and turn-In Bay, Illumination for these areas will be same as office.

(b) For administrative areas. Fluorescent lighting fixtures with T8 lamp will be utilized. Each room, occupancy sensor shall be provided and supersede by a lighting switch.

(c) Exit and emergency lighting systems: Exit lights will be provided and will be equipped with battery for emergency operation upon failure of normal supply. Battery powered emergency lights will be provided to provide a means of egress in the event of normal power failure.

(3) Power requirements: Panelboards will be circuit breaker type. Branch circuits will generally be loaded to 80% of their rating.

(4) Power outlets: Duplex receptacles will be provided throughout the facility. Special power outlets are not required.

(5) Wiring system will consist of insulated copper conductors in rigid steel conduit, intermediate metal conduit, electrical metallic tubing or metal clad cable. An aluminum option will be given for conductors of #6 and larger. A separate grounding conductor will be provided for receptacle circuits.

(6) Special items (security, specialized equipment, etc.): No special requirements.

(7) Special communication/electronic requirements: None.

(8) Fire alarm and signal systems: Fire alarm system will consist of manual stations, bells, and visual indicators. System will be non-coded within the building. Upon operation of a manual station or duct mounted smoke detector an alarm will be initiated and exhaust and supply fans shut down. A transmitter will be provided for transmission of a coded alarm signal to the fire station.

(9) Telephone and LAN systems: Telephone outlets with RJ45 connectors will be provided to the building. Dual telephone outlets with two RJ45 connectors will be provided. Outlets for LAN (Cat 6 system) should be installed to support for computers in office, mechanical room, fire pump room and warehouse area.

(10) Wireless Access Point (WAP) will be provided. WAP is for wireless LAN connection. Each WAP outlet consists of one Cat. 6 cable and a standard 8-pin modular connector. The outlet box will be installed 55 ft part to meet the I3A requirement. The intend of this WAP grid is to provide a pre-cabling grid to support 802.11 wireless LAN in future. Wireless survey shall be required to ensure proper wireless coverage as final wireless design implementing.

(11) Hazardous areas: Not required.

(12) Lightning protection: Will be determined by risk analysis as approach final design.

(13) Static grounding system: Not Required.

(14) Voltage drop will be limited to 2% for feeder, and 3% for branch circuits.

(15) Emergency power distribution: None.

- (16) Energy conservation:  
Design shall meet ASHRAE 90.1 and EPCACT05 requirements. Followings are the criteria to achieve energy conservation requirements. See calculation Section for Energy calculation.
- (a) All induction motors 5 HP and larger will be provided with capacitors to improve the power factor to .95 or more.
  - (b) Motion sensor will be provided for large administrative area lighting.
  - (c) Day light harvesting will be utilized in warehouse area. Motion Sensor and photocell will be provided.
  - (d) Photocell control will be provided for out door lighting.
  - (e) Voltage drop will be limited to ASHRAE 90.1 standard requirements.
- (17) Maintenance and operations enhancements: No special provisions.
- (18) Cable TV: No special requirements.
- (19) Economics: Equipment selections and system configuration will be based on most economical system consistent with criteria.

3. **Exterior Electrical Distribution System.**

- a. Functional and Technical Requirements.
- (1) Primary source will be in accordance with project criteria.
  - (2) Loads and load factors: No special requirements.
  - (3) Installation and equipment standards: No special requirements.
  - (4) Voltage will be existing system voltage.
  - (5) Stand-by generation: Not required.
  - (6) Switching: No special requirements.
  - (7) Communications: 100 pair of telephone cable and 12 strand of single mode fiber optic will be from a new manhole to the building. Equipment will be of the rack mounted type. 4' X 8' plywood sheets will be mounted on the communication room walls with quad receptacles, each on a dedicated circuit installed below each sheet.
  - (8) Electronic security, surveillance, and intrusion detection: Not required.
  - (9) Cable TV system: Not required.
  - (10) Energy conservation and energy monitoring: No special requirements.
  - (11) Power and lighting for site elements: Parking lot lights, roadway lighting and security lighting around security fence will be provided.
  - (12) Cathodic protection will be provided for underground metallic gas line option as required by

Federal Regulations.

(13) Public address system: PA system is required around the building.

b. Design Objectives and Provisions.

(1) Point of primary supply will be tapped off from a nearest point to the project vicinity.

(2) Primary voltage will be existing system voltage. Secondary distribution voltage will be 480/277V for building service.

(3) Transformer will be a 3-phase, pad-mounted type. The distance of the transformer and building shall meet AT/FP requirements.

(4) Switching: No special switching will be provided.

(6) Conductor types:

(a) Underground primary conductors will be copper or 1350 alloy aluminum.

(b) Underground secondary conductors will be copper or aluminum for #6 AWG and larger, copper sizes and copper for less than #6 AWG.

(7) Exterior distribution system will conform to TM 5-811-1/AFM 88-9, Ch 1.

(8) Lighting: Security, roadway and parking lot lighting will be provided. For eliminate "lighting trespass", roadway lighting will be cut-off type and security fence flood light will have external glare control.

(9) Cathodic protection will be provided for underground metallic gas line option. System will be sacrificial type utilizing magnesium anodes.

(10) Hazardous areas: None.

(11) Utility monitoring and control systems (UMCS): Prewired raceway systems will be provided in accordance with project criteria.

(12) Emergency power distribution: None.

(13) Energy conservation: No special provisions.

(14) Maintenance and operations enhancements: No special provisions.

(15) Economics: Equipment selections and system configuration will be based on most economical system consistent with criteria.

4. **Calculations.**

a. Energy.

(1) Interior Lighting Power Allowance.

Building area method will be used for the lighting power allowance.

## A. Interior Lighting Power.

Building Width: 260 FT  
 Building Length: 82 FT  
 Building Total Area: 21,320 SQFT

## Warehouse Area

1. warehouse Operation area: 11,438 SQFT
  2. Secure Storage Room: 150 SQFT
  3. Restrooms: 280 SQFT
  4. Janitor Room: 20 SQFT
  5. Mech. & Elec. Room: 259 SQFT
  6. Charge Station: 195 SQFT
  7. Fire Pump Room: 110 SQFT
- Total Warehouse Area: 12,452 SQFT

Per ASHRAE 90.1, Table 9-B interior power for warehouse is 0.8W/ SQFT.

Total interior power allowance for warehouse area: 0.8W/ SQFT X 12,452 SQFT  
 Total interior power allowance for warehouse area = 9,962 W.

## Office Area:

Total office area = Total Building Area – Total Warehouse Area  
 = 21,320 – 12,452  
 = 8,863 SQFT

Per ASHRAE 90.1, Table 9-B interior power for warehouse is 1.0W/ SQFT.  
 Total interior power allowance for office area: 1.0W/ SQFT X 8,863 SQFT  
 Total interior power allowance for office area = 8,863 W.

Total interior power allowance for building = 8,863 W + 9,962W  
 Total interior power allowance for building = 18,830 W.

ASHRAE 90.1 interior lighting power allowance is 18,830 W

EPACT 05 interior power allowance is 13,177W

As shown on Table 2 in section f the total power for interior lighting is 9,404 W.

Total interior lighting power usage is less than ASHRAE 90.1 and EPACT 05 allowance.

## (2) Exterior Power Allowance:

|                                  |             | Power Allowance | Total    |
|----------------------------------|-------------|-----------------|----------|
| Parking (closed to building):    | 4,240 SQFT  | 0.15W / SQFT    | 636 W    |
| Parking (outside security fence) | 10,548 SQFT | 0.15W/ SQFT     | 1,582 W  |
| Covered Storage                  | 6,300 SQFT  | 1.25W/ SQFT     | 7,875 W  |
| Loading/Unloading Apron          | 12,800 SQFT | 1.25W/ SQFT     | 16,133 W |

Total exterior lighting power allowance for building = 26,226 W

ASHRAE 90.1 exterior lighting power allowance is 26,226 W

EPACT 05 interior power allowance is 18,358W

As indicated in drawing the total power for exterior lighting is 13,854 W.

Total exterior lighting power usage is less than ASHRAE 90.1 and EPACT 05 allowance.



## b. Voltage Drop.

$$VD = L \times I \times N \times 10E-6$$

Conductor Size = 8                      N = 1426

System Voltage =

VD Limited = 5%

L = One-way length of circuit conductor in ft.  
 I = Current in Amp.  
 N = 613 Voltage loss see table "voltage Loss"  
 V = Voltage at the location  
 VD = Voltage drop  
 dV = System voltage drop at the location  
 VD% = Percent voltage drop

| PA-7 | V = 277 | WIRE Size: 10 |        | N = 2221 |       |       |  |
|------|---------|---------------|--------|----------|-------|-------|--|
| L    | I       | VA            | V      | VD       | dV    | VD%   |  |
| 65   | 33.6    | 800           | 277.00 | 4.8507   | 272.1 | 1.75% |  |
| 35   | 22.4    | 250           | 272.15 | 1.7413   | 270.4 | 0.63% |  |
| 20   | 11.2    | 800           | 270.41 | 0.4975   | 269.9 | 0.18% |  |
| 15   | 5.6     | 800           | 269.91 | 0.1866   | 269.7 | 0.07% |  |
| 14   | 2.8     | 800           | 269.72 | 0.0871   | 269.6 | 0.03% |  |

Total VD  
= 2.63%

| PA-8 | V = 277 | WIRE Size: 8 |        | N = 1426 |       |       |  |
|------|---------|--------------|--------|----------|-------|-------|--|
| L    | I       | VA           | V      | VD       | dV    | VD%   |  |
| 175  | 16.8    | 250          | 277.00 | 4.1924   | 272.8 | 1.51% |  |
| 35   | 5.6     | 1600         | 272.81 | 0.2795   | 272.5 | 0.10% |  |
| 26   | 2.8     | 800          | 272.53 | 0.1038   | 272.4 | 0.04% |  |

Total VD  
= 1.65%

| PA-9 | V = 277 | WIRE Size: 10 |        | N = 2221 |       |       |  |
|------|---------|---------------|--------|----------|-------|-------|--|
| L    | I       | VA            | V      | VD       | dV    | VD%   |  |
| 53   | 6.3177  | 250           | 277.00 | 0.7437   | 276.3 | 0.27% |  |
| 83   | 5.4152  | 250           | 276.26 | 0.9982   | 275.3 | 0.36% |  |
| 31   | 4.5126  | 250           | 275.26 | 0.3107   | 274.9 | 0.11% |  |
| 47   | 4.5126  | 250           | 274.95 | 0.4711   | 274.5 | 0.17% |  |
| 25   | 3.6101  | 250           | 274.48 | 0.2005   | 274.3 | 0.07% |  |
| 23   | 3.6101  | 250           | 274.28 | 0.1844   | 274.1 | 0.07% |  |
| 26   | 2.7076  | 250           | 274.09 | 0.1564   | 273.9 | 0.06% |  |
| 48   | 1.8051  | 250           | 273.94 | 0.1924   | 273.7 | 0.07% |  |
| 56   | 0.9025  | 250           | 273.74 | 0.1123   | 273.6 | 0.04% |  |

Total VD  
= 0.98%

| PB-14,16,18 | V =  | 480  |        | WIRE Size: | 10    | N =   | 1921 |
|-------------|------|------|--------|------------|-------|-------|------|
| L           | I    | VA   | V      | VD         | dV    | VD%   |      |
| 90          | 10.5 | 2000 | 480.00 | 1.8153     | 478.2 | 0.38% |      |
| 90          | 7    | 2000 | 478.18 | 1.2102     | 477.0 | 0.25% |      |
| 90          | 3.5  | 2000 | 476.97 | 0.6051     | 476.4 | 0.13% |      |

Total VD  
= 0.76%

| PB-8,10,12 | V = | 480  |        | WIRE Size: | 10    | N =   | 1921 |
|------------|-----|------|--------|------------|-------|-------|------|
| L          | I   | VA   | V      | VD         | dV    | VD%   |      |
| 90         | 5.6 | 2000 | 480.00 | 0.9682     | 479.0 | 0.20% |      |
| 70         | 3.5 | 2000 | 479.03 | 0.4706     | 478.6 | 0.10% |      |

Total VD  
= 0.30%

| PB-7,9,11 | V =  | 480  |        | WIRE Size: | 10    | N =   | 1920 |
|-----------|------|------|--------|------------|-------|-------|------|
| L         | I    | VA   | V      | VD         | dV    | VD%   |      |
| 230       | 8.41 | 480  | 480.00 | 3.7139     | 476.3 | 0.77% |      |
| 55        | 6.3  | 250  | 476.29 | 0.6653     | 475.6 | 0.14% |      |
| 55        | 4.2  | 250  | 475.62 | 0.4435     | 475.2 | 0.09% |      |
| 55        | 2.1  | 1250 | 475.18 | 0.2218     | 475.0 | 0.05% |      |

Total VD  
= 1.05%

| LA-14 | V = | 120 |        | WIRE Size: | 8     | N =   | 1426 |
|-------|-----|-----|--------|------------|-------|-------|------|
| L     | I   | VA  | V      | VD         | dV    | VD%   |      |
| 245   | 7.5 | 900 | 120.00 | 2.6203     | 117.4 | 2.18% |      |

Total VD  
= 2.18%

| LA-16 | V =    | 120 |        | WIRE Size: | 8     | N =   | 1426 |
|-------|--------|-----|--------|------------|-------|-------|------|
| L     | I      | VA  | V      | VD         | dV    | VD%   |      |
| 255   | 9.8333 | 500 | 120.00 | 3.5757     | 116.4 | 2.98% |      |
| 15    | 5.6667 | 180 | 116.42 | 0.1212     | 116.3 | 0.10% |      |
| 15    | 4.1667 | 500 | 116.30 | 0.0891     | 116.2 | 0.07% |      |

Total VD  
= 3.16%

| LA-18 | V = | 120 |        | WIRE Size: | 8     | N =   | 1426 |
|-------|-----|-----|--------|------------|-------|-------|------|
| L     | I   | VA  | V      | VD         | dV    | VD%   |      |
| 281   | 7.5 | 180 | 120.00 | 3.0053     | 117.0 | 2.50% |      |
| 10    | 6   | 360 | 116.99 | 0.0856     | 116.9 | 0.07% |      |
| 10    | 3   | 360 | 116.91 | 0.0428     | 116.9 | 0.04% |      |

|       |        |     |        |            |       |       |          |       |
|-------|--------|-----|--------|------------|-------|-------|----------|-------|
|       |        |     |        |            |       |       | Total VD |       |
|       |        |     |        |            |       |       | =        | 2.61% |
| 0     |        |     |        |            |       |       |          |       |
| LA-2  | V =    | 120 |        | WIRE Size: | 12    | N =   | 3502     |       |
| L     | I      | VA  | V      | VD         | dV    | VD%   |          |       |
| 85    | 9      | 540 | 120.00 | 2.6790     | 117.3 | 2.23% |          |       |
| 12    | 4.5    | 180 | 117.32 | 0.1891     | 117.1 | 0.16% |          |       |
| 4     | 3      | 360 | 117.13 | 0.0420     | 117.1 | 0.04% |          |       |
|       |        |     |        |            |       |       | Total VD |       |
|       |        |     |        |            |       |       | =        | 2.43% |
| LA-4  | V =    | 120 |        | WIRE Size: | 10    | N =   | 2221     |       |
| L     | I      | VA  | V      | VD         | dV    | VD%   |          |       |
| 117   | 7.5    | 360 | 120.00 | 1.9489     | 118.1 | 1.62% |          |       |
| 16    | 4.5    | 180 | 118.05 | 0.1599     | 117.9 | 0.13% |          |       |
| 14    | 3      | 180 | 117.89 | 0.0933     | 117.8 | 0.08% |          |       |
| 5     | 3      | 180 | 117.80 | 0.0333     | 117.8 | 0.03% |          |       |
| 20    | 1.5    | 180 | 117.76 | 0.0666     | 117.7 | 0.06% |          |       |
|       |        |     |        |            |       |       | Total VD |       |
|       |        |     |        |            |       |       | =        | 1.92% |
| LA-6  | V =    | 120 |        | WIRE Size: | 8     | N =   | 1426     |       |
| L     | I      | VA  | V      | VD         | dV    | VD%   |          |       |
| 187   | 9      | 540 | 120.00 | 2.4000     | 117.6 | 2.00% |          |       |
| 14    | 4.5    | 180 | 117.60 | 0.0898     | 117.5 | 0.07% |          |       |
| 10    | 3      | 360 | 117.51 | 0.0428     | 117.5 | 0.04% |          |       |
|       |        |     |        |            |       |       | Total VD |       |
|       |        |     |        |            |       |       | =        | 2.11% |
| LA-27 | V =    | 120 |        | WIRE Size: | 6     | N =   | 926      |       |
| L     | I      | VA  | V      | VD         | dV    | VD%   |          |       |
| 305   | 8.6667 | 500 | 120.00 | 2.4477     | 117.6 | 2.04% |          |       |
| 12    | 4.5    | 180 | 117.55 | 0.0500     | 117.5 | 0.04% |          |       |
| 22    | 3      | 360 | 117.50 | 0.0611     | 117.4 | 0.05% |          |       |
|       |        |     |        |            |       |       | Total VD |       |
|       |        |     |        |            |       |       | =        | 2.13% |
| LA-29 | V =    | 120 |        | WIRE Size: | 8     | N =   | 1426     |       |
| L     | I      | VA  | V      | VD         | dV    | VD%   |          |       |
| 340   | 4.5    | 180 | 120.00 | 2.1818     | 117.8 | 1.82% |          |       |
| 30    | 3      | 180 | 117.82 | 0.1283     | 117.7 | 0.11% |          |       |
| 23    | 1.5    | 180 | 117.69 | 0.0492     | 117.6 | 0.04% |          |       |
| 35    | 1.5    | 180 | 117.64 | 0.0749     | 117.6 | 0.06% |          |       |
| 20    | 0      |     | 117.57 | 0.0000     | 117.6 | 0.00% |          |       |
|       |        |     |        |            |       |       | Total VD |       |
|       |        |     |        |            |       |       | =        | 2.03% |

|      |      |     |        |            |       |       |          |       |
|------|------|-----|--------|------------|-------|-------|----------|-------|
| BL-2 | V =  | 120 |        | WIRE Size: | 6     | N =   | 926      |       |
| L    | I    | VA  | V      | VD         | dV    | VD%   |          |       |
| 70   | 15.6 | 936 | 120.00 | 1.0112     | 119.0 | 0.84% |          |       |
| 90   | 7.8  | 936 | 118.99 | 0.6501     | 118.3 | 0.54% |          |       |
|      |      |     |        |            |       |       | Total VD |       |
|      |      |     |        |            |       |       | =        | 1.38% |

|       |     |     |        |            |       |       |          |       |
|-------|-----|-----|--------|------------|-------|-------|----------|-------|
| LA-32 | V = | 120 |        | WIRE Size: | 8     | N =   | 1426     |       |
| L     | I   | VA  | V      | VD         | dV    | VD%   |          |       |
| 340   | 4.5 | 540 | 120.00 | 2.1818     | 117.8 | 1.82% |          |       |
|       |     |     |        |            |       |       | Total VD |       |
|       |     |     |        |            |       |       | =        | 1.82% |

|      |      |     |        |            |       |       |          |       |
|------|------|-----|--------|------------|-------|-------|----------|-------|
| LB-4 | V =  | 120 |        | WIRE Size: | 6     | N =   | 926      |       |
| L    | I    | VA  | V      | VD         | dV    | VD%   |          |       |
| 150  | 15.6 | 936 | 120.00 | 2.1668     | 117.8 | 1.81% |          |       |
| 90   | 7.8  | 936 | 117.83 | 0.6501     | 117.2 | 0.54% |          |       |
|      |      |     |        |            |       |       | Total VD |       |
|      |      |     |        |            |       |       | =        | 2.35% |

|      |      |     |        |            |       |       |          |       |
|------|------|-----|--------|------------|-------|-------|----------|-------|
| LB-6 | V =  | 120 |        | WIRE Size: | 6     | N =   | 926      |       |
| L    | I    | VA  | V      | VD         | dV    | VD%   |          |       |
| 90   | 15.6 | 936 | 120.00 | 1.3001     | 118.7 | 1.08% |          |       |
| 90   | 7.8  | 936 | 118.70 | 0.6501     | 118.0 | 0.54% |          |       |
|      |      |     |        |            |       |       | Total VD |       |
|      |      |     |        |            |       |       | =        | 1.63% |

|      |      |     |        |            |       |       |          |       |
|------|------|-----|--------|------------|-------|-------|----------|-------|
| LB-8 | V =  | 120 |        | WIRE Size: | 6     | N =   | 926      |       |
| L    | I    | VA  | V      | VD         | dV    | VD%   |          |       |
| 190  | 15.6 | 936 | 120.00 | 2.7447     | 117.3 | 2.29% |          |       |
| 90   | 7.8  | 936 | 117.26 | 0.6501     | 116.6 | 0.54% |          |       |
|      |      |     |        |            |       |       | Total VD |       |
|      |      |     |        |            |       |       | =        | 2.83% |

|      |     |     |        |            |       |       |          |       |
|------|-----|-----|--------|------------|-------|-------|----------|-------|
| LB-1 | V = | 120 |        | WIRE Size: | 10    | N =   | 2221     |       |
| L    | I   | VA  | V      | VD         | dV    | VD%   |          |       |
| 58   | 7.5 | 180 | 120.00 | 0.9661     | 119.0 | 0.81% |          |       |
| 22   | 6   | 180 | 119.03 | 0.2932     | 118.7 | 0.24% |          |       |
| 22   | 4.5 | 180 | 118.74 | 0.2199     | 118.5 | 0.18% |          |       |
| 45   | 6   | 360 | 118.52 | 0.5997     | 117.9 | 0.50% |          |       |
| 29   | 3   | 360 | 117.92 | 0.1932     | 117.7 | 0.16% |          |       |
|      |     |     |        |            |       |       | Total VD |       |
|      |     |     |        |            |       |       | =        | 1.89% |

| LB-3 | V = 120 | WIRE Size: 8 |        | N = 1462 |       |          |       |
|------|---------|--------------|--------|----------|-------|----------|-------|
| L    | I       | VA           | V      | VD       | dV    | VD%      |       |
| 150  | 6       | 180          | 120.00 | 1.3158   | 118.7 | 1.10%    |       |
| 24   | 4.5     | 180          | 118.68 | 0.1579   | 118.5 | 0.13%    |       |
| 63   | 3       | 180          | 118.53 | 0.2763   | 118.2 | 0.23%    |       |
| 16   | 3       | 180          | 118.25 | 0.0702   | 118.2 | 0.06%    |       |
| 38   | 1.5     | 180          | 118.18 | 0.0833   | 118.1 | 0.07%    |       |
|      |         |              |        |          |       | Total VD |       |
|      |         |              |        |          |       | =        | 1.59% |

## c. Panel Feeders

## FEEDER: PANEL PB

SYSTEM: 480 Volts, 3-Phase

## DESIGN BASIS:

|   |                            |                        |
|---|----------------------------|------------------------|
| Demand Amps = 49                            | Circuit Design Amps = 50.2 | Power Factor = 0.9     |
| Max Voltage Drop = 2%                       | Feeder Length = 10 feet    |                        |
| Type: Copper conductors in magnetic conduit |                            |                        |
| SELECTION:                                  |                            |                        |
| Conductors: #4                              | Ampacity = 80              | Percent Loaded = 89.1% |
| Voltage Drop = 0.08% (0.38 Volts)           |                            |                        |
| Overcurrent Protection: 90 Amps             |                            |                        |

## FEEDER: PANEL LA

SYSTEM: 208 Volts, 3-Phase

## DESIGN BASIS:

|   |                           |                        |
|---|---------------------------|------------------------|
| Demand Amps = 112                           | Circuit Design Amps = 112 | Power Factor = 0.9     |
| Max Voltage Drop = 2%                       | Feeder Length = 30 feet   |                        |
| Type: Copper conductors in magnetic conduit |                           |                        |
| SELECTION:                                  |                           |                        |
| Conductors: #3/0                            | Ampacity = 200            | Percent Loaded = 74.7% |
| Voltage Drop = 0.32% (0.67 Volts)           |                           |                        |
| Overcurrent Protection: 200 Amps            |                           |                        |

## FEEDER: PANEL LB

SYSTEM: 208 Volts, 3-Phase

## DESIGN BASIS:

|   |                          |                        |
|---|--------------------------|------------------------|
| Demand Amps = 59                            | Circuit Design Amps = 59 | Power Factor = 0.9     |
| Max Voltage Drop = 2%                       | Feeder Length = 10 feet  |                        |
| Type: Copper conductors in magnetic conduit |                          |                        |
| SELECTION:                                  |                          |                        |
| Conductors: #1/0                            | Ampacity = 150           | Percent Loaded = 84.3% |
| Voltage Drop = 0.15% (0.31 Volts)           |                          |                        |
| Overcurrent Protection: 150 Amps            |                          |                        |

## FEEDER: PANEL PA

SYSTEM: 480 Volts, 3-Phase

## DESIGN BASIS:

Demand Amps = 146

Max Voltage Drop = 2%

Type: Copper conductors in magnetic conduit

Circuit Design Amps =  
157.2

Feeder Length = 60 feet

Power Factor = 0.9

## SELECTION:

Conductors: #3/0

Ampacity = 200

Percent Loaded = 83.4%

Voltage Drop = 0.28% (1.34 Volts)

Overcurrent Protection: 200 Amps

## d. Load Summary

## PANEL LA LOAD SUMMARY

| <u>LOAD CATEGORY</u> | <u>CONNECTED</u><br><u>VA</u> | <u>DEM</u><br><u>FAC</u> | <u>DEMAND</u><br><u>VA</u> |
|----------------------|-------------------------------|--------------------------|----------------------------|
| Duplex Receptacles   | 20880                         | 0.74                     | 15451                      |
| Other                | 7204                          | 1.00                     | 7204                       |
| Spare                | 17600                         | 1.00                     | 17600                      |

Total Connected Load = 45684 VA

Total Demand Load = 40255 VA

## PANEL LB LOAD SUMMARY

| <u>LOAD CATEGORY</u> | <u>CONNECTED</u><br><u>VA</u> | <u>DEM</u><br><u>FAC</u> | <u>DEMAND</u><br><u>VA</u> |
|----------------------|-------------------------------|--------------------------|----------------------------|
| Duplex Receptacles   | 3380                          | 1.00                     | 3380                       |
| Other                | 4444                          | 1.00                     | 4444                       |
| Spare                | 13600                         | 1.00                     | 13600                      |

Total Connected Load = 21424 VA

Total Demand Load = 21424 VA

## PANEL PA LOAD SUMMARY

| <u>LOAD CATEGORY</u> | <u>CONNECTED</u><br><u>VA</u> | <u>DEM</u><br><u>FAC</u> | <u>DEMAND</u><br><u>VA</u> |
|----------------------|-------------------------------|--------------------------|----------------------------|
| Lighting             | 33136                         | 1.00                     | 33136                      |
| Duplex Receptacles   | 20880                         | 0.74                     | 15451                      |
| Motors               | 25590                         | 1.00                     | 25590                      |
| Other                | 10204                         | 1.00                     | 10204                      |
| Spare                | 36600                         | 1.00                     | 36600                      |

Total Connected Load = 126410 VA

Total Demand Load = 120981 VA

PANEL PB LOAD SUMMARY

| <u>LOAD CATEGORY</u> | <u>CONNECTED</u><br><u>VA</u> | <u>DEM</u><br><u>FAC</u> | <u>DEMAND</u><br><u>VA</u> |
|----------------------|-------------------------------|--------------------------|----------------------------|
| Motors               | 25590                         | 1.00                     | 25590                      |
| Other                | 3000                          | 1.00                     | 3000                       |
| Spare                | 12000                         | 1.00                     | 12000                      |

Total Connected Load = 40590 VA

Total Demand Load = 40590 VA

e. Transformer Sizing

TRANSFORMER

T-1

75 KVA 3-Phase Dry Type 480-120/208 Volts

Load Served: LA

Load = 40255 VA (55.4% Loaded)

TRANSFORMER

T

150 KVA 3-Phase Pad Mount Type 13800-277/480 Volts

Load Served: PA

Load = 122250 VA (81.5% Loaded)

f. Short Circuit Calculation.

Transformer: 150KVA

Primary voltage 13.8KV

Secondary voltage: 480V/277V

Transformer impedance: 5%

Short circuit three-phase current on primary side: 126A at 13.8KV

Short circuit three-phase current on secondary side: 3609A at 208V

g. Luminance

(1) Interior

**Table 1:** Illumination Schedule.

| LUMINAIRE SCHEDULE  |       |     |                              |  |   |                         |        |      |       |
|---|-------|-----|------------------------------|--|---|-------------------------|--------|------|-------|
| Symbol  | Label | Qty | Catalog Number               | Description                                    | Lamp  | File                    | Lumens | LLF  | Watts |
|    | LM-1  | 0   | HTGS24XNA12O43HT SERIES EP11 | COMMERCIAL LENSED TROFFER, 2X4                 | THREE 32 WATT SYLVANIA LAMPS  | HTGS24XNA12 O43EP11.ies | 2950   | 0.75 | 96    |
|    | LM-2  | 2   | HWSM4DSH71O42 EP11           | HW SERIES PREMIUM WRAPAROUND, 8.6X48           | TWO 32 WATT FLUORESCENT LAMPS   | HWSM4DSH7 1O42EP11.ies  | 3000   | 0.75 | 64    |
|    | LM-3  | 7   | HTGS24XNA12O43HT SERIES EP11 | COMMERCIAL LENSED TROFFER, 2X4                 | THREE 32 WATT SYLVANIA LAMPS  | HTGS24XNA12 O43EP11.ies | 2950   | 0.75 | 96    |
|    | LM-4  | 7   | HTGS24XNA12O42HT SERIES EP11 | COMMERCIAL LENSED TROFFER, 2X4                 | TWO 32 WATT SYLVANIA LAMPS  | HTGS24XNA12 O42EP11.ies | 2950   | 0.75 | 64    |
|    | LM-5  | 0   | HTGS24XNA12O43HT SERIES EP11 | COMMERCIAL LENSED TROFFER, 2X4                 | THREE 32 WATT SYLVANIA LAMPS  | HTGS24XNA12 O43EP11.ies | 2950   | 0.75 | 96    |
|   | A     | 8   | 8O2AZ (26TRT)                | 8" OPEN DOWNLIGHT WITH SPECULAR REFLECTOR.     | ONE 26-WATT TRIPLE TUBE COMPACT FLUORESCENT, VERTICAL BASE-UP POSITION. | 8O2AZ_(26TRT).ies       | 1800   | 1.00 | 29    |
|  | LM-6  | 0   | HISS04SF30SO42 EP11          | HIS SERIES PREMIUM INDUSTRIAL, 48              | TWO 32 WATT FLUORESCENT LAMPS   | HISS04SF30S O42EP11.ies | 3050   | 0.75 | 58    |
|  | LM-7  | 2   | WASN4XNACLO42 EP11           | WA SERIES COMMERCIAL WRAPAROUND, 6.6X48        | TWO 32 WATT FLUORESCENT LAMPS   | WASN4XNACL O42EP11.ies  | 3050   | 0.75 | 57    |
|  | L-3   | 5   | HWSM4DSH71O43 EP11           | HW SERIES PREMIUM WRAPAROUND, 8.6X48           | THREE 32 WATT FLUORESCENT LAMPS   | HWSM4DSH7 1O43EP11.ies  | 3000   | 0.81 | 85    |
|  | C     | 42  | IV35400WXXXIVPOLX            | POINTELLIVUE WITH 3411 LENS                    | (3) 54W FLUORESCENT T5 HO   | IV35400WXXXI VPOLX.ies  | 5000   | 1.00 | 175   |
|  | D     | 2   | PMO G 1 17 4LS               | OPTIMAX 1'X2' 1 LAMP T8 4 CELL LOW IR SPEC LVR | ONE 17--WATT T8 LINEAR FLUORESCENT.                                     | PMO_G_1_17_4LS.ies      | 1350   | 1.00 | 24    |



SSA LIGHTING SCHEDULE

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Table 2: Statistics For Each Area

| STATISTICS          |        |         |         |         |         |         |
|---------------------|--------|---------|---------|---------|---------|---------|
| Description         | Symbol | Avg     | Max     | Min     | Max/Min | Avg/Min |
| WAREHOUSE           | +      | 19.4 fc | 34.6 fc | 4.1 fc  | 8.4:1   | 4.7:1   |
| CHARGER RM          | +      | 9.9 fc  | 24.8 fc | 0.6 fc  | 41.3:1  | 16.5:1  |
| CLS OFFICE          | +      | 34.3 fc | 46.4 fc | 21.6 fc | 2.1:1   | 1.6:1   |
| COMM. RM            | +      | 53.1 fc | 57.0 fc | 49.5 fc | 1.2:1   | 1.1:1   |
| CONF RM             | +      | 35.7 fc | 47.1 fc | 27.8 fc | 1.7:1   | 1.3:1   |
| CUSTOMER ISSUE BAY  | +      | 28.8 fc | 35.5 fc | 12.7 fc | 2.8:1   | 2.3:1   |
| CUSTOMER SERVICE    | +      | 14.4 fc | 18.2 fc | 11.5 fc | 1.6:1   | 1.3:1   |
| FIRE PUMP RM        | +      | 25.0 fc | 28.8 fc | 22.5 fc | 1.3:1   | 1.1:1   |
| HALLWAY             | +      | 12.9 fc | 25.4 fc | 1.7 fc  | 14.9:1  | 7.6:1   |
| MECH/ELEC RM        | +      | 21.8 fc | 28.2 fc | 13.5 fc | 2.1:1   | 1.6:1   |
| OFFICE              | +      | 30.7 fc | 33.8 fc | 27.5 fc | 1.2:1   | 1.1:1   |
| RECEIVING/ISSUE BAY | +      | 30.1 fc | 36.7 fc | 21.9 fc | 1.7:1   | 1.4:1   |
| RESTROOM            | +      | 11.4 fc | 17.4 fc | 6.6 fc  | 2.6:1   | 1.7:1   |
| SECURE STORAGE      | +      | 19.5 fc | 22.4 fc | 15.7 fc | 1.4:1   | 1.2:1   |
| STOCK CONTRL RM     | +      | 9.4 fc  | 29.6 fc | 0.2 fc  | 148.0:1 | 47.0:1  |
| TURN-IN BAY         | +      | 29.2 fc | 35.0 fc | 22.5 fc | 1.6:1   | 1.3:1   |

Calculated values include direct and interreflected components.



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STATISTICS

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Table 3: Power Density

| POWER DENSITY STATISTICS                   |              |             |                         |                       |
|--|--------------|-------------|-------------------------|-----------------------|
| Name                                       | # Luminaires | Total Watts | Area                    | Density               |
| FIRE PUMP RM Power Density                 | 1            | 85.0 W      | 103.8 ft <sup>2</sup>   | 0.8 W/ft <sup>2</sup> |
| SECURE STR Power Density                   | 2            | 128.0 W     | 150.9 ft <sup>2</sup>   | 0.8 W/ft <sup>2</sup> |
| CHARGER RM Power Density                   | 2            | 114.0 W     | 259.8 ft <sup>2</sup>   | 0.4 W/ft <sup>2</sup> |
| CLS OFFICE Power Density                   | 3            | 288.0 W     | 220.3 ft <sup>2</sup>   | 1.3 W/ft <sup>2</sup> |
| COMM. RM Power Density                     | 2            | 170.0 W     | 74.5 ft <sup>2</sup>    | 2.3 W/ft <sup>2</sup> |
| CONF RM Power Density                      | 3            | 192.0 W     | 228.1 ft <sup>2</sup>   | 0.8 W/ft <sup>2</sup> |
| CUSTOMER ISSUE BAY Power Density           | 7            | 1225.0 W    | 1768.5 ft <sup>2</sup>  | 0.7 W/ft <sup>2</sup> |
| CUSTOMER RECEIVING/ISSUE BAY Power Density | 13           | 2275.0 W    | 3658.8 ft <sup>2</sup>  | 0.6 W/ft <sup>2</sup> |
| HALLWAY Power Density                      | 5            | 145.0 W     | 382.8 ft <sup>2</sup>   | 0.4 W/ft <sup>2</sup> |
| MECH/ELEC RM Power Density                 | 2            | 170.0 W     | 178.5 ft <sup>2</sup>   | 1.0 W/ft <sup>2</sup> |
| WAREHOUSE Power Density                    | 19           | 3325.0 W    | 10994.0 ft <sup>2</sup> | 0.3 W/ft <sup>2</sup> |
| REST ROOM Power Density                    | 1            | 24.0 W      | 132.4 ft <sup>2</sup>   | 0.2 W/ft <sup>2</sup> |
| TURN-IN BAY Power Density                  | 2            | 350.0 W     | 527.6 ft <sup>2</sup>   | 0.7 W/ft <sup>2</sup> |



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POWER DENSITY STATISTICS

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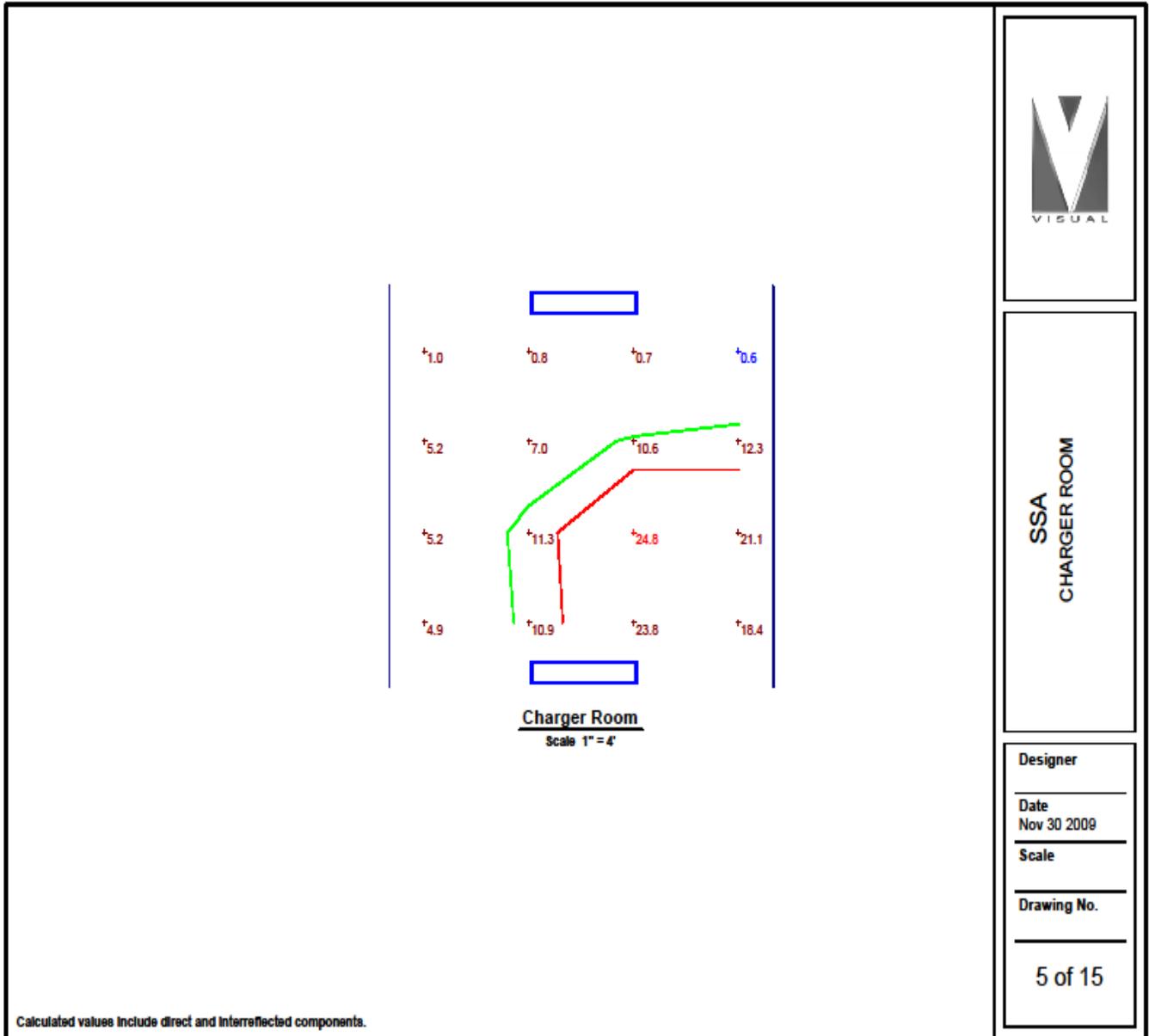
Date  
Nov 30 2009

Scale

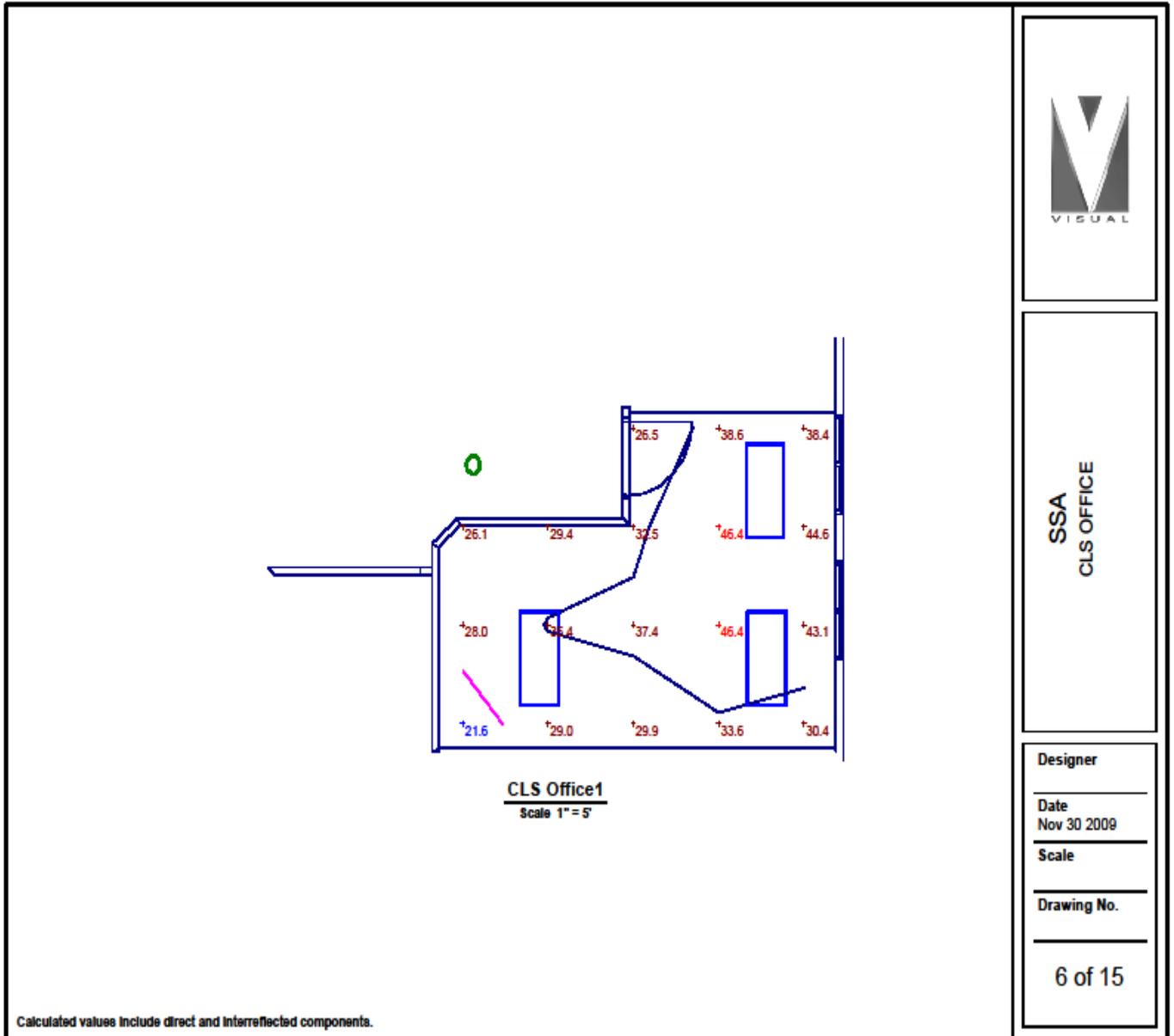
Drawing No.

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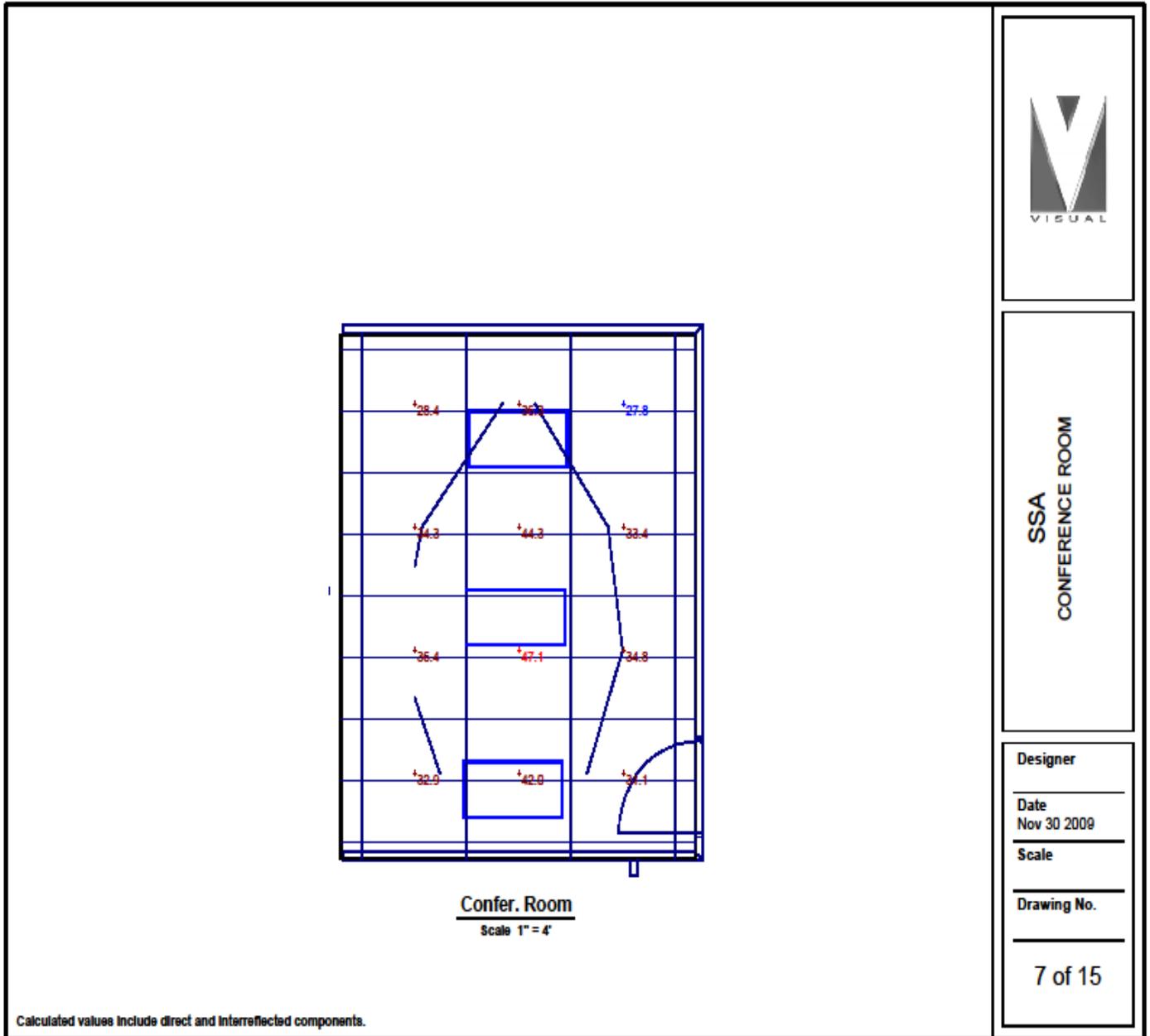
Lighting Calculation for Charger Room



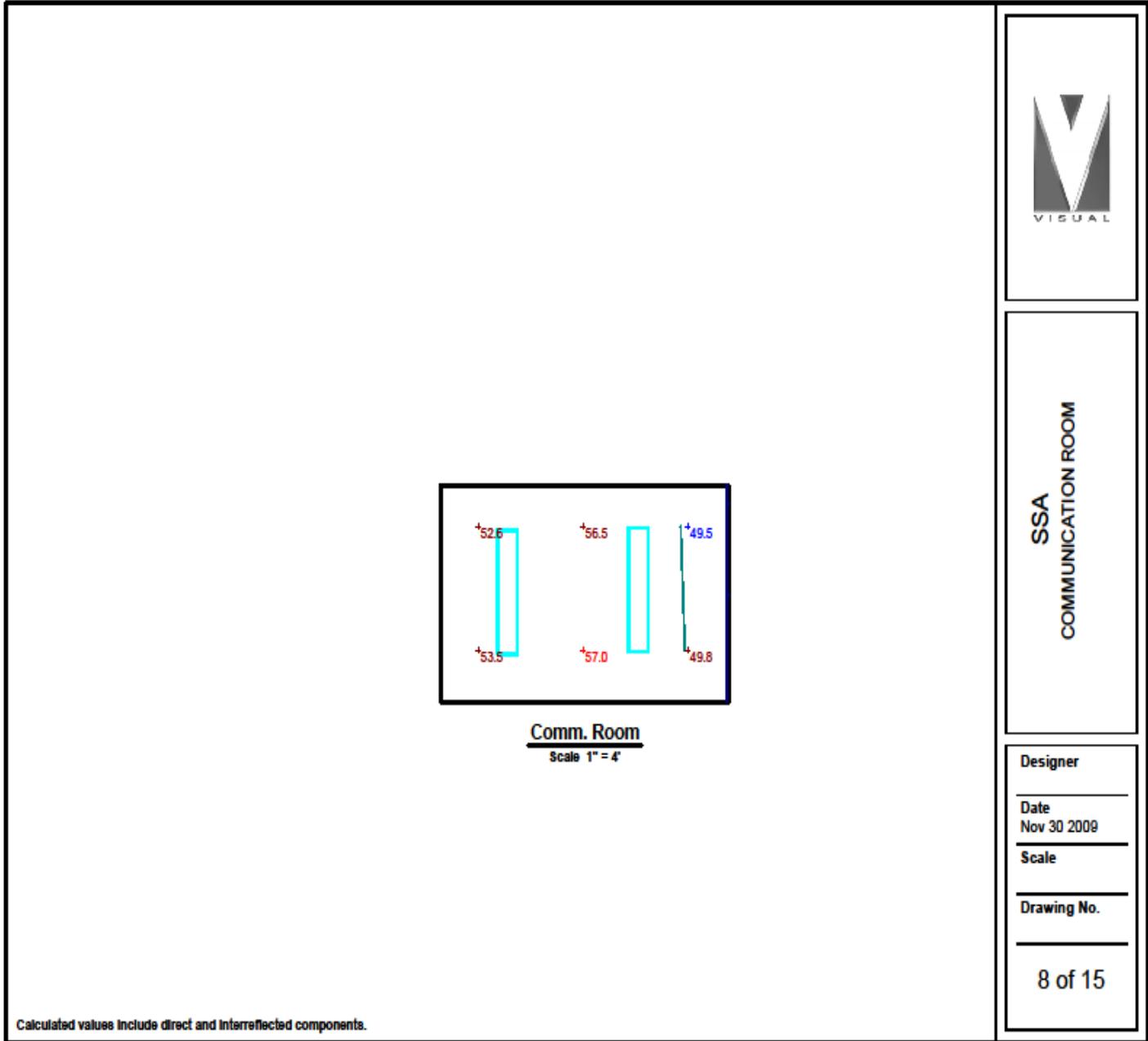
Lighting Calculation for CLS Office



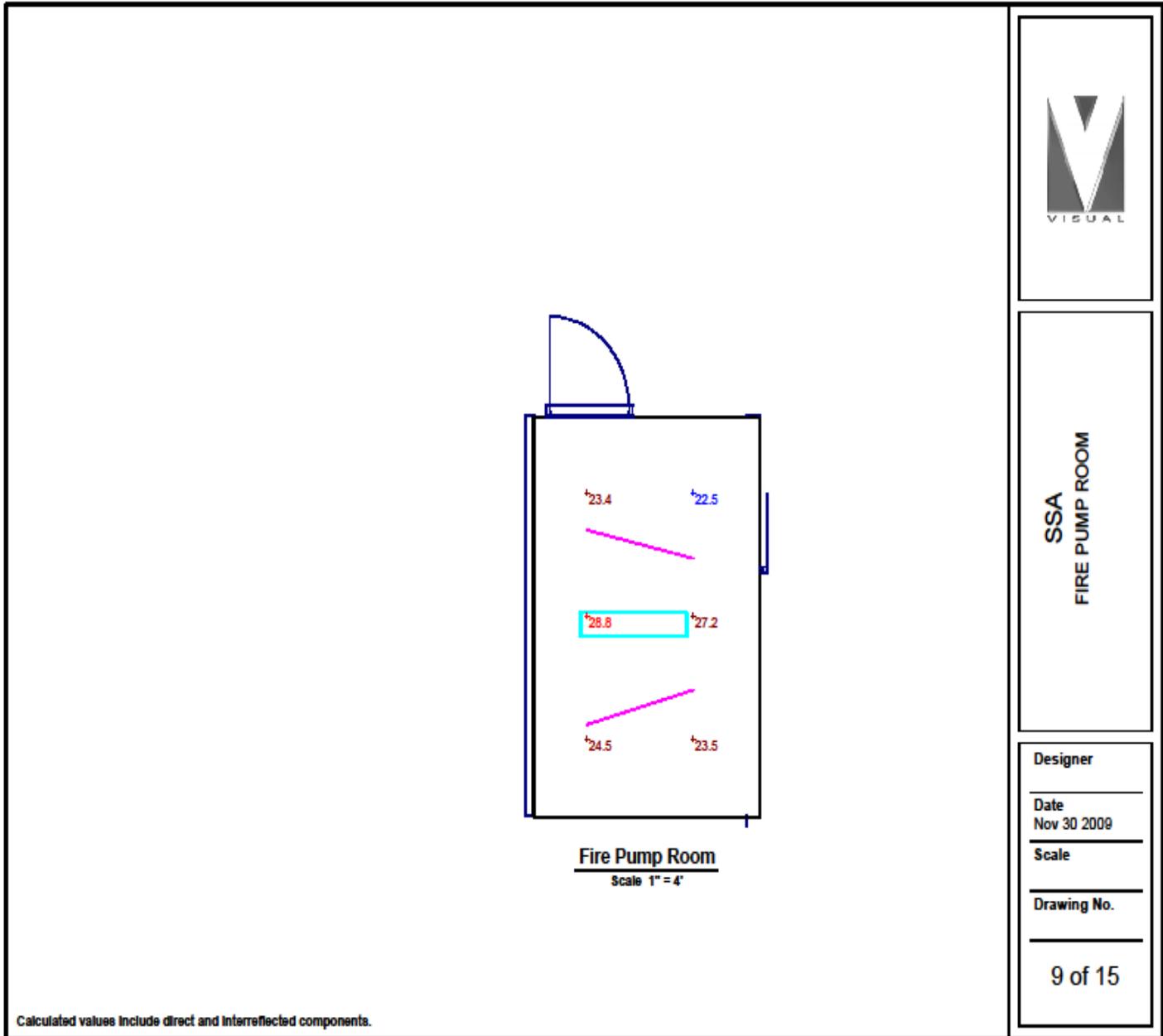
Lighting Calculation for Conference Room



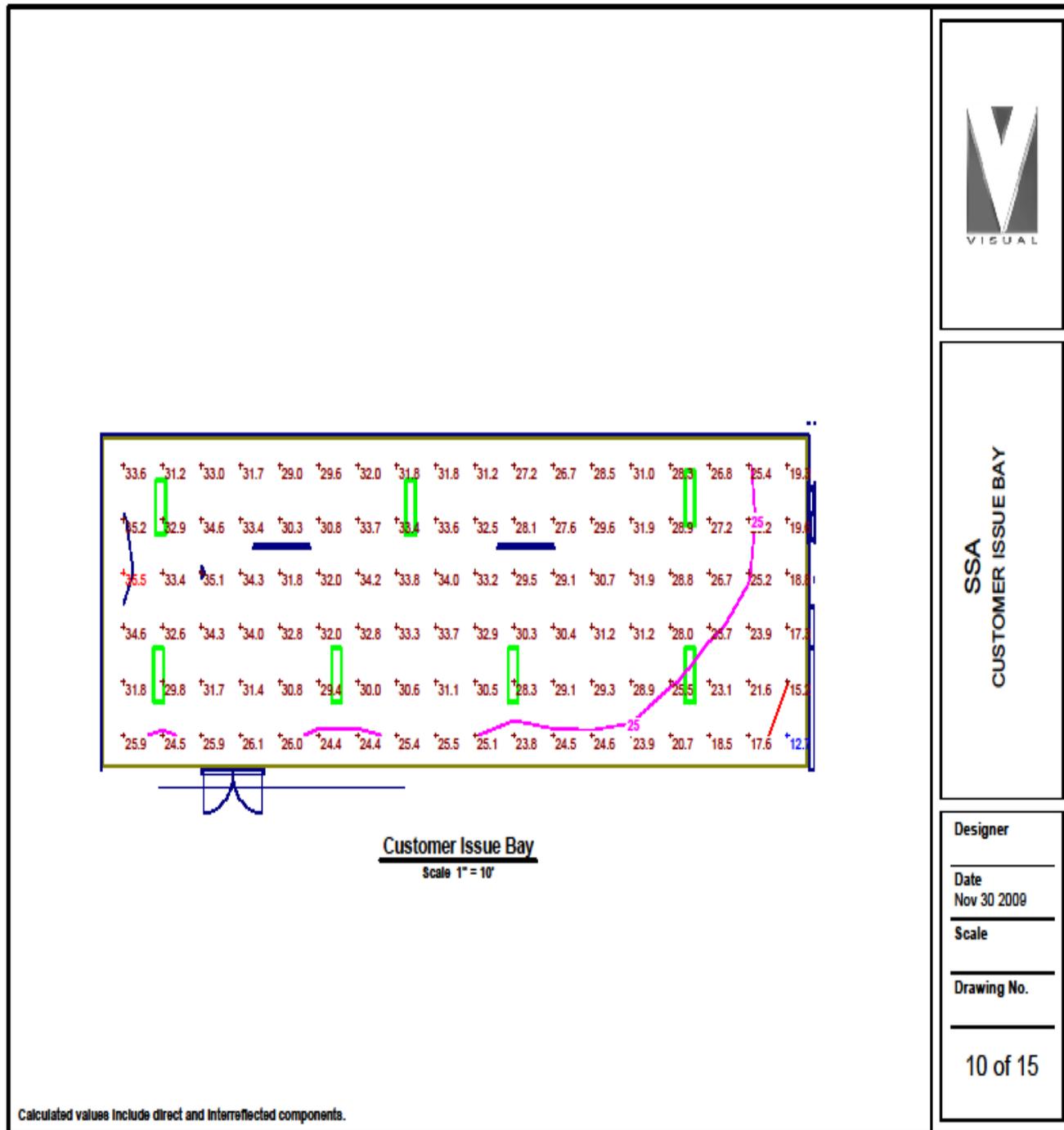
Lighting Calculation for communication Room



Lighting Calculation for Fire Pump Room



Lighting Calculation for Customer Issue Bay



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CUSTOMER ISSUE BAY

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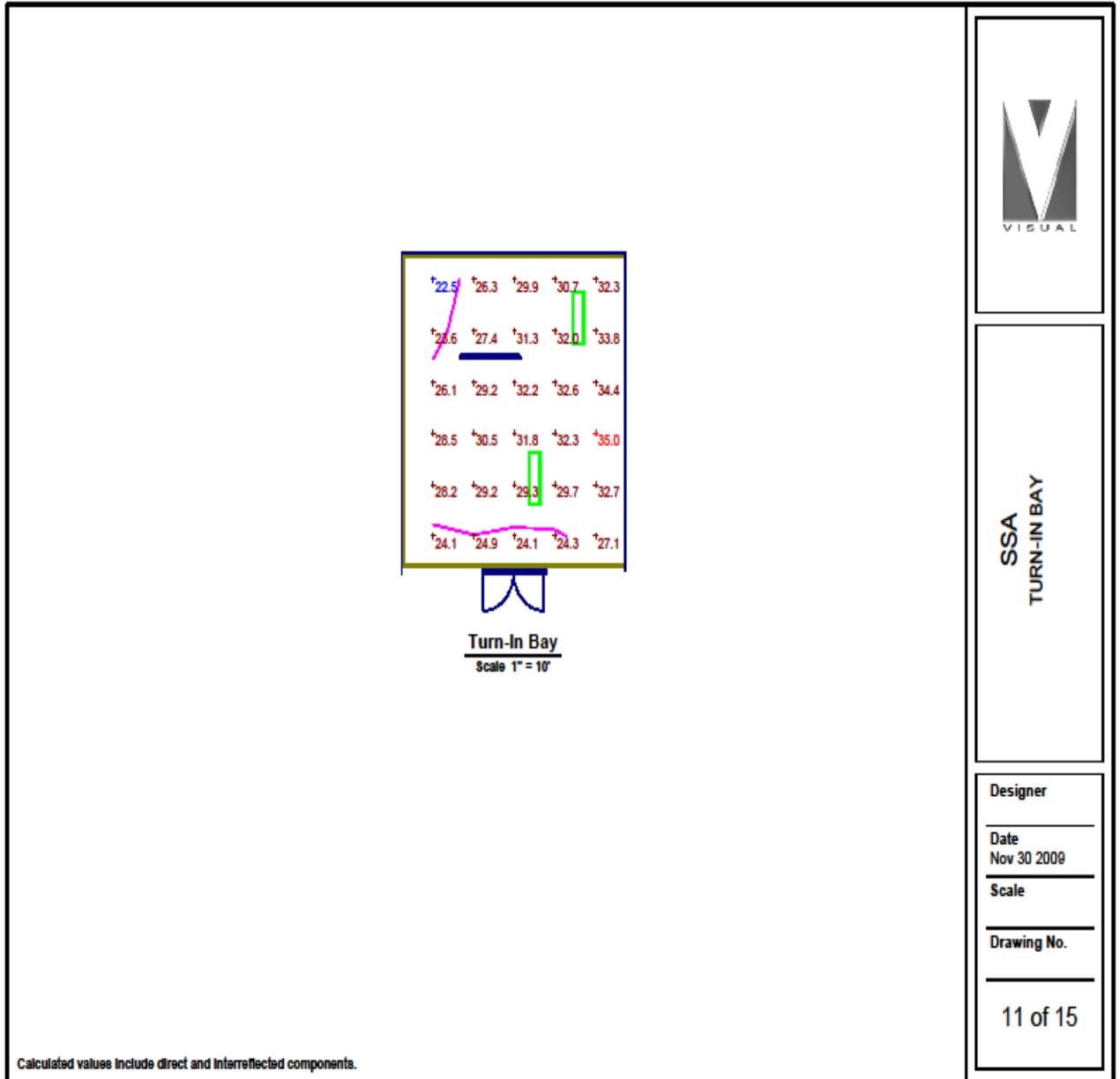
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Nov 30 2009

Scale

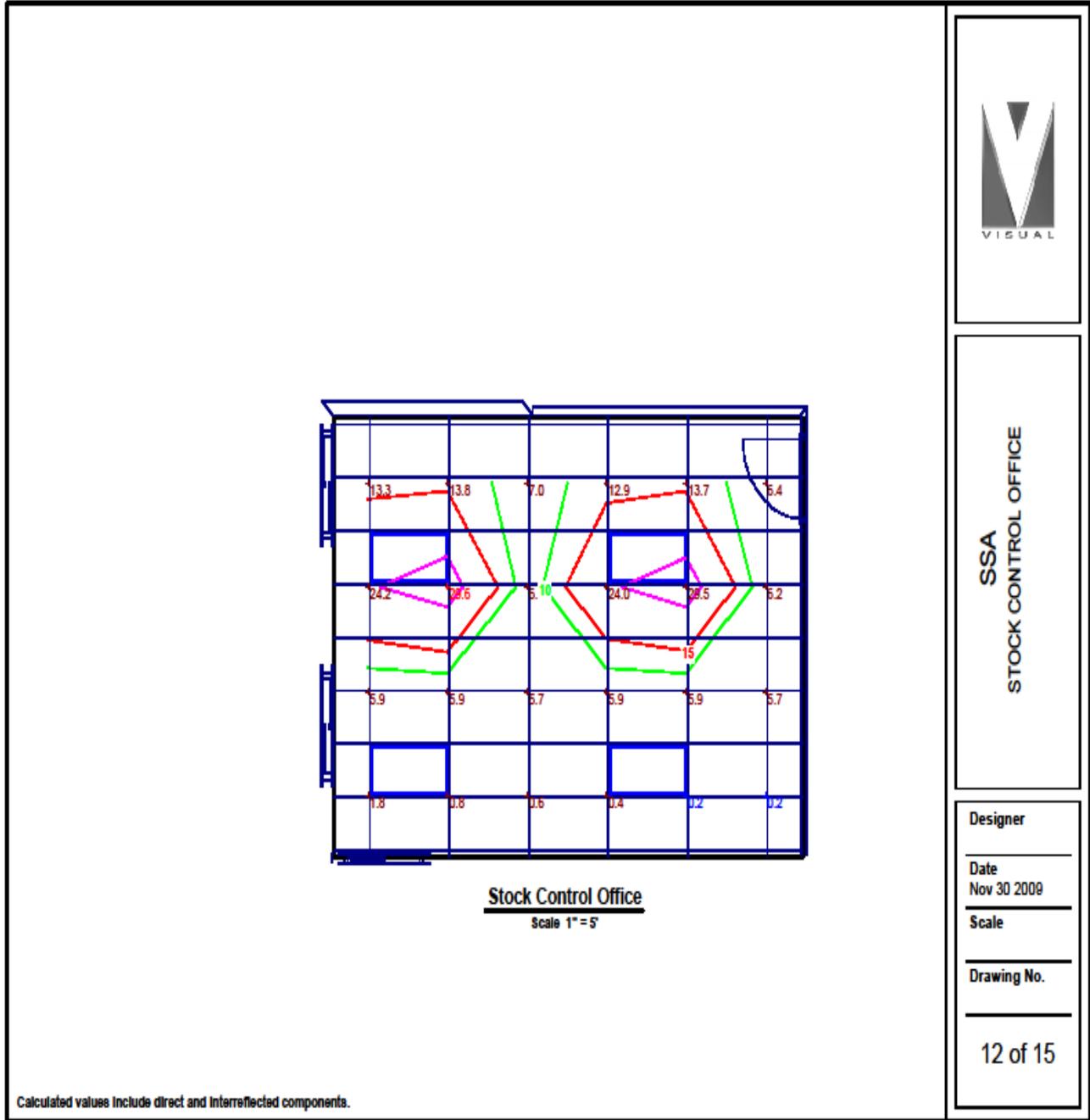
Drawing No.

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Lighting Calculation for Turn-In Bay



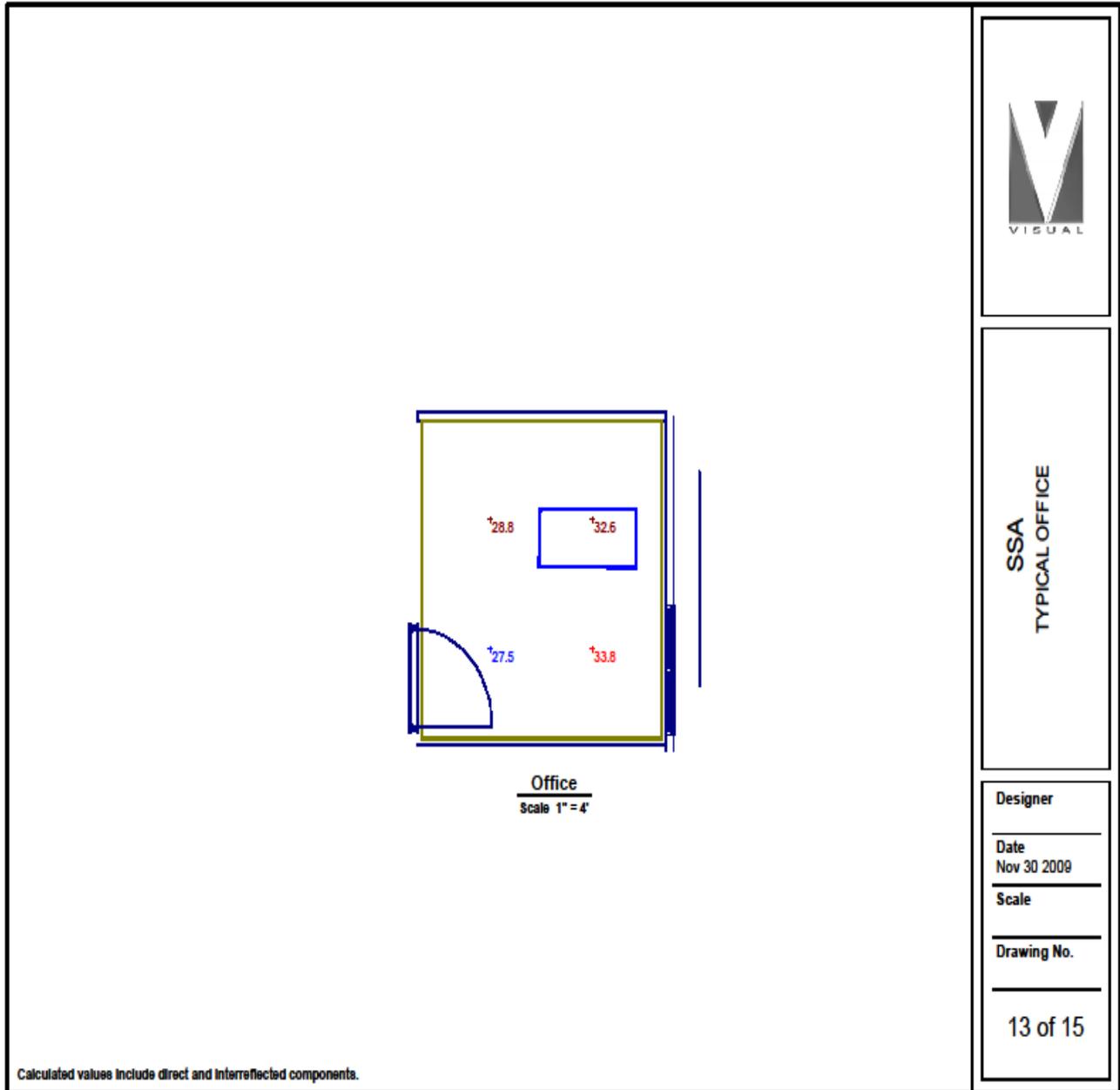
Lighting Calculation for Stock Control Office



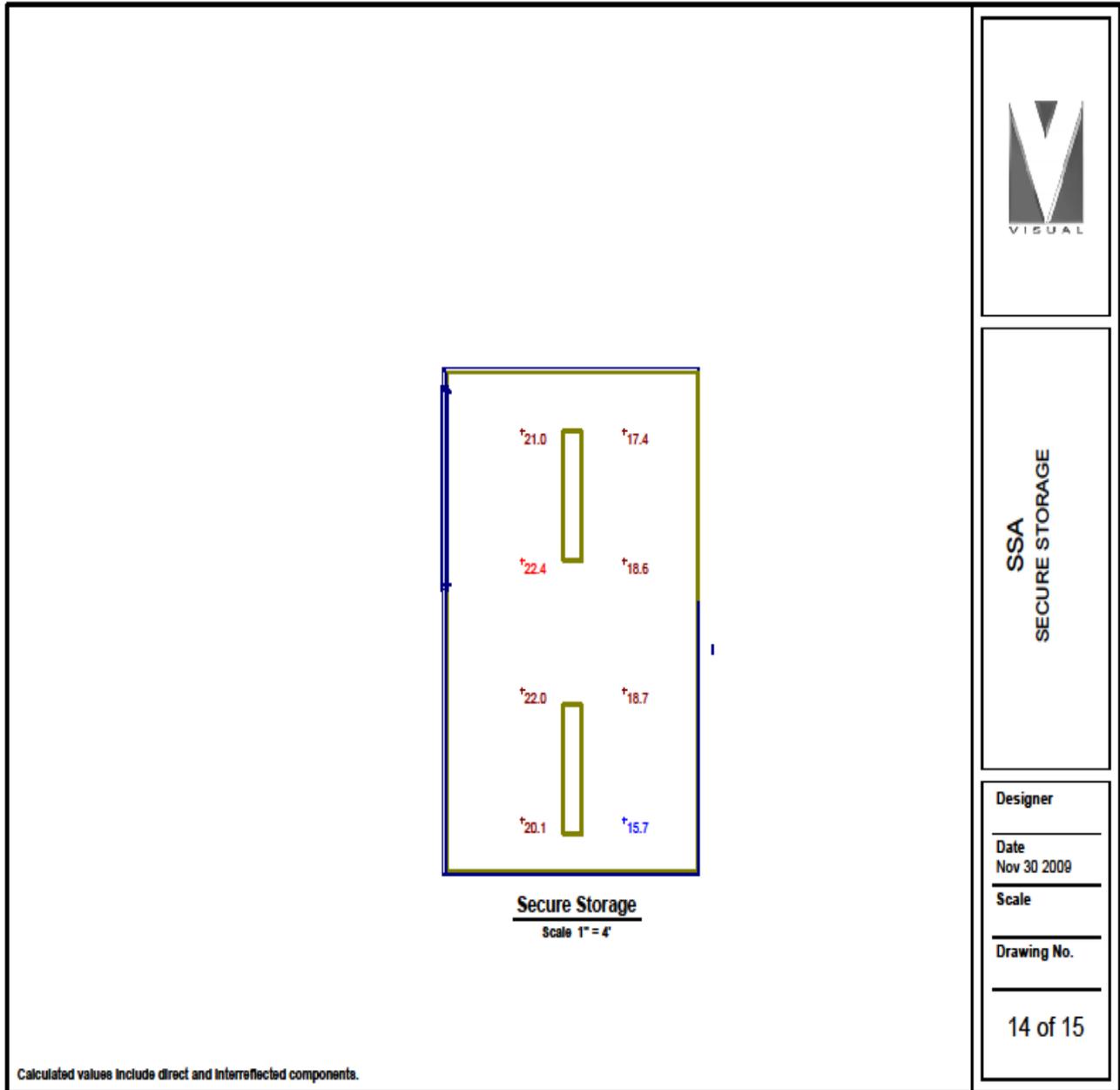
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STOCK CONTROL OFFICE

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Nov 30 2009  
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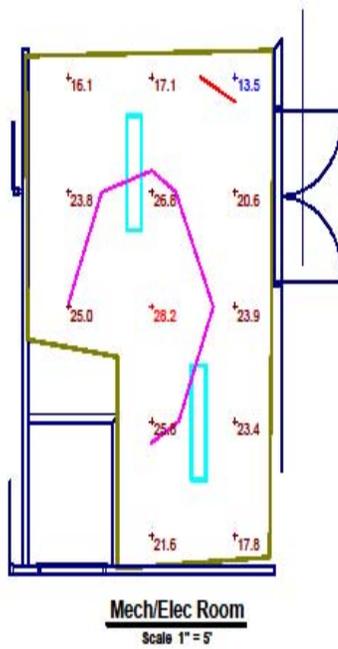
Lighting Calculation for Office



Lighting Calculation for Secure Storage



Lighting Calculation for Mech/Elec. Room



Calculated values include direct and interreflected components.

(2) Exterior Security Fence

Lighting Schedule and Statistics for Security Fence and Parking.

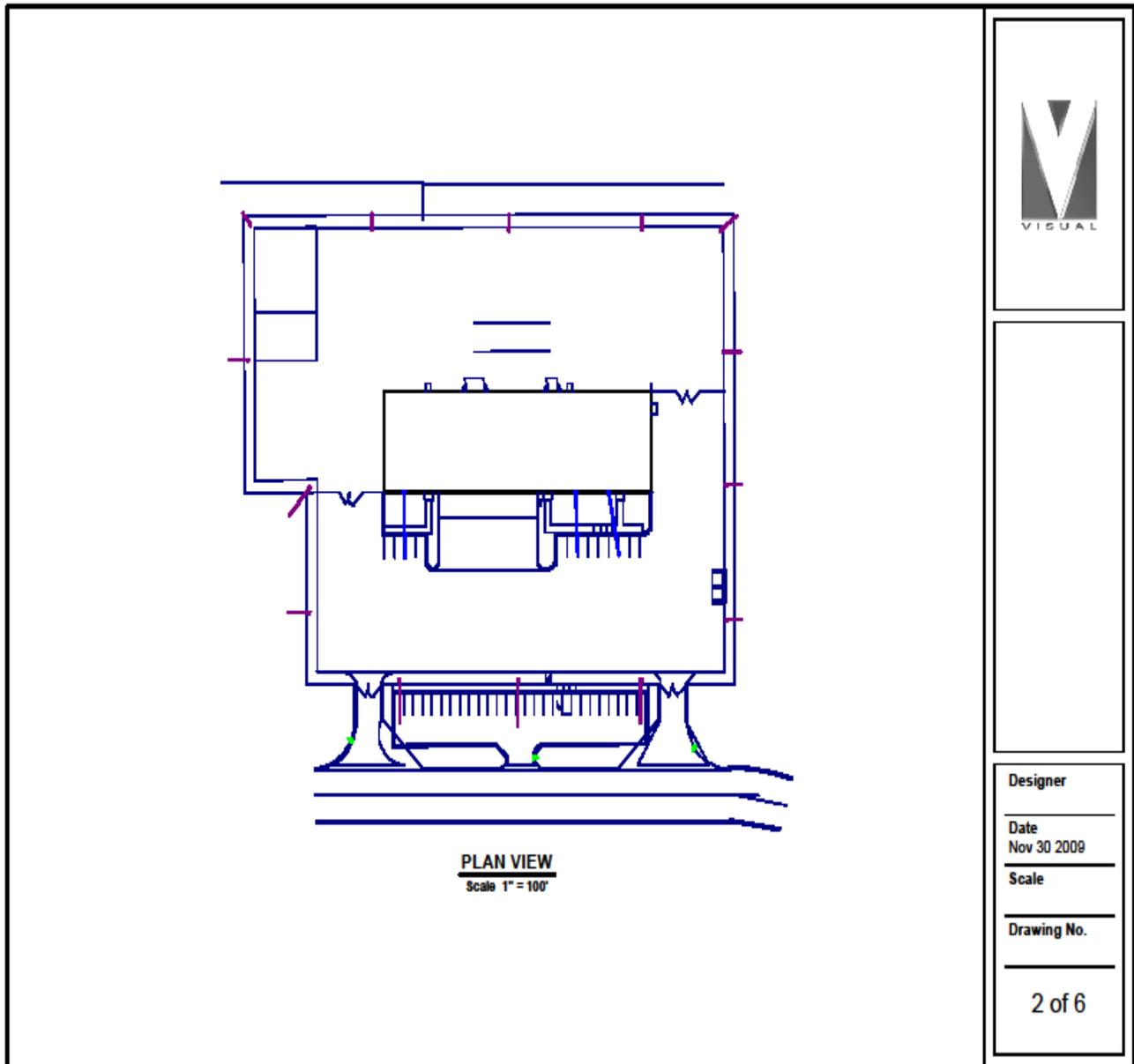
| LUMINAIRE SCHEDULE  |       |     |                             |  |  |                                   |        |      |       |
|---|-------|-----|-----------------------------|--|--|-----------------------------------|--------|------|-------|
| Symbol  | Label | Qty | Catalog Number              | Description  | Lamp   | File                              | Lumens | LLF  | Watts |
|  | B     | 3   | ASF2 250M WDF (PULSE START) | AERIS FLOOD LUMINAIRE, 250-WATT METAL HALIDE, WIDE FLOOD, CLEAR LAMP | ONE (1) 250 WATT CLEAR BT28 PULSE START METAL HALIDE LAMP IN VERTICAL BASE UP POSITION | ASF2_250M_WDF_(PULSE_START)-2.ies | 22500  | 1.00 | 288   |
|  | D     | 14  | TFR 250M TA (PULSE START)   | SPECIFICATION FLOODLIGHT, TA DISTRIBUTION, 250W MH, W/ CLEAR LAMP.   | ONE (1) 250 WATT CLEAR BT28 PULSE START METAL HALIDE LAMP IN HORIZONTAL POSITION       | TFR_250M_TA_(PULSE_START).ies     | 22500  | 1.00 | 288   |
|  | F     | 3   | KDC2 250S R3 FL             | KDC1 SERIES 250W HPS TYPE 3 DIST. MED CUTOFF                         | ONE 250-WATT HIGH PRESSURE SODIUM.   | KDC2_250S_R3_FL.ies               | 28500  | 1.00 | 465   |



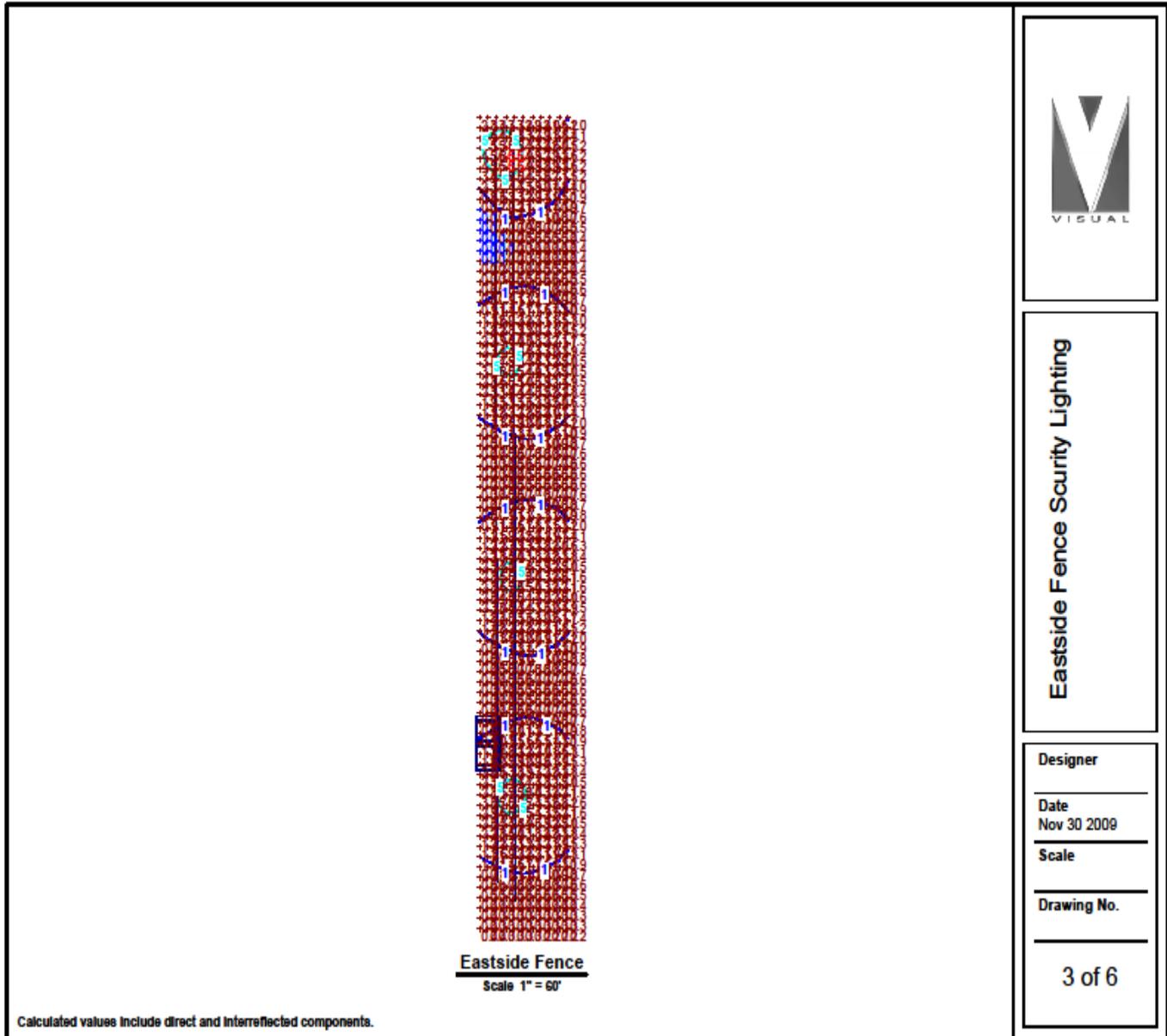
| STATISTICS              |        |        |        |        |         |         |
|-------------------------|--------|--------|--------|--------|---------|---------|
| Description             | Symbol | Avg    | Max    | Min    | Max/Min | Avg/Min |
| Southside Fence/Parking | +      | 1.8 fc | 7.5 fc | 0.2 fc | 37.5:1  | 9.0:1   |
| Eastside Fence          | +      | 1.9 fc | 6.6 fc | 0.1 fc | 66.0:1  | 19.0:1  |
| Northside Fence         | +      | 2.0 fc | 7.6 fc | 0.0 fc | N / A   | N / A   |
| Westside Fence          | +      | 1.5 fc | 7.7 fc | 0.0 fc | N / A   | N / A   |

Calculated values include direct and interreflected components.

Exterior Plan View



Lighting Calculation for Eastside Fence



Eastside Fence Security Lighting

Designer

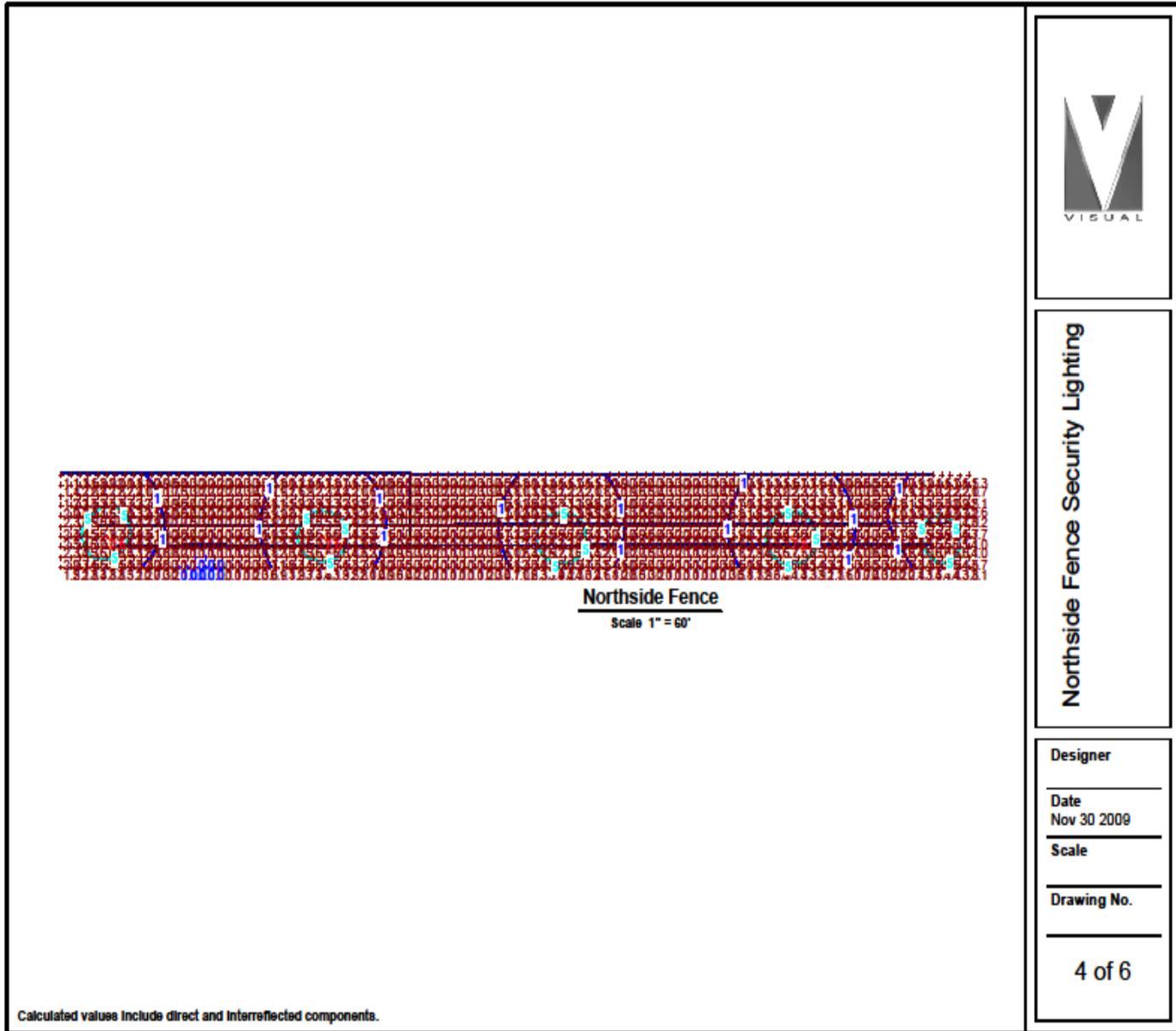
Date  
Nov 30 2009

Scale

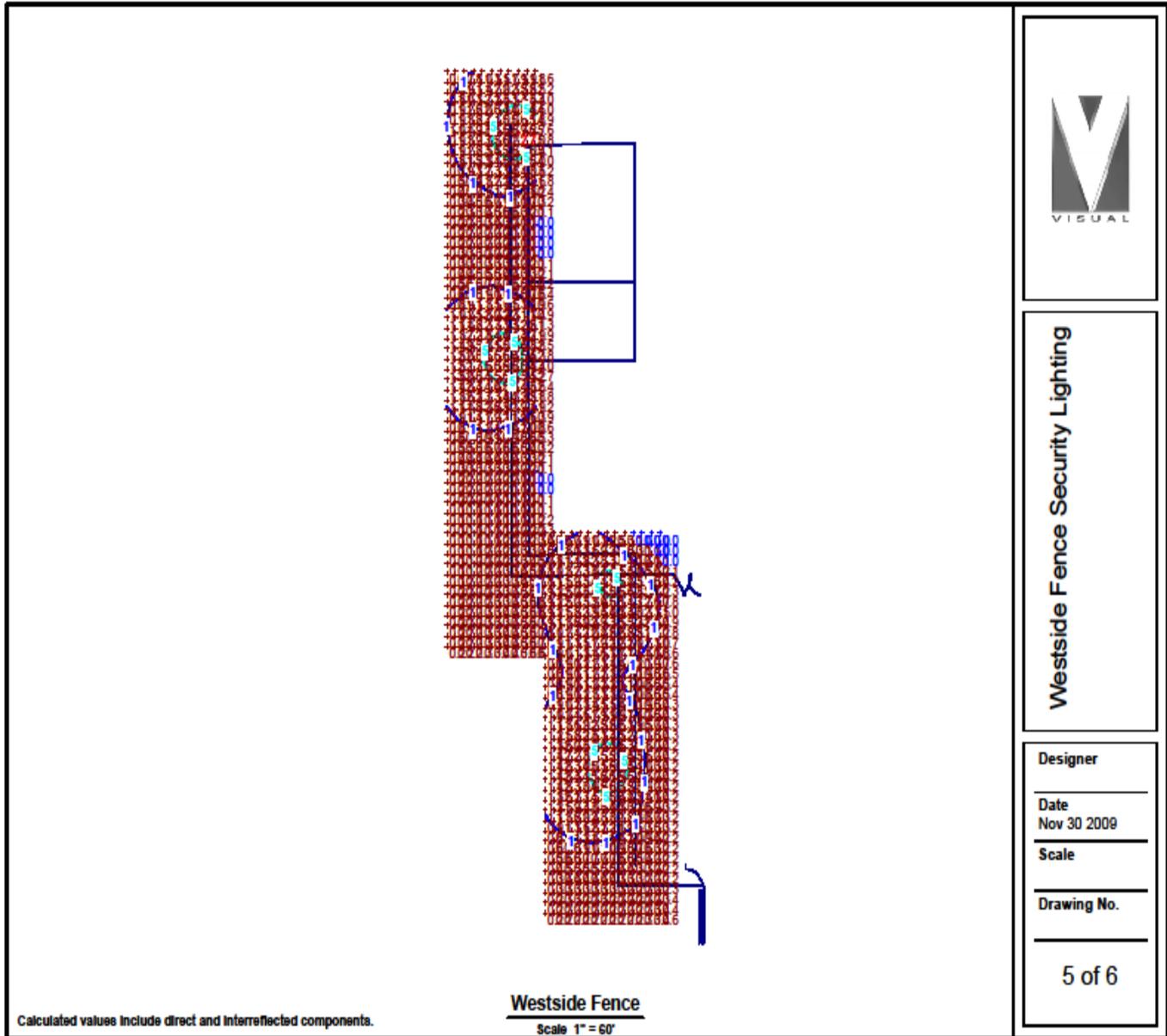
Drawing No.

3 of 6

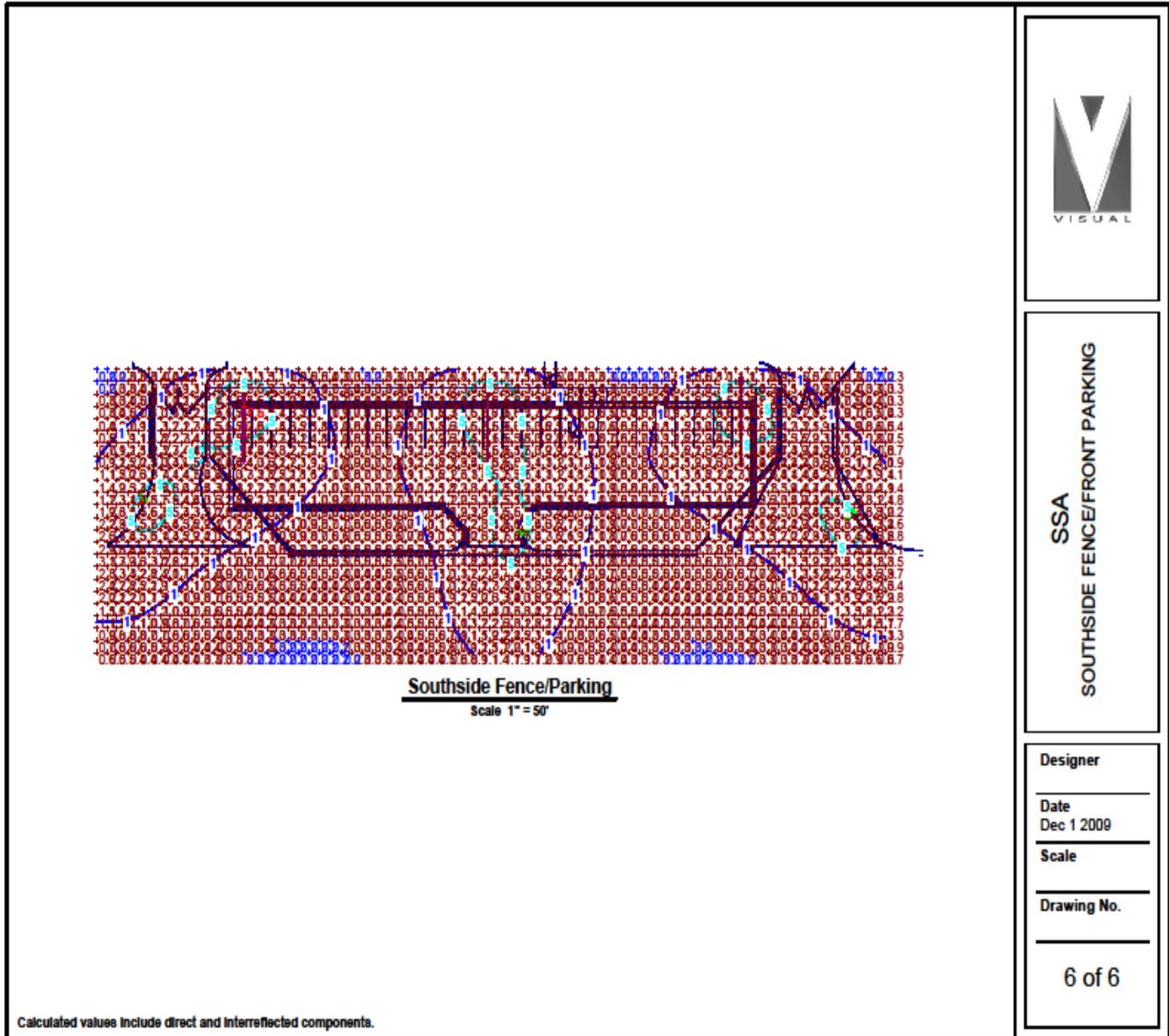
Lighting Calculation for Northside Fence



Lighting Calculation for Westside Fence



Lighting Calculation for Southside Fence/Parking



SSA  
SOUTHSIDE FENCE/FRONT PARKING

Designer

Date  
Dec 1 2009

Scale

Drawing No.

6 of 6

Calculated values include direct and interreflected components.

(3) Exterior Lighting Around Building

Lighting Schedule and Statistics for Around Building

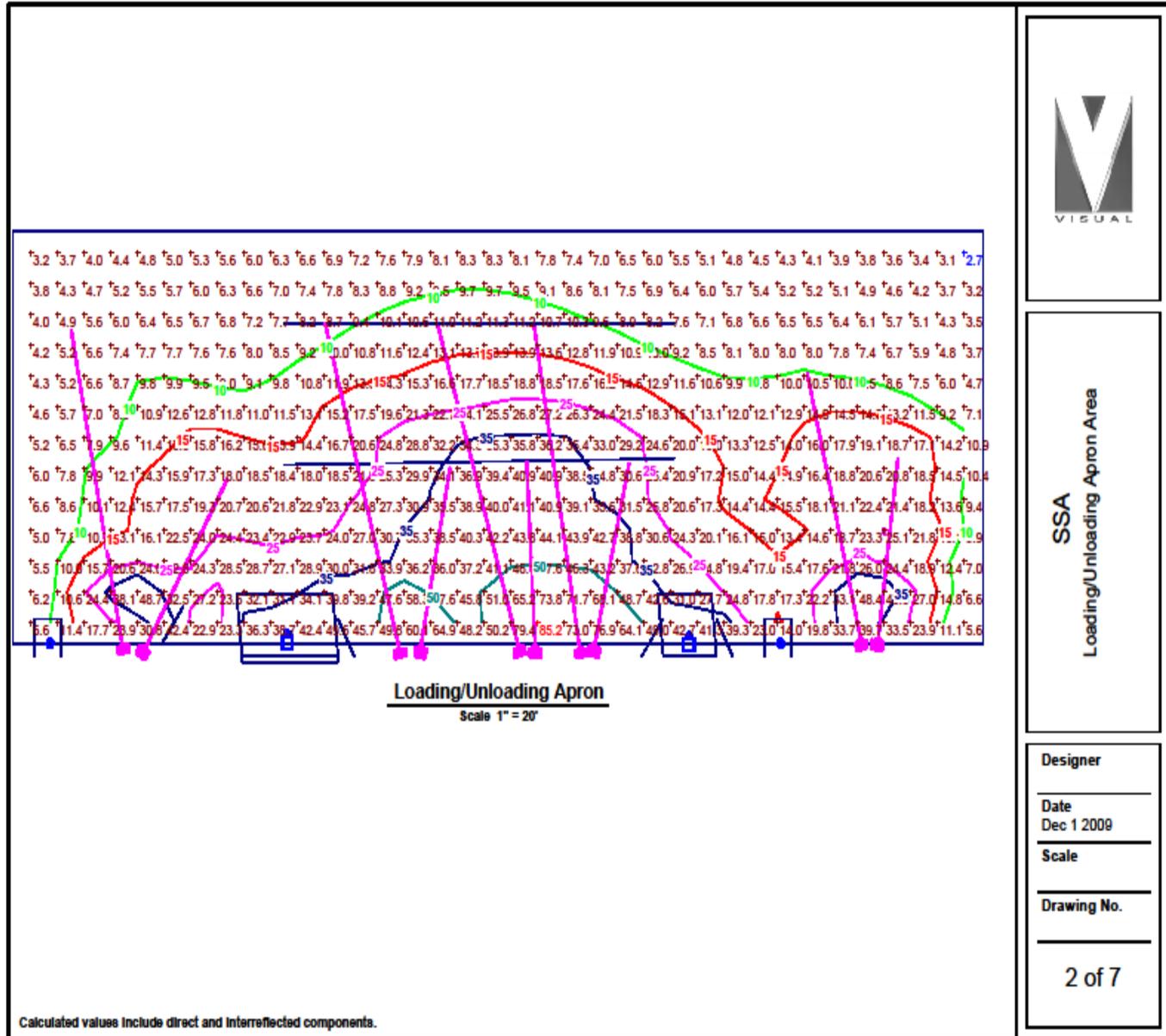
| LUMINAIRE SCHEDULE   |       |     |                             |  |  |                                   |        |      |       |
|--|-------|-----|-----------------------------|--|--|-----------------------------------|--------|------|-------|
| Symbol   | Label | Qty | Catalog Number              | Description  | Lamp   | File                              | Lumens | LLF  | Watts |
|   | A     | 10  | HFR 400S RC                 | HAZARDOUS FLOODLIGHT, RC DISTRIBUTION, 400W HPS, W/ CLEAR LAMP.                  | ONE 400-WATT CLEAR ET-18 HIGH PRESSURE SODIUM, HORIZONTAL POSITION.                    | HFR_400S_RC .ies                  | 50000  | 1.00 | 488   |
|   | B     | 0   | ASF2 250M WDF (PULSE START) | AERIS FLOOD LUMINAIRE, 250-WATT METAL HALIDE, WIDE FLOOD, CLEAR LAMP             | ONE (1) 250 WATT CLEAR BT28 PULSE START METAL HALIDE LAMP IN VERTICAL BASE UP POSITION | ASF2_250M WDF_(PULSE_START)-2.ies | 22500  | 1.00 | 288   |
|   | C     | 8   | TWS 32TRT                   | GENERAL PURPOSE BUILDING MOUNTED LUMINAIRE, 32W TRIPLE TUBE COMPACT FLUORESCENT. | ONE 32-WATT TRIPLE TUBE COMPACT FLOURESCENT, VERTICAL BASE UP POSITION.                | TWS_32TRT.ies                     | 2400   | 1.00 | 36    |
|   | D     | 2   | TWH 150M FS                 | GENERAL PURPOSE BUILDING MOUNTED LUMINAIRE, 150W MH, CLEAR LAMP, W/ FULL SHIELD. | ONE 150-WATT CLEAR ED-28 PULSE START METAL HALIDE, HORIZONTAL POSITION.                | TWH_150M_FS.ies                   | 14000  | 1.00 | 189   |
|  | E     | 9   | TWH 250M (PULSE START)      | GENERAL PURPOSE BUILDING MOUNTED LUMINAIRE, 250W MH, W/ CLEAR LAMP.              | ONE 250-WATT ED28 PULSE START METAL HALIDE, HORIZONTAL POS.                            | TWH_250M_(PULSE_START).ies        | 25000  | 1.00 | 288   |



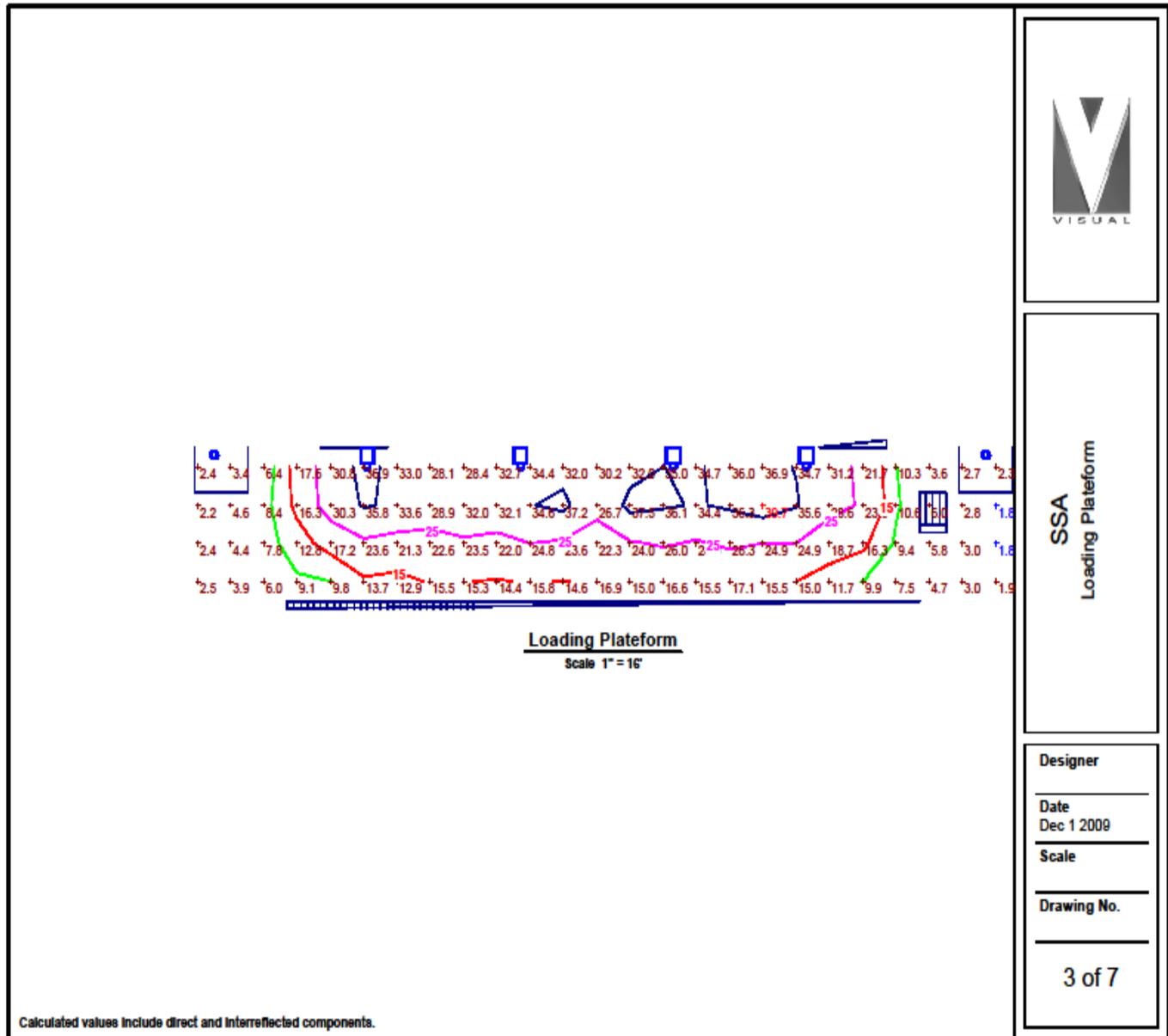
| STATISTICS                 |        |         |         |        |         |         |
|----------------------------|--------|---------|---------|--------|---------|---------|
| Description                | Symbol | Avg     | Max     | Min    | Max/Min | Avg/Min |
| Eastside Calc Zone         | +      | 1.4 fc  | 19.7 fc | 0.1 fc | 197.0:1 | 14.0:1  |
| Eastside Parking Lot       | +      | 6.9 fc  | 13.7 fc | 3.9 fc | 3.5:1   | 1.8:1   |
| Loading/Unloading Platform | +      | 19.0 fc | 85.2 fc | 2.7 fc | 31.6:1  | 7.0:1   |
| Southside Loading Platform | +      | 19.3 fc | 39.7 fc | 1.8 fc | 22.1:1  | 10.7:1  |
| Westside Calc Zone         | +      | 2.0 fc  | 17.8 fc | 0.1 fc | 178.0:1 | 20.0:1  |
| Westside Parking Lot       | +      | 6.4 fc  | 14.0 fc | 2.7 fc | 5.2:1   | 2.4:1   |

Calculated values include direct and interreflected components.

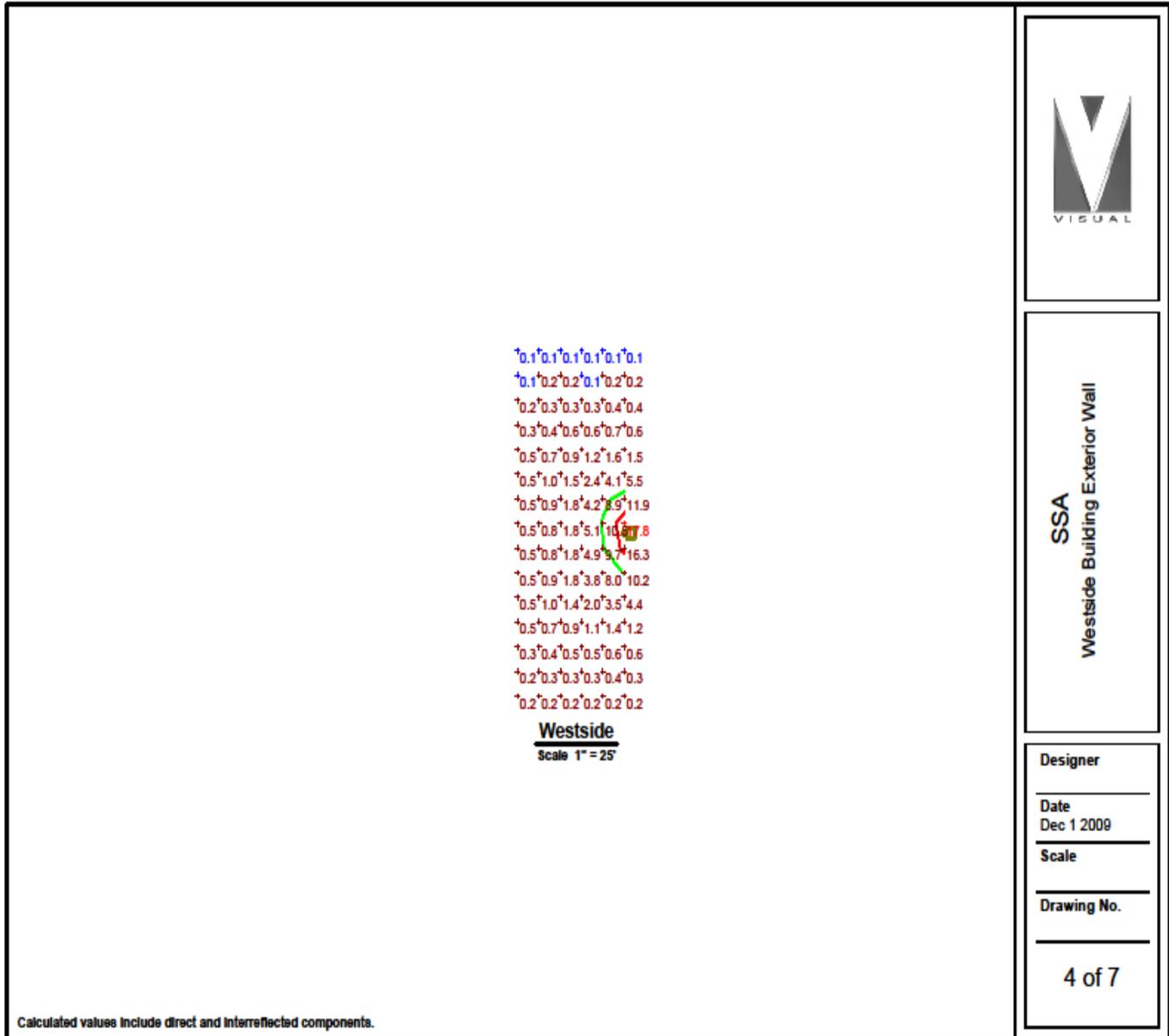
Lighting Calculation for Loading/Unloading Apron



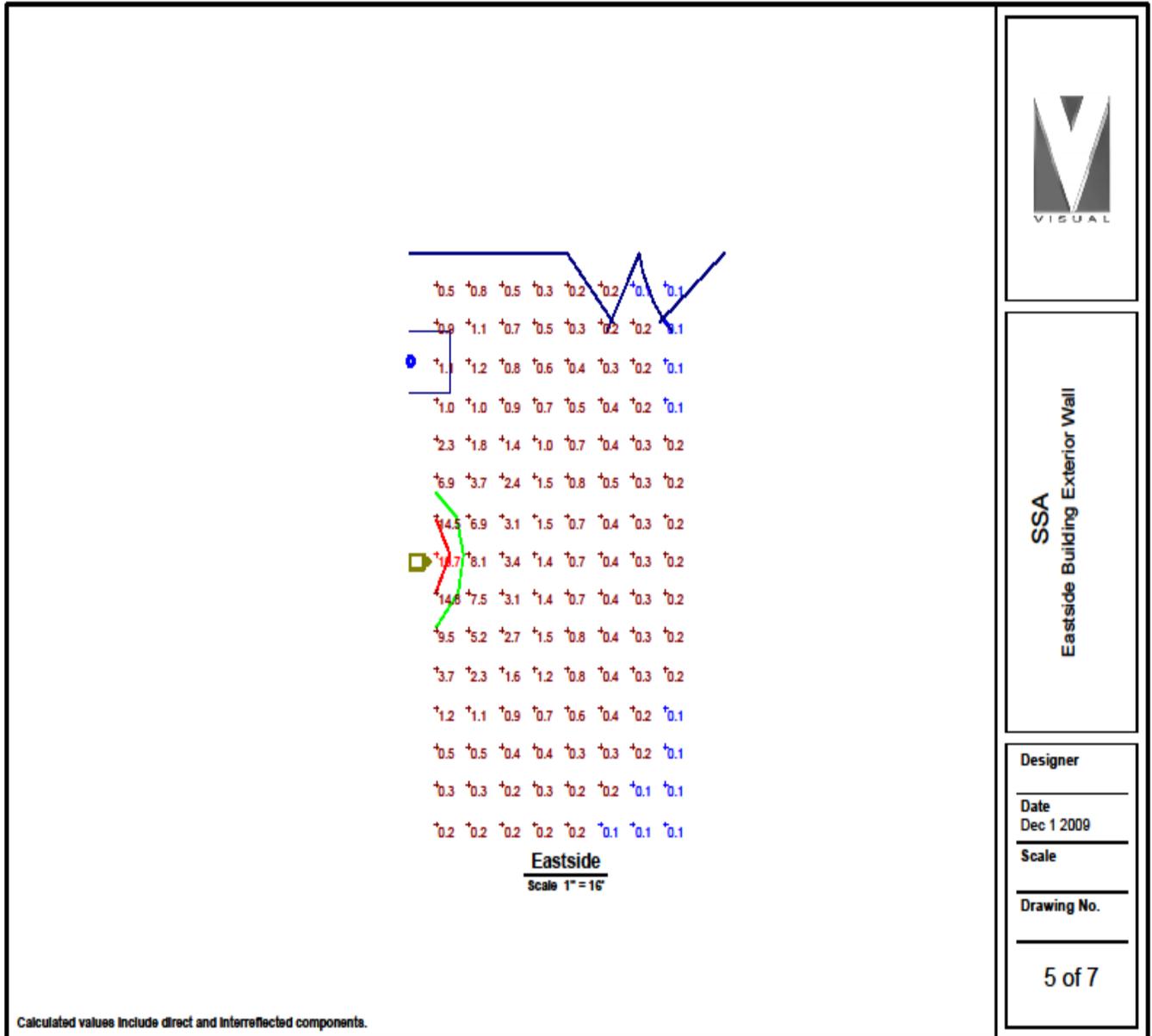
Lighting Calculation for Loading Platform



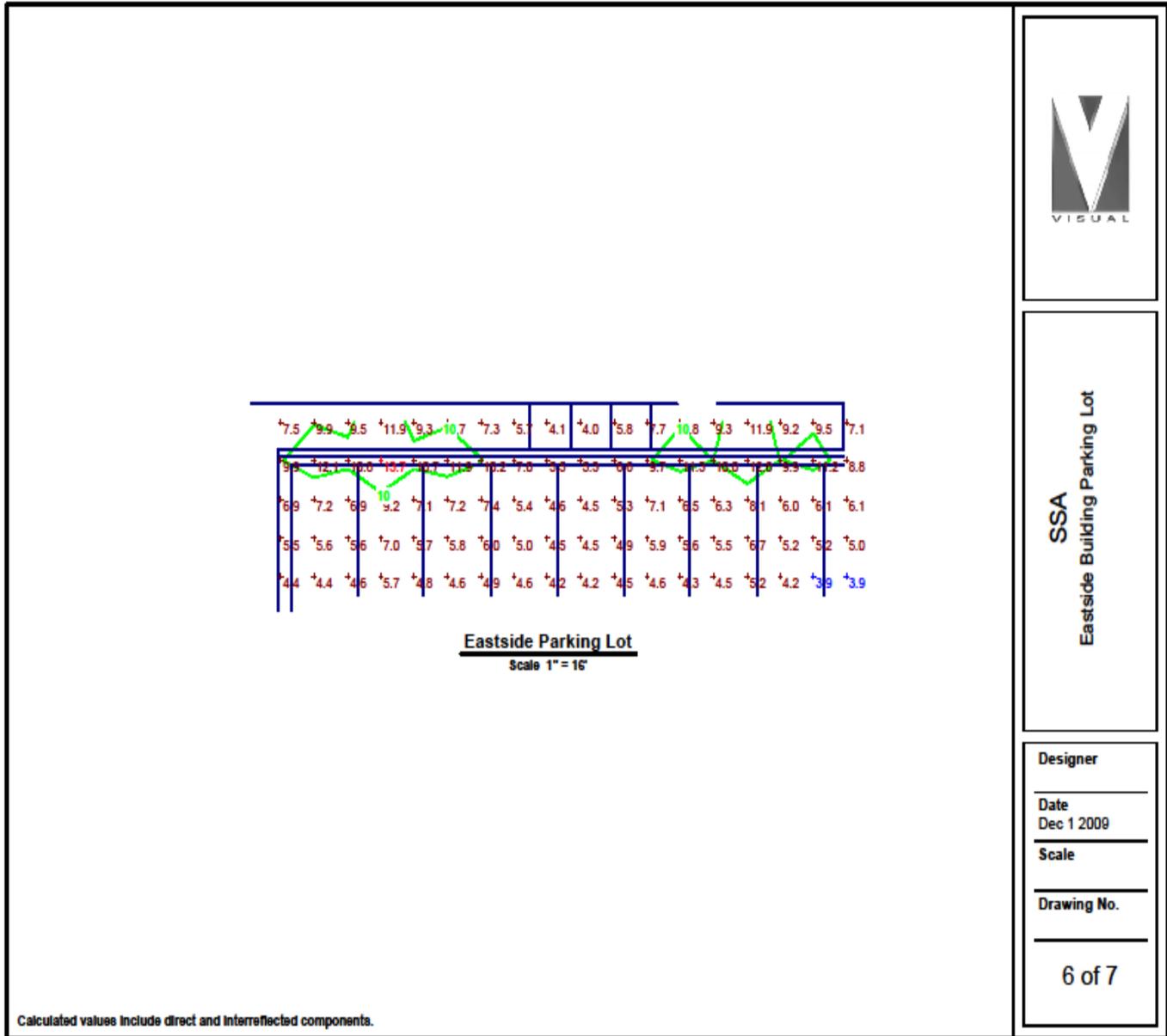
Lighting Calculation for Westside Building



Lighting Calculation for Eastside Building



Lighting Calculation for Eastside Parking Lot



SSA  
Eastside Building Parking Lot

Designer

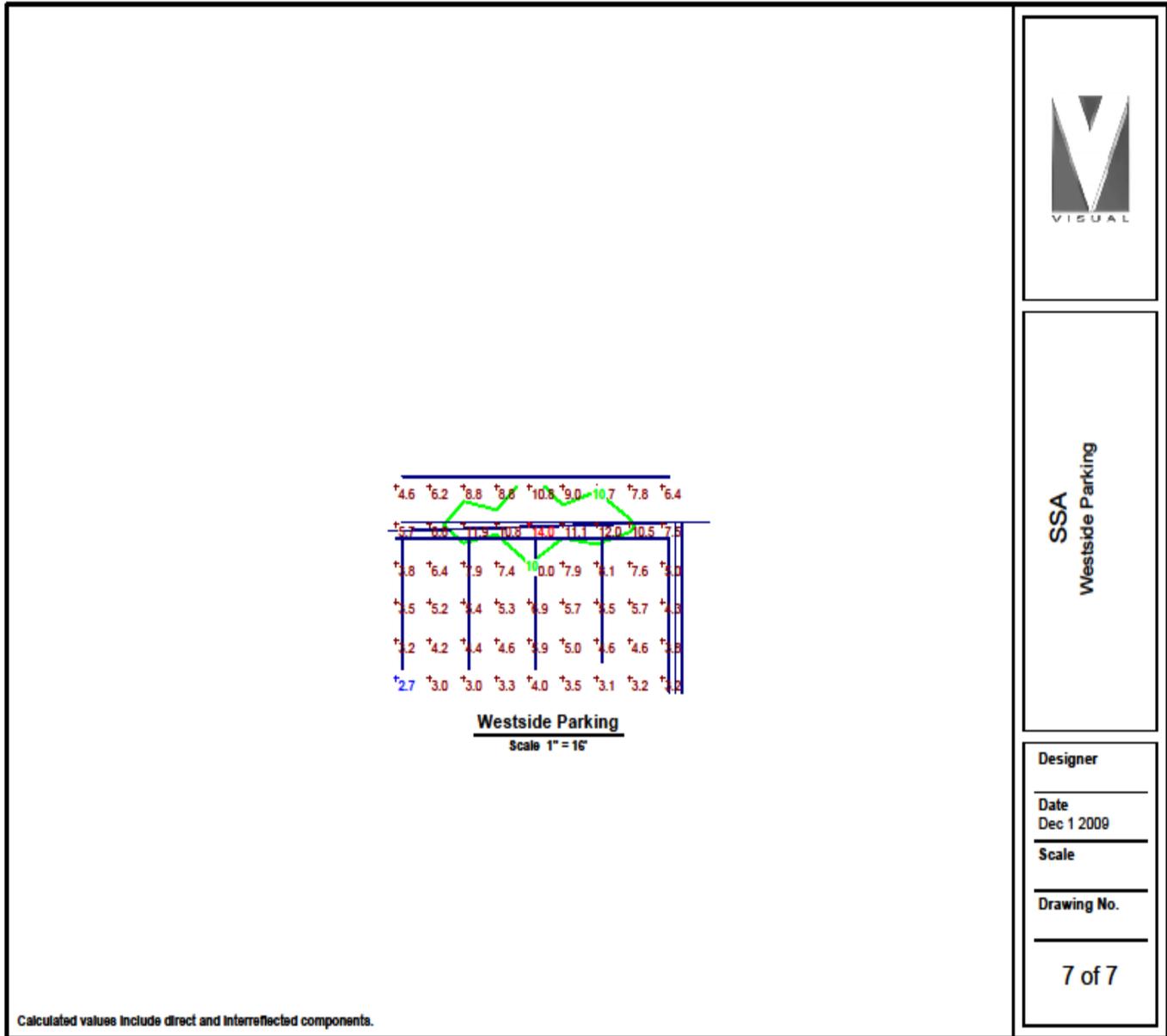
Date  
Dec 1 2009

Scale

Drawing No.

6 of 7

Lighting Calculation for Westside Parking



SSA  
Westside Parking

Designer

Date  
Dec 1 2009

Scale

Drawing No.

7 of 7



**PART 1 GENERAL**

## 1.1 REFERENCES

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

## ALUMINUM ASSOCIATION (AA)

AA 30(1986) Aluminum Structures, Construction Manual Series Section 1

AA 45(2003) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101(2002) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD(1995a) AISC Quality Certification Program

AISC Pub No. S303(2000) Code of Standard Practice for Steel Buildings and Bridges

AISC S329(1985) Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts

AISC S335(1989) Structural Steel Buildings Allowable Stress Design and Plastic Design

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7(2002) Minimum Design Loads for Buildings and Other Structures

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M(2004) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A 252(1998; R 2002) Welded and Seamless Steel Pipe Piles

ASTM A 36/A 36M(2004) Carbon Structural Steel

ASTM A 463/A 463M(2002a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A 500(2003a) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 501(2001) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

ASTM A 529/A 529M(2004) High-Strength Carbon-Manganese Steel of Structural Quality

ASTM A 53/A 53M(2004a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 570/A 570M(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled

- ASTM A 572/A 572M(2004) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- ASTM A 588/A 588M(2004) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
- ASTM A 606(2004) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
- ASTM A 607(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled
- ASTM A 618(2004) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
- ASTM A 653/A 653M(2004a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- ASTM A 755/A 755M(2004a) Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
- ASTM A 792/A 792M(2003) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
- ASTM B 209(2004) Aluminum and Aluminum-Alloy Sheet and Plate
- ASTM B 209M(2004) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
- ASTM B 221(2004a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- ASTM B 221M(2004) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
- ASTM B 241/B 241M(2002) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
- ASTM B 308/B 308M(2002) Aluminum-Alloy 6061-T6 Standard Structural Profiles
- ASTM B 429(2002) Aluminum-Alloy Extruded Structural Pipe and Tube
- ASTM C 1289(2003) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- ASTM C 236(1989; R 1993e1) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
- ASTM C 518(2004) Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- ASTM C 553(2002) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
- ASTM C 578(2004) Rigid, Cellular Polystyrene Thermal Insulation
- ASTM C 612(2004) Mineral Fiber Block and Board Thermal Insulation
- ASTM C 991(2003) Flexible Glass Fiber Insulation for Metal Buildings
- ASTM D 1308(2002e1) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- ASTM D 1654(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 2244(2002e1) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

ASTM D 2247(2002) Testing Water Resistance of Coatings in 100% Relative Humidity

ASTM D 2794(1993; R 2004) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D 3359(2002) Measuring Adhesion by Tape Test

ASTM D 3841(1997; R 2001) Glass-Fiber-Reinforced Polyester Plastic Panels

ASTM D 4214(1998) Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D 4397(2002) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM D 522(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings

ASTM D 523(1989; R 1999) Specular Gloss

ASTM D 5894(1996) Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

ASTM D 610(2001) Evaluating Degree of Rusting on Painted Steel Surfaces

ASTM D 714(2002) Evaluating Degree of Blistering of Paints

ASTM D 828(1997; R 2002) Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus

ASTM D 968(1993; R 2001) Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM E 84(2004) Surface Burning Characteristics of Building Materials

ASTM E 96(2000e1) Water Vapor Transmission of Materials

ASTM F 1642(2004) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading

ASTM G 23(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

**BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)**

BHMA A156.1(2000) Butts and Hinges

BHMA A156.2(2003) Bored and Preassembled Locks and Latches

BHMA A156.3(2001) Exit Devices

BHMA A156.4(2000) Door Controls - Closers

**CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)**

CMAA 70(2004) EnviroTop Running and Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes, No. 70

**METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)**

MBMA MBSM(2002) Metal Building Systems Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual(2003, 6th Ed) Architectural Sheet Metal Manual

STEEL DECK INSTITUTE (SDI)

SDI DDM02(1987) Diaphragm Design Manual

STEEL DOOR INSTITUTE (SDI)

SDI A250.8(2003) Standard Steel Doors and Frames

STEEL WINDOW INSTITUTE (SWI)

SWI SGSW(2002) Architect's Guide to Steel Windows

UNIFIED FACILITIES CRITERIA (UFC)

UFC 4-010-01(2003) DoD Minimum Antiterrorism Standards for Buildings

UNDERWRITERS LABORATORIES (UL)

UL 580(1994; Rev thru Feb 1998) Tests for Uplift Resistance of Roof Assemblies

## 1.2 SYSTEM DESCRIPTION

### 1.2.1 Design Requirements

#### 1.2.1.1 Design Analysis

The design analysis shall be the design of a licensed Professional Engineer experienced in design of this work and shall include complete calculations for the building, and its components. Foundations shown on the drawings are based on loads derived from a representative set of similar building types. The Contractor shall obtain the services of a licensed Professional Engineer to verify that the foundations shown are adequate for the building supplied using the criteria in paragraph Foundations. Formulas and references shall be identified. Assumptions and conclusions shall be explained, and cross-referencing shall be clear. Wind forces on various parts of the structure, both positive and negative pressure, shall be calculated with the controlling pressure summarized. Computer programmed designs shall be accompanied by stress values and a letter of certification, signed by a licensed Professional Engineer, stating the design criteria and procedures used and attesting to the adequacy and accuracy of the design.

A narrative of the computer program delineating the basic methodology shall be included. Computer program output shall be annotated and supplemented with sketches to verify the input and output. Critical load conditions used in the final sizing of the members shall be emphasized. The design analysis shall include the name and office phone number of the designer, who shall function as a point of contact to answer questions during the detail drawing review.

#### 1.2.1.2 Dimensions

Building dimensions shall be as standard with manufacturer, not less than those indicated, but exceeding the indicated dimensions only by the amount of the closest standard size thereto. Eave height shall be measured from the top of finished floor to intersection of insides of roof and sidewall sheets. The clear height between finished floor and bottom of roof steel shall be as indicated.

#### 1.2.1.3 Framing

Provide building with vertical walls and gable roof. Building shall be two-span or multiple-span structures with one of the following framing systems: columns with rigid frame, or rigid frame type, similar to AISC S335, Type I construction. No moments shall be transferred to the foundation. End walls shall be of beam and column design. Roof slope shall be a minimum of 2 to 12. Design framed openings structurally. In addition to the above rigid framing system, the SAME pre-engineered metal building manufacturer (contractor) shall be responsible for the framings of mezzanine structure, West side entrance, suspended jogging track, stairs, basketball goals/backboard, accordian partition, window and door openings, metal panel connections and all other structural steel elements of the building. Conceptual framings for Mezzanine and Entrance are shown on plans.

#### 1.2.1.4 Foundation Requirements

The building foundation shown on the contract drawings is the minimum required and is designed for the loads as shown on the contract drawings. The contractor shall check the foundation for actual reactions and notify the contracting officer if actual moment frame or bracing reactions are greater than shown. Any revisions to the foundation shall be at no additional cost to the government.

#### 1.2.2 Performance Requirements

MBMA MBSM, for loading combinations and definitions with the exceptions of wind load, Antiterrorism/Force Protection (ATFP) Static Equivalent Loads, and special collateral loads. Design for each material shall be as specified by the Design Authority as listed in MBMA MBSM unless otherwise noted.

##### 1.2.2.1 Dead Loads

The dead load shall consist of the weight of all permanent construction such as roof, framing, covering members and all other materials of the building system.

##### 1.2.2.2 Roof Live Loads

a. Uniform Loads: Uniform roof live loads, including maintenance traffic and construction loads, shall be determined and applied in accordance with ASCE 7.

b. Concentrated Loads: In addition to ASCE 7 roof live loads, a minimum design concentrated load of 300 pounds shall be used to simulate a construction load on roof panels. The concentrated load shall be applied at the panel midspan and shall be resisted by a single standing seam metal roof panel, or a 24 inches wide corrugated metal panel, assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

##### 1.2.2.3 Antiterrorism/Force Protection (ATFP) Static Equivalent Loads

In addition to the requirements for normal environmental loads, Antiterrorism/Force Protection (ATFP) static equivalent loads per UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings shall be used for all frames and support members of all windows and glazed storefronts. (Refer to specification Section 08520A ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS and Section 08120 ALUMINUM DOORS AND FRAMES.) Support members (headers, sills, and jambs) of windows, translucent panels; frame connections to header, sill, and jamb support members of the window, translucent panels; connections of the headers and sills to the jambs; and connection of jamb to bottom and top support structure shall be designed to withstand the following ATFP static equivalent loads. For design of structural components subjected to dynamic loads, the U.S. Army Corps of Engineers Protective Design Center (PDC) developed SBEDS, Single-Degree-of-Freedom Blast Effects Design Spreadsheets (SBEDS). SBEDS is available at the software tab of the PDC website, <https://pdc.usace.army.mil/>.

ATFP loads shall be applied to the surface of the glazing and frame.

##### 1.2.2.4 Wind Loads

Compute and apply wind pressures, ASCE 7. Basic wind speed and multiplying factors are as indicated.

#### 1.2.2.7 Collateral Loads

As indicated.

Collateral load of 6 pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings. This allowance does not include the weight of hung equipment weighing 50 pounds or more. Equipment loads of 50 pounds or more shall be shown on the shop (detail) drawings and the structure (frame, purlins, girts) shall be strengthened as required. The Contractor is responsible for providing the pre-engineered metal building manufacturer the magnitude and approximate location of all concentrated loads greater than 50 pounds before design of the building commences. Additionally UFC 4-010-01 requires all equipment, fixtures and overhead utilities weighing 31 pounds or more (excluding distributed systems) have designed mountings which resist forces of 0.5 times the equipment weight in any horizontal direction and 1.5 times the equipment weight in the downward direction.

#### 1.2.2.8 Deflection

a. Structural Members: The maximum deflection of main framing members shall not exceed 1/240th of their respective spans. The maximum deflection due to live load in roof panels and purlins shall not exceed 1/180th of their respective spans.

b. Roof Panels: Refer to specification section 07416A - Structural Standing Seam Metal Roof (SSMR) system.  
c. Wall Panels: Refer to specification section 07413 - Metal Wall Panels.

d. Openings: Frame all equipment openings over 12 by 12 inches.

#### 1.2.2.9 Provisions for Gutters and Downspouts

Gutters and downspouts shall be designed according to the requirements of SMACNA Arch. Manual for storms which should be exceeded only once in 5 years and with adequate provisions for thermal expansion and contraction. Supports for gutters and downspouts shall be designed for the anticipated loads. Roof drainage system to withstand rainfall intensity of 5.9 inches per hour, with 5-minute duration.

#### 1.2.2.10 Provisions for Louvers

Louvers shall be in accordance with section 10201 METAL WALL AND DOOR LOUVERS

#### 1.2.2.12 Drift Provisions

Lateral deflections, or drift, at the roof level of a structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements, shall conform to MBMA MBSM and be limited to 1/240 times building height. All interior partitions shall be detailed to accommodate drift. .

#### 1.2.2.14 Grounding and Lightning Protection

Not required.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

**SD-02 Shop Drawings**

Pre-engineered Building; G

Template for anchorage

Submit as necessary to erect the building and install components.

**SD-03 Product Data**

Pre-engineered metal building materials

Submit sufficient data indicating conformance to specified requirements on materials provided under this section.

Instruction Manuals

Erection

Qualifications

**SD-04 Samples**

Factory color finish

Accessories

Fasteners

Gaskets and Insulating Compounds

Sealant

**SD-05 Design Data**

Building; G

Foundation loads; G

Anchor bolts; G

Purlins and girts; G

Bracing; G

Members and connections with ATEP Static Equivalent Loads; G

**SD-06 Test Reports**

Factory Color Finish

**SD-07 Certificates**

Pre-engineered metal building materials

Submit certificates attesting that materials comply with this specification.

**SD-10 Operation and Maintenance Data**

Pre-engineered Building, data package 1; G

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

**1.4 QUALITY ASSURANCE****1.4.1 Qualifications**

Qualifications of the manufacturer, the manufacturer's Representative when one is used, and qualifications and experience of the building erector. A brief list of locations where buildings of similar design have been used shall be included with the detail drawings and shall also include information regarding date of completion, name and address of owner, and how the structure is used.

**1.4.1.1 Manufacturer**

The manufacturer shall have AISC FCD, category MB certification.

**1.4.1.2 Installer**

Erector shall have specialized experience in the erection of metal building systems for a period of at least 3 years.

**1.4.1.3 Manufacturer's Representative**

A representative designated by the building manufacturer, who is familiar with the design of the building supplied and experienced in the erection of metal buildings similar in size to the one required under this contract, shall be present at the job site during construction, from the start of the structural framing erection until completion of the installation of the exterior covering, to assure that the building is erected properly.

**1.4.2 Regulatory Requirements****1.4.2.1 Drawings: Pre-engineered Building**

Submit complete design drawings for the pre-engineered building. Submit drawings for the foundations and anchorage.

**1.4.2.2 Design Data Building**

Submit design calculations for the entire pre-engineered building and foundations, prepared and stamped by a professional engineer. Also, submit for components requested, and stamp with the seal of a professional engineer. Include sizes and location of anchor bolts.

**1.4.3 Coordination Meeting**

A coordination meeting shall be held within 45 days after contract award for mutual understanding of the metal building system contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roofing/metal building system manufacturer, the roofing/metal building supplier, the erector, the designer, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

**1.4.4 Instructions**

#### 1.4.4.1 Instruction Manuals

Manufacturer's literature for individual building component systems.

#### 1.4.4.2 Erection

Manufacturer's erection instruction and erection drawings describing the preparation requirements, assembly sequence, temporary bracing, shoring, and related information necessary for erection of the metal building including its structural framework and components.

#### 1.4.5 Samples

##### 1.4.5.1 Factory color Finish

Submit one sample of each color indicated for verification that the color matches the colors indicated.

##### 1.4.5.2 Accessories

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration. All accessories shall be compatible with roof and wall panel systems specified elsewhere.

##### 1.4.5.4 Fasteners

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

##### 1.4.5.6 Gaskets and Insulating Compounds

Two samples of each type to be used and descriptive data.

##### 1.4.5.7 Sealant

One sample, approximately 1 pound, and descriptive data.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle manufactured items so that materials remain dry and undamaged. Do not store in contact with materials that might cause staining.

#### 1.6 WARRANTIES

##### 1.6.1 Warranty

The Metal Building System, composed of framing and structural members, roofing and siding, gutters and downspouts, accessories, fasteners, trim, and miscellaneous building closure items such as doors and windows (when furnished by the manufacturer) shall be warranted as described below against material and workmanship deficiencies, system deterioration caused by exposure to the elements and service design loads, leaks and wind uplift damage. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

##### 1.6.2 Prime Contractor's Weather-tightness Warranty

The Metal Building System shall be warranted by the Contractor on a no penal sum basis for a period of five years against materials and workmanship deficiencies; system deterioration caused by exposure to

the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The Metal Building System covered under this warranty shall include but is not limited to the following: framing and structural members, roofing and siding panels and seams, interior or exterior gutters and downspouts, accessories, fasteners, trim, flashings and miscellaneous building closure items such as doors and windows (when furnished by the manufacturer), connectors, components, and fasteners, and other system components and assemblies installed to provide a weather-tight system; and items specified in other sections of these specifications that become part of the metal building system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's written warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and/or system manufacturer, which shall be submitted along with Contractor's warranty. However, the Contractor is ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR METAL BUILDING SYSTEMS, and start upon final acceptance of the facility. The Contractor shall provide a separate bond in an amount equal to the installed total metal building system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire metal building system as outlined above.

## PART 2 PRODUCTS

### 2.1 WALL AND ROOF MATERIALS

MBMA MBSM except as specified otherwise herein. Design roof and wall panels, accessories, and flashings to be completely weather-tight and free of abrasions, loose fasteners, and deformations. Each piece or part of the assembly shall be clearly and legibly marked to correspond with the drawings.

#### 2.1.1 Minimum Thickness

As required to conform to design requirements but not less than the following:

| Items  | Minimum Thickness (Uncoated)                              |
|--|---|
| Steel Structural Members<br>Other Than Roof and<br>Wall Panels | 18 Manufacturer's Standard (MFG STD)<br>gage, 0.0478 inch |
| Girders and Columns  | 3/16 inch   |
| Purlins and Girts  | 14 Manufacturer's Standard gage (MFG STD)                 |
| Bracing  | 3/16 inch thick steel members                             |
| Column Base Plates   | 5/8 inch thick  |
| Column Anchor Bolts  | 5/8 inch diameter   |

#### 2.1.2 Panels

Roof panels are specified in Section: 07416A STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM. Wall panels are specified in Section: 07413 METAL WALL PANELS.

### 2.2 FRAMING AND STRUCTURAL MEMBERS

#### 2.2.1 Steel

ASTM A 36/A 36M, ASTM A 529/A 529M, ASTM A 572/A 572M, or ASTM A 588/A 588M.

#### 2.2.2 Aluminum

ASTM B 221 or ASTM B 308/B 308M.

#### 2.2.3 Uncoated Steel

ASTM A 570/A 570M, ASTM A 606, or ASTM A 607.

#### 2.2.4 Galvanized Steel

ASTM A 653/A 653M, G 90 coating designation, 0.045-inch minimum thickness.

#### 2.2.5 Aluminum Sheet

Aluminum sheet shall conform to ASTM B 209, 0.032-inch minimum thickness. Aluminum structural shapes and tubes shall conform to ASTM B 221 or ASTM B 308/B 308M. Structural pipe shall conform to ASTM A 53/A 53M, ASTM A 252, ASTM A 500, ASTM A 501, ASTM A 618, ASTM B 221, ASTM B 241/B 241M, or ASTM B 429. Holes for structural connections shall be made in the shop.

#### 2.2.6 Structural Tube

ASTM A 500 or ASTM B 221.

### 2.3 ACCESSORIES

#### 2.3.1 Plates and Miscellaneous Framing

Wall plates, base angles or base channels, and other miscellaneous framing members may be standard structural steel shapes, or may be formed from steel not lighter than 18 gage thick.

#### 2.3.2 Closure Strips

Closure strips for standing seam metal roof are specified in Section 07416A STRUCTURAL STANDING SEAM (SSSMR) METAL ROOF SYSTEM.

#### 2.3.3 Sealant

Provide elastomeric type sealant containing no oil or asphalt. Exposed sealant shall cure to a rubberlike consistency. Concealed sealant may be the nonhardening type.

#### 2.3.4 Gaskets and Insulating Compounds

Provide nonabsorptive gaskets and insulating compounds suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

#### 2.3.5 Fasteners

Roof fasteners for standing seam metal roofs are specified in Section 07416A STRUCTURAL STANDING SEAM (SSSMR) METAL ROOF SYSTEM.

##### 2.3.5.1 Screws

Provide self-tapping screws not less than No. 14 diameter and not less than No. 12 diameter if self-drilling/self-tapping type.

### 2.3.5.2 End-Welded Studs

Provide automatic shouldered type studs with a shank diameter of not less than 3/16 inch and cap or nut for holding covering against the shoulder.

### 2.3.5.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank diameter of not less than 0.145 inch with a shank length of not less than 1/2 inch for fastening panels to steel and not less than one inch for fastening panels to concrete.

### 2.3.5.4 Blind Rivets

Provide aluminum rivets with 3/16 inch nominal diameter shank or stainless steel rivets with 1/8 inch nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Provide hollow stem rivets with closed ends.

### 2.3.5.5 Bolts

Provide bolts not less than 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

## 2.3.6 Blanket Insulation

### 2.3.15.3 Blanket Insulation

Blanket insulation is specified in Section 07416A STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM.

## 2.3.7 Doors and Windows

Doors and windows are specified in Section 08110 STEEL DOORS & FRAMES, Section 08520A ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS and Section 08120 ALUMINUM DOORS AND FRAMES. Provide flashings as necessary for installation of the doors and windows. Provide support framing members for glazed doors and windows in accordance with paragraph 1.2.2.3 Antiterrorism/Force Protection (ATFP) Static Equivalent Loads.

## 2.4 FINISH

### 2.4.1 Shop Painting

Ferrous metal work, except factory-finished work, zinc-coated work, aluminum-coated work, and work specified to be painted herein, shall be (1) cleaned of dirt, rust, scale, loose particles, grease, oil, and other deleterious substances; (2) phosphate treated; and (3) then be given one coat of an approved rust-inhibiting primer paint of the type standard with the metal building manufacturer.

### 2.4.2 Factory Color Finish

Provide exterior and interior exposed surfaces of roof ventilators, louvers, gutters, downspouts, and metal accessories with a thermal-cured factory finish. Color shall be as indicated in Section 09915 COLOR SCHEDULE. Provide an exterior finish top coat of 70 percent resin fluoropolymer. Provide standard dry film thickness of 0.8 mil for exterior coating exclusive of primer. Provide exterior primer minimum thickness 0.2 mil. Interior color finish shall consist of a backer coat with dry film thickness of 0.5 mil thick prime coat. Provide exterior color finish meeting the test requirements specified below. Tests shall have been performed on the same factory finish and thickness provided.

### 2.4.3 Testing of Factory Color Finishes

#### 2.4.3.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610 and a rating of 6, over 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

#### 2.4.3.2 Accelerated Weathering Test

ASTM G 23, Method 2, Type D apparatus minimum 2000 hours or Type EH apparatus minimum 500 hours, no checking, blistering or loss of adhesion; color change less than 5 NBS units by ASTM D 2244 and chalking less than No. 8 rating by ASTM D 4214.

#### 2.4.3.3 Flexibility

ASTM D 522, Method A, 1/8 inch diameter, 180 degree bend, no evidence of fracturing to the naked eye.

#### 2.4.3.4 Adhesion

ASTM D 3359, Method B, for laboratory test and film thickness less than 5 mil and Method A for site tests. There shall be no film removed by tape applied to 11 parallel cuts spaced 1/8 inch apart plus 11 similar cuts at right angles.

#### 2.4.3.5 Impact

ASTM D 2794, no loss of adhesion after direct and reverse impact equal to 1.5 times metal thickness in mils, expressed in inch-pounds.

#### 2.4.3.6 Humidity Resistance

ASTM D 2247, 1500 hours, no signs of blistering, cracking, creepage or corrosion on score panel.

#### 2.4.3.7 Specular Gloss

ASTM D 523, finished surfaces exposed to the building exterior shall have a specular gloss of 10 measured at an angle of 85 degrees.

#### 2.4.3.9 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

#### 2.4.3.10 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

### **PART 3 EXECUTION**

#### **3.1 INSPECTION**

Check concrete dimensions, anchor bolt size and placement, and slab elevation with the metal building manufacturer's templates and drawings before setting any steel.

#### **3.2 ERECTION**

Erect in accordance with the manufacturer's approved erection instructions and diagrams. Correct defects and errors in the fabrication of building components in a manner approved by the Contracting Officer. If defects or errors in fabrication of components cannot be corrected, remove and provide nondefective components. When installing wall and roof systems, install closure strips, flashing, sealing material, and other accessories in accordance with building manufacturer's instructions to provide a weather-tight system, free of abrasions, loose fasteners, and deformations. After erection is complete, repair and coat abraded and damaged, primed or factory-finished surfaces to match adjacent surfaces.

### 3.2.1 Dissimilar Materials

Prevent direct contact between aluminum surfaces, and ferrous or other incompatible metals, by one of the following methods:

- a. Paint the incompatible metal with a coating of manufacturer's standard heavy-bodied primer and paint.
- b. Paint the incompatible metal with a prime coat of corrosion inhibitive primer followed by one or two coats of aluminum metal-and-masonry paint, or other suitable protective coating, excluding products containing lead and chromium pigmentation.
- c. Provide an approved nonabsorptive gasket.
- d. Apply an approved calking between the aluminum and the incompatible metal.

If drainage from incompatible metal passes over aluminum, paint the incompatible metal by method (a) or (b). Paint aluminum surfaces in contact with concrete or masonry materials by method (a). Paint green or wet wood, or wood treated with incompatible wood preservatives, by method (a) or use two coats of aluminum paint.

### 3.2.2 Rigid Frames, Bases, and Sill Members

Brace frames as necessary to ensure safety. Set accurately, using a nonshrink grout to obtain uniform bearing on the concrete and to maintain a level base line elevation. Separate leveling plates under column base plates shall not be used. Members shall be accurately spaced to assure proper fitting of panels. As erection progresses, the work shall be securely fastened to resist the dead load and wind and erection stresses. Clean surfaces to receive the mortar and thoroughly moisten immediately before placement of mortar. Water cure exposed surfaces of mortar with wet burlap for 7 days.

#### 3.2.2.1 Field Welding

Steel, AWS D1.1/D1.1M. Aluminum, AA 30.

#### 3.2.2.2 Field Bolting

AISC S329. Improper or mislocated bolt holes in structural members or other misfits caused by improper fabrication or erection, shall be repaired in accordance with AISC Pub No. S303. Concrete work is specified in Section 03300A CAST-IN-PLACE STRUCTURAL CONCRETE. Anchor bolts shall be accurately set by template while the concrete is in a plastic state.

### 3.2.5 Installation of Gutters and Downspouts

Gutters and downspouts shall be rigidly attached to the building. Spacing of cleats for gutters shall be 16 inches maximum. Spacing of brackets and spacers for gutters shall be 36 inches maximum. Supports for downspouts shall be spaced according to manufacturer's recommendations.

### 3.2.6 Louvers and Ventilators

Louvers and ventilators shall be rigidly attached to the supporting construction to assure a weather tight

installation.

3.2.7 Doors and Windows

Doors and windows, including frames and hardware, shall be securely anchored to the supporting construction, shall be installed plumb and true, and shall be adjusted as necessary to provide proper operation. Joints at doors and windows shall be sealed according to manufacturer's recommendations to provide weather-tight construction.

3.3 FIELD PAINTING

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same color and material used for the shop coat. Section 09900 PAINTS AND COATINGS, for painting of shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows.

3.4 FIELD QUALITY CONTROL

At the discretion of the Contracting Officer, sample panels may be taken at random from each delivery or from stockpiles on the site at any time during the construction period, and tests may be made to check the conformance of the materials to the requirements specified in paragraph entitled "Factory Color Finish." Failure of the sample sheets to pass the required tests shall be cause for rejection of all sheets represented by the samples and replacement of the entire shipment.

3.5 WARRANTIES

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY FOR PREENGINEERED METAL BUILDINGS

FACILITY DESCRIPTION: \_\_\_\_\_

BUILDING NUMBER: \_\_\_\_\_

CORPS OF ENGINEERS CONTRACT NUMBER: \_\_\_\_\_

CONTRACTOR

CONTRACTOR: \_\_\_\_\_ ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

OWNER

OWNER: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION AGENT: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY FOR PREENGINEERED METAL BUILDINGS (continued)

THE METAL BUILDING SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY [\_\_\_\_\_] FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE AND STRUCTURAL FAILURE WITHIN PROJECT SPECIFIED DESIGN LOADS, AND LEAKAGE. THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: FRAMING AND STRUCTURAL MEMBERS, ROOFING AND SIDING PANELS AND SEAMS, INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS, ACCESSORIES, TRIM, FLASHINGS AND MISCELLANEOUS BUILDING CLOSURE ITEMS SUCH AS DOORS AND WINDOWS (WHEN FURNISHED BY THE MANUFACTURER), CONNECTORS, COMPONENTS, AND FASTENERS, AND OTHER SYSTEM COMPONENTS AND ASSEMBLIES INSTALLED TO PROVIDE A WEATHERTIGHT SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS THAT BECOME PART OF THE METAL BUILDING SYSTEM. ALL MATERIAL AND WORKMANSHIP DEFICIENCIES, SYSTEM DETERIORATION CAUSED BY EXPOSURE TO THE ELEMENTS AND/OR INADEQUATE RESISTANCE TO SPECIFIED SERVICE DESIGN LOADS, WATER LEAKS AND WIND UPLIFT DAMAGE SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE ASSOCIATED WITH THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON [\_\_\_\_\_] AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

\_\_\_\_\_  
(Company President) (Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY FOR PREENGINEERED METAL BUILDINGS (continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE METAL BUILDING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY.

#### EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE BUILDING SYSTEM DUE TO ACTIONS BY THE OWNER WHICH INHIBIT FREE DRAINAGE FROM THE ROOF, AND GUTTERS AND DOWNSPOUTS; OR CONDITIONS WHICH CREATE PONDING WATER ON THE ROOF OR AGAINST THE BUILDING SIDING.
6. THIS WARRANTY APPLIES TO THE METAL BUILDING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES. REPORTS OF LEAKS AND BUILDING SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSR SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED

#### CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY FOR PREENGINEERED METAL BUILDINGS (Exclusions from Coverage Continued)

IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE METAL BUILDING SYSTEM REPLACED OR REPAIRED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR. IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION, UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED THE PARTIES SHALL, WITHIN 10 DAYS JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND

CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN 10 DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT. A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.