

***Texas Department of Transportation***

# FACILITY DESIGN STANDARDS AND PRODUCTION GUIDELINES

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# **PART – 1**

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## **ARCHITECTURAL DESIGN STANDARDS**

**TxDOT Maintenance Division  
Facilities Management Section  
Capital Improvement Program Branch**

**Architectural Design Standards**

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- f) UPC (Uniform Plumbing Code) , Latest Edition
- g) UMC (Uniform Mechanical Code), Latest Edition
- h) FED–STD–795 – Uniform Federal Accessibility Standards (UFAS)
- i) National Historic Landmark District

#### C. FEDERAL REGULATORY REQUIREMENTS

- 1 ADA (Americans with Disabilities Act) of 1990, as a public accommodation, as implemented in the Code of Federal Regulations (CFR):
  - a) 29 CFR 1910; Occupational Safety and Health Standards.
  - b) 29 CFR 1926; Safety and Health Regulations for Construction
  - c) 40 CFR 61; National Emissions Standards for Hazardous Air Pollutants.
  - d) 40 CFR 261; Identification and Listing of Hazardous Waste.
  - e) 40 CFR 262; Standards Applicable to Generators of Hazardous Waste.
  - f) 40 CFR 265; Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
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  - h) 42 CFR 84; Approval of Respiratory Protective Devices.
  - i) 49 CFR 107; Hazardous Materials Program Procedures.
  - j) 49 CFR 171; General Information, Regulations and Definitions
  - k) 49 CFR 172; Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.
  - l) 49 CFR 173; Shippers – General Requirements for Shipments.

## D. STATE REGULATORY REQUIREMENTS

### 1 TxDOT REVIEW

- a) MNT Division / Facilities Management Section Review sets must include drawings, specifications, design calculations and cost estimate submitted for TxDOT review at the Schematic Design, Design Development, 50%, 90% and 100% Construction Document Phases unless identified differently in the A/E consultant contract. TxDOT will issue review comments at the SD, DD and 90% CD Phases that will require a formal response from the A/E team. The 50% submission is a progress set and the 100% is the sealed set ready for bidding.
- b) Occupational Safety Division (OCC) must review all Preliminary Designs at the point of finalization, but prior to District approval. PM must forward set of drawings for review to OCC.

### 2 TDLR –WATER WELL

- a) If a water well is required on the site, the Texas Board of Well Drillers standards must be met as regulated by the Texas Department of License Regulation (TDLR) (see Civil Standards).

### 3 TCEQ – WATER SYSTEM

- a) All public water systems must comply with TCEQ Public Water Standards (see Civil Standards).

### 4 TCEQ – SEPTIC SYSTEMS (OSSF)

- a) Any new septic system, or OSSF (On-Site Sewage Facility) must comply all TCEQ Chapter 285 Rules and Regulations (see Civil Standards).

### 5 TDLR – TEXAS ACCESSIBILITY STANDARDS

- a) Construction Documents and new construction must comply with all Texas Accessibility Standards (TAS) requirements and be submitted to Texas Department of License Regulation (TDLR) for review by the A/E of Record or the Owner's rep if an A/E is not involved in the design. The A/E consultant will pay for the TAS review and construction inspection, or the agency will pay fees if an A/E is not in involved.

## 6 TCEQ – WETLANDS

- a) Consultant may be directed by TxDOT to have an environmental study performed to determine if the project is located on land designated as Texas Wetlands (Note: Study may have been completed prior to consultant involvement. If completed, TxDOT will give necessary information to consultant). If the project is located on Texas Wetlands, consultant must coordinate with the Texas Commission on Environmental Quality (TCEQ) to insure necessary restrictions and precautions are followed. Precautions, obligations and restrictions should be noted within the Contract Documents near the scope of work, to alert the bidding contractors of their obligations.

## 7 SECO - ENERGY CONSERVATION

- a) Per the State Energy Design Standard for New State Buildings, the Architect/ Engineer must certify, in writing, compliance with ASHRAE 90.1-Latest Edition and with the TX.GOV.CODE, TITLE 4, CHAPTER 447.004 as administered by the State Energy Conservation Office (SECO).

## 8 TBAE (Texas Board of Architectural Examiners)

- a) Projects must comply with the statutes that regulate professional design services for architects, landscape architects and interior designers. Refer to the appropriate regulatory agency to verify current requirements when professional design services are mandatory.
- b) The Texas Architect Practice Act (When an Architect is required) regulates the types of public projects that require an architect. According to Chapter 1051, Subchapter K, par. 1.212 of the Texas Occupations Code, an Architect is required for Publicly Owned Buildings if:
  - c) New construction
    - 1) Exceeds \$100,000, and
    - 2) Intended for education (instructional purposes), assembly (50+ people) or office/business use

d) Alterations to Existing Buildings

1) Exceeds \$50,000, and

- (a) Intended for education (instructional purposes), assembly (50+ people) or offices/ business use
- (b) The alteration or addition requires removal, relocation or addition of a wall, or partition, or the alteration, or addition of an exit.
- (c) Alterations to Existing Buildings (exempt if not considered Substantial Alteration)
- (d) Substantial Alteration if the structural change must be prepared by a licensed engineer (See Engineer Practice Act requirements below).
- (e) Substantial Alteration if the exit way change will affect a path of egress intended to be used by more than fifty (50) persons.

E. HEALTH AND SAFETY

- 1 Fire Resistance: Provide construction in accordance with IBC- Latest Edition.
- 2 Prevention of Accidental Injury: As required by code and as follows:
  - a) Safety Glazing: As defined by 16 CFR 1201; provide in locations required by code, glazed areas subject to human impact, glazed areas at walking surfaces and doors.
  - b) Lightning Hazard: Design to prevent damage to occupants, structure, services, and contents due to lightning strikes.
    - 1) Provide protection equivalent to that specified in NFPA 780; supplementary strike termination devices, ground conductors, and grounding electrodes are required only where the integral portions of the structure cannot perform those functions.

## c) Health Hazards:

- 1) Design to prevent growth of fungus, mold, and bacteria on surfaces and in concealed spaces.
  - 2) Hazardous Construction Materials: Design and construct to comply with the requirements of the code.
  - 3) Indoor Air Quality: Design and construct to comply with the code and the acceptable air quality as defined by ASHRAE 62.
- 3 Physical Security: In addition to any provisions that may be required by law or code, design and construct both exterior and interior spaces to incorporate accepted principles of Crime Prevention Through Environmental Design (CPTED), using natural (as opposed to technological) methods of providing surveillance, access control, and territorial reinforcement wherever possible. Provide minimum protective measures such as an unobstructed view around the facility, elimination of locations of concealment, lighting that focuses away from the building, and minimum number of shadow areas.
  - 4 Electrically–Operated Equipment and Appliances: UL listed for application or purpose to which they are put; suitable for wet locations listing for exterior use.

## F. STRUCTURE

- 1 Building Loads: Accommodate loads as prescribed by code, IBC – Latest Edition for each specific use as listed in the code.

## G. OTHER APPLICABLE STANDARDS

- 1 The following standards shall apply to technical features of design and construction. Standards shall be the current issue in effect at the time of issuance the Construction Documents. No attempt has been made to list all applicable codes and standards; therefore, where a particular design aspect is not covered by any of the codes or standards listed, nor by the requirements specified herein, the A/E shall be guided by other nationally recognized and accepted codes or standards which do apply. The AHJ shall be TxDOT's Facility Management Director or representative.

2 TxDOT Standards are listed below :

- a) Engineering Services Branch
- b) Telecommunication Infrastructure System Environmental And Technical Specifications
- c) Fuel Storage/Delivery System Standard
- d) CAD Production Standards
- e) Asphalt Paving Standards

#### H. LOCAL PERMITS

- 1 TxDOT projects on state owned property will not require a building permit from the local government. The Texas Attorney General has issued an opinion on this matter and a copy is available from the Project Manager as needed if local authorities demand building permits.
- 2 All project related work outside of state property and for utility connections may require permits that will be the General Contractors responsibility to obtain and pay any costs.

#### I. DURABILITY

- 1 Expected Service Life Span: The overall expected functional service life of the facility is fifty (50) years. During the design and construction of a state facility, the A/E and the General Contractor need to base decisions on durability. Service life of individual elements may differ from the overall project life span and are defined in other Sections.
- 2 Animals: Do not use materials that are attractive to or edible by animals or birds. Prevent animal entry into building, attic space or under foundation.
- 3 Insects: Do not use materials that are edible by insects, unless access by insects is prevented. Prevent insect entry into building, attic space or under building.

#### J. PROTOTYPICAL BUILDING DESIGNS

- 1 Prototype building designs consist of a pre-engineered steel structure except for metal studs and masonry veneer at office area, insulated metal siding exterior through out.

2 Prototypical building designs are available from the FM Project Manager.

#### K. SPECIFICATION FORMAT

1 Provide specifications in the Construction Specifications Institute's (CSI) 16 Division format with 3 Part Section format (General, Products, Execution).

#### L. OPERATION AND MAINTENANCE

- 1 Space Efficiency: Minimize floor area required while providing specified spaces and space relationships, plus circulation and services areas required for functions.
- 2 Energy Efficiency: Minimize energy consumption while providing function, amenity, and comfort specified.
  - a) Provide energy efficient design using procedures and values to meet those specified in ASHRAE 90.1, 2007.
  - b) Evaluate the life cycle cost for large facilities for source cooling and heating. Submit the analysis with preliminary design:.
    - 1) Cooling: Air-cooled vs. water-cooled water chilling units.
    - 2) Heating: Individual electric heating elements where required vs. gas-fired hot water boilers, pumps, and piping
    - 3) Water Heating: Electric vs. gas vs. solar water heating.
- 3 Water Consumption: Minimize water consumption and comply with rainwater collection statute for buildings with 10,000 square feet of roof area. Provide a separate water meter for landscaping purposes.
- 4 Waste (Trash/Debris) Removal during Construction: The General Contractor is required to remove all construction debris and trash on a regular basis to keep site clean during construction. GC must recycle as much waste as practical with a goal of 80% construction waste recycled diverting materials from landfill.
- 5 Waste Recycling at Facilities: Provide space for recycling containers inside buildings and on site if recycling is available in the local area. For information about the recycling program for TxDOT contact the GSD / Recycling Manager.

- 6 Ease of Operation: Provide facility, equipment, and systems that are easily operated by personnel with a reasonable level of training for similar activities.
- 7 Ease of Maintenance: Minimize the amount of maintenance required and determine that expertise and supplies are available to maintain equipment and facility systems as specified. Maintenance must be economical for CIP facilities.
- 8 Ease of Repair: Elements that do not meet the specified requirements for ease of repair may be used, provided they meet the specified requirements for ease of replacement of elements not required to have service life span equal to that specified for the project as a whole; the service life expectancy analysis and life cycle cost substantiation specified for service life are provided; and TxDOT's acceptance is granted. Assure that repairs to specified equipment can be made by local trades and that parts and equipment can be readily replaced as needed.

#### M. ELEMENTS AND PRODUCTS

- 1 Provide products and elements that comply with the following paragraphs.
- 2 Elements Made Up of More Than One Product:
- 3 Where an element is specified by performance criteria, the project's construction will be either proven-in-use or proven-by-mock-up, unless otherwise indicated.
  - a) Proven-In-Use: Proven to comply by having actually been built to the same or very similar design with the same materials as proposed and functioning as specified.
  - b) Proven-by-Mock-Up: Compliance reasonably predictable by having been tested in full-scale mock-up using the same materials and design as proposed and functioning as specified. Testing need not have been accomplished specifically for this project; when published listings of independent agencies include details of testing and results, citation of test by listing number is sufficient (submittal of all test details is not required).
  - c) The A/E Team may choose whether to use elements proven-in-use or proven-by-mock-up, unless either option is indicated as specifically required.

- d) Where test methods accompany performance requirements, use those test methods to test the mock-up.

#### N. COLOR SELECTION FOR BUILDING MATERIALS AND SURFACES

- 1 All color selections and overall color scheme must receive the approval of the Facilities Management Director of the Maintenance Division. The submission of color scheme shall be in the form of a color board with samples identified by product name and location within the building facility. This includes major exterior and interior finishes. Color selection must be submitted all at one time with 100% Design Development submission.

#### O. ASBESTOS CONTROL

- 1 No product shall be specified that contains asbestos. The Architect / Engineer shall provide a statement in the specifications that no asbestos products were specified.
- 2 General Contractor must make all subcontractors aware that secondary products that are not specifically project specified, but supplied by them on the project site must be verified to not contain asbestos. The General Contractor shall sign a statement that NO products containing asbestos were used or installed by the General Contractor and subcontractors for the TxDOT project.
- 3 Specifications shall include the stipulation that all questionable product submittals (floor and ceiling tiles, sealant, exterior sheathing, roofing materials, etc.) shall contain a letter from the material manufacturer's representative stipulating that the product being installed does not contain asbestos. The TxDOT Project Manager shall maintain these letters and/ or MSDS (Material Safety Data Sheet) in the project file.
- 4 These asbestos related items should be included in the agenda of the Pre-Construction meeting.

#### P. ENVIRONMENTALLY RESPONSIBLE DESIGN

- 1 General: In addition to other requirements, provide design and construction of capital facilities that minimizes adverse effects on the natural environment, enhances the quality of the indoor environment, and minimizes consumption of energy, water, construction materials, and other resources.
- 2 Goals: The goals indicated below as "required" must be achieved. The goals indicated as "desirable" will be given high priority in evaluating the

design phases. The goals indicated as "if possible" must be achieved if the design and site considerations allow. The goals indicated "as specified" have different requirements specified in other Sections.

a) Sitework:

- 1) Restoration of degraded site areas: Required
- 2) Minimum surface disturbance: Required
- 3) Preservation of existing trees and topsoil: Desirable
- 4) Sediment and erosion control: Required
- 5) No net increase of storm water runoff: Required

b) Water Conservation:

- 1) Reduction of water used by plumbing fixtures, appliances, and equipment, in excess of regulatory requirements: Desirable
- 2) Reduction of potable water use by harvesting rainwater, condensation, etc. as required by HB 4 from 2007 Legislative Session: Required

c) Energy Conservation:

- 1) State Energy Code: Exceed by 20%, the State Energy Design Code (ASHRAE 90.1.–2007) in the envelope design. The designer shall provide certification of compliance and documentation of energy calculations. Improvement of efficiency through basic building commissioning: Desirable
- 2) No use of CFC–based refrigerants: Required

d) Conservation of Materials and Resources:

- 1) Location for collection and storage of recyclables: Required
- 2) Recycling of construction waste: Required
- 3) Use of materials containing recycled content: Required
- 4) Use of local/regional materials: Required

## e) Indoor Environmental Quality:

- 1) Smoking will be prohibited in the building: Required
- 2) Design and construction that prevents or avoids common causes of indoor air quality problems: Required
- 3) Use of materials that are low-emitting, , non-toxic, and chemically inert; low VOC finishes: Required by law and/ or as specified
- 4) Thermal comfort conditions: Required
- 5) Humidity control: Required

## Q. ACOUSTICAL DESIGN – NOISE DESIGN CRITERIA FOR TYPICAL OCCUPANCIES

- 1 Design in accordance with good practice to achieve conventional ambient noise levels qualified in Noise Criteria (NC) defined in current ASHRAE Applications Volume, Chapter 42 and ANSI S1.8 Reference Quantities for Acoustical Levels ASA 84.
- 2 The ambient sound level of an occupied space is not to exceed the following NC listed for its respective typical occupancy unless specifically directed otherwise by the Project Manager and TxDOT's statement of project program requirements. Spatial forms, materials, assemblies, systems and equipment selections are to be designed as required to achieve a standard quality of specified level of maximum background noise.

a) Typical Occupancy \_\_\_\_\_ Max. Noise Criteria(NC)1) Offices:

(a) Executive	30
(b) Conference rooms	30
(c) Private	35
(d) Open-plan areas	40
(e) Computer-Business machine areas	45
(f) Public circulation	45

2) <u>Laboratories</u>	
(a) Laboratories	
(b) Research & General	35
(c) Teaching	30
(d) At Hoods: 4' AFF, 3' in front	
0-50% sash position	55
(e) Corridors	35
(f) Public areas	40
3) <u>Training Rooms:</u>	
(a) Lecture and classrooms	30
(b) Open-plan classrooms	35
(c) Lecture theaters	30
4) <u>Recording studios:</u>	
(a) Recording room	20
(b) Sound control room	25
(c) Other control rooms	25

- 3 These conventional standards of the level of ambient noise in a space are independent of and prior to the installation of any Owner-furnished equipment, furniture and furnishings unless specified otherwise.
- 4 Other resource material describing conventional ambient noise criteria is available in the current edition of Ramsey/Sleeper Architectural Graphic Standards.

END OF SECTION



required for accessible route from ADA parking to the building entrance. Do not design handrails along the accessible route if possible.

- 3 During Design, the Architect to prepare a site plan drawing that locates spot elevations for sidewalks, pavement next to building, along curbs at parking lots and finish grading around buildings to assure good drainage away from building entrances. During Construction, the General Contractor is required to survey the form-work before pouring walks, curbs and pavement to confirm compliance with spot elevations on Construction Drawings. The A/E must approve the form survey from GC before pouring concrete (see TxDOT specification).

### C. LANDSCAPING

- 1 The typical landscape design shall include an automatic-irrigation system, minimal planting beds around building entrances, minimal select trees to shade windows and parking, and full sod lawn around the main office building between the building and the curbed parking and drives with a 5% slope of the finish grade.
- 2 If the landscape design is not provided with Bid Set, then specify a \$30,000 allowance for each new facility (except District HQ's). Specify how the GC will procure landscape design and qualifications of the designer using a licensed irrigator for irrigation system design. The landscape design must be approved by MNT / FM Director before installation.
- 3 Provide 4" sleeves under sidewalks and paving for future irrigation system.
- 4 Implement "xeriscape" approach by selecting native plants for the local climate requiring minimal watering and maintenance. After the first year to establish root system, most plants should need very little water that can be supplied by rainwater collection system.
- 5 Irrigation system - Use rainwater collection system when possible to water landscaping per state statute for building roofs over 10,000 square feet (see Engineering Section). Provide a separate meter for landscaping irrigation system when water is purchased from a utility.
- 6 Provide solid curbs or edging for all planting beds to prevent grass spreading into beds from lawn. Shape of planting beds shall be conducive to using a power mower and the entire lawn shall be configured to maintain with a power mower only. Use mow strips along fence line and building edges, or select vegetation that doesn't require mowing.

#### D. LANDSCAPING ADJACENT TO BUILDING PERIMETER

- 1 Provide a minimum a twelve (12") vertical drop between building finish floor and the exterior finish grade at lawn or planting beds (this includes top of mulch in planting beds). All masonry weep holes and all siding must be above lawn and planting bed material.
- 2 Provide a permanent, hard surface to drain water from downspout to outside of planting beds if rainwater is not collected. The surface material can be stone, brick, large rocks, etc. that is complimentary to the building design. Standing water in planting beds from roof drains is unacceptable.

#### E. ROLLING GATES TO MAINTENANCE YARDS

- 1 Provide bi-parting, 15' wide rolling gates at yard entrances with concrete center strip for future card readers. Include underground conduit with pull wire for future electrical wiring to avoid cutting pavement. Locate gate in view of Maintenance Supervisor's Office windows. Cantilever gates are unacceptable.

#### F. FLAG POLES

- 1 Specify a single, 30' high, brushed aluminum flagpole, tapered from 6" base to 3" top and 6" ball with gold anodized finish.
- 2 Do not place flagpoles in the center of entrance sidewalks.
- 3 Do not light flagpoles to conserve energy and to comply with "dark sky initiative".

#### G. TERMITE CONTROL

- 1 Specify non-chemical termite control to stop subterranean termites from entering a building by blocking any entrances the foundation with stainless steel mesh and clamps per manufacturer's recommendation. Chemical controls will not be accepted as a substitution.

#### H. RETENSION PONDS

- 1 Verify elevations of proposed retention ponds to assure that water will not back up into adjacent areas and will not flood adjacent landowners.
- 2 Select appropriate vegetation that will be easy to maintain.

I. MONUMENTAL FACILITY SIGN

- 1 Provide a monumental sign design based on TxDOT standard that is similar to facility design including materials. TxDOT details available.
- 2 Provide galvanized tube frame for TxDOT provided sign between two columns.

END OF SECTION



- 3 Office Building Columns- 12" web depth (maximum) with straight-leg below ceiling height for office building or occupied spaces with drywall and ceilings.
- 4 Roof Deck- In conditioned spaces, provide a structural, metal deck welded to steel purlins with rigid insulation board on top of deck.
- 5 Roof Purlins- In unconditioned spaces, provide steel purlins on rigid frame with metal roof attached to purlins using manufacturer's standard details and complying with MBMA's standards.
- 6 Insulation (thermal performance)
  - a) Conditioned space use R19 insulation for walls and R30 for roofs.
  - b) Semi-heated space use R11 insulation for walls and R19 for roofs.

#### C. MASONRY

- 1 Masonry Veneer Walls - The main office building shall be the most prominent building on TxDOT site and will typically have masonry on all public sides- front and each side. Provide galvanized steel lintels at openings. Brick or stone veneer to be selected by Architect from a mock-up panel erected on site by the General Contractor. The Architect will determine the appropriate regional style for the specific locale. Design a metal stud backup with deflection maximum of  $L/720$  of span and horizontal joint reinforcement per BIA guidelines.
- 2 CMU Walls- Concrete Masonry Unit exterior walls, load bearing or non-load bearing, shall not be used on new TxDOT facilities unless approved by the FM Director for specific needs like Truck Wash Bays, or matching existing building with addition.

#### D. MASONRY LEDGES

- 1 For masonry veneer walls, provide a masonry ledge on the foundation a minimum of 4" below finish floor, but on coursing. Provide 1 ½" air space, membrane flashing and weep holes at 4' o.c. to insure proper drainage and the prevention of water entering the building at floor level. Locate weep holes a minimum of 4" above finish grade of lawn or planting beds.

#### E. METAL WALL PANELS

- 1 The rear elevation of the main office building facing the Maintenance Yard shall be 24 gauge, pre-finished, metal panels with concealed fasteners. The

utilitarian buildings like shops and storage buildings shall have 24 gauge, pre-finished, metal panels with exposed fasteners to match panel color. Color to match metal panels on all buildings as selected by Architect.

#### F. TEXAS STAR or STATE SEAL OF TEXAS

- 1 All new capital program facilities must have a five-pointed, "Texas Star" or the official State Seal of Texas located above the main building entry. The "Texas Star" or the State Seal shall measure twenty-four (24) inches in diameter, minimum, and the star must be three-dimensional. The Star or Seal must be fabricated of stone (cut or cast) or cast metal (stainless steel, aluminum or bronze) as selected by Architect. The "Texas Star" design will consist of a star within a circle with star tips attached to inside of circle. Detail available from FM Section.

#### G. WAINSCOTS

- 1 Do not mix materials on walls in horizontal bands around the perimeter of a building. Use uniform material the entire height of walls (metal, brick or stone). Brick soldier or sailor courses are acceptable. The two different metal siding profiles are acceptable with a manufacturer's standard waterproof trim between upper and lower panels.

#### H. METAL ROOFS

- 1 All new capital program buildings shall have standing seam metal roofs with a minimum roof slope of 3:12. All metal roofs to have 22 gauge, 16" wide smooth, flat panels without striations, single or double lock seams, Galvalume finish; smooth; fix panels at ridge and floating edge at eave. All roof trim to be 24 gauge with matching Galvalume finish. Roofs shall meet UL 90 uplift rating.
- 2 Exceptions: Utilitarian buildings, such as storage buildings and shop storage buildings, may have metal roofs with a minimum 1:12 pitch if approved by manufacturer for slope to qualify for warranty. ½ : 12 pitch acceptable on porches if approved by manufacturer. If existing metal roofs have different slope or different color finish, then consideration will be made to match the existing.
- 3 Insulation- Placement of insulation shall be at the roof plane. Do not place insulation directly above or on ceilings.
- 4 Ventilation- Provide gravity ventilation in attic spaces or in unconditioned buildings with continuous ridge vents and soffit vents based on climate of

region. Provide operable dampers or adjustable louvers in buildings to control comfort if unconditioned space.

- 5 Accessories- All roof top accessories attached to the roof or through roof must be provided and installed by the roofing contractor to assure compliance with warranty requirements. Locate all roof penetrations and roof top equipment on back side of roof ridge opposite of main entrance; coordinate with MEP.
- 6 Skylights are prohibited for CIP projects unless approved by FM Director.
- 7 Warranty- Specify 20 Year, NDL (No Dollar Limit) Weather- tightness, material and finish warranties for all roofs. Specify two year warranty to provide by the roof installer and the remaining warranty provided by the manufacturer.

#### I. ROOF OVERHANG

- 1 All roofs on occupied, air-conditioned buildings shall have a minimum overhang of 36 inches around the perimeter of the building to direct water away from the building exterior and to shade glazing including gable ends.
- 2 Buildings that are unoccupied and/or unconditioned, do not require overhangs, but the architect may decide to add if needed for other functional purposes.

#### J. GUTTERS & DOWNSPOUTS

- 1 All occupied buildings to include gutters and downspouts to prevent water infiltration of building, erosion of topsoil, landscaping damage and staining at the base of perimeter walls. Gutters and downspouts shall be located at the edge of the roof overhang; do not locate internally within the building structure or building envelope.
- 2 Gutter and eave trim to match roof finish (Galvalume) and downspouts to match wall color.
- 3 Downspouts at paved areas need to be protected by bollards or specify cast iron boots to prevent damage from vehicles.
- 4 Pre-cast concrete splash blocks to be sloped away from building at each downspout unless water spills onto concrete pavement. Concrete or stone gutters must be installed through planting beds from downspouts to prevent flooding of beds or erosion of plant materials.

- 5 Provide calculations of gutter sizes and downspout quantities based on peak rainfall for the specific geographic region.
- 6 Coordinate downspouts with rainwater collection system used to supply landscape irrigation, truck fill and other non-potable water needs (see Engineering Standards).

#### K. MEMBRANE ROOFS

- 1 Low-sloped, roof membranes for existing roof replacements (1/4" / foot slope minimum and 1/2" / foot slope preferred). Specify modified bitumen, EPDM or TPO, fully-adhered membranes unless approved by TxDOT.
- 2 Slope all roofs to perimeter to drain water into gutters; interior roof drains prohibited unless pre-existing prior to roofing project.
- 3 Spray foam, PVC or coal tar roof materials are prohibited.
- 4 Insulation- Placement of insulation shall be at the roof plane. Do not place insulation directly above or on ceilings. If existing roofs do not have minimum slope, then specify tapered, rigid insulation for slope.
- 5 No flat roofs are allowed on Capital Improvement Program projects.
- 6 Skylights are prohibited for CIP projects.
- 7 Warranty- Specify 20 Year, NDL (No Dollar Limit) Weather- tightness, finish and material warranties for all roofs.

#### L. WINDOWS

- 1 Windows located within occupied building areas, conference rooms and meeting rooms shall be operable. Single hung, clear anodized aluminum frames glazed with tinted, 1" insulated, low-E glass windows are required in typical buildings. If a room contains multiple windows, it is not necessary for all of the windows within the space to be operable. Include a sufficient number of operable windows in each space to provide suitable fresh air by cross- ventilation. Aluminum screens required on all operable windows.

#### M. DOORS

- 1 Aluminum Doors- Clear anodized aluminum door at all main entrances that match aluminum windows with 1 3/4" face frame; 3'-0"x 7'-0" minimum size of door opening and full, 1" insulated glass; solid, brushed stainless steel pulls.

- 2 Hollow Metal Doors & Frames- Hollow metal doors shall be full, flush seamless,

1 ¾" thick, 18 ga. galvanized steel, factory primed and field painted. Provide vision panels on exterior doors unless noted otherwise. Hollow metal frames shall be 16 ga., galvanized, primed and painted with welded, mitered corners & ground smooth welds.

#### N. DOOR HARDWARE

- 1 Door hardware to be solid, stainless steel with brushed finish; all doors to include ball-bearing hinges with non-removable hinges, lever handle with Best, 7 pin locksets with removable cores to TxDOT keying system, deadbolt, closer, hold-open device, door stop, silencers, kick-plate and compatible with TxDOT security card reader system.

#### O. STOREFRONT SYSTEMS

- 1 Storefront systems that terminate at the floor level shall have a positive drop of a minimum of ½" and an aluminum subsill set in full bed of mastic.

#### P. VESTIBULES & COVERED PORCHES

- 1 Air-lock type vestibules at the building entrance are not allowed unless the specific site requires wind protection, or it vestibule is approved by the FM Director.
- 2 Covered porches are acceptable for main entrances to office building, breezeways between buildings and loading areas.

#### Q. DOOR THRESHOLDS

- 1 Provide a ½" drop at the threshold of all exterior, personnel doors that complies with ADA. Aluminum threshold to be sealed continuously between threshold and slab with full bed of mastic or continuous foam strip. Provide an adjustable, aluminum door bottom with neoprene strip and rain shield for all doors exposed to driving rain. Neoprene strip must be adjustable to completely seal door bottom. A standard TxDOT door sill detail is available from FM Section.

#### R. OVERHEAD DOORS

- 1 All overhead doors shall be manual, coiling type, 3 rows of vision panels, full width at 5' above finish floor; insulated in conditioned space. Powder coat finish as selected by the Architect.

- 2 All overhead doors shall utilize 3" tracks if sectional doors used to match existing.
- 3 Provide a ¾" drop at the threshold of all overhead doors to assist in forming a seal at the door. The pre-fabricated sill shall be a single, galvanized steel angle with anchor bolts embedded in the concrete.

#### S. LOUVERS & VENTS

- 1 All exterior wall louvers shall have a 4" deep, extruded aluminum frame with drainable blades; standard Kynar or powder coat finish and aluminum insect screen with a minimum of 40% free air intake/ exhaust performance (coordinate with mechanical engineer).
- 2 If an opening requires the louver to be adjustable, specify a combination type louver with the exterior louver fixed and the interior louver adjustable similar to louver above.

#### T. SEALANTS

- 1 Seal all exterior material joints and around all door and window openings with a multi-component urethane sealant with a backer rod. Joint widths to be consistent with ¼" minimum and ½" maximum joint width and finish to be uniform without breaks or variations in sealant bead. Colors as selected by Architect from standard colors to match one of the adjacent material colors. Specify sealant with a minimum of a ten (10) warranty.

END OF SECTION

TxDOT Maintenance Division  
Facilities Management Section

**Architectural Design Standards**

**Title:** Building Interior **Number:** A1.04

**Issue Date:** March 2009 **Rev #:** 0

**Approved:** \_\_\_\_\_  
Capital Improvements Supervisor

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**A. MEETING ROOM**

- 1 Provide an exterior door and an interior door from Lobby to the Break / Meeting Room. This will eliminate need for work crews passing through Lobby.
- 2 Provide built in plastic laminate counter top, base and overhead cabinets with stainless steel sink. Appliances are not supplied by TxDOT, but electrical outlets will be provided for refrigerators and microwave ovens. Garbage disposals and cook stoves/ovens are not allowed. Cooking exhaust fans are not required.
- 3 Provide marker board and tack board; provide blocking for projection screens.

**B. CONFERENCE ROOM**

- 1 Provide a small conference room for AE Offices with a window and door adjacent to public corridor.
- 2 Design partitions and doors to provide good acoustical speech privacy when door is closed with an NC rating of 30 (see Acoustical Design in General Requirements).
- 3 Specify marker board and tack board; provide blocking for future projection screen that will be provided by districts.



### C. PRIVATE OFFICES

- 1 Area Engineer Office and Maintenance Office Buildings- Provide private offices for Area Engineer, Assistant Area Engineer , Maintenance Supervisor and Assistant Maintenance Supervisor. Make all offices the same size (11'-6 wide by 14'-0") unless approved by Facilities Management (FM) Director.
- 2 District Office- Ratio of private offices to open space will vary between District's needs and operations that will be determine by FM with district's coordination. The preliminary ratio of private offices to open office is 20% private to 80% open office, and this ratio will be finalized during the design process.
- 3 Design partitions and doors to provide good acoustical speech privacy when door is closed with an NC rating of 30 (see Acoustical Design in General Requirements).

### D. LOBBY / RECEPTION AREA

- 1 Provide space for one work station for Area Engineer support staff, one work station for Maintenance Supervisor staff and waiting area for 3 visitors. Work stations to be located with direct view of the front parking and walk.
- 2 Provide space for filing cabinets convenient to work stations.
- 3 The location of fuel control and fire control panels shall be near Lobby, but out of immediate view and meeting code requirements.

### E. DOORS AND FRAMES

- 1 Provide solid core, stain-grade red oak wood doors or accepted equal, hollow metal or aluminum frames for office type buildings. Specify hollow metal doors for utilitarian rooms like shops, equipment storage, material storage, laboratories, etc. Hollow metal doors shall be full, flush seamless, 1 ¾" thick, 18 ga. steel, factory primed and field painted. Provide vision panels for doors at public rooms (meeting rooms, stairs, etc). Hollow metal frames shall be 16 ga. steel, primed and painted with welded, mitered corners. Provide galvanized doors and frames in wet areas subject to high humidity. Comply with latest edition of the HMMA.

### F. DOOR HARDWARE

- 1 Door hardware to be solid, stainless steel with brushed finish; all doors to include ball-bearing hinges with non-removable hinges on secured doors, lever handle with Best, 7 pin locksets with removable cores to TxDOT keying system, deadbolt, closer, hold-open device, door stop, silencers,

kick-plate as scheduled and compatible with TxDOT security card reader system.

#### G. WINDOWSILLS

- 1 Windowsills in occupied areas shall be approximately 34" – 36" above finish floor to allow building occupants to view approaching vehicles and visitors, and to avoid low modular panels blocking window opening. Coordinate height of low modular panels before establishing sill height. Use wood, plastic laminate or other durable materials for sills; do not use gypsum board on windowsills.

#### H. FLOOR FINISHES

- 1 Resilient Flooring- Specify either 12"x12" vinyl composition tile (VCT) or rubber tile with 4" rubber base for all occupied office spaces. Field form rubber base corners. Vinyl base is unacceptable. Finish with sealer or wax recommended by manufacturer.
- 2 Sealed Concrete- Apply clear sealer in unoccupied spaces.
- 3 Ceramic Tile- Specify 2x2, unglazed ceramic tile for Restrooms and Shower / Dressing Areas (See more detail in Sections L. & M below).
- 4 Carpeting- Specify glue-down, minimum of 50% recycled content, nylon carpet tile with low-VOC adhesives for District Headquarters only unless approved by FM Director.

#### I. DRYWALL (GYPSUM BOARD) PARTITIONS

- 1 Standard gypsum board shall be taped, floated, textured and painted and 5/8" minimum thickness.
- 2 High-impact and wet areas shall be impact resistant gypsum board with acrylic epoxy paint finish.
- 3 Paint finish for all drywall partitions shall be eggshell or low luster finish. Flat finish is prohibited since it shows marks easily and it is difficult to clean.
- 4 Extend drywall partitions full height to structure for security, privacy, or code as required. All other partitions to stop 6" above ceiling.
- 5 Vinyl covered gypsum board is prohibited for any location within the Capital Program building facilities.

#### J. WALL / PARTITION CONSTRUCTION

- 1 Perimeter Wall- Along perimeter walls of the pre-engineered, steel structural frame, of conditioned spaces, construct walls with 6" minimum metal studs at 16" o.c. with ½ exterior gypsum board on exterior face and 5/8" gypsum board on interior face, and R-19 batt insulation. Cover exterior sheathing with damp-proof, building wrap like "Tyvek" before installing metal siding or masonry veneer. Along perimeter walls of the pre-engineered, steel structural frame, with heating only or no climate control, provide standard vinyl-faced metal building insulation.
- 2 Perimeter metal sole plate to be set with continuous sealer between metal and concrete, either mastic or closed-cell foam strip.
- 3 CMU walls/partitions shall not be used in new TxDOT facilities, unless pre-approved for a specific reason (Truck Wash, existing CMU, Lab Wet Rooms, etc.).

#### K. PAINT

- 1 Water based, latex acrylic paints for typical painted finishes with a minimum of one coat of primer and two coats of latex paint.
- 2 Eggshell or a low luster finish for wall paint with zero VOC content and semi-gloss finish with low VOC content for painted metal finishes like doors and hollow metal door frames. Flat wall finish is unacceptable. Surfaces must be washable with soap and water.
- 3 Water based, epoxy latex acrylic paints with low VOC content for high impact and wet areas.
- 4 Clear, polyurethane finish with satin finish and low VOC for stain-grade wood finishes unless approved by PM for a different finish.
- 5 Special coating for painting Fuel System to meet TxDOT specification.

#### L. CEILINGS

- 1 Heights- The minimum ceiling height for all occupied spaces shall be:
  - a) 9'-0" for typical interior rooms
  - b) 10'-0" for large room like Open Office Area and Break/Meeting Room
  - c) 8'-0" height in small, gypsum board ceiling rooms like Store Rooms.
  - d) No ceiling for open to structure without ceilings in unoccupied spaces like Shops and large Storage Rooms

- 2 Suspended acoustical ceiling systems with 2x2, exposed two-way metal grid shall be used in typical office and occupied spaces. Specify fissured patterned, mineral or wood fiber with a minimum of 40% recycled content.
- 3 Special ceiling treatment is allowed only in selected areas like lobbies, special meeting rooms, etc. as approved by the FM Director.

#### M. RESTROOMS

- 1 Floors- Specify 2x2, unglazed ceramic tile on floor and coved base 4" high on all walls and epoxy grout for floors and bases only; sanded floor grout unacceptable.
- 2 Walls- Specify 2x2, matte glazed ceramic tile on "wet wall" containing plumbing. Install full height of wall with accent (different color) tile shall be less than 10% of entire tiled wall. Install ceramic tile on wing walls adjacent to urinals.
- 3 Specify all standard ceramic trim pieces; cut tile in lieu of trim pieces is unacceptable. Trim must match color of adjacent tile.
- 4 Specify impact resistant gypsum board with acrylic epoxy paint finish.
- 5 Toilet stalls shall be 3'-4" wide, center to center of partitions, except ADA stalls.
- 6 All toilet and urinal partitions shall be solid, 100% recycled, high-density polyethylene polymer (HDPE) plastic or phenolic with uniform color and stainless steel support brackets and anchors.
- 7 Provide a square, brass floor drain centered below toilet partition.
- 8 Specify stainless steel clothing hooks near lavatory.
- 9 Specify semi-recessed, stainless steel toilet accessories.
- 10 Good lighting at mirrors and lavatories.

#### N. SHOWER & DRESSING AREAS

- 1 Recess concrete slab 1 1/2" in Shower and Dressing Area for thick set ceramic tile if one room. If Shower is separate room, then recess only Shower slab. Specify 2x2, unglazed ceramic tile on floor and coved base 4" high on all walls and epoxy grout for floors and bases only; sanded floor grout is unacceptable.
- 2 Specify 2x2, matte glazed ceramic tile on full height of all walls with accent (different color) tile shall be less than 10% of entire tiled wall.

- 3 Provide a square, brass floor drain inside Shower and slope tile to drain.
- 4 Schedule moisture resistant gypsum board with acrylic epoxy paint finish.
- 5 Specify damp-proof, recessed lights in Shower and Dressing Area.
- 6 Provide shower curtains, towel and clothing hooks in Dressing Area.

O. LOCKERS & BENCHES

- 1 Lockers- Specify full height, 18"x18"x72" lockers; one for each employee; one ADA locker in each Dressing Room. Mount lockers on 4" raised concrete curb. Specify sheet steel, commercial quality, 16 ga., free-standing with sloped top, vented top and bottom, lockable with one shelf and clothing hooks, baked enamel paint finish.
- 2 Benches- Specify laminated, red oak with clear finish, 19" high pedestals of brushed chrome finish. ADA bench: 24"x 48" with four pedestals.

P. COFFEE BAR

- 1 All new Area Office facilities shall have a 5' coffee bar located in a corridor, or other convenient location in addition to the one in the Meeting Room.
- 2 Provide a plastic laminate counter finish with 4" high plastic laminate splash, base and overhead cabinets with stainless steel sink.
- 3 Schedule moisture resistant drywall with acrylic epoxy paint finish above counter.

Q. FIRE EXTINGUISHERS

- 1 Locate fire extinguishers no less than 75' apart per code in corridors.
- 2 Specify semi-recessed cabinets with fire extinguishers in occupied spaces.
- 3 Specify brackets and fire extinguishers in unoccupied spaces like Shops.
- 4 Specify new, 16 lb. dry chemical ABC fire extinguisher in each cabinet that is UL listed, DOT rated and complies with NFPA 10.

R. WINDOW BLINDS

- 1 Specify horizontal louver blinds with 1" aluminum slats with baked polyester finish, or finish to match clear, anodized aluminum window frames as selected by Architect for all windows.

## S. MODULAR FURNITURE

### 1 General Guidelines

- a) MNT does not fund or provide free standing furniture, i.e., chairs, filing cabinets, shelving, conference and meeting room furniture, etc. Existing furniture to be relocated to new facility.
- b) Individual Districts / Divisions / Offices (D/D/O) are responsible for funding any modular furniture that goes into their fixed-wall offices after the construction is completed. Modular furniture cost must not exceed \$25,000 or it is a capital funded asset that is approved, funded, and managed by MNT.
- c) MNT budgets modular furniture funding for the biennium in which the building is completed.
- d) If building completion occurs in a different biennium than when the building construction started, then a new charge number, or CIP Project Detail Number must be requested by the MNT/FM Project Manager. However, the CIP Project Number remains the same.

### 2 New Facilities

- a) MNT funds modular furniture for open office and reception areas only.

### 3 Additions and Renovations

- a) MNT funds modular furniture for open office areas depending on the amount of modular furniture each D/D/O has and the phasing of project.

### 4 Role of D/D/O and MNT/FM Project Managers (PM)

- a) The D/D/O coordinates with the PM before the modular furniture vendor provides a layout and places order. If any furniture is ordered directly by D/D/O without PM approval, the furniture will not be funded by MNT.
- b) The PM oversees design and agrees to a general layout for the essential components of the modular furniture with the D/D/O input.
- c) The PM sends detailed layouts, component list and cost estimate to FM Equipment Relocation Coordinators (Gary Murrell and Keith Ballard) for their review and approval before ordering furniture. New furniture must be coordinated with the PM before construction starts to assure delivery is made at end of project to be connected by the General Contractor before TxDOT moves into the new facility.

END OF SECTION

## **PART – 2**

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**STRUCTURAL STANDARDS  
MECHANICAL STANDARDS  
ELECTRICAL STANDARDS  
PLUMBING STANDARDS  
CIVIL STANDARDS**

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Structural Design Standards**

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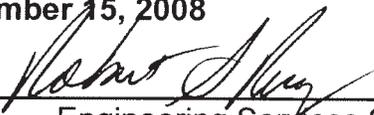
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**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title: Structural Design** **Number: S1.01**

**Issue Date: December 15, 2008** **Rev #: 0**

**Approved:**  \_\_\_\_\_  
Engineering Services Supervisor

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**A. SPECIAL CONSIDERATIONS**

1. The structural design and construction documents shall be developed in accordance with architectural drawings.
2. Value engineering methods shall be applied to develop an economical structure to meet the state requirements.
3. In design development the consideration shall be given for expansion and contraction of structural elements resulting from temperature affects.
4. Consideration shall be given for rigid frame and purlins vertical deflection when metal studs and ceiling hangers are directly attached to these elements.
5. Minimum of following notes shall be included in the construction drawings.
  - a) General notes: instruction to contractor, coordination and safety requirements.
  - b) Site preparation c) Foundations d) Reinforced Concrete E) Structural Steel f) Light Gage Steel framing g) Wood/Timber h) Masonry i) Pre-Engineered Metal Building.
  - j) Testing requirements. Any of these items that are not used can be eliminated.
6. Structural engineer shall coordinate with MEP engineer for equipment lay out, loading and large penetrations to incorporate into structural drawings. All large openings in structural steel shall be framed including doors and windows.
7. Coordinate foundation design with Geotechnical report. Every attempt should be made to develop slab on grade with beams for foundation design, if economically feasible.
8. Provide schedule of abbreviations used in the drawings.
9. Show key plan, graphic scale and north arrow on each plan drawing.

## B. STRUCTURAL CALCULATIONS

1. Develop comprehensive calculations for each structural element such as foundations, floors, walls, columns, frames and roof framing. The calculation shall be self explanatory and stand alone with complete references. If a computer program is used identify it with version and revision number. The calculation should clearly show the inputs used and how lateral and gravity loads are addressed. Diaphragms, shear walls or bracings etc shall be clearly reflected in the calculation. Calculation should also show the connection design and details.

## C. CODES AND STANDARDS

1. All designs shall be based on standards and recommendations made in the current edition of:

- |    |                                       |   |
|----|---------------------------------------|---|
| a. | IBC-2003:                             | International Building Code                             |
| b. | AISC 9 <sup>th</sup> edition for ASD: | Manual of Steel Construction                            |
| c. | ACI 318-05<br>Concrete                | Building Code Requirements For Structural Concrete      |
| d. | NDS-2001<br>Construction              | National Design Specifications For Wood Construction    |
| e. | MDG-3                                 | Masonry Designers' Guide                                |
| f. | ASTM Standards                        | American Society for Testing and Materials              |
| g. | AISI Manual                           | American Iron and Steel Institute                       |
| h. | ASCE 7-05<br>Other Structures         | Minimum Design Loads For Buildings and Other Structures |

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Mechanical Design Standards**

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State of Texas, or by the local jurisdiction, whichever is appropriate to their area of expertise.

- a. All HVAC work shall be performed by an air conditioning contractor holding a current Class A or B air conditioning license as issued by the Texas Department of Licensing and Regulation.
  - b. The contractor shall provide evidence of required licensing including expiration dates when so requested by the State's Representative.
2. All workers shall be required to be thoroughly experienced in the particular class of work for which they are employed.
  3. All work performed by the Contractor shall be professional in design, equipment selection and installation.

### C. SUBSTITUTIONS

1. Substitutions, unless a sole source manufacturer is justified and approved by TxDOT in writing, shall be allowed for materials or equipment for which the performance, capacity and quality are equal to that scheduled or specified. Use the terms, "or approved equal," and include on the drawings and in the specifications the following paragraphs:
  - a. "It is the intent of the Drawings and/or Specifications neither to limit products to any particular manufacturer nor to discriminate against an APPROVED EQUAL product as produced by another manufacturer. Some proprietary products may be mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. On the other hand, when a manufacturer's name appears in these Specifications or in the Drawings, it shall not be interpreted that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).
  - b. "The specified products have been used in preparing the Drawings and Specifications and thus establish minimum qualities with which substitutes must be at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the Engineer is final.
  - c. "In the event that the Contractor submits a proposal for a substitution, and the review and negotiation of the substitution (if handled in a timely, expedited manner) results in a delay of the contract work, then a reasonable extension of time for the contract may be allowed."
2. Substitutions or deviations shall only be made by specific request by the Contractor. The Uniform General Conditions also require that the Contractor make written requests for "specific deviations" from the Construction Documents.

3. It should also be noted that deviations from the Contract Documents will not be allowed in the submittal process. If deviations are included in submittals, but not specifically noted, then the deviation will not be allowed, even if the submittal is noted "without exceptions."

#### D. ROOF PENETRATIONS

1. Equipment curbs, if used, shall be supplied by the Mechanical Contractor, and installed by the Roofing Contractor. The number and size of roof penetrations shall be minimized.

#### E. TRENCHING

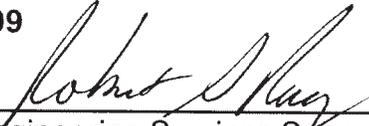
1. All underground piping systems shall be buried a minimum of 24 inches deep and bedded in a minimum of 2 inches of clean sand, above, below, and on all sides.
2. If trenching across existing pavement, contact project manager about whether to allow open trenching or require boring under pavement.
3. In all cases, when installing piping under paved traffic areas, sleeves shall be provided to allow for future replacement of the piping system. Sleeve sizes shall be a minimum of two nominal pipe sizes larger than the pipe, or 6 inches, whichever is greater. Sleeves shall be Schedule 80 PVC, C-900 PVC, or piping of comparable strength to withstand anticipated traffic and shall extend approximately 4 feet beyond the pavement on both sides.
4. Specifications shall contain a requirement for a contractor-provided Trenching Plan, sealed by a Civil Engineer, for trenches deeper than five feet.

#### F. PROHIBITION OF ASBESTOS

1. Include in the project specifications a section detailing the prohibition of materials and equipment containing any form of asbestos. Also require a certification from the Contractor. A sample specification section (with blank affidavit form attached) is available upon request.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** HVAC Systems **Number:** M2.01  
**Issue Date:** March 2009 **Rev #:** 1  
**Approved:**   
Engineering Services Supervisor

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**A. SPECIAL CONSIDERATIONS**

1. Most TxDOT offices are also in areas where the availability of contractors is limited. It has proven to be successful to restrict HVAC system design considerations to unitary and/or self contained equipment.
2. Every attempt should be made to limit the size of heating and cooling equipment to a nominal 5 tons. It will also be necessary, due to the likely unavailability of natural gas, to use heat pumps.
3. It is preferred that heat pump equipment provide back up electric heat in all locations.

**B. HVAC SYSTEM DESIGN CRITERIA**

1. All system designs and equipment selections shall comply with the current Texas State Energy Standard. Currently, this standard is the ASHRAE/ANSI Standard 90.1-2004.
2. HVAC cooling and heating system designs shall be based on the criteria recommended in the current edition of the ASHRAE Handbook of Fundamentals for the location (or a representative location) of the project site, and all calculations shall follow the recommended procedures given. Climatic data used shall be for 99.6% Heating Dry Bulb and 0.4% Cooling Dry Bulb/Mean Wet Bulb.
3. Acceptable ranges of temperature and humidity control shall be compatible with the zones shown in Figure 5, page 8.12 of the 2005 ASHRAE Handbook of Fundamentals, "ASHRAE Summer and Winter Comfort Zones."
4. Ventilation design shall conform to the current edition (with all current addenda) of ASHRAE Standard 62.1, "Ventilation for Acceptable Indoor Air

Quality.”

#### C. EQUIPMENT MANUFACTURERS

1. For small commercial equipment (5 tons or less) such as split DX or heat pump with gas or electric-backup heat, the following manufacturers are considered acceptable: Lennox, Carrier, and Trane.
2. For large commercial equipment the following have been found to be acceptable:
  - a. Air handlers: Lennox, Trane, Temtrol, Thermal, and Marcraft.
  - b. Chillers: Trane, Carrier, and York.

#### D. EQUIPMENT AND SYSTEMS

1. Note comments on “Special Considerations” above.
2. System designs for offices shall be based primarily on horizontal, split systems. Locate equipment above ceilings in close proximity to the zone served for a minimum length of ductwork. Unit shall be installed high enough for sufficient headroom for ease of maintenance, but low enough to ensure ease of access. (Note that a detail is provided for specific requirements.)
3. All horizontal cooling units shall be installed with overflow pans with a float micro switch to disable the unit in the event the pan fills with water. The pan shall also be installed with a capped drain.
4. In general, air conditioning units and systems should be limited to a maximum of nominal 5 ton cooling capacity, keeping the supply air flow below 2000 cfm. (This will avoid the code requirement to install duct mounted smoke detectors and related fire alarm controls.) **Note that the “twinning” of units is not acceptable.**

5. Air conditioning equipment shall be sized and selected to accommodate published sensible/total cooling ratios required by the zone loads. Specifications shall require that systems be matched, performance-rated equipment.
6. All unitary systems and equipment shall be required to be certified in accordance with ARI Standard 210/240, rated in accordance with ARI Standard 270, and listed by Underwriters Laboratories (UL). Equipment shall bear the seal of ARI for unitary equipment, as well as the UL seal.
7. When applying unitary packaged or split system equipment, special care shall be taken not to exceed the allowable external static pressure (ESP) for the equipment, as published by the equipment manufacturer.
8. Provide a dedicated, “ductless” split system for Data/Com (“Hub”) Rooms, to provide cooling only. The units shall be selected to accommodate the high sensible cooling loads.
9. All condensate lines shall be rigid, hard drawn, Type “K” copper, fully insulated with closed-cell foam type insulation (Armaflex or approved equal).
10. In shop and equipment buildings, only ventilation shall be provided, except that tube type radiant heat shall be provided for vehicle shop areas, only. The only exceptions shall be office areas and special purpose areas, individually designated for specific environmental control. Office areas shall be considered the same as in office buildings.

E. WARRANTY:

1. The specifications shall require that the Contractor shall guarantee all installed equipment, material, and work against any defects in material or workmanship and shall satisfactorily correct, at no cost to the State, any such defect that may become apparent within a period of one year after completion of the installation. The warranty period shall commence on the date of acceptance of the contract by the State. A manufacturer’s 5 year compressor warranty shall be required for all sizes of unitary and self-contained direct expansion equipment. Insurance policies shall not acceptable.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** HVAC Ductwork **Number:** M2.02  
**Issue Date:** March 2009 **Rev #:** 3  
**Approved:**   
Engineering Services Supervisor

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**A. DUCTWORK**

1. Ductwork systems designed for supply, return, and exhaust systems shall minimize static loss and shall accommodate the available static from the air handler, furnace or fan. The total static loss shall be calculated or simulated by computer program. The results of the calculation or simulation shall be available for review on request.
2. Air Conditioning supply ductwork shall be minimum 26 gauge galvanized sheetmetal construction, constructed and installed to a SMACNA 2" rating.
3. Furnish splitter dampers and turning vanes at all tee connections.
4. Furnish single thickness turning vanes at all 90° elbows.
5. Furnish manufactured taps with raised regulator volume dampers.
6. Design systems with runouts of externally insulated round metal duct and connect diffusers using flexible metal duct (maximum 4'-0" in length).
7. The lengths of duct runs shall be minimized in consideration of the ability of the unitary equipment to develop limited static pressure. Ductwork shall be sized to reduce static loss and generated noise in the system(s).
8. Duct sealant shall be water based latex type. Solvent based duct sealants shall be prohibited.
9. Fabricate and support ductwork in accordance with SMACNA duct construction standards.

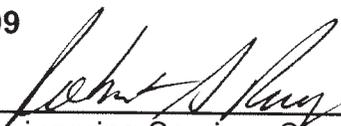
10. Flexible duct (flex duct), if used, shall be plenum rated, Flexmaster TL-V “or approved equal,” constructed of round, flexible expanded aluminum, insulated with fiberglass blanket, and protected with a reinforced metalized outer jacket. Maximum thermal conductance of the insulation shall be 0.23. The flexible aluminum duct shall be secured and sealed to the adjoining sheet metal duct using sheetmetal screws and duct sealant. All materials shall be installed as recommended by the manufacturer. Flame spread/smoke developed ratings shall be equal to or less than 25/50 respectively. Lengths of flex duct runs shall be limited to 48 inches in each application.
11. Ceiling supply air diffusers shall be louvered, pattern type. **Neither perforated nor linear diffusers nor returns shall be used on TxDOT projects without specific approval.** All diffusers shall be all aluminum construction with a baked coating to match the surrounding construction, or as specified by the Architect. Extruded aluminum is preferred. Each device may include an OBD, but it SHALL NOT be used for balancing, except under special, pre-approved circumstances. All supply diffusers and outside air grilles shall be insulated externally.
12. Ceiling return air grilles may be either pattern type, or egg-crate. (“Egg-crate” is preferred.) All grilles shall be all aluminum construction with a baked coating to match the surrounding construction, or as specified by the Architect. Extruded aluminum is preferred. It shall be required that the interior of the duct shall be painted flat black insofar as it is visible from the occupied space. **Neither perforated nor linear return air grilles shall be used on TxDOT projects without specific approval.**
13. Sidewall supply and return grilles shall be vertical bar type and shall include integral opposed blade dampers. All grilles shall be all aluminum construction with a baked coating to match the surrounding construction, or as specified by the Architect. Extruded aluminum is preferred.
14. All air devices shall be commercial quality, NOT residential.
15. The drawings shall indicate a volume damper for each diffuser drop, at the point of tap from the main (“trunk”) supply duct. All volume dampers shall consist of raised-regulator type, insulated under the regulator.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** HVAC Insulation **Number:** M2.03

**Issue Date:** March 2009 **Rev #:** 2

**Approved:**   
Engineering Services Supervisor

**A. INSULATION**

1. All insulation shall be applied by mechanics skilled in the installation of insulation and regularly engaged in such occupation.
2. All adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA and UL requirements for fire resistant ratings (maximum of 25 flame spread, 10 fuel contribution, and 50 smoke developed ratings, when tested to NFPA 255 standards), shall carry a UL label on each container and/or package, and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system. Certificates to this effect shall be submitted along with the Company's submittal prior to installation. All surfaces to be insulated shall be clean and dry before applying insulation.
3. All supply, return, and outside air ducts shall be externally insulated with Owens-Corning, Knauf, Johns Manville, or approved equal, minimum 1.0 pcf (pounds per cubic foot), 1-1/2" thick all service blanket type, commercial grade, flexible glass fiber insulation with Kraft vapor barrier facing. Installed R value of insulation shall be minimum 4.5. Internally insulated ductwork shall be avoided. Specifications shall stipulate that all seams shall be sealed.
4. All specified insulation shall be applied by mechanics skilled in this particular work and regularly engaged in such occupation.
5. All surfaces to be insulated shall be clean and dry before applying the insulation.
6. All heating hot water and chilled water piping shall be insulated with 1-1/2" thick polyurethane closed cell pipe insulation complete with all service jacket (ASJ) vapor barrier. Fittings shall be insulated with the same thickness as the pipe insulation and covered with PVC molded insulation covers with complete

vapor seal. ASJ vapor barrier laps shall be stapled and sealed with approved vapor barrier mastic and/or adhesives.

7. The contractor shall provide an isolating vapor seal between the pipe insulation jacket and the pipe at all butt joints, fittings, flanges, valves and hangers.
8. Valves and flanges shall be insulated with mitered polyurethane covers and vapor sealed.
9. Minimum sixteen (16) gauge galvanized metal insulation saddles, 18 inches long, shall be used at all hangers and points of support.
10. Refrigerant liquid and suction lines shall be insulated with a minimum of 1/2" closed cell Armaflex insulation or approved equal.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title: HVAC Ventilation** **Number: M2.04**

**Issue Date: March 2009** **Rev #: 2**

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

**A. OFFICE BUILDING VENTILATION**

1. Do not return air from restrooms where the unit serves other areas in the building. The minimum exhaust from restrooms shall be as recommended in the current version of ASHRAE Standard 62.1. The area immediately in front of shower stall(s), and immediately above the farthest water closet shall be exhausted.
2. Conditioned air shall be supplied to restrooms and shower rooms in the area of the lavatories, close to the entrances to the rooms.
3. Power to exhaust fan(s) shall be switched with the lighting in the restroom or shower room. Exhaust fans shall be roof mounted and shall be as manufactured by Greenheck, Cook, or ACME.

**B. SHOP BUILDING VENTILATION**

1. Ventilation from rooms and areas in Shop Buildings shall be as recommended in the current version of ASHRAE 62.1. Ventilation fans shall be located on the roof of the building.
2. In Shop and Equipment Buildings where required, exhaust for LPG alarm or emergencies shall be installed in the rear wall, at 18 to 24 inches above finished floor to the bottom of the exhaust opening. This type of ventilation shall be exclusive and redundant to the required building ventilation system(s) and shall be controlled by the LPG detection system(s).
3. Openings in walls and roofs for exhaust/ventilation fans shall be of a minimum size required for the air being exhausted.
4. All exhaust fans shall be installed with gravity or motorized backdraft dampers. Motorized dampers shall only be employed where absolutely

necessary. Dampers shall be installed in fabricated collars extended from the roof or wall penetration and covered with birdscreen (1/4" by 1/4") mesh.

5. Outside air louvers shall be installed to accommodate the exhaust/ventilation fans. Louvers shall be sized to provide for the total flow of all fans operating simultaneously. All louvers shall be designed to incorporate gravity backdraft dampers. Motorized dampers shall be used only when required for the proper operation of the system(s).

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** HVAC Testing, Adjusting and Balancing **Number:** M2.05

**Issue Date:** March 2009 **Rev #:** 2

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

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**A. TESTING, ADJUSTING AND BALANCING**

1. An independent TAB firm, employed by the Contractor, shall perform Testing, Adjusting and Balancing (TAB) of all HVAC systems over 500 cfm total airflow. The TAB firm shall be certified by NEBB, AABC, or both. Full compliance with NEBB or AABC Standards shall be required.
2. The Contractor shall make all necessary adjustments to assure proper balance of air within the limits recommended in AABC National Standards. Refer to Chapter 16, Figure 16.1, and Chapter 20. A final TAB report shall be submitted using NEBB or AABC recommended forms. Final payment shall not be approved prior to receipt and approval of this drawing and report by the engineer of record and the state's engineer.
3. The measurement and verification of building conditions by the final test and air balance report shall be based on the engineer's design, as documented in the construction plans and specifications.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** HVAC Plumbing **Number:** M2.06

**Issue Date:** March 2009 **Rev #:** 1

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

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A. HVAC Plumbing:

1. Refrigerant line sizes shall be selected to optimize performance of the equipment and to maintain the published seasonal efficiency ratings (SEER or EER) of the manufacturer. The sizing of the line sets shall incorporate the length of the line set as well as the capacity of the system. All refrigerant piping shall be sized and installed as recommended by the manufacturer of the equipment.
2. Condensate lines shall be rigid, hard drawn, Type K copper, insulated with 1/2" Armaflex (or approved equal) closed cell insulation, including the trap and vent, installed in accordance with the manufacturer's published recommendations.
3. Condensate drains shall terminate at the nearest floor drain, mop sink or service sink. (Never hard-connect to sanitary drain. Always provide an air gap.)
4. Secondary or "overflow" drains shall be piped to an obvious location, over a sink, shower, or drain, but shall not drain to a location where damage to the building or furnishings is possible.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title: HVAC Controls** **Number: M2.07**

**Issue Date: March 2009** **Rev #: 1**

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

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A. HVAC Controls:

1. Where a campus wide EMCS (Energy Management and Control System) exists, all controls shall be direct digital, specified to interface with the existing system, or to a new central EMCS (if a new campus).
2. For stand-alone office and shop (non-public) buildings, install commercial programmable thermostats, without guard.
3. All HVAC controls in public buildings (e.g. Safety Rest Areas) shall be programmable thermostats with vandal resistant covers on accessible thermostats in public areas. An option available to the designer is to provide remote sensors mounted in return air ducts, with the temperature control located remotely in mechanical room(s).
4. Thermostats (or zone temperature sensors) shall be located within the zone being air conditioned in the interior of the building, away from outside walls. The preferred location is close to the return air grille serving the zone.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Electrical Design Standards**

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**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Guide**

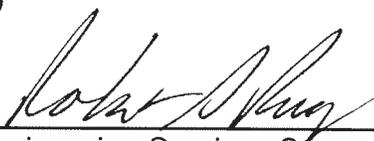
**Title: General Electrical**

**Number: E1.01**

**Issue Date: March 2009**

**Rev #: 0**

**Approved:**

  
Engineering Services Supervisor

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- A. All designs and construction shall follow the most current editions of:
1. Texas Board of Professional Engineers (TBPE)
    - a. Projects must comply with statutes that regulate professional design services for engineers. Refer to the appropriate regulatory agency to verify current requirements when professional design services are required. Reference Texas Occupation Code 1001.053.
  2. State of Texas Energy Standard for Buildings (ANSI/ASHRAE/IESNA 90.1)
  3. National Electric Code.
  4. NFPA Standards
  5. IES Standards
- B. Quality Assurance
1. All electrical work shall be performed by an electrician holding at least a current Journeyman Electrician License under the general supervision of an electrician holding a Masters Electrician License.
    - a. The contractor shall provide evidence of required licensing including expiration dates when so requested by the State's Representative
    - b. All workers shall be required to be thoroughly experienced in the particular class of work for which they are employed.
  2. All work performed by the Contractor shall be professional in design, equipment selection and installation.

3. Electrical equipment shall be Underwriters Laboratory (UL) listed and comply with UL standards in all cases where UL has published lists and standards applicable to type of equipment to be provided.

#### C. SUBSTITUTIONS

1. Substitutions, unless a sole source manufacturer is justified and approved by TxDOT in writing, shall be allowed for materials or equipment for which the performance, capacity and quality are equal to that scheduled or specified. Use the terms, "or approved equal," and include on the drawings and in the specifications the following paragraphs:
  - a. "It is the intent of the Drawings and/or Specifications neither to limit products to any particular manufacturer nor to discriminate against an APPROVED EQUAL product as produced by another manufacturer. Some proprietary products may be mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. On the other hand, when a manufacturer's name appears in these Specifications or in the Drawings, it shall not be interpreted that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).
  - b. "The specified products have been used in preparing the Drawings and Specifications and thus establish minimum qualities with which substitutes must be at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the Engineer is final.
  - c. "In the event that the Contractor submits a proposal for a substitution, and the review and negotiation of the substitution (if handled in a timely, expedited manner) results in a delay of the contract work, then a reasonable extension of time for the contract may be allowed."
2. Substitutions or deviations shall only be made by specific request by the Contractor. The Uniform General Conditions also require that the Contractor make written requests for "specific deviations" from the Construction Documents.
3. It should also be noted that deviations from the Contract Documents will not be allowed in the submittal process. If deviations are included in submittals, but not specifically noted, then the deviation will not be allowed, even if the submittal is noted "without exceptions."

#### D. PROHIBITION OF ASBESTOS

1. Include in the project specifications a section detailing the prohibition of materials and equipment containing any form of asbestos. Also require a certification from the Contractor. A sample specification section (with blank affidavit form attached) is available upon request.

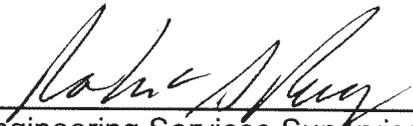
**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** Electrical Distribution System **Number:** E1.02

**Issue Date:** March 2009 **Rev #:** 1

**Approved:** \_\_\_\_\_

  
Engineering Services Supervisor

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**A. RACEWAYS**

1. Minimum conduit size shall be 3/4".
2. Minimum Underground Raceway Size: 1" unless otherwise specified.
3. Conduit type shall be per the following:
  - a. All interior wiring shall be run in steel conduit, concealed in finished areas. Conduit 2" and smaller shall be EMT with compression fittings. Set screw type connectors are not allowed. Conduit larger than 2" shall be rigid, hot-dip galvanized steel (RGS) with screwed connectors and fittings.
  - b. All conduit installed on building exterior, in wet locations, in crawl spaces, and on roofs shall be RGS with screwed connectors and fittings.
  - c. Underground conduit shall be Schedule 40 PVC or RGS double wrapped with 3M #35 electrical tape. Transition from PVC shall be made underground and all elbows to risers shall be RGS.
- 3 All flexible metal conduit to motors and in wet locations shall be liquid tight.
- 4 A separate ground conductor shall be run in each raceway.

**B. ELECTRICAL CONDUCTORS**

1. All wiring shall be in a raceway and shall be THHN or THWN copper conductors.
2. Minimum conductor size shall be #12.
3. Conductors #10 and smaller shall be solid. #8 and larger shall be stranded.

4. Conductors shall be color coded as follows:
  - a. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
    - 1) Black, red, and blue for circuits at 120/208 volts single or three phase, wye systems.
    - 2) Purple, brown, and yellow for circuits at 277/480 volts single or three phase, wye systems.
    - 3) Black for "A" leg and red for "B" leg for circuits at 120/240 volts single phase.
    - 4) Black and red for the non-hi-leg phases and orange for the hi-leg phase for circuits at 120/240 volts three phase, open-delta.
    - 5) Three-way and four-way switch travelers shall be purple or lavender. Switch leg conductors shall be color coded different from the traveler conductors and the phase conductors of the system. The color used for switch leg conductors shall be the same throughout the project. The color used for traveler conductors shall be the same throughout the project.
  - b. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
    - 1) Black, red, and blue for circuits at 120/208 volts single or three phase, wye system.
    - 2) Purple, brown, and yellow for circuits at 277/480 volts single or three phase, wye system.
    - 3) Black for "A" leg and red for "B" leg for circuits at 120/240 volts single phase.
    - 4) Black and red for the non-hi-leg phases and orange for the hi-leg phase for circuits at 120/240 volts three phase, open-delta.
  - c. Neutral Conductors: White or gray per NEC. When two neutral conductors are routed in one conduit, install one white conductor and one gray conductor and identify each with the proper circuit number. When two or more neutrals are located in one conduit, individually identify each with proper circuit number, or use gray wire for one or more of the neutrals.
  - d. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded per Part A above.
  - e. Feeder Circuit Conductors: Uniquely color code each phase per above.
  - f. Ground Conductors:
    - 1) For 6 AWG and smaller: Green.
    - 2) For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.
  - g. Acceptable manufacturers are: Diamond Wire & Cable Co., Essex Group Inc., and General Cable Co.

### C. PANEL BOARDS

1. All panel boards shall utilize copper bus and shall include a ground bus. An isolated ground bus shall be installed where required.
2. All breakers shall be bolt-on type.
3. Interrupting current shall be as required for the installation. However, any service entrance panel shall not be rated less than 22,000 AIC. Full ratings shall be used instead of series rated.
4. Interior panel boards shall be NEMA 1 and exterior panel boards shall be NEMA 3R.
5. Acceptable manufacturers are: Square D, General Electric, and Cutler Hammer.

### D. DISCONNECT SWITCHES

1. Disconnect switches shall be heavy-duty type and provided as required by NEC.
2. Interior disconnect switches shall be NEMA 1 and exterior shall be NEMA 3R.
3. Acceptable manufacturers are: Square D, General Electric, and Cutler Hammer.





metal halide lamp. Color shall be coordinated with Architect.

5. Parking area and drive lights shall be Lithonia Type KSF or equal with metal halide lamp mounted on Lithonia Type RTS pole. Color shall be coordinated with Architect. In coastal and other corrosive environments, round tapered fiberglass poles shall be used.
6. Lighting for TxDOT sign shall be ground mounted Lithonia Type TFL or equal with metal halide lamp. Color shall be dark bronze.
7. The electronic ballasts shall have rapid start lamp ignition and incorporate electronic circuitry to cut off lamp cathode heat after lamps are ignited. The ballasts shall operate the lamps at 60 Hz and provide full rated 20,000-hour lamp life. The ballasts shall not contain secondary filament transformer. Line current total harmonic distortion shall not exceed ten percent. The lamp current crest factor shall not exceed 1.4. The minimum and maximum ballast factors shall be 0.85 and 0.925 respectively. For all ballasts, recommended manufacturers are Lithonia, Magnetek, Motorola, Advance, or approved equal.
8. Fluorescent lamps shall be F32T8 lamps. The lamps shall have a full rated 20,000-hour operating life. The operating temperature shall be 3500K with a color rendering index not less than 85. The lamps shall have an initial output of not less than 2,850 lumens.
9. Acceptable fixture manufacturers are: Lithonia, Columbia, General Electric, Hubbell, or approved equals.

Any exceptions to this guide require approval by the Engineering Services Supervisor. All requests for exceptions and approvals must be in writing.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** Gas Monitoring System **Number:** E1.05

**Issue Date:** March 2009 **Rev #:** 1

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

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The following gas monitoring guidelines apply:

- A. A Gas Monitoring System (GMS) shall be provided in the vehicle maintenance shop only. Storage areas do not have a GMS.
- B. The GMS shall operate as stand alone system(s). The monitors shall be engineered to continuously monitor for the presence of propane gas. When gas concentration surpasses the preset limit in any sensor module in a zone, audible alarm indication and relays shall be activated for that particular zone. Sensor reaction shall be instantaneous; however alarms shall be capable of being delayed dependent on user preference, and dedicated flashing warning lights for visual indication and low mounted side wall exhaust fans for propane gas evacuation shall be immediately activated.
- C. GMS shall be installed in accordance with manufacturer's instructions, NFPA 58, local codes, the National Electric Code (NEC) and the engineering Drawing.
- D. Monitor – Bottom of monitor panel shall be mounted on wall 48" above floor.
- E. Sensors – Shall be mounted on wall 18" above floor. All wiring shall be run in conduit with no exposed wiring.
- F. Strobe Warning Light – Shall be mounted on wall 10 feet above floor. All wiring shall be run in conduit with no exposed wiring.
- G. Alarm Annunciators – Shall be mounted on wall 10 feet above floor (or just below ceiling in office areas). All wiring shall be run in conduit with no exposed

wiring.

- H. Side wall exhaust fans shall be wired into the GMS and set to activate set upon detection of LP gas. .
- I. Acceptable manufacturers: Armstrong Monitoring Corporation, BW Technologies, Enmet Corporation, Thermo Gas Tech, Rel-Tek Corporation , or approved equal.

Any exceptions to this guide require approval by the Engineering Services Supervisor. All requests for exceptions and approvals must be in writing.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Plumbing Design Standards**

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- a. All plumbing work shall be performed by a firm holding a valid Master Plumber License issued by the Texas State Board of Plumbing Examiners (TSBPE). Employees performing the work shall have a valid Journeyman Plumber license issued by TSBPE.
- b. The contractor shall provide evidence of required licensing including expiration dates when so requested by the State's Representative.
2. All workers shall be required to be thoroughly experienced in the particular class of work for which they are employed.
3. All work performed by the Contractor shall be professional in design, equipment selection and installation.

### C. SUBSTITUTIONS

1. Substitutions, unless a sole source manufacturer is justified and approved by TxDOT in writing, shall be allowed for materials or equipment for which the performance, capacity and quality are equal to that scheduled or specified. Use the terms, "or approved equal," and include on the drawings and in the specifications the following paragraphs:
  - a. "It is the intent of the Drawings and/or Specifications neither to limit products to any particular manufacturer nor to discriminate against an APPROVED EQUAL product as produced by another manufacturer. Some proprietary products may be mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. On the other hand, when a manufacturer's name appears in these Specifications or in the Drawings, it shall not be interpreted that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).
  - b. "The specified products have been used in preparing the Drawings and Specifications and thus establish minimum qualities with which substitutes must be at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the Engineer is final.
  - c. "In the event that the Contractor submits a proposal for a substitution, and the review and negotiation of the substitution (if handled in a timely, expedited manner) results in a delay of the contract work, then a reasonable extension of time for the contract may be allowed."
2. Substitutions or deviations shall only be made by specific request by the Contractor. The Uniform General Conditions also require that the Contractor make written requests for "specific deviations" from the Construction Documents.
3. It should also be noted that deviations from the Contract Documents will not

be allowed in the submittal process. If deviations are included in submittals, but not specifically noted, then the deviation will not be allowed, even if the submittal is noted "without exceptions."

#### D. ROOF PENETRATIONS

1. The Roofing Contractor shall also provide, install, flash and seal all penetrations for sanitary vents indicated in the plumbing plans.
2. The number and size of roof penetrations shall be minimized.

#### E. TRENCHING

1. All underground piping systems shall be buried a minimum of 24 inches deep and bedded in a minimum of 2 inches of clean sand, above, below, and on all sides.
2. If trenching across existing pavement, contact project manager about whether to allow open trenching or require boring under pavement.
3. In all cases, when installing piping under paved traffic areas, sleeves shall be provided to allow for future replacement of the piping system. Sleeve sizes shall be a minimum of two nominal pipe sizes larger than the pipe, or 6 inches, whichever is greater. Sleeves shall be Schedule 80 PVC, C-900 PVC, or piping of comparable strength to withstand anticipated traffic and shall extend approximately 4 feet beyond the pavement on both sides.
4. Specifications shall contain a requirement for a contractor-provided Trenching Plan, sealed by a Civil Engineer, for trenches deeper than five feet.

#### F. PROHIBITION OF ASBESTOS

1. Include in the project specifications a section detailing the prohibition of materials and equipment containing any form of asbestos. Also require a certification from the Contractor. A sample specification section (with blank affidavit form attached) is available upon request.



shall be concealed, automatic, electronically actuated Sloan Royal, Zurn AquaVantage, or approved equal. Override buttons shall be installed on all water closets and urinals. (Note that Sloan sensor operated flush valves for water closets usually include an override button, but urinal flush valves do not. In order to designate the override button option, add "OR" to the model number, e.g. #195-1.0 ES-S-**OR**, and specify that it shall include an override button. This does not appear in the Sloan catalogue or on the website; however this has been verified directly with the Sloan factory.)

7. Pitch all water piping to a drainable location; all piping shall be drainable.
8. Insulate all hot and cold water piping with a minimum of one inch thick, jacketed fiberglass insulation, and provide PVC covered fitting insulation at all fittings and valves. Insulate all exposed piping under all lavatories in the Restrooms with insulation designed for that purpose, such as by Truebro.
9. Water closets and urinals shall be vitreous china. All water closets and urinals in all types of buildings shall be wall hung. All fixture heights shall conform to ADA requirements. All installations shall be required to include water closet chairs and carriers.
10. All lavatories shall be vitreous china. If counter mounted lavatories are used, they shall be self-rimming type. (Under counter-mounted lavatories are not acceptable.) The installation of wall hung lavatories shall be required to include extended arm carriers.
11. Provide a mop sink and floor drain in Janitor Closets for maintenance use. The faucet scheduled for installation with mop and service sinks shall be based on Chicago Faucet products. Specify a wall-braced faucet with bucket hook. Provide a backsplash and wall mounted mop hooks with all mop sinks.
12. Provide floor drains in Restrooms, located under the open area of partitions and under lavatory areas to avoid tripping hazards.
13. All floor drains (except floor drains in shower stalls) shall have trap primers.
14. "Instantaneous" electric water heaters are prohibited for use on TxDOT projects.
15. Emergency eyewashes and showers shall be provided in all labs and vehicle shops. Provide a locking ball valve for isolation for service, locked in the open position. The installation shall conform to NFPA 101.

#### C. Non-potable Water Systems

1. Water supplies to non-potable water systems (such as water truck fill stations and wash bay use) shall be provided with full sized double check valve backflow preventer assemblies, manufactured and listed, with test ports, as

defined in the Uniform Plumbing Code. The double check valve assemblies shall be installed in a ground vault designed and sized for that purpose if it is not convenient to install it in a weather protected location.

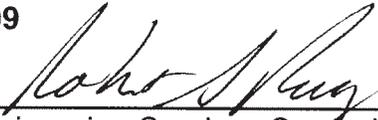
2. Water supplies to irrigation systems shall be provided with full sized reduced pressure zone backflow preventer assemblies, manufactured and listed, with test ports, as defined in the Uniform Plumbing Code. The backflow preventer shall be installed in a location close to the water meter and it shall be protected from traffic and freezing. Note that if the same system serves other non-potable uses such as a truck fill station or washbay, then no other backflow prevention device will be required on the system.
3. Water piping sizes for water truck filling stations shall provide a minimum of 1000 gallons in a maximum of 20 minutes, for a minimum of 50 gallons per minute. The minimum water supply piping size shall be two inches.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title: Sanitary Plumbing Systems Number: P2.02**

**Issue Date: March 2009 Rev #: 1**

**Approved:**   
Engineering Services Supervisor

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**A. Sanitary Plumbing**

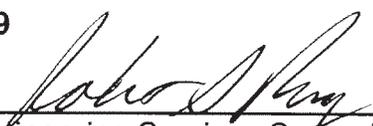
1. Sanitary piping from a point 5 feet outside the building footprint to the building and under slab shall be gasketed cast iron with "Ty-seal" type joints to a point at least 12" A.F.F. All piping above slab in buildings (including vents) shall be no-hub cast iron or gasketed cast iron with "Ty-seal" type joints.
2. All sanitary waste and vent piping shall be sloped 1/8" to 1/4" per foot (1 to 2 percent) in the direction of flow.
3. Roof drain piping within buildings shall be insulated (as specified for water piping) a minimum of 15 feet from the drain.
4. Cleanouts shall be shown to be installed so that the maximum amount of piping can be accessed.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** Exterior Plumbing Systems **Number** P2.03

**Issue Date:** March 2009 **Rev #:** 1

**Approved:**   
Engineering Services Supervisor

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A. Exterior plumbing

1. All buried piping systems, including sleeves, shall be a minimum of 24" deep, bedded in minimum 2" of sand on all sides, top, and bottom. This shall include under slab piping.
2. Exterior water piping up to 5 feet from the building footprint shall be as described in Design Guide P2.01.
3. Exterior fuel gas piping shall be as described in Design Guide P2.04.
4. Exterior compressed air piping shall be as described in Design Guide P2.05.
5. Exterior sanitary piping up to 5 feet from the building footprint shall be Schedule 40 or C-900 PVC.
6. Sanitary piping shall have cleanouts at intervals no greater than 75 feet.
7. Exterior hose bibbs on building(s) shall be freezeproof.
8. Exterior plumbing under pavement shall be sleeved as described elsewhere in these guidelines.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title: Fuel Gas Plumbing Systems** **Number: P2.04**

**Issue Date: March 2009** **Rev #: 1**

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

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A. Fuel Gas (natural and LPG gas) Piping

1. All fuel gas piping and fittings within buildings shall be schedule 40 black steel, threaded up to 2 inch, and welded 2-1/2" and over.
2. Piping size changes shall be made using bell reducers, or reducing fittings. The use of bushings shall be prohibited.
3. Exterior, buried fuel gas piping shall be either corrosion protected black steel or safety yellow colored polyethylene piping, specifically manufactured for fuel gas service. Joining of polyethylene piping shall be by butt fusion method.
4. The construction documents shall specifically prohibit the use of galvanized steel and copper piping and fittings for use as fuel gas piping.
5. Dirt legs and flexible gas hose shall be required at all connections to appliances and points of use.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** Compressed Air Plumbing Systems **Number:** P2.05

**Issue Date:** March 2009 **Rev #:** 1

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

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- A. Compressed Air Systems (Shop Buildings and Labs)
1. Compressed air piping shall be rigid, hard drawn, Type K copper.
  2. Dirt legs and quick disconnect fittings shall be required at all points of use.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title:** Grease and Oil Plumbing System **Number:** P2.06

**Issue Date:** March 2009 **Rev #:** 1

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

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A. Centralized Grease and Oil Systems (Shop Buildings, if required)

1. Grease and oil piping shall be Schedule 80, black steel pipe and fittings.
2. Systems shall include central grease system and pump, piped to a point of use in the center of the vehicle shop.
3. Systems shall include a set of retractable reels for grease, oil (if used), water, compressed air, and 120 volt power.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Civil Design Standards**

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**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Civil Design Standard**

**Title: Construction Notes** **Number: C1.02**

**Issue Date: March 2009** **Rev #: 1**

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

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- A. General Notes shall include but not be limited to the following:
1. A project description
  2. A reference to Texas Department of Transportation Standard Specifications, 2004, for materials and methods.
  3. A reference to Texas Commission on Environmental Quality (TCEQ) Chapters 290 and 317 for water and wastewater improvements. All materials and methods for water and wastewater improvements shall be in accordance with current AWWA requirements.
  4. A note that all construction operations shall be accomplished in accordance with State and Federal Health and Safety Codes.
  5. A note that all work within TxDOT rights of way will be coordinated with the Roadway Maintenance Supervisor. Provide the name and phone number.
  6. Provide the phone numbers for the local Police Department and/or Sheriff Office, Fire Department, Water Department and Wastewater Department. Other numbers as may be appropriate.
- B. Utilities
1. A note for the contractor to contact the area "One Call" system 48 hours prior to beginning any excavation.
  2. Contractor notification prior to shutting off a waterline or disconnecting a wastewater line.
  3. If working in a TxDOT right of way all work will require a Utility Permit from the TXDOT District Office and shall provide traffic control measures in accordance with the TMUTCD.
  4. Other notes the consultant feels are necessary or prudent to include.

C. Environmental

1. Install erosion/sedimentation per the plans prior to beginning construction.
2. Conduct a pre-construction meeting, including the District Environmental Coordinator, to insure compliance with the Storm Water Pollution Prevention Plan (SW3P).
3. Seeding for erosion control shall be in accordance with Items 164 and 166, TxDOT Standard Specifications, 2004, for the \_\_\_\_\_ District #\_\_\_\_.



**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Civil Design Standard**

**Title:** Water Improvements **Number:** C1.04

**Issue Date:** March 2009 **Rev #:** 1

**Approved:** \_\_\_\_\_  
Engineering Services Supervisor

- A. Water supply will vary from site to site. In general, if a public water system is available for service this is the preferred option. If the site does not come under the requirements of TCEQ as a Public Water Supply (PWS) the improvements will still be designed per TCEQ Rules. If the system is considered a PWS the design and approvals will be in accordance with TCEQ Rules. If the site requires a new water well coordinate this with the Engineering Services Branch for the design.
- B. Off site water improvements that are being provided by a PWS will be designed in accordance the providers requirements and in compliance with TCEQ Rules.
- C. On site water improvements will include the following:
1. Water lines less than two inches will be Type K copper and a rated working pressure of 150 psi.
  2. Lines two inches but less than four inches may be Type K copper, or gasketed (glued joints are not acceptable) PVC Schedule 40 or 80.
  3. Lines four inches and greater will be AWWA C-900, SDR 18 or SDR 14.
  4. If lines 4" or greater are placed in fill material (not in-situ excavation) the pipe material will be ductile iron, push-on or mechanical joint pipe (AWWA C-151).
  5. Provide sufficient valves for operation and maintenance. Valves less than four (4) inches will be brass ball valves, valves four (4) inches and greater will be iron body gate valves. All valves will be placed in valve boxes with ball valves in concrete boxes with cast iron lids and gate valves in cast iron boots with cast iron lids. If valve boxes having locking mechanisms or gate valves are specified have the contractor provide the appropriate valve box and/or valve keys. Valves will be placed on pea gravel.
  6. Fittings will be appropriate to the type pipe being used and will conform to AWWA Standards.

7. Water and wastewater separation distances and crossings will be in compliance with TCEQ Rules.
8. Water services will terminate five (5) feet from buildings at locations determined by the buildings' Mechanical Engineer. Provide a building shut-off valve and valve box.
9. Water service for irrigation systems will be coordinated with the Project's Landscape Architect or the irrigation system designer.
10. Water pipe will be in a bedding envelope. If trenched in silts, sands, clays or some combination thereof provide a fine aggregate bedding material of either a washed sand or a washed pea gravel. If trenched in rock provide a coarse aggregate bedding of clean gravel, crushed gravel or crushed limestone. Provide a size gradation for the materials specified.
11. All waterlines will be installed with a tracer tape or wire.
12. At tees, bends, etc. on waterlines will have restrained joints or be blocked.



- have a cast iron boot and lid, a concrete collar and will match the paved surface. Cleanouts in non-paved surfaces will have a concrete collar and may match the finished surface.
  - 8. Water and wastewater separation distances and crossings will be in compliance with TCEQ Rules.
  - 9. Wastewater services will terminate five (5) feet from buildings at locations determined by the buildings' Mechanical Engineer. Provide a cleanout or manhole.
  - 10. Wastewater pipe will be in a bedding envelope. If trenched in silts, sands, clays or some combination thereof provide a fine aggregate bedding material of either a washed sand or a washed pea gravel. If trenched in rock provide a coarse aggregate bedding of clean gravel, crushed gravel or crushed limestone. Provide a size gradation for the materials specified.
- D. Systems requiring lift stations will provide the following:
1. Wet wells will be pre-cast concrete with a concrete bottom and ballast (check the station for floatation) and a concrete pad a minimum of 6 inches above the finished surface. The backfill will be a washed sand or clean pea gravel.
  2. The wet well will have an aluminum or stainless steel hinged, locking, access hatch. In no case will steel lids be allowable.
  3. In coastal areas, fiberglass wet wells and lids may be considered on a case by case basis.
  4. The station will have a duplex pump system with stainless guide rails and mercury type float controls, mounted on a stainless steel hanger, for low level shutoff, lead pump on, lag pump on and a high water alarm.
  5. The station will have an alarm light and an audible alarm.
  6. Each pump will have a H-O-A switch and an accumulative run time counter.
  7. The control panel will be a NEMA-4 Stainless box mounted on a galvanized steel or stainless steel frame a minimum of 36 inches from the bottom to the finished grade. If the station is located in a flood prone area raise the station's finished grade to prevent inundation.
  8. The specified pumps will be a grinder type that are relatively easy to maintain and operate. Parts and service should be available within a one to two hour drive of the site or provide a replacement pump with the new system.
  9. The pump motors should be three phase if three phase power is available. Provide a pump design that provides the best operating efficiency with the minimum power requirements.
  10. Provide a stainless steel pump lift hoist.
  11. Ball valves and check valves on each discharge line will be installed outside the wet well in concrete valve boxes with cast iron lids. In no case will valves inside the wet well be acceptable.
  12. Force mains may be PVC gasketed Schedule 40 or 80 or PVC pipe meeting a 150 psi operating pressure. The line is to be sized to have a

minimum scour velocity of 2.5 feet per second. A maximum of eight fps, but preferably no more than 5 fps.

13. If there high spots in the force main profile provide appropriate air release or combination air release/vacuum valves.

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Civil Design Standard**

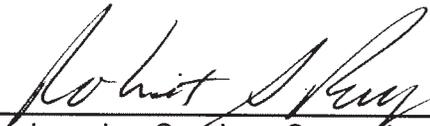
**Title:** Flexible Pavement

**Number:** C1.06

**Issue Date:** March 2009

**Rev #:** 2

**Approved:**

  
Engineering Services Supervisor

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**A. PAVEMENT SECTION DESIGN GUIDELINES**

1. Pavement section designs shall comply with the following guidelines for all capital improvement projects. All designs will require review and approval of the Maintenance Division. Any consultant engineer or district wishing to modify these guidelines must request, through the project's Project Manager, proposed changes in writing to Zane Webb, P. E., Director, Maintenance Division.
2. Specifications: All Item references are to the current Texas Department of Transportation, STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS, STREETS, AND BRIDGES, 2004 or as may be referred to as TEXAS STANDARD SPECIFICATIONS 2004.

**Subgrade:** Soils which soil boring samples indicate are stable for the intended purpose and at the discretion of the Engineer, shall not require additives for proper density and may be prepared in situ and Proof Rolled per Item 216.

All other subgrades shall be scarified or cut and pulverized to a minimum depth of 6". Clay soils shall be lime stabilized by slurry or dry placement method at a rate of 3% by weight or as shown on the plans in accordance with Item 260. Sandy soils shall be cement stabilized at a rate of 3% by weight or as shown on the plans in accordance with Item 275. All deleterious materials shall be removed from this layer prior to any stabilization and/or compaction. Compaction methods shall be Ordinary Compaction, or as specified by the engineer, in accordance with Item 132.

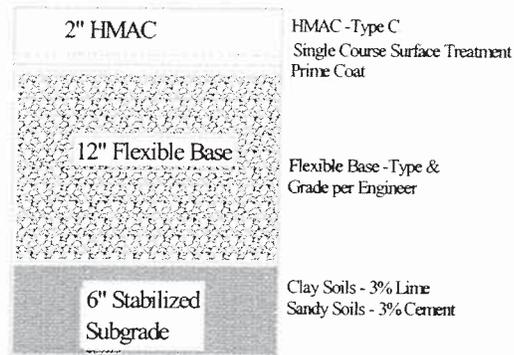
**Flexible Base:** Flexible Base shall be a minimum of 12" of a type and grade material as specified by the Engineer and in accordance with Item 247. If, in the opinion of the Engineer, this standard should be modified, prepare a justification for this modification and submit it to the Project Manager.

**Prime Coat:** The prime coat shall be a MC – 30, in accordance with Item 300, and applied at a rate of 0.2 gallons per square yard, in accordance with Item 310.

**Surface Treatment:** The surface treatment shall be a single course treatment constructed in accordance with Item 316. The asphalt shall be a material listed for Surface Treatment in Table 18, Item 300 and/or as directed by the Engineer, and specify a recommended approximate application rate. The aggregate shall be a Type B Grade 4 in accordance with Item 302.

**Pavement Surface:** The pavement surface course shall be 2 inches of Type C hot mix asphaltic concrete (HMAC) in accordance with Item 340.

The above descriptions are to direct intent and not considered complete specifications. Engineers are directed to the TxDOT web site, <http://www.dot.state.tx.us/business/specifications.htm>, for appropriate special designs, provisions and specifications.



Typical Pavement Section

**Pavement Materials Note:**

The Design Engineer must establish the following material types and estimated ranges of material rates. The exact rates must be selected during construction based on materials used.

Subgrade Treatment: \_\_\_\_\_

Flexible Base: Type \_\_\_\_\_, Grade \_\_\_\_\_

Prime Coat: Type \_\_\_\_\_, Application rate \_\_\_\_\_ Gal/SY

Surface Treatment:

Aggregate: Type \_\_\_\_\_, Grade \_\_\_\_\_, Application rate \_\_\_\_\_ CY/SY

Asphalt: Type \_\_\_\_\_, Application rate \_\_\_\_\_ Gal/SY

Pavement Surface: 2" HMAC Type \_\_\_\_\_

## **PART – 3**

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# **ENERGY CONSERVATION STANDARDS**

**TxDOT Maintenance Division  
Facilities Management Section  
Engineering Services Branch**

**Design Standard**

**Title: Energy Conservation**

**Number: EC1.01**

**Issue Date: March 2009**

**Rev #: 1**

**Approved:**

  
Engineering Services Supervisor

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**DESIGN STANDARDS**

Use of ASHRAE/ANSI Standard 90.1-2007 is required for all facility construction and/or major renovation projects. The Architects and Engineers responsible for the project must certify, seal and date (requires a registered Architect or Engineer) a statement of compliance that the project design conforms to the requirements of ASHRAE/ANSI Standard 90.1-2007.

All drawings and specifications shall be reviewed and approved by TxDOT Maintenance Division Facility Management Section Engineering Services Group prior to release for bidding.

The Engineering Services Group will certify to the State Energy Conservation Office that the project is in compliance with State Energy Conservation Code.

## **PART – 4**

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### **SPECIAL PROVISION COMPUTER FILES FOR DOCUMENT AND INFORMATION EXCHANGE**

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PART 1a: Document and Information Exchange	Page 2
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## PART 1a: DOCUMENT AND INFORMATION EXCHANGE

### A. GENERAL (Texas Department of Transportation, Maintenance Division, Facilities Management Section hereafter referred to in this document as "TxDOT")

1. TxDOT shall not be held responsible for the usage of files contained on the included CD. These files are standard sheets and tools to assist the Architect / Engineer and usage is optional.
2. Copyright – All sheets composing the construction documents shall bear copyright symbol indicating the year of its bid date. This symbol is located on the TxDOT standard cover sheet and title block edit text to reflect the correct year.
3. Progress, final and as-built construction document drawings shall be prepared with Computer-Aided Design and Drawing (CADD) technology. Drawing files shall be delivered to the State in one of the following file formats: DWG - AutoCAD® Release 2007 or earlier. Raster scanned drawings will not be accepted. All plot files referenced in drawings shall be provided. Drawings created in 3D format shall be converted to 2D format prior to submittal. Specifications shall also be required in electronic format with all section names following the current CSI format. An index shall be provided. All specification files shall be submitted in MS Word® Release 97 or later compatible files and PDFs capable of being opened with Acrobat Reader 5.0. Each Section shall have its own separate file (i.e. 08111.doc and 08111.pdf). Electronic copies (Compact Disks) of the specifications, progress, final, and as-built drawings, as appropriate, shall be submitted with the hard copy deliverables for each phase of the work being reviewed.
4. Obtaining any standard publications and documents mentioned in this document is the sole responsibility of the consultant.
5. The files shall be submitted on CD, and each CD shall bear a label containing the following information:

PROJECT NAME  
CONSULTANT NAME  
PROJECT NUMBER  
PHASE NAME  
CONTRACT NUMBER  
DISK NUMBER OF TOTAL DISKS

### B. NAME AND FOLDER STRUCTURE:

1. All drawings and specifications shall be submitted to TxDOT in electronic format including a hardcopy. All drawings shall be submitted under folder structure diagram shown in Figure#1. The folder name shall be the firm company name or an abbreviation of the firm name followed by the underscore character and the last three digits of the project number; special characters are prohibited the firm folder name shall be equal or less than sixteen characters. Consultants shall make use of relative path external references by following the shown folder structure in Figure#1 the path links shall be maintained by maintaining the folder structure. Provide the discipline folders as

applicable. The submitted drawings shall include the folder structure and all applicable drawings. Reference External references Figure#1 for the folder structure diagram.

### C. COVER SHEET

1. **Cover Sheet** – The standard TxDOT coversheet shall be used on all projects. The cover sheet shall include the following:
  - a. An area and a region location map (AutoCAD® generated)
  - b. The sheet index
  - c. Scope of work in detail
  - d. Phasing (If applicable)
  - e. Square footage Statistics (as applicable for complete new buildings)
  - f. Parking Statistics (as applicable)
  - g. A list of applicable code standards used during the project’s design (as applicable)
  - h. The TxDOT Project number
  - i. The Project Title (as it appeared when it received funding)
  - j. The title of the project and TxDOT project number shall occur a second time in the location given in the example file where it can be identified when the drawings are rolled up.

### D. PROFESSIONAL SEAL

1. **Professional Seal** – If the drawings submitted contain an electronic seal the following information shall be included:
  - a. **Architect** – “The record copy of this drawing is on file at the offices of (name of firm), (address of firm). This electronic document is released for the purposes of reference, coordination, and/or facility management under the authority of (name), (registration number) on (date). Any modification(s) to this drawing shall be in compliance with the Texas Board of Architectural Examiners’ rules.”
  - b. **Engineers** – “The seal appearing on this document was authorized by (Example: Leslie H. Doe, P.E. 0112) on (date).”

### E. TITLE BLOCK

1. **Title Block** – All sheets except the cover sheet shall use the standard TxDOT title block located on the CD.

### F. SHEET SIZE

1. **Sheet Size** – All sheets shall be set up to plot at 22” x 34”. All view ports shall be laid out according to the scale factor that each element should be plotted. All disciplines shall follow the architectural view port scale for each floor plan. Provide a 22”x34” and 11”x17” plotted set at time of submittal.

## G. COMPANY LOGOS

1. **Company Logos** – Logos may be used, however the logo shall not contain fonts that are not standard AutoCAD® font files.

## H. DRAWING FILE NAMES

1. **Drawing File** names shall match the sheet number. Refer to the drawing numbering standards, however replace the period with an underscore. Example: A2.1 = A2\_1.DWG. Drawing files using multiple layout tabs shall be named with the range of sheets included. (ie. a file with all of the elevations would be named A5\_1to2 with 1to2 indicating that A5.1 and A5.2 are included within that file). Files containing Plan Sheets should not have multiple layout tabs within one file that are not directly related to each other by means of a common x-ref. Section, Detail and Schedule Sheets maybe combined into one file where determined logical by the drafter.

## I. DRAWING NUMBERING FORMAT STANDARDS

1. **Construction Drawings:** Sheet Numbers shall be constructed of 3 parts. A letter denoting the discipline, a number denoting the Series and a second number after a decimal point the number of the sheets in the respective series. (ie. A2.1 indicates that it is the first Plan Sheet in the Architectural. Sheet Numbers for Plan Sheets shall be kept consistent across all disciplines. (ie. A2,1, S2.1, M2.1, E2.1, P2.1 should all be the same building.) The letter abbreviation for sheet discipline and the order in which they shall occur will be as follows: C (civil), L (landscape), A (architectural), S (structural), M (mechanical), P (plumbing), E (electrical), FP (fire protection), T (telecommunications), F (furnishings), G (graphics & signage), K (kitchen or food service). Demolition Sheets if required shall be a standard Sheet Number preceded by a (D) denoting them as Demolition Sheets. Demolition Sheets shall be included in the drawing set at the beginning of each of their respective Disciplines Sections. Projects containing a small amount of Demolition work not requiring a demolition contract are exempt from the requirement for separate Demolition Sheets and shall use clearly defined and identified demolition notes on the Plan Sheets. The State's determination as to the requirement for Demolition Sheets shall be final. Abbreviations for other disciplines shall be assigned as required. Sheet number assignment and sheet content may vary with size and scope of the project. Refer to Table 1 below for Drawing Numbering and content distribution:

Table 1

DRAWING NUMBERING STANDARDS		
SHEET DISCIPLINE	SHEET SERIES/NUMBER	DESCRIPTION
COVER	COVER	COVER SHEET
CIVIL		
C	C1.1, C1.2 ETC.	GENERAL NOTES / DIMENSIONAL PLAN
	C2.1, C2.2 ETC.	EROSION AND SEDIMENTATION CONTROL
	C3.1, C3.2 ETC.	GRADING/ STORM SEWER/ PROFILES
	C4.1, C4.2 ETC.	WATER AND WASTEWATER PLANS

	C5.1, C5.2 ETC.	CIVIL DETAILS AND TREE PROTECTION
<b>LANDSCAPE</b>		
L	L1.1, L1.2 ETC.	TREE PROTECTION PLANS AND DETAILS
	L2.1, L2.2 ETC.	LANDSCAPE DETAILS
	L3.1, L3.2 ETC.	IRRIGATION PLAN
	L4.1, L4.2 ETC.	VEGETATION SCREENING PLANS & SUMMARIES
	L5.1, L5.2 ETC.	BED LAYOUT AND PLANTING AT BUILDINGS
<b>ARCHITECTURAL</b>		
A	DA1.1, DA1.2 ETC.	SITE DEMOLITION PLANS
	DA2.1, DA2.2 ETC.	ARCHITECTURAL DEMOLITION FLOOR PLANS
	A1.1, A1.2 ETC.	SITE PLAN/LANDSCAPE, SITE DETAILS
	A2.1, A2.2 ETC.	FLOOR PLANS/PARTIAL PLANS
	A3.1, A3.2 ETC.	ROOF PLAN / DETAILS
	A4.1, A4.2 ETC.	REFLECTED CEILING PLANS
	A5.1, A5.2 ETC.	EXTERIOR BUILDING ELEVATIONS
	A6.1, A6.2 ETC.	ENLARGED FLOOR PLANS AND INTERIOR ELEVATIONS
	A7.1, A7.2 ETC.	BUILDING SECTIONS
	A8.1, A8.2 ETC.	WALL SECTIONS / PARTITION DETAILS
	A9.1, A9.2 ETC.	FINISH, WINDOW, DOOR SCHEDULES / DETAILS
	A10.1, A10.2 ETC.	MISCELLANEOUS DETAILS
	A11.1	TAS STANDARDS DETAIL SHEET
<b>STRUCTURAL</b>		
S	S1.1, S1.2 ETC.	FOUNDATION PLAN / DETAILS
	S2.1, S2.2 ETC.	FRAMING PLANS / DETAILS
	S3.1, S3.2 ETC.	SCHEDULES
	S4.1, S4.2 ETC.	MISCELLANEOUS DETAILS
<b>SITE UTILITY</b>		
PE	DPE1.1, DPE1.2 ETC.	SITE UTILITY DEMOLITION PLANS
	PE1.1, PE1.2 ETC.	SITE UTILITY PLANS
<b>MECHANICAL</b>		
M	DM2.1, DM2.2 ETC.	MECHANICAL DEMOLITION FLOOR PLANS
	M2.1, M2.2 ETC.	MECHANICAL FLOOR PLANS
	M4.1, M4.2 ETC.	MECHANICAL SCHEDULES
	M5.1, M5.2 ETC.	MECHANICAL DETAILS
<b>PLUMBING</b>		
P	DP2.1, DP2.2 ETC.	PLUMBING DEMOLITION FLOOR PLANS
	P2.1, P2.2 ETC.	PLUMBING FLOOR PLANS
	P3.1, P3.2 ETC.	PLUMBING RISERS
	P4.1, P4.2 ETC.	PLUMBING SCHEDULES
	P5.1, P5.2 ETC.	PLUMBING DETAILS
<b>ELECTRICAL</b>		
E	DE2.1, DE2.2 ETC.	ELECTRICAL DEMOLITION FLOOR PLANS
	E2.1, E2.2 ETC.	ELECTRICAL FLOOR PLANS
	E3.1, E3.2 ETC.	ELECTRICAL RISERS
	E4.1, E4.2 ETC.	ELECTRICAL SCHEDULES
	E5.1, E5.2 ETC.	ELECTRICAL DETAILS
<b>WASTEWATER</b>		
W	W1.1, W1.2 ETC.	SYSTEM NOTES, DIMENSION CONTROL PLAN
	W2.1, W2.2 ETC.	HYDRAULIC PROFILES, GRADING

	W3.1, W3.2 ETC.	WASTE WATER DETAILS
<b>ORDER AND ABBREVIATIONS OF ADDITIONAL DISCIPLINES AS REQUIRED BY PROJECT SCOPE:</b>		
FP	FP1.1, FP1.2 ETC.	FIRE PROTECTION
T	T1.1, T1.2 ETC.	TELECOMMUNICATIONS
F	F1.1, F1.2 ETC.	FURNISHINGS
G	G1.1, G1.2 ETC.	GRAPHICS AND SIGNAGE
K	K1.1, K1.2 ETC.	KITCHEN OR FOOD SERVICE
<b>ADDENDUM DRAWINGS</b>		
EXAMPLE	AD2C2.1	
	(AD) ADDENDUM DRAWING	
	(2) ADDENDUM NUMBER	
	(C) SHEET SERIES (CIVIL)	
	(2.1) SHEET NUMBER	

## PART 1b: AUTOCAD DRAFTING STANDARDS

### A. PLOT STYLES

1. All Drawings shall be drawn utilizing the “**txdot.ctb**” Plot Style Table included in the CD. This Plot Style Table is designed to have 13 restricted colors (10-18 as well as 251-254) set up with various levels of screening while leaving the remaining 243 colors effectively transparent and unrestricted. This enables lineweight control of the remaining 243 unrestricted colors to be accomplished in the individual drawings on a bylayer basis. “**Txdot.ctb**” will override any changes that are made in the drawing file to the restricted colors(10-18 and 251-254). The Drafter is prohibited from editing the Plot Style Table.

### B. TEXT STYLES:

1. Text style named “**TXDOT**” shall reference the font named “**Roman-s**”. This text style shall be used for dimensions, leaders, general notes, keyed notes, tags, schedules, risers, door labels, floor plan notes. The text height shall be set at 3/32” when plotted on sheet size ANSI D 22” x 34” landscape.
2. Text style named “**TITLE**” shall reference the font named “**Arial**”. This text style will be used for the external reference title block, insertion title block, detail call out block, headers and titles. This text style is already created within the drawings listed above. Headers and titles which identify subtopic information shall be set at 3/16” when plotted on sheet size ANSI D 22” x 34” landscape.

### C. DIMENSION STYLES:

1. Architectural and Structural dimension styles named according to the drawing scale shall reference the text style named “**TXDOT**”. Each scale used in each drawing shall have a dimension style with the overall scale set in accordance to the named dimension style. Each dimension style will have the arrowheads set to architectural tick for dimensions and closed filled arrowheads for leaders.
2. Optional engineering dimension style named “**TXDOT-E**” shall reference the text style named “**TXDOT**”. This dimension style shall have the arrowheads set to closed filled for dimensions and leaders.

### D. SCALING SINGLE LINE AND MULTILINE TEXT TO ACHIEVE THE TEXT HEIGHT:

1. Determine the scale by referencing a scaling chart or perform the following arithmetic.
2. If the viewport scale is set at  $3/8" = 1'$  the scale factor can be calculated as shown below.  $(1 / (3/8 \text{ inches})) * (12 \text{ inches} / 1 \text{ foot}) = 8/3 * 12 = 32$  (The scale factor is 32)
3. The text shown in model space through the scaled viewport set at a given scale must to be multiplied by the scale factor to achieve the standard text height.
4. The standard printed text height for floor plan notes is 3/32”, if the scale for a given viewport is set at  $3/8" = 1'$  then multiply  $3/32 * 32$ . This means the text height shall be set at 3”.

#### **E. SCALING DIMENSIONS AND LEADERS USING DIMENSION STYLES ASSOCIATED TO SCALE:**

1. Architectural and Structural disciplines shall use the dimension style to set the desired dimension scale. Each scale has a corresponding dimension style with a preset overall scale. This allows the drafter to set the dimension scale by making the dimension styles corresponding to the desired drawing scale current.

#### **F. SCALING DIMENSIONS BY OVERRIDING DIMENSION STYLES WITH DIMSCALE:**

1. Optional engineering disciplines minus Structural can utilize the keyboard command named "dimscale" to set the overall scale required for the drawing scale. This scales the text height, arrowhead size and offsets created in the dimension style for dimensions and leaders.
2. Dimensions and leaders can be updated to the current dimension scale by using the update dimension scale icon.
3. The dimension scale can be changed when drafting at different drawing scales for new dimensions and leaders at a different drawing scale. Once a dimension and/or leader is created, it will not inherit the current dimension scale unless you intentionally update the scale.

#### **G. SCALING LINETYPES**

1. The drafter shall set the linetype scale to one, the default setting in AutoCad. The check box indicating use paper space units for scaling shall be checked under the linetype manager dialog box. Use the keyboard command named, "ltscale" and set the linetype scale to the scale factor required for the current drawing scale while drafting in model space if desired. The drafter will then see the linetypes as they appear in paper space.

#### **H. EXTERNAL REFERENCE FILES (X\_refs)**

1. The drafter shall not have duplicate copies of the same floor plan in the same drawing; all items shall be drawn over the same floor plan utilizing layers freeze to filter out layers in different view ports.
2. X\_refs shall be overlayed utilizing the relative path option and attached at 0, 0, 0 coordinate point on layer X-ANNO-REFR. In order to make this possible all X\_ref files for a specific building shall maintain the same location relative to 0, 0, 0. This will insure proper alignment of various X\_ref plans for a given building. A base floor plan or any other X\_ref plan shall not be moved once the drawings have started to develop. This can cause significant alignment problems for other disciplines and files that are referencing these files. This allows all drawings to have the same datum point of 0,0,0 at bottom left corner edge of slab.
3. Drafters shall not place text and notes pertaining to one specific discipline into drawings that are to be X\_refed. An example of notes required for all drawings would be room labels. The room labels need to be on a separate layer so other disciplines can

reference the room labels, yet turn them off for display due to interfering locations in host drawings.

4. X\_ref file names shall be constructed of the following 3 parts all separated by underscores. An X denoting that it is an X\_ref Drawing, a four character discipline indicator, and a 2 character building designator indicating what building it is for. (ie. X\_ARCH\_OF indicates it is an Architectural X\_ref file of the Office Building.) The 2 character Building designators should be as follows:
  - a. Office Building – OF
  - b. Lab/Shop Building – LS
  - c. Vehicle Storage Building – VS
  - d. Fuel Station – FS
  - e. Wash Bay – WB
  - f. Shop Building – SH
  - g. Lab Building - LB
  
5. All X\_ref drawings shall be placed in the “X\_REF” folder. All projects folders shall have the same directory tree structure to insure that the relative location of the X\_REF folder with respect to the drawing folders remains the same. The entire project shall be as listed in the file structure shown in Figure#1. If a discipline is not required in your project you do not have to include the folder. All drawings shall be under the discipline corresponding folder as indicated in Figure#1.

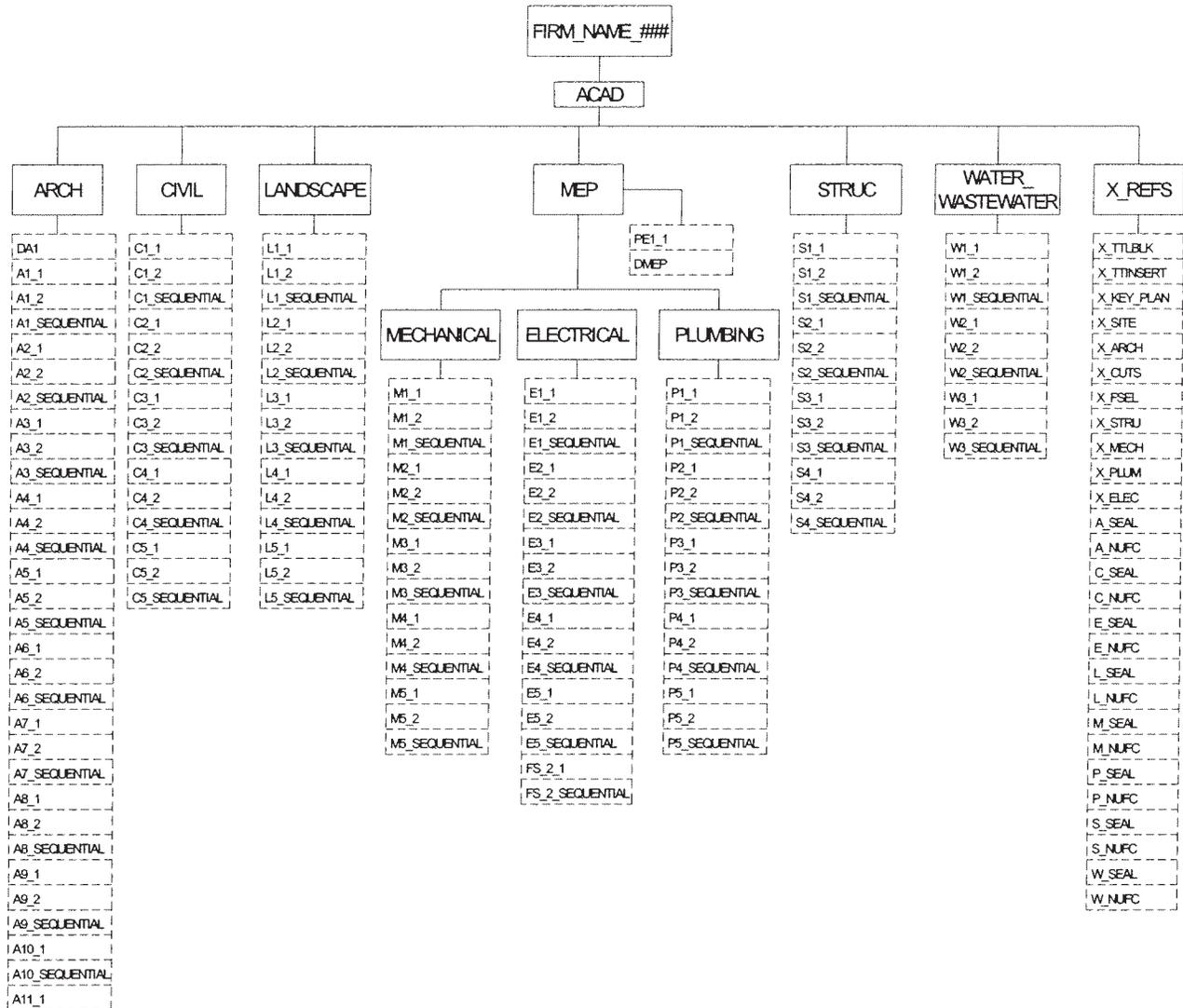


Figure 1

6. X\_REFS REQUIRED:

(Note: All objects and entities drawn or inserted into an X\_ref plan shall have the color and line weight set to “By Layer” for all Layers . The drafter is prohibited from overriding the layer color and line weight of individual items in an X\_ref plan. The drafter may create an additional layer when necessary as described in the layer naming standard)

- a. **Each Site shall have a base Site Plan minus text which shall be referenced into all other Site drawings called “X\_SITE”. The X\_ref shall show the following to scale. All other items shall be indicated in the plan sheets.**
  - i. New and existing buildings

- ii. Existing and abandoned Utilities including water, electrical, sanitary sewer, natural and LPG gas, compressed air
  - iii. Right of Way
  - iv. Trees
  - v. Grading
  - vi. Pavement design
  - vii. Flat work
  - viii. Fences including gates
  - ix. Existing and new fuel islands
  - x. Existing and new wash bay pads
  - xi. North arrow
  - xii. Equipment foundations
  - xiii. New and existing asphalt tanks
  - xiv. New and existing LPG tanks
  - xv. Highway designation
  - xvi. In no case should there be text which is specific to one discipline.
- b. **Architectural shall provide a base floor plan minus text for each building which shall show and set the locations for the following. The base plan shall be called "X\_ARCH". This is the responsibility of the architectural drafter. All other items shall be indicated in the plan sheets.**
- i. Plumbing fixtures
  - ii. Reflected ceiling plan
  - iii. Walls
  - iv. Identifiable Fire walls
  - v. Identifiable walls to structure
  - vi. Windows
  - vii. Doors
  - viii. Room labels (exception to no text allowed)
  - ix. Floor drain locations
  - x. Modular furniture
  - xi. Headers
  - xii. Cabinets
  - xiii. Structural columns
  - xiv. Soffits
  - xv. Restroom partitions
  - xvi. Gutter down spouts and roof drains
  - xvii. Roof outline
  - xviii. Edge of slab
- c. **Where a building requires critical sections when requested by a drafter on a case by case basis, the architectural drafter shall provide a separate drawing with base sections minus text for each building called "X\_CUTS". The X\_ref shall show the following. This is the responsibility of the architectural drafter. All other items shall be indicated in the plan sheets.**
- i. Walls
  - ii. Roof outline
  - iii. Joist
  - iv. Columns

- d. **Each building shall have a base structural plan minus text to be referenced into other drawings called “X\_STRU”. The X\_ref shall show the following. This is the responsibility of the structural drafter. All other items shall be indicated in the plan sheets**
- i. Grade beams
  - ii. Structural columns
  - iii. Wind bracing
  - iv. Roof purlins
  - v. Ceiling joists
  - vi. Roof joists
- e. **Each building shall have a base mechanical plan minus text to be referenced into other drawings called “X\_MECH”. The X\_ref shall show the following. This is the responsibility of the mechanical drafter. All other items shall be indicated in the plan sheets**
- i. Air Inlets and outlets
  - ii. Exhaust fans
  - iii. Infrared heaters including thermostats
  - iv. Indoor units
  - v. Outdoor units
  - vi. Louvers
  - vii. HVAC equipment including thermostats
  - viii. Combustion vents through roofs
  - ix. Fire dampers
  - x. Roof top equipment including exhaust fans
  - xi. Unit heaters
  - xii. Roof Jacks
  - xiii. Equipment identification labels
- f. **Each building shall have a base plumbing plan minus text to be referenced into other drawings called “X\_PLUM”. The X\_ref shall show the following. This is the responsibility of the plumbing drafter. All other items shall be indicated in the plan sheets**
- i. Water recycle equipment
  - ii. Water Heaters
  - iii. Vent stacks
  - iv. Air Compressors
  - v. Any plumbing device requiring electrical power
  - vi. All piping.
  - vii. Equipment identification labels
- g. **Each building shall have a base electrical plan minus text to be referenced into other drawings called “X\_ELEC”. The X\_ref shall show the following. This is the responsibility of the electrical drafter. All other items shall be indicated in the plan sheets**
- i. Interior lights

- ii. Exterior building lights
  - iii. Switchgear
  - iv. Voice data outlets
  - v. Receptacles
  - vi. Control panels
  - vii. Annunciator panels
  - viii. Leak detection panels
- h. **Each discipline shall have a base seal to be referenced into other drawings called “X\_SEAL”. The “X” position shall represent the discipline designator, for example A\_Seal.dwg shall represent the architectural seal. The drawing shall be externally referenced into the architectural drawings at zero, zero, zero insertion point. The X\_ref shall include the seal name and number this text shall be capable of being modified at anytime. The title block drawing shall not contain blocks for seals.**
- i. **Each discipline shall have a base seal to be referenced into other drawings called “X\_NUFC”. The “X” position shall represent the discipline designator, for example M\_NUFC.dwg shall represent the mechanical not used for construction disclaimer label. The drawing shall be externally referenced into the mechanical drawings at zero, zero, zero insertion point. The X\_ref shall include the seal name, number and date this text shall be capable of being modified at anytime. The title block drawing shall not contain not used for construction disclaimer labels.**
- j.
- I. SCALE AND NORTH ARROW**
1. **Scale and North Arrow** - shall occur on all Plan sheets. The North Arrow shall indicate both plan north and actual north. Plan North shall be defined on the Site Plan and shall be kept consistent through all other plan sheets. The Site Plan shall be set so that Actual North is straight up (90°) and Plan North shall be the direction that is closest to actual North and perpendicular to one face of the building. All Plan Sheets should be set up whenever practical so that Plan North is at 90°. In some case it maybe necessary for sheets to be set with Plan North at 0° or 180°. In such case the Location Key Plan shall be rotated to the same angle. An indication of the scale to which the plan is drawn should be indicated directly under the plan title in either 1/8” or 3/16” letters and in graphic form. A general note should be included on each sheet stating the original sheet size in which the project’s Construction Documents were issued.

**J. LOCATION KEY PLANS OR SECTIONS DIMENSIONING**

1. **Location Key Plans or Sections** – Provide a Location Key Plan whenever there is more than one structure in the Project. Location Key Plans shall include all structures for which there will be Plan Sheets in the Project and any existing structures already onsite. Location Key Plans should be located consistently in the lower right corner of the sheet . The Location Key Plan shall be oriented so that the building on the plan sheet is at the same orientation. As previously mentioned all Plan Sheets should be set up whenever practical so that Plan North is at 90°. In some cases it maybe necessary for sheets to be set with Plan North at 0° or 180°. In such cases the Location Key Plan shall be rotated to the same angle.

## K. DIMENSIONING

### 1. Plan Dimensioning

- a. Working drawings shall be dimensioned consistently from one side of the face of stud or masonry to the other consistent side of the wall.
- b. All masonry and lumber dimensions shall be nominal dimensions.
- c. Dimension walls and interior partitions from center line of columns. Avoid interior strings of dimensions; only necessary dimensions to construct work and critical dimensions.

### 2. Building / Wall Sections

- a. Reference all vertical dimensions from the Finish Floor elevation. Dimension bearing points or eave heights of major structural components.
- b. Show 12" minimum drop from Finish Floor elevation to exterior finish grade.

### 3. Detail Dimensioning

- a. All masonry and lumber dimensions shall be actual dimensions.
- b. Tie detail components to major building elements like column centerline or structural elements like slab edge, bearing points that installer can use for reference points.

## L. Exterior Dimension Strings:

1. Exterior dimension strings, as needed, shall consistently occur, a recommended minimum of ½" apart on 22" x 34" sheets, in the following order beginning with the string located farthest from the plan.
  - a. The overall out to out dimension string (taken to outside surface of main internal wall construction material, ie. CMU, metal stud. etc.). Note: Foundation plan out to out dimension shall be taken to the exterior edge of the foundation wall.
  - b. The structural column grid string (if internal columns exist) runs from the exterior of the out to out dimension string to the centerline of the structural columns.
  - c. The mass dimension string shall run from the exterior of the out to out dimension string to the exterior corner of any projections occurring in the plan.
  - d. The opening dimension string shall dimension "rough" or "masonry" openings occurring in the plans for windows and doors and shall not continue from the exterior edges of the out to out dimension string. The dimension string shall originate from either outside corners, or centerlines of columns. The dimension shall include, as applicable, R.O. for rough opening or M.O. for masonry opening. For store front or curtain wall systems, which utilize multiple vertical mullions, the string shall locate the centerline of these mullions within the M.O. or R.O. limits.

## M. LAYER NAMING STANDARD:

1. Reuse graphic information by layer management to reduce duplication. The Layer Naming Standards are based on "AIA CAD Layer Standards. The Layer Names are constructed from four individual parts all separated by hyphens. Layer names consist of a single character discipline designator (e.g., "A" for Architectural, "M" for Mechanical etc.), followed by a four character major group layer description.(e.g., "wall" for walls, "DOMW" for domestic water piping systems). followed by a Minor Group layer descriptions up to four characters. (e.g., A-WALL-FULL for full height walls, P-DOMW-CPIP for domestic cold water piping) and if further required followed by a Minor Group Series description up to four Project and any existing structures already onsite characters long. (e.g. A-WALL-FULL-INTR for interior full height walls,A-WALL-FULL-

EXTR for exterior full height walls). Refer to Figure 2 below for a graphical explanation of the AIA CAD Layer Standard convention. Layers are provided on CD; add layers as required following this convention.

Figure 2

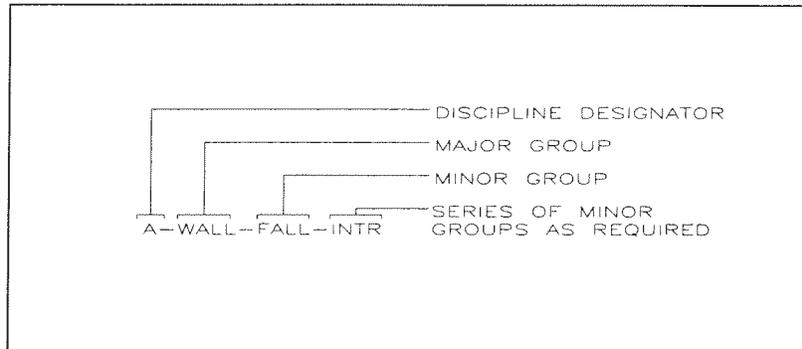


Table 2

<b>REQUIRED LAYERS AND ITEMS FOR CIVIL</b>					
<b>NO.</b>	<b>LAYER NAME</b>	<b>DESCRIPTION</b>	<b>COLOR</b>	<b>LINETYPE</b>	<b>LINewT</b>
0	LAYER 0				
1	DEFPOINTS	NOT TO BE USED			
<b>General Information</b>					
2	C-ANNO-DIMS	Dimension text	RED	Continuous	0.006
3	C-ANNO-KEYN	Reference keynotes with leaders	YELLOW	Continuous	0.012
4	C-ANNO-NPLT	Non-Plotting graphic Information	BLUE	Continuous	Default
5	C-ANNO-PATT	Miscellaneous patterning and hatching	GREEN	Continuous	0.012
6	C-ANNO-NOTE	General notes and general remarks	YELLOW	Continuous	0.012
7	C-ANNO-SYMB	Miscellaneous symbols	MAGENTA	Continuous	0.012
8	C-ANNO-TEXT	Miscellaneous text with leaders	YELLOW	Continuous	0.012
9	C-ANNO-REFR	X_ref Dwgs	WHITE	Continuous	Default
<b>Alignments Information</b>					
10	C-ALGN-DATA	Alignments coordinates and data	GREEN	Continuous	0.012
11	C-ALGN-LINE	Alignments	YELLOW	Continuous	0.012
12	C-ALGN-STAT	Floor outline	WHITE	Continuous	0.020
<b>Buildings and Structures</b>					
15	C-BLDG-OTLN	Buildings and other Structures	WHITE		0.020
16	C-BLDG-IDEN	Building and other structure annotation	9	Continuous	0.012
<b>Site Improvement</b>					
17	C-SITE-FENC	Fences and Handrails	MAGENTA	Continuous	0.012
18	C-SITE-STRC	Site structures	9	Continuous	0.016
19	C-SITE-IDEN	Site Annotation	CYAN	Continuous	0.012
20	C-SITE-IMPR	Site Improvements	CYAN	Continuous	0.024
21	C-SITE-EROS	Riprap, dikes, jetties	RED	Continuous	0.014
22	C-SITE-STRS	Stairs and Ramp	MAGENTA	Continuous	0.012
23	C-SITE-WALK	Walks, trails and paths	BLUE	Continuous	0.012

Property				
27	C-PROP-ESMT	Easement	BLUE	Continuous 0.028
28	C-PROP-CONS	Construction limits	WHITE	Continuous 0.014
28	C-PROP-RWAY	Right of Way	CYAN	Continuous 0.012
29	C-PROP-IDEN	Property Annotation	RED	Continuous 0.012
Storm Drainage				
30	C-STRM-STRC	Storm drainage structures	MAGENTA	Continuous 0.028
31	C-STRM-IDEN	Storm drainage structures annotation	GREEN	Continuous 0.012
Pavement				
32	C-PVMT-ROAD	Roads, parking lots, railroads	RED	Continuous 0.016
33	C-PVMT-ANNO	Roads, parking lots, railroads annotation	GREEN	Continuous 0.012
34	C-PVMT-PATT	Joint patterns, text and dimensions	GREEN	Continuous 0.010
35	C-PVMT-MRKG	Pavement markings and signs	CYAN	Continuous 0.010
Topography				
36	C-TOPO-COOR	Coordinate grid ticks and text	YELLOW	Continuous 0.012
37	C-TOPO-MAJR-ANNO	Major contours annotation	CYAN	Continuous 0.010
38	C-TOPO-MAJR	Major contours	GREEN	Continuous 0.016
39	C-TOPO-MINR	Minor contours	YELLOW	Continuous 0.006
40	C-TOPO-MINR-ANNO	Minor contours - Annotation	CYAN	Continuous 0.012
41	C-TOPO-SLOP-FILL	Cut / Fill slope	MAGENTA	Continuous 0.012
42	C-TOPO-SLOP-ANNO	Cut / Fill slope Annotation	CYAN	Continuous 0.012
43	C-TOPO-SPOT	Spot elevations	YELLOW	Continuous 0.008
44	C-TOPO-TOPT	Top / Toe slopes	MAGENTA	Continuous 0.008

Table 3

## REQUIRED LAYERS AND ITEMS FOR ARCHITECTURAL

NO.	LAYER NAME	DESCRIPTION	COLOR	LINETYPE	LINEWT
0	LAYER 0				
1	DEFPOINTS	NOT TO BE USED			
General Information					
2	A-ANNO-DIMS	Dimension text	RED	Continuous	0.008
3	A-ANNO-KEYN	Reference keynotes with leaders	YELLOW	Continuous	0.012
4	A-ANNO-NPLT	Non-Plotting graphic Information	BLUE	Continuous	0.012
5	A-ANNO-PATT	Miscellaneous patterning and hatching	GREEN	Continuous	0.006
6	A-ANNO-NOTE	General notes and general remarks	YELLOW	Continuous	0.012
7	A-ANNO-SYMB	Miscellaneous symbols	MAGENTA	Continuous	0.012
8	A-ANNO-TEXT	Miscellaneous text with leaders	YELLOW	Continuous	0.012
9	A-ANNO-REFR	X_ref Dwgs	WHITE	Continuous	Default
Floor Information					
10	A-FLOR-IDEN	Room Name	GREEN	Continuous	0.012
11	A-FLOR-NUMB	Room/Space identification number	GREEN	Continuous	0.012
12	A-FLOR-OTLN	Floor outline	WHITE	Continuous	0.020
13	A-FLOR-SPCL	Architectural Specialties	GREEN	Continuous	0.012
14	A-FLOR-PATT	Paving, tile, carpet patterns	16	Continuous	0.006
Columns					
15	A-ANNO-GRID	Grid notation	15	Center	0.006
16	A-COLS	Column	9	Continuous	0.018
Walls					
17	A-WALL-CAVI	Cavity wall lines	RED	Continuous	0.012
18	A-WALL-CNTR	Wall centerlines	9	Center 2	0.008
19	A-WALL-CWMG	Curtain wall mullions and glass	RED	Continuous	0.010
20	A-WALL-FULL	Full height walls	WHITE	Continuous	0.016
21	A-WALL-FIRE	Fire wall designators	YELLOW	Continuous	0.010
22	A-WALL-IDEN	Wall identification/type text or tags	GREEN	Continuous	0.012
23	A-WALL-MOVE	Moveable walls/ partitions	BLUE	Continuous	0.008
24	A-WALL-PATT	Wall insulation, hatching, fill	14	Continuous	0.006
25	A-WALL-PRHT	Partial height walls	RED	Continuous	0.008
26	A-WALL-SPCL	Wall-hung / attached specialties	RED	Continuous	0.012
Openings					
27	A-GLAZ-SILL	Window sills	BLUE	Continuous	0.008
28	A-WALL-HEAD	Door and window headers	CYAN	Continuous	0.012
29	A-WALL-JAMB	Door and window jambs	RED	Continuous	0.012
Doors					
30	A-DOOR-FULL	Full height door floor to ceiling	MAGENTA	Continuous	0.008
31	A-DOOR-IDEN	Door number and symbol	GREEN	Continuous	0.010
32	A-DOOR-PRHT	Partial height door, swing and leaf	GREEN	Continuous	0.014
33	A-DOOR-SYMB	Miscellaneous Door symbols	RED	Continuous	0.010
Windows					
34	A-GLAZ-FULL	Full height glazed walls	RED	Continuous	0.012
35	A-GLAZ-IDEN	Window number and symbol	GREEN	Continuous	0.010

36	A-GLAZ-PRHT	Window and partial height partitions	RED	Continuous	0.012
Plumbing Fixtures					
37	A-FLOR-FIXT	Plumbing fixtures	MAGENTA	Continuous	0.012
38	A-FLOR-TPTN	Toilet partitions	RED	Continuous	0.008
Elevators					
39	A-FLOR-EVTR	Elevator cars and equipment	CYAN	Continuous	0.010
Stairs					
40	A-FLOR-STRS	Stair risers / treads / ladders	YELLOW	Continuous	0.014
41	A-FLOR-HRAL	Stair handrails, guard rails	RED	Continuous	0.006
Woodwork					
42	A-FLOR-CASE	Casework (manufactured)	CYAN	Continuous	0.010
43	A-FLOR-WDWK	Architectural woodwork	GREEN	Continuous	0.012
Ceiling Penetrations					
44	A-FLOR-OVHD	Overhead items	CYAN	Continuous	0.010
Ceiling Information					
45	A-CLNG-ACCS	Access panels	MAGENTA	Continuous	0.024
46	A-CLNG-CTLJ	Ceiling control joints	YELLOW	Continuous	0.016
47	A-CLNG-GRID	Ceiling grid	RED	Continuous	0.008
48	A-CLNG-OPEN	Openings, ceiling / roof penetrations	GREEN	Continuous	0.021
49	A-CLNG-PATT	Ceiling patterns	WHITE	Continuous	0.014
50	A-CLNG-TEES	Main Tees	BLUE	Continuous	0.012
51	A-CLNG-SUSP	Suspended elements, fans	MAGENTA	Continuous	0.014
Lights					
52	A-LITE-CLGN	Specialty lights not shown on Electrical Plan	CYAN	Continuous	0.028
Roof Information					
53	A-ROOF-CRTS	Cricket flow arrows flow info	RED	Continuous	0.012
54	A-ROOF-RFDR	Roof Drains	RED	Continuous	0.014
55	A-ROOF-GUTR	Roof internal gutters	GREEN	Continuous	0.010
56	A-ROOF-EXPJ	Expansion joints	BLUE	Continuous	0.006
57	A-ROOF-HRAL	Stair handrails, nosings, guard rails	RED	Continuous	0.008
58	A-ROOF-LEVL	Level changes	BLUE	Continuous	0.012
59	A-ROOF-OTLN	Roof perimeter / edge, roof geometry	MAGENTA	Continuous	0.020
60	A-ROOF-PATT	Roof surface patterns, hatching	RED	Continuous	0.006
61	A-ROOF-SPCL	Roof specialties, accessories	GREEN	Continuous	0.008
62	A-ROOF-STRS	Stair risers / treads, ladders	BLUE	Continuous	0.012
63	A-ROOF-WALK	Roof Walkways	GREEN	Continuous	0.012
64	A-ROOF-WALL	Parapet walls and wall caps	YELLOW	Continuous	0.016
Elevations					
65	A-ELEV-CASE	Casework	GREEN	Continuous	0.012
66	A-ELEV-FIXT	Miscellaneous fixtures	YELLOW	Continuous	0.016
67	A-ELEV-FNSH	Finishes, woodwork, trim	GREEN	Continuous	0.010
68	A-ELEV-IDEN	Component identification numbers	CYAN	Continuous	0.010
69	A-ELEV-OTLN	Building outlines	RED	Continuous	0.020
70	A-ELEV-PATT	Textures and hatch patterns	BLUE	Continuous	0.006
71	A-ELEV-PFIX	Plumbing fixtures	MAGENTA	Continuous	0.012
72	A-ELEV-SIGN	Signage	MAGENTA	Continuous	0.010

Table 4

<b>REQUIRED LAYERS AND ITEMS FOR STRUCTURAL</b>					
<b>NO.</b>	<b>LAYER NAME</b>	<b>DESCRIPTION</b>	<b>COLOR</b>	<b>LINETYPE</b>	<b>LINEWT</b>
0	LAYER 0				
1	DEFPOINTS				NOT TO BE USED
General Information					
2	S-ANNO-DIMS	Dimension text	RED	Continuous	0.008
3	S-ANNO-KEYN	Reference keynotes with leaders	YELLOW	Continuous	0.012
4	S-ANNO-NPLT	Non-Plotting graphic Information	BLUE	Continuous	0.012
5	S-ANNO-PATT	Miscellaneous patterning and hatching	8	Continuous	0.000
6	S-ANNO-NOTE	General notes and general remarks	YELLOW	Continuous	0.012
7	S-ANNO-SYMB	Miscellaneous symbols	MAGENTA	Continuous	0.012
8	S-ANNO-TEXT	Miscellaneous text with leaders	YELLOW	Continuous	0.012
9	S-ANNO-REFR	X_ref Dwgs	WHITE	Continuous	Default
Floor Information					
10	S- FOUN-OTLN	Foundation outline	WHITE	Continuous	0.016
11	S-BEAM-GB	Foundation grade beam outline	GREEN	Dashed	0.012
12	S-SPRE-FOOT	Spread footing outline	CYAN	Continuous	0.006
13	S-ABLT	Anchor bolts	YELLOW	Continuous	0.005
14	S-COLS	Column	BLUE	Continuous	Default
15	S-PLAT	Base plate	CYAN	Continuous	0.005
16	S-GRID	Column grid, text and symbol	15	Center 2	0.008
Section Details					
17	S-CONC-BSEC	Concrete beam sections	WHITE	Continuous	Default
18	S-RBAR	Concrete steel reinforcement	YELLOW	Dashed	0.006
19	S-VAPO-BARR	Plastic vapor barrier	RED	Continuous	Default
Roof Framing					
20	S-ROOF-FRAM	Structural steel frames and beams	WHITE	Dashed	0.006
21	S-ROOF-PURL	Roof purlin	CYAN	Continuous	0.004
22	S-PARI-PURL	Roof perimeter purlin	BLUE	Continuous	0.012

Table 5

<b>REQUIRED LAYERS AND ITEMS FOR MECHANICAL</b>					
<b>NO.</b>	<b>LAYER NAME</b>	<b>DESCRIPTION</b>	<b>COLOR</b>	<b>LINETYPE</b>	<b>LINEWT</b>
1	LAYER 0	Nothing Should Stay On This Layer			
2	DEFPOINTS	Do Not Use This Layer			
3	M-ANNO-REFR	Place X-REFS On This Layer	WHITE	Continuous	DEFAULT
4	M-ANNO-NPLT	Design Notes Non-Printing Layer / View ports	252	Continuous	0.012"
5	M-COND	Condensers/Outdoor Units	120	Continuous	0.008"
6	M-COND-IDEN	Equipment Label For M-COND	61	Continuous	0.004"
7	M-EFAN	E-Fan Above Conditioned Space	53	Continuous	0.008"
8	M-EFAN-IDEN	Equipment Label For M-EFAN	71	Continuous	0.004"
9	M-EFAN-WELD	Welding/Auto Exhaust Fan	52	Continuous	0.008"
10	M-EFAN-WELD-IDEN	E-Fan Label For M-EFAN-WELD	74	Continuous	0.004"
11	M-FIRE-DAMP	FIRE DAMPERS	RED	Continuous	0.008"
12	M-FIRE-DAMP-IDEN	EQPT Label For M_FIRE-DAMP	53	Continuous	0.004"
13	M-FURN	Indoor Air Handlers/Furnaces	YELLOW	Continuous	0.008"
14	M-FURN-IDEN	Equipment Label For M-FURN	120	Continuous	0.004"
15	M-HEAT	Unit Heaters / Infrared Heaters	40	Continuous	0.010"
16	M-HEAT-IDEN	EQPT Label For M-HEAT-IDEN	31	Continuous	0.004"
17	M-HVAC-CDFF	Grilles/ Registers in Ceiling	MAGENTA	Center	0.008"
18	M-HVAC-SUPP	Supply Air Duct	GREEN	Continuous	0.008"
19	M-HVAC-WDFF	Louvers/Grilles/ Registers in Wall	61	Continuous	0.012"
20	M-HVAC-WDFF-IDEN	Device Label For M-HVAC-WDFF	31	Center 2	0.004"
21	M-PENE-ROOF	Show Roof Penetration Holes	WHITE	Continuous	0.008"
22	M-ROOF-EFAN	Exhaust Fan Located On Roof	74	Continuous	0.008"
23	M-ROOF-EFAN-IDEN	EQPT Label For M-ROOF-EFAN	74	Continuous	0.004"
24	M-ROOF-EQPM	Barometric Relief Dampers, Misc.	YELLOW	Continuous	0.008"
25	M-ROOF-EQPM-IDEN	EQPT Label For M-ROOF-EQPM	231	Continuous	0.004"
26	M-ROOF-LDET-EFAN	Leak Detection EFAN on Roof	55	Continuous	0.008"
27	M-ROOF-LDET-EFAN-IDEN	EQPT for M-ROOF-LDET-EFAN	21	Continuous	0.004"
28	M-THER-120V	120 Volt Thermostat W/ Label	142	Continuous	0.004"
29	M-THER-24V	24 Volt Thermostat	YELLOW	Continuous	0.006"
30	M-THER-24V-IDEN	T-Stat Label for M-THER-24V	211	Continuous	0.004"

31	M-ANNO-KEYN	Keyed Notes in Plan	WHITE	Continuous	0.006"
32	M-ANNO-NOTE	Paper space Notes / Duct Sizes	YELLOW	Continuous	0.006"
33	M-COND-PIPE	Condensate Piping	YELLOW	Condensate2	0.002"
34	M-DETL-TAGS	Detail Call Outs In Plan	243	Continuous	0.004"
35	M-HVAC-EXHS	Exhaust Air Duct	74	Continuous	0.004"
36	M-HVAC-RETN	Return Air Duct	BLUE	Continuous	0.016"
37	M-HVAC-TAGS	Grille/Louver/Register Labels	CYAN	Continuous	0.004"
38	M-REFG-PIPE	Refrigerant Piping	RED	Refrigerant2	0.004"
39	M-VIEW-SCAL	Graphical Scale	YELLOW	Continuous	0.004"

Table 6

<b>REQUIRED LAYERS AND ITEMS FOR ELECTRICAL</b>					
<b>NO.</b>	<b>LAYER NAME</b>	<b>DESCRIPTION</b>	<b>COLOR</b>	<b>LINETYPE</b>	<b>LINEWT</b>
1	LAYER 0	Nothing Should Stay On This Layer			
2	DEFPOINTS	Do Not Use This Layer			
3	E-ANNO-REFR	Place X-REFS On This Layer Design Notes Non-Printing	WHITE	Continuous	DEFAULT
4	E-ANNO-NPLT	Layer / View ports	252	Continuous	0.012"
5	E-DATA-EQPM	Backboard/Voice Data Rack	YELLOW	Voice_Data	0.010"
6	E-DATA-JACK	Voice Data Outlets	41	Continuous	0.006"
7	E-EQPM-GDET	LPG Panel/Sirens/Sensors	41	Continuous	0.006"
8	E-EQPM-IDEN	Label for Switchgear & Consoles Lighting	241	Continuous	0.004"
9	E-LITE-FIXT	Fixtures/Exit/Emergency	CYAN	Continuous	0.008"
10	E-LITE-IDEN	Fixture Label for E-LITE Power Pole Symbols/ Gen Set / Transformer Label	241	Continuous	0.004"
11	E-POWR-CIRC	Emergency Generator w/ Pad	MAGENTA	Continuous	0.012"
12	E-POWR-GENR	Switchgear	83	Continuous	0.012"
13	E-POWR-PANL	Wall Outlets	GREEN	Continuous	0.014"
14	E-POWR-WALL	Irrigation Panel, Misc.	MAGENTA	Continuous	0.006"
15	E-SPCL-PANL	Pad Mounted Transformer	140	Continuous	0.008"
16	E-TRAN-PADM	Paper space Notes	74	Continuous	0.012"
17	E-ANNO-NOTE	Light Branch Circuits/Switches	YELLOW	Continuous	0.006"
18	E-LITE-CIRC	Lighting Keyed Notes	WHITE	Continuous	0.004"
19	E-LITE-KEYN	Feeders Entering and Leaving Bldg. Exterior Service	40	Continuous	0.006"
20	E-POWR-FEED	Gas Detection Circuits Keyed Notes and Plan Notes	21	U-Ground- Electric2	0.005"
21	E-POWR-GDET	Power Keyed Notes	52	Continuous	0.006"
22	E-POWR-KEYN	Detail Call Outs In Plan	60	Continuous	0.006"
23	E-POWR-TAGS	Keyed Notes For Enlarged Hub Room	75	Continuous	0.004"
24	E-TELE-KEYN	Graphical Scale	121	Continuous	0.006"
25	E-VIEW-SCAL		YELLOW	Continuous	0.004"

Table 7

## REQUIRED LAYERS AND ITEMS FOR PLUMBING

NO.	LAYER NAME	DESCRIPTION	COLOR	LINETYPE	LINEWT
1	LAYER 0	Nothing Should Stay On This Layer			
2	DEFPOINTS	Do Not Use This Layer			
3	P-ANNO-REFR	Place X-REFS On This Layer	WHITE	Continuous	DEFAULT
4	P-ANNO-NPLT	Design Notes Non-Printing Layer / View ports	252	Continuous	0.012"
5	P-ACCS-PANL	Access Panels	MAGENTA	Continuous	0.012"
6	P-CMPA-EQPM	Air Compressor and Oil Separator	YELLOW	Continuous	0.005"
7	P-CMPA-EQPM- IDEN	Equipment Label For P-CMPA- EQPM	43	Continuous	0.004"
8	P-CMPA-PIPE	Compressed Air Piping & Disconnects	MAGENTA	COMP_AIR2	0.002"
9	P-DOMW-CWS	Domestic Cold Water Supply	BLUE	D-Water_SupplyX2	0.006"
10	P-DOMW-EQPM	Water Boxes/ Washing Machine Box	YELLOW	Continuous	0.006"
11	P-DOMW-HWS	Domestic Hot Water Supply	RED	H-Water_SupplyX2	0.005"
12	P-FUEL-NGAS	Natural Gas Piping	RED	Nat_Gas	0.002"
13	P-PENE-ROOF	Show Roof Penetration Holes	WHITE	Continuous	0.008"
14	P-SANR-FLDR	Floor Sinks For Condensate	GREEN	Continuous	0.008"
15	P-SANR-SEWR	Sanitary Sewer Piping	GREEN	Continuous	0.008"
16	P-SANR-VENT	Sanitary Vent Piping	CYAN	Continuous	0.004"
17	P-WHTR	Water Heater	YELLOW	Center	0.008"
18	P-WHTR-IDEN	Water Heater Label for P-WHTR	31	Continuous	0.004"
19	P-ANNO-KEYN	Keyed Notes in Plan	WHITE	Continuous	0.006"
20	P-ANNO-NOTE	Paper space Notes/ Fixture Labels/ Flow Line Notes	YELLOW	Continuous	0.006"
21	P-ANNO-NPLT- RISR	Design Notes Non-Printing Layer	MAGENTA	Continuous	0.012"
22	P-DETL-TAGS	Detail Call Outs In Plan	243	Continuous	0.004"
23	P-RISER-CWS	Riser Cold Water Piping	BLUE	D-Water- SupplyX2	0.004"
24	P-RISER-HWS	Riser Hot Water Piping	RED	H-Water- SupplyX2	0.007"
25	P-RISER-NOTE	Riser Notes	YELLOW	Continuous	0.002"
26	P-RISER-SANR	Riser Sanitary Piping	GREEN	Continuous	0.007"
27	P-RISER-VENT	Riser Vent Piping	CYAN	Dashed2	0.004"
28	P-VIEW-SCAL	Graphical Scale	YELLOW	Continuous	0.004"