

# STRUCTURAL DESIGN CRITERIA

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# STRUCTURAL DESIGN CRITERIA

## I GENERAL

- A. The Design Professional shall use this document in conjunction with the Educational Specifications and District Master Specification (DMS) to develop the design and contract documents.
- B. Goals:
  - 1. Design the project to USGBC LEED for Schools Silver requirements; see USGBC LEED for Schools Recommendation List in the Architectural Criteria for point recommendations.
    - a. Coordinate with Architect – see Architectural Design Criteria for additional goals and documentation requirements.
    - b. The LEED Team shall exhibit to SDPBC PM that information specific to the section is represented accurately in the LEED for Schools certification process.
  - 2. Provide a safe, economical, and easy way to built school facilities under uniform criteria.
- C. This division contains requirements for the following elements.
  - 1. General Structural Requirements
  - 2. Threshold Buildings
  - 3. Load requirements
  - 4. Concrete
  - 5. Masonry
  - 6. Metals
- D. In this document, the term Engineer represents the professionally qualified Design Engineer of Record and/or Engineering Consultant, duly licensed in the State of Florida, that signs and seals project design documents.
- E. The Engineer is the person responsible for the design and development of all project documents.
- F. The Engineer must request, in advance and in writing, deviations from these Structural requirements.
  - 1. The SDPBC shall review the requested deviations; based on good engineering practices and/or economics, and either approve or deny the request in writing.
  - 2. Any approved deviations are valid only for the specific request.
- G. Design shall incorporate the latest editions of the following design requirements or code requirements.
  - 1. Florida Building Code (FBC)
  - 2. American Society of Civil Engineers (ASCE)
  - 3. American Concrete Institute (ACI)
  - 4. American Institute of Steel Construction (AISC)
  - 5. American Iron and Steel Institute (AISI)
  - 6. American Society for Testing and Materials (ASTM)
  - 7. American Welding Society (AWS)
  - 8. Applied Technology Council (ATC)
  - 9. Concrete Reinforcing Steel Institute (CRSI)
  - 10. Portland Cement Association (PCA)
  - 11. Pre-stressed Concrete Institute (PCI)
  - 12. Steel Deck Institute (SDI)
  - 13. Steel Joist Institute (SJI)
  - 14. Tilt-Up Concrete Association (TCA)
  - 15. List other documents
- H. Submittal requirements (plans, specification, and geotechnical report) as listed in procedure BD-001 Submission for Project Documents
- I. The Criteria is applicable to new construction and to the remodeling and renovation of existing facilities.

- J. The Criteria shall not limit or restrain the performance and liability of the professional or professionals responsible for the integrity and performance of the structure.
- K. The use of the Criteria in this document does not exempt the Design Professionals from any federal or state code or standards controlling the design and construction of any Facility.
- L. The Criteria establish the minimum structural standards that will govern the structural design, contractual documents, and construction of the SDPBC facilities.
- M. The drawings, specifications, and calculations shall contain all required information describing the proposed work in a clear and concise manner.

## II CRITERIA

### A. GENERAL STRUCTURAL REQUIREMENTS

1. Florida Registered Professional Engineer shall sign and seal all plans containing structural requirements.
2. Plans shall indicate building location and all floor elevations (NGVD) per SFWMD permit and the requirements of the District Design Criteria – Civil.
3. Submit signed and sealed engineer's geotechnical report in the project specification manual.
4. Design the structural systems and methods for ease and speed of erection, cost effectiveness, long life, minimum maintenance, maximum flexibility, and adaptation for future expansion.
5. Provide visual record of surrounding structure, both on and off site of the project in areas that affected by foundation system requiring excessive soil compaction.
  - a. Maintain record before, during, and after completion of work.
6. Design floors to minimize vibration effects and the transfer of noise between floors.
7. Design and provide expansion joints, control joints, construction joints, and isolation joints to prevent uncontrolled stress cracks in the structure and site work according to the latest engineering standards.
  - a. Use components designed for applicable locations and install according to manufacturer's requirements.
  - b. Show details for expansion joints on both architectural and structural documents.
  - c. Show details for other joints on the appropriate documents.
8. Floor slabs: Plans shall indicate all contraction, isolation, construction, and expansion joints for poured concrete on grade.
  - a. Space joints in accordance with good engineering practice, per ACI guidelines.
  - b. Longer side of a rectangular panel should not exceed more than 1½ times the smaller.
  - c. Provide additional joints as required to control cracking.
  - d. Provide a diamond shape construction joint around freestanding interior columns.
  - e. Call for contraction joints to be saw-cut to ¼ of the slab's depth minimum.
  - f. Provide diagonal reinforcement at re-entrant corners where contraction joints do not intersect at that corner.
  - g. Add protection against termites to the description of concrete floors on grade.
9. Exterior walls shall be masonry or concrete.
  - a. Engineered cold rolled metal stud framing systems of at least 20-gauge at exterior wall location, are accepted only on a per condition basis with prior SDPBC approval and in areas not subject to corrosive atmospheres.
  - b. Exception: Soffits may use cold rolled metal framing of adequate capacity to resist all gravity and wind loads, and code mandated load combinations.
10. Do not use paper backed gypsum board or plywood on the exterior of building behind stucco.
11. Cementations grout shall be non-metallic, non-corrosive, non-shrink, non-staining, and non-reactive with surrounding metals and substrates.
12. Use high-strength, expansion grout for the setting of base plates.
13. Use high-strength, expansion grout for the setting of railing posts.

14. Provide inserts, anchors, bolts, hangers, or other means to support equipment, pipes, ceilings, or other items suspended from structure.
  - a. The engineer shall verify the weight of all hanging loads.
15. Design roofs to resist ponding of water.
16. Coordinate the construction of transformer vaults with Electrical Requirements and current FPL Standards for Vault Design.
17. Roofs of EHPA's shall be cast-in-place minimum 4 inch normal weight concrete; (See exceptions FBC 423.25.4)
  - a. A liquid membrane system cannot be the sole waterproof protection; must use a built-up, or other approved system.
  - b. May use, as an alternate, structural pre-cast, pre-stressed concrete deck, minimum 4" thick or other Department of Education (DOE) approved system.
  - c. These roofs and roofing components must have adequate bearing, anchorage against wind uplift, diaphragm anchorage action, impact resistance, and resistance to rain based on the design loads expected on the system.
18. Provide calculations of major structural components conforming to the following:
  - a. Provide legible, organized, indexed, and collated calculations showing all of the load conditions considered and engineering assumptions made, including load reductions with code basis.
  - b. Calculations generated by a computer program shall include both the input and analysis/design as part of the output.
  - c. A Florida Professional Engineer shall sign and seal the calculations.

#### B. PILE CONSTRUCTION

1. Provide information supporting the need for piles.
2. Provide the design parameters for the piles and pile caps.
3. Provide visual record of surrounding structure, both on and off site of the project in areas affected by pile driving procedure.
  - a. Maintain record before, during, and after completion of the pile driving.
4. Provide construction specifications on the installation of the piles.
5. Provide inspection plan and verification method for the installation of the piles.

#### C. THRESHOLD BUILDINGS

1. Definition: "Threshold building" means any building which is greater than three stories or 50' in height, or which has an assembly occupancy classification as defined by the Florida Building Code that exceeds 5,000 SF in area and an occupant content of greater than 500 persons, or is an enhanced hurricane protection area.
2. Threshold Building plans shall contain a statement certifying that to the best of the Engineer's knowledge, the plans and specifications comply with the applicable minimum building codes.
3. The Engineer of record shall prepare a structural inspection plan, showing the proposed schedule and procedure for performing the inspection.
  - a. Note: The structural inspection plan shall provide specific inspection procedures to allow for adequately inspect during construction.
4. The project manual shall include the procedure for preparation and submittal following:
  - a. Certified shoring and re-shoring plans and details
  - b. The Shoring and Reshoring plans shall indicate the length of time that the shoring and reshoring shall remain in place.
  - c. Submit the Shoring and Reshoring plans to the SDPBC Building Department before beginning the structural portions of the job.
  - d. A specialty engineer registered in the State of Florida shall certify the shoring plan.
  - e. The specialty engineer shall inspect the installed shoring and reshoring prior to placing any concrete.

5. The Engineer shall review the Districts sample threshold plan and may use it as a base for development of a project specific plan.
6. A threshold plan is required with the construction plans submitted for a permit.

#### D. LOAD REQUIREMENTS

1. Provide a load matrix - live load, dead load, and total load for classrooms, corridors, media center, mechanical rooms, storage rooms, stairs, roofs, etc.
  - a. Dead loads shall include beams, slabs, M.E.P., partitions, ceilings, roofing, re-roofing, etc.
2. Provide a wind design matrix for the main force resisting system, window and door opening, components & cladding and a sketch of designated areas on the drawings.
3. The structural design for wind forces shall comply with requirements of ASCE-7 as referenced in the FBC; the building envelope shall maintain its integrity and protect the building contents.
  - a. Designer may use the Applied Technology Council Windspeed by Location charts and calculator; link; <http://www.atcouncil.org/windspeed/> Design all buildings and portions of buildings as “enclosed”, do not design for a “partially enclosed” structure.
  - b. All openings shall have a passive impact resistant system to meet the FBC requirements for opening protection in section 1609.1.2.
  - c. Pay special attention to louvered rooms such as mechanical rooms that will create an imbalance in the internal pressure. Depending on building geometry, this may require “internal” doors and walls designed for external pressures (compartmentalization).
4. Roof loads
  - a. Design all roofs for live load 20-psf. minimum, and in accordance with the FBC.
  - b. Design all roofs appropriately for any special loading situations such as rooftop equipment, penthouses, and other equipment supported by the roof structure, etc.
    - 1) Superimposed design dead loads on roofs shall be the actual dead loads of systems, roofing, MEP allowance, collateral load, etc plus 5-psf (allowance for re-roofing) or 25-psf for steel framed roofs, whichever is greater.
    - 2) For concrete roof assemblies, superimposed design dead loads on roofs shall be the actual dead loads of systems, roofing, MEP allowance, collateral load, etc plus 5-psf, (allowance for re-roofing), but not less than 15-psf.
  - c. Roof uplift designs and assembly shall comply with the design loads as determined by ASCE 7 using the criteria listed above.
5. Design interior partitions for minimum of a 5-psf lateral load.
6. Design stairs (steel or concrete) and their supports for a 100-psf minimum live load.
  - a. Design railings and guardrails in accordance with chapter 16 of the FBC.
  - b. Design the system for each load case and size members based on maximum stresses occurring in those members.
7. Design all exterior soffits and their supports for the appropriate wind positive and negative pressures due to wind load in conjunction with gravity loads.
8. All buildings and portions of buildings shall meet the impact requirements stated in the FBC Chapter 16 and section 423 (24) (d) as applicable.
9. Foundation and/or embedment length of lighting poles, flagpoles, and scoreboard poles, etc. shall resist loads per ASCE 7 and chapters 16 and 18 FBC
  - a. Provide details based on active pressure and passive resistance of soil.
  - b. Design flagpole foundations with two 3' x 5' flags in place.
10. Design mechanical equipment room dead load for the equipment scheduled for the room (equipment pad, air handlers, pipes, etc) with minimum load of 150 psf.

#### E. CONCRETE

1. General Design Criteria
  - a. All concrete members shall use a minimum of f'c 4,000 -psi, except as follows.
    - 1) Concrete slabs-on-grade designated as concrete pavement - f'c 3,000 psi

- 2) Architectural Precast Concrete - f'c 5,000 psi
- b. Lightweight concrete shall be at least 2" thick
- c. Form all surfaces to receive concrete.
  - 1) Earth forming of foundation work is not permitted for foundations or slabs-on-grade.
    - a) Exception: With the prior approval of the Building Official, the Engineer of record may specify earth forming based on the soil report and their professional evaluation.
      - (1) This requires the Engineer to inspect the work just before the placement of the concrete.
  - d. Lintels abutting cast-in-place columns shall also be cast-in-place.
  - e. Provide corner reinforcing at tie beam and footing intersections as required by the FBC.
    - 1) Detail structural beams per ACI standards and requirements.
  - f. Mix design for slabs on grade shall conform to recommendations in ACI 302.
    - 1) Consider the addition of a midrange water reducer into the mix design.
  - g. Consider the addition of a high range water reducer into the mix design for highly congested/reinforced spaces.
  - h. Exterior stairs are to be made of concrete, unless granted a variance.
- 2. Concrete Slab - Non-Sidewalk or Courtyard Paving
  - a. Provide the design strength of the concrete.
  - b. Minimum thickness 4"
  - c. Provide vapor barrier as specified in the District Master Specifications (10 mil) for slabs on grade.
  - d. Reinforce all concrete structural slabs with steel bars or welded wire fabric, synthetic fiber mesh not allowed.
  - e. Plans shall clearly indicate the location and size of all contraction, isolation, construction, and expansion joint in the slab(s). (See A.7 & A.8 of this document).
  - f. Slabs shall be flat and level to finish tolerance as specified in the District Master Specification.
  - g. Slabs under coolers and freezers shall two layers of concrete with a layer of rigid insulation between the two layers.
    - 1) Provide a thermal barrier between the freezer and cooler, the slabs and the other slabs.
    - 2) Exception, if cooler/freezer units used have a built in thermo barrier (provide equipment specifications)
  - h. Do not place electrical conduits in elevated concrete slabs.
    - 1) Exception: they do not interfere with the reinforcing steel, have adequate coverage, and approved by the Structural Engineer of Record.
- 3. Concrete Slab – Sidewalk and Courtyard Paving
  - a. Minimum thickness 4"
  - b. Minimum thickness in vehicle access area is 6"
  - c. Designer may use synthetic fiber reinforcement to control shrinkage and thermal cracking in nonstructural concrete (plain concrete) slabs on grade.
    - 1) Do not use to replace any required steel reinforcement.
  - d. Provide minimum 4-mil vapor barrier under sidewalk slabs greater than 6' wide, to control dehydration during curing.
  - e. Plans shall clearly indicate the location and size of all contraction, isolation, construction, and expansion joint in the slab(s), (see A.7 & A.8 of this document).
- 4. Concrete Reinforcing
  - a. Specify size, grade, and location of steel reinforcing in concrete.
  - b. Specify the minimum concrete coverage of reinforcing steel.
  - c. Specify the splice and lap splice length of all reinforcing.
  - d. Minimum column tie sizes are:

- 1) #3 for column bars #10 and smaller
- 2) #4 for column bars #11-#18
- e. Minimum tie spacing is the least of 16 bar diameters, 48 tie diameters, or the least dimension of the column.
- f. Intermediate ties shall be within 6 inches of vertical bar support with tie.
- g. Tie beams shall have minimum stirrups of #3 @ 24" o.c.
5. Pre-Stressed Concrete Joists with a Composite Slab Construction:
  - a. Recommend this system for second floor structures.
  - b. Composite slabs shall be thick enough to allow for any in-slab conduit or similar items to have the proper coverage, without displacing reinforcing steel.
  - c. Provide reinforcing in composite slab in both directions as per ACI requirements.
  - d. Do not support concrete joist on masonry wall, provide concrete tie beam on masonry wall.
  - e. Maximum tensile stress at service loads shall not exceed  $6 \sqrt{f'c}$  in pre-compressed tensile zone.
  - f. The Specialty Engineer shall sign, date, and seal the pre-stressed concrete joists shop drawings.
6. Tilt-Up and Pre-Cast Concrete Construction
  - a. Provide anchorage at base of concrete tilt-up panels to concrete slab-on grade or foundation in the form of cast-in-place steel reinforcing bars or welded embedded anchor plates.
    - 1) Design embedded anchor plate assemblies to provide protection from corrosion for the life of the structure.
    - 2) Slab-on-grade welded wire fabric is not acceptable as the medium of anchorage to tilt-up panels.
  - b. Conform to ACI 551 (Tilt-Up Concrete Structures) and ACI 533 (Guide for Pre-cast Concrete Wall Panels) as applicable.
  - c. The Specialty Engineer shall sign, date, and seal the tilt-up shop drawings.
  - d. Coordinate with Architect and requirements in the DDC- Architectural.
  - e. Seal exterior tilt-wall joints inside and outside.
  - f. Provide lap joints at the edges of the panel to resist the passage of water.
  - g. Provide reveal on jambs and head of all window openings to accept window units with off-set flanges, coordinate with Architect.
  - h. Provide for Precast sill or form for sill profile as indicated in 08 51 13 of the DMS.
  - i. Avoid the use of 45-degree angles on exterior corner joints, Architect must provide written request and details on how to make and install panels with the 45-degree corners.
  - j. Check the weight of tilt-wall panels; recommend maximum weight of 40 tons per panel.

## F. MASONRY

1. General Design Criteria
  - a. The tie-beam/tie-column construction method as defined in the FBC is acceptable.
    - 1) Tie beam/tie-column must satisfy all design loads imposed upon them by gravity and/or wind.
    - 2) Do not mix tie-beam/tie-column construction and reinforced masonry construction in the same building.
  - b. Concrete masonry units in a fire-resistive assembly do not cut or channel in a way to reduce the assembly's fire resistance rating.
  - c. Structures designed using reinforced masonry shall conform to the FBC and ACI 530/530.1.
    - 1) This pertains to structurally designed masonry construction reinforced, partially reinforced, or non-reinforced.
  - d. The maximum spacing of vertical reinforcing in masonry walls, that support axial loads in addition to their own weight shall be 4'-0" o.c.
  - e. Do not use reinforced masonry columns for point loads in excess of 20,000 lbs. (use a poured concrete column or steel columns).

- f. Do not place 2 layers of reinforcing in a single cell of an 8" wide masonry wall.
    - 1) Use a thicker wall, stagger the reinforcing, or provide another method to limit the number of bars in a single cell of an 8" wall.
  - g. Provide lateral support for block walls, both vertical and horizontal.
    - 1) The vertical heights of masonry between horizontal supports shall be in accordance with the wall lateral support requirements as per the FBC, Table 2107.1.
  - h. Footings supporting more than 10' of bearing block wall shall be a stem wall footing.
  - i. Show on structural plans details and location of expansion joints in masonry walls.
    - 1) Space expansion joints at three times the height or 50'.
    - 2) Expansion joints do not go through tie beams
  - j. Use ladder type reinforcing in masonry walls
  - k. Extend masonry wall dowels 48 diameters above the finished floor.
  - l. Grout masonry below grade solid.
  - m. Non-bearing interior walls shall have minimum 1" spacing between top of wall and underside of slab for deflection.
    - 1) If fire rated wall, detail how to maintain fire rating and prevent sound transfer.
    - 2) If non-fire rated wall, detail how to prevent sound transfer.
  - n. Label all four-hour fire rated walls, detail their construction, and coordinate with the Architect.
2. Glass Block
- a. Designer may use glass block in limited applications.
  - b. Glass block at exterior wall locations shall be solid glass block.
  - c. Glass block at interior locations shall have a wall thickness of at least 3".
  - d. Glass block walls shall be limited in square footage based on area/load table listed in ACI 530 Chapter 7.
  - e. Set glass block in 16-gauge minimum steel frames.

## G. METALS

1. General Design Criteria
- a. Engineered cold rolled metal studs, joist, or framing, if allowed shall be at least 20-gauge galvanized G90.
  - b. Exception lightweight metal studs used for interior partitions shall be spaced 16" on center, minimum 22 gauge galvanizing G40 for interior and G60 when adjacent to (in direct contact) masonry or concrete.
    - 1) Provide minimum of two 18-gauge studs tied together with straps adjacent to interior doors and windows of steel framed walls.
  - c. Limit the use of products made of aluminum, aluminized, or otherwise treated with aluminum to a significant extent on the facility's grounds or at the exterior building perimeter unless accepted by SBBC on a per condition basis.
  - d. Specify isolation coatings where dissimilar metals are in contact or where aluminum is in contact with concrete or lime surfaces.
  - e. DO NOT use lead-based paints or primers.
  - f. Specify a coat of rust preventative touch-up paint applied to all damaged surfaces of steel members, joists, and metal decking.
    - 1) In non-exposed areas, the touch up coat shall be of a different color from the shop coat.
    - 2) Use a zinc-rich galvanizing paint for galvanized members and connections.
  - g. The SDPBC discourages the use of standing seam metal roofs.
  - h. Detail structural steel connections or provide the design load (shears and moments) and specify that a Specialty Engineer is designing them.
  - i. Protect all structural or miscellaneous steel exposed to earth or weather from corrosion with hot dipped galvanization or other approved method.

- 1) Steel encased in concrete or to receive spray-on-fireproofing does not require a primer coat.
- 2) All other steel shall receive a primer applied at the shop.
- j. For metal-framed components or assemblies, the structural drawings shall clearly detail the entire component or assembly including all members and connections.
  - 1) In lieu of showing the complete design, the designer shall modify the appropriate specification sections and put the Engineering and Shop Drawing requirements in those sections.
  - 2) Clearly identify and specify all areas delegated to the Contractor's Engineer on the drawings as requiring a Specialty Engineer.
  - 3) The designer shall review and approve the Shop Drawings.
  - 4) Specialty design engineer will sign and seal all plans and calculations.
2. Structural Steel and Other Metals
  - a. Provide design grade of structural steel.
  - b. Provide with camber where applicable to eliminate or minimize deflection due to design loads, do not exceed allowable deflections as stated in the FBC, Table 1601.1, and the following:
    - 1) Camber for structural steel members shall not exceed  $L/240$  or 2" maximum.
  - c. Structural Steel shall be fire-protected UL steel assembly rating provided to comply with applicable fire-resistive requirements.
  - d. Single fastener connections are not allowed.
3. Steel Joists
  - a. Add a note "Joists shall not be fabricated using electrical resistance welding".
  - b. Steel joist and joist girder shop drawings are to include but are not be limited to the erection and fabrication plans.
    - 1) Submit calculations to the Building Department - signed, dated, and sealed by a State of Florida Professional Engineer.
  - c. Indicate typical joist connection per SJI standards but not less than the minimum required to resist all combined live and dead loads or uplift loads (whichever is greater).
    - 1) Indicate the minimum length of bearing and bearing condition of joist.
  - d. In joists subject to uplift, add continuous bottom bridging at the first interior bottom panel point.
  - e. Supports shall provide an anchored stabilizer plate for joist girders and tie joists (as required).
  - f. Provide joists with camber to eliminate or minimize deflection due to design loads.
  - g. Steel joists shall bear on steel bearing plates embedded in concrete construction.
  - h. In steel construction, steel joists shall bear on the top flange of steel beams or girders.
  - i. Fire ratings of steel assemblies shall comply with applicable fire-resistive requirements.
  - j. Steel joists maybe used in the framing of the floors above grade with the following conditions:
    - 1) The deflection of the members is limited to a total load span /360.
    - 2) The system uses AISC 11 Steel Design Guide Series to limit detectable vibration of the floor system.
4. Metal Deck:
  - a. Roofs with metal decks provide an angle or other structural element around the perimeter of building to connect the deck to, both parallel and perpendicular to joist bearing.
    - 1) Connections of metal deck around the perimeter shall be as required to resist the required diaphragm and uplift loads, but not more than 12" apart.
  - b. Provide a welding pattern for metal deck.
  - c. Call out connectors and connection spacing of metal deck to supporting framing.
  - d. Do not use vented metal deck beneath a dry system roof deck.
  - e. All metal deck shall be galvanized G-90.
  - f. Metal deck supporting roof loads shall not be less than 22-gauge.
5. Steel Trusses

- a. Factory build light gauge metal trusses manufactured similar to American Truss & Framing Co. or equal are acceptable structural steel trusses are preferred.
  - 1) Light gauge metal trusses manufactured from lightweight steel studs are not acceptable.
- b. Specify bolting or welding trusses to supports.
- c. Indicate all required bracing, both temporary and permanent.
- d. Connect all hanging loads supported by trusses at the panel points, at the top chord.
  - 1) The load will not exceed the moment allowed in the design load schedule for the MEP loads.
  - 2) The Engineer may design the joist to allow supporting items from the bottom chord.
    - a) The plans and specifications must clearly identify what the engineer is allowing.

#### H. ALUMINUM COVERED WALKWAYS

- 1. Specify isolation coating where dissimilar metals are in contact with each other or where aluminum is in contact with concrete or masonry.
- 2. Provide structural calculation.
- 3. Florida Professional Engineer shall sign and seal plans and calculation submitted to the Building Department.
- 4. Provide minimum 2' set back from the curb of a traffic lane to any column or beam.
- 5. Covered walkways extending over roads will have a minimum clear height of 12' (road gutter to underside of beams).
- 6. Covered walkways shall have Solar Reflective Index (SRI) Values meeting LEED for Schools Sustainable Sites Credit 7.2 Heat Island Effect Roof.

#### I. MISCELLANEOUS

- 1. Indicate on plans the length (height above grade minimum 100'), the diameter, and embedment depth (minimum 20') of the ITV antenna mast into the pole
  - a. Coordinate the required height with SDPBC TEN-Department.
  - b. If the antenna mast is in two sections, indicate how to connect the two sections to prevent their separation during high winds.
  - c. Provide embedded ladder rungs on the face behind the antenna with the first rung starting at 20' above the ground.
- 2. Specify anchorage of handrails and guardrails so they comply with the code requirements.

END OF SECTION