

# PRE-CHECK (PC) DESIGN CRITERIA FOR PRECAST CONCRETE BUILDINGS: 2019 CBC

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**Disciplines:** All

**History:** Issued 04/16/20

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Division of the State Architect (DSA) documents referenced within this publication are available on the [DSA Forms](#) or [DSA Publications](#) webpages.

**PURPOSE:** This Interpretation of Regulations (IR) clarifies requirements relating to pre-check (PC) submittals to promote uniform statewide criteria for code compliance in design and in plan review of precast concrete buildings for projects under DSA jurisdiction. The PC Design Criteria documents were created by DSA as a means for the responsible engineer to demonstrate code compliance when developing and submitting construction documents for DSA review.

The provisions of this IR are intended to be a tool to identify and highlight the common and unique, critical and/or overlooked code requirements that must be considered and incorporated into the design, as applicable, to provide a complete and consistent set of construction documents accepted at all DSA regional offices. Other methods proposed by design professionals to solve a particular issue may be considered by DSA and reviewed for code and regulation compliance, subject to concurrence of DSA Codes and Standards Unit. For methods not specifically prescribed in the code, see California Building Code (CBC) Section 104.11.

Appendix A is provided as a guide to assist design professionals and DSA plan reviewers when preparing and reviewing site-specific project applications that incorporate PC precast concrete buildings designed in accordance with this IR.

**SCOPE:** The provisions of this IR apply to 2019 PC plans for new buildings utilizing precast concrete wall panels submitted to DSA under the 2019 CBC after January 1, 2020. This document does not address, modular buildings, relocatable buildings, nor modular elevator towers.

As noted in *BU 18-01: Applicability of Pre-Check (PC) Design Criteria for Non-PC Projects*, these provisions shall also be considered and incorporated in site-specific submittals for structures of the same project type, even if the submittal is not part of a PC application.

**BACKGROUND:** The PC approval process is intended to streamline DSA plan review by providing a procedure for approving the design of commonly used structures prior to the submittal of plans to DSA for construction projects. PC approval process allows designers to incorporate designs for structures that have already been “prechecked” by DSA into their plans for actual site-specific construction projects. The design criteria provided in this document are neither regulations nor law and are not appropriate for verbatim inclusion in project specifications. The design professional in responsible charge is responsible for specifying and detailing requirements for each project. Additional information regarding the design and site application of PC structures can be found in the following documents:

- Procedure *PR 07-01: Pre-Check Approval*
- Policy *PL 07-02: Over-the-Counter Review of Projects Using Pre-Check Approved Designs*

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**PRE-CHECK (PC) DESIGN CRITERIA FOR PRECAST CONCRETE BUILDINGS:  
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- 1.1 Pre-Check Approval Requirements:** See PR 07-01 for a more detailed list of items that are required for all PC submittals (e.g., design information on coversheet, example form *DSA 103: List of Required Structural Tests and Special Inspections* on the drawings, PC sheet index, etc.). The documents required to be submitted for PC approval are listed on form *DSA 3: Project Submittal Checklist*. Site-specific information is not necessary, as that information will be provided when a specific construction project is submitted for DSA review.
- 1.2 Design Information on Coversheet:** See PR 07-01 Section 2.4 and Appendices B & C. Indicate snow and ice loads allowed. Note 0 pounds per square foot (psf) if not used in design.
- 1.3 Structural Tests and Special Inspections:** Provide example form(s) DSA-103 on the drawings. Example form DSA 103 will be used as a guide to develop a site-specific form DSA-103 for the site-specific project. Example forms on the PC drawings will be crossed out when the site-specific form DSA-103 is provided during plan review. See PR 07-01 Section 2.5.
- 1.3.1** A qualified representative of Laboratory of Record (LOR) or approved Special Inspector shall verify all steel identification per CBC Section 2202A.1 and *IR 17-3: Structural Welding Inspection*, Section 3.2.3
- 1.3.2** Only the site-specific form DSA 103 can incorporate exemptions from the required structural tests and special inspections in accordance with the Appendix of form DSA 103. Applicability and consideration of exemptions may be discussed during plan review for site-specific applications and shall be justified by the applicable project design professional for DSA review and approval. Refer to Appendix A for additional information.
- 1.4 Options and Variations:** Provide checkboxes of options and variations if there is more than one configuration or design load criteria. See PR 07-01 Section 3 for more details, including the maximum number of options permitted in a single PC.
- 1.5 Design Parameters:** Provide on the coversheet (and subsequent sheets as necessary) Design Information as defined in PR 07-01 Section 2.4 and Appendix B. If the PC includes design variations for multiple tiers or levels of the same design parameter(s), all or part of the Design Information should be presented in a checklist format and provide general direction to future users (design professionals and plan reviewers) for the application of the PC to site-specific projects. Additionally, refer to and coordinate with PL 07-02 Section 3, which summarizes common site specific parameters to be verified at Over-the-Counter (OTC) plan reviews.
- 1.6 Risk Category and Occupant Load:** PC drawings must indicate the maximum Risk Category (RC) and Occupant Load the structure is designed for in the Design Information section on the coversheet. In addition, the Design Information section shall require the intended Use and Occupancy be specified on the site application drawings. This information is necessary for the DSA reviewer to verify the RC of the PC structure as it applies to the site in accordance with CBC Section 1604A.5.
- 1.7 Flood Zone:** Design shall comply with CBC Section 1612A and procedure *PR 14-01: Flood Design and Project Submittal Requirements*.

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- 1.7.1 The Design Information section of the PC drawings shall include a note requiring the building pad be raised above the design flood elevation. See PL 07-02 section 4.9 for additional information.
- 1.7.2 Location of electrical elements shall conform to American Society of Civil Engineers (ASCE) 24 Section 7.2 as required per PR 14-01 Section 1.2.1.
- 1.8 **Geohazard Report:** Provide a note in the Design Information section indicating that submittal to and approval of a geohazard report by the California Geological Survey (CGS) is required. See *IR A-4: Geohazard Report Requirements*.
- 1.9 **PC Sheet Index:** Provide a PC sheet index. See PR 07-01 Appendix E.
- 1.10 **DSA ID Stamp and PC Stamp:** Provide 2019 CBC PC Stamp per PR 07-01 Section 6.1.  
  
Provide two blank areas on each PC sheet title block as indicated in procedure *PR 18-04: Electronic Plan Review for Design Professionals of Record Using Bluebeam*, Section 1.2.2.2: one for the PC ID stamp and one for the future site-specific DSA Identification Stamp. See *PL 18-02: Record Sets of DSA-Approved Construction Documents*.
- 1.11 **Structural Products Acceptance:** All structural products shall meet the requirements set forth in *IR A-5: Acceptance of Products, Materials, and Evaluation Reports*. Code-based engineering calculations to support a manufactured product will be considered.
- 1.12 **Utility and Service Lines:** Per ASCE 7 Section 13.6.9 all cables or flexible conduit across separation joints shall be designed to accommodate, without rupture or distress, differential movements from design displacements between cable connection points. PC drawings must indicate the maximum drift demand for each building option in the Design Information section of the coversheet.
- 1.13 **CALGreen/Energy Code Requirements:** PC designs for precast concrete buildings must comply with the mandatory measures of the California Green Code (CALGreen) and the California Energy Code (Energy Code). Plans must show the primary exterior entries are protected from water intrusion by adding a recessed door, awning, or roof overhang at least 4 feet in depth in addition to using nonabsorbent floor and wall finishes within 2 feet around and perpendicular to such openings in accordance with CALGreen Section 5.407.2.2. For a more detailed list of CALGreen/Energy items that are required for all PC submittals refer to PR 07-01, procedure *PR 18-02: Pre-Check (PC) Permanent Modular or Relocatable Building Designs CALGreen/Energy Code Compliance Review*, and form *DSA 403-PC: CALGreen and Energy Code-Compliance Checklist for Pre-Checked (PC) Permanent and Modular Relocatable Building Designs*.
- 1.14 **Test Loads for Post-Installed Anchors:** Refer to CBC Section 1910A.5 for load testing criteria. Specify installation torque loads for expansion and screw anchors and tension test loads for adhesive anchors on plans.
- 2. **GRAVITY LOAD DESIGN:**
  - 2.1 **Ponding Loads:** Roof configurations that allow for ponding are to be properly drained with primary and secondary drain systems, and roof framing design to account for any ponding buildup in event of primary drain blockage. Refer to ASCE 7 Chapter 8 and CBC Sections 1502 and 1611A.
  - 2.2 **Solar Zone on Solar Ready Roof:** Refer to PR 18-02 and CBC Sections 1603A.1.8.1 and 1607A.13.5.

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- 2.2.1** Where portions of the roof are designated as solar zones, the building design loads (dead load, roof live load, any superimposed load for future solar components, etc.) for the solar zone shall be clearly indicated on the construction documents. Include information to define the effective seismic weight considered in the structural design. The selection of the superimposed design loads for future solar components are solely at the discretion of the design professional and DSA will not mandate any additional prescribed minimum load.
- 2.2.2** Provide a note in the Design Information section of the PC drawings indicating that future solar installation will require a separate DSA application.
- 2.3 Equipment Locations and Weights:** The roof plans shall show the allowed locations and weights of mechanical equipment, coordinated with the mechanical plans.
- 2.4 Roof Dead Loads:** Per CBC Section 1606A.3 the design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof is permitted to be applied over the original roofing without its removal.
- 2.5 Floor Live Load and Roof Snow Load Posting:** Refer to CBC Section 106.1 for signage requirements. Signs for load postings shall be posted in public view.
- 2.6 Snow Load:**
- 2.6.1** Effective seismic weight shall include snow load per ASCE 7 Section 12.7.2.
- 2.6.2** If the structure is designed for snow load, the Design Information section of the PC drawings shall include a note the same as or similar to the following: "Site application design professional and DSA plan reviewer shall verify the structure to be located at least xx feet from any adjacent higher structure" where the distance "xx" is calculated and stated by the PC applicant. See ASCE 7 Section 7.7. If the horizontal separation from a higher structure is less than 20-ft and six times the vertical dimension separating the roofs, snow drift analysis shall be provided by the PC applicant, and the project is not eligible for OTC submittal.
- 2.7 Diagonal Bracing to CFS Roof or Floor Framing:** When diagonal bracing (for ceilings, piping, etc.) perpendicular to the purlin span direction is attached to the bottom flange or web of the framing member, justify framing and load path for transfer of loads to the diaphragm for the horizontal load, or provide blocking between at least two purlins. Design shall account for any horizontal loads imposed on purlin.
- 2.8 Canopies:** If canopies are part of the PC design, the load path to the building shall be coordinated. The allowed locations or options of canopies shall be indicated on the PC drawings. Partial plans must show any added roof framing or bracing required where canopies frame to the side of a wall. Wall panel design shall account for all loads imposed by the canopy.
- 2.9 Floor and Roof Framing Connections to Panels:** Long spans and/or heavy loads may result in large loads on the embedded connection, require several anchors to the panel, and/or require close coordination of the embedded plate with the rebar to avoid conflicts in construction and field problems. Design anchorage to wall panels per the American Concrete Institute (ACI) 318 Chapter 17 except where rebar dowels are used for the anchorage. Anchorage shall account for combined gravity and lateral loads: See Section 3.5 below.

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**PRE-CHECK (PC) DESIGN CRITERIA FOR PRECAST CONCRETE BUILDINGS:  
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**3.1.1 Maximum Seismic Force:** If the design is based upon the maximum  $S_S$  value for the state of California (ASCE 7-16 data), the PC can be used at any site in the state. Other  $S_S$  values are permitted but will limit the applicable site locations for the PC.

**3.1.2 Ground Motion Hazard Analysis:** Due to the site-specific ground motion analysis requirements of ASCE 7 Section 11.4.8, PC designs shall be based on the short period seismic response parameter  $S_{DS}$  and ASCE 7 Equations 12.8-2 and 12.8-5. Where a PC design is provided for Site Class E, the short-period site coefficient as required by ASCE 7 Section 11.4.8 Exception 1 shall be used. Alternatively, if the PC design is not based on the short period seismic response parameter  $S_{DS}$ , the PC design shall comply with the requirements of ASCE 7 Section 11.4.8, and the Design Information section shall state the fundamental period of the structure(s) and include notes alerting the site-specific user of the PC to the conditions requiring a site-specific ground motion hazard analysis.

**3.1.3 Maximum  $S_{DS}$  Value in Determination of  $C_s$  and  $E_v$ :** The base shear is permitted to be calculated using a cap on the maximum design spectral response acceleration parameter value of  $S_{DS}$  in accordance with ASCE 7 Section 12.8.1.3, provided that *all* of the noted criteria are met.

**3.1.3.1** The PC design shall demonstrate compliance with the required criteria specific to the precast concrete building structure: e.g., no irregularities, period not exceeding 0.5 seconds, redundancy factor equal to 1.0, etc. The PC drawings shall list these properties in the Design Information section. For the purpose of checking compliance with these criteria, the period shall be determined based on the actual properties of the structure, including foundation flexibility, and not use the approximate period in ASCE 7 Section 12.8.2.1.

**3.1.3.2** The Design Information section of the PC drawings shall also contain a note stating the site specific limitations of the design based on the  $S_{DS}$  cap and requiring these be verified by the site-specific project applicant: e.g. Site Class E or F not allowed, RC I or II, etc.

**3.1.3.3** Per PR 07-01 Appendix C, if a capped value of  $S_{DS}$  is used to determine  $C_s$ , the Design Information section of the coversheet shall list the  $S_{DS}$  (cap) used to determine  $C_s$  as well as the  $S_{DS}$  (no cap) used for verification of site-specific application and to determine other parameters such as non-structural component anchorage.

**3.2 In-Plane Relative Panel Rigidities:** Mathematical model shall represent actual panel to panel interconnection, panel to base connection, and floor and roof deck stiffness values. The effect of the connections made between panel joints shall be considered in evaluating the rigidity of a line of panels. A stiffness analysis shall be performed, complying with ASCE 7 Section 12.7.3. See Section 4.5.6 of the Precast/Prestressed Concrete Institute (PCI) Design Handbook 7<sup>th</sup> Edition for guidance.

**3.3 Torsional Irregularity:** Check for torsional irregularity with a rigid or semi-rigid diaphragm. See ASCE 7 Table 12.3-1. Extreme torsional irregularity is not permitted per CBC Section 1617A.1.19 (ASCE7 section 12.3.3.1) unless the exception based on the diaphragm type, diaphragm aspect ratio, and maximum story drift limitations of that section are met.

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- 3.4 Structural Walls, In-Plane Design:** See ACI 318 Section 18.5 and 18.11 for Intermediate precast structural walls and Special precast structural walls respectively.
- 3.4.1** Wall Piers: Design shall comply with ACI 318 Section 18.10.8. See ACI 318 Section 18.10.8.2 for horizontal reinforcement required above and below openings.
- 3.4.2** Boundary Elements: Design shall comply with ACI 318 Section 18.10.6.
- 3.4.3** Verify there is sufficient space and clearance at the connection to the foundation for the reinforcement from the weld plate or other hold down detail to lap with the vertical reinforcement, particularly where boundary elements are required.
- 3.4.4** Coupling Beams: For special structural walls with openings, comply with ACI 318 Section 18.10.7 to determine if and where coupling beam design is required.
- 3.4.5** Effect of Openings: Forces in-plane of panels with relatively large openings or multiple openings can cause frame-like action. Check piers and lintels for shear and moment. See ACI 318 Section 18.10.8 and commentary R18.10.8 regarding piers. See section 18.10.4 regarding shear strength.
- 3.4.6** Effect of “Knock-Outs”: “Knock-outs” (optional pre-determined openings that may be used in future) create multiple configurations of rigidities and in-plane load distributions. All possible configurations must be accounted for in analysis.
- 3.4.7** Special Structural Walls: Design shall comply with ACI 318 Sections 18.10 and 18.11, and CBC Sections 1905A.1.10 and 1905A.1.11. System design parameters shall be per ASCE 7 Table 12.2-1 Item A.1.
- 3.5 Structural Walls, Out-of-Plane Design:** The path of vertical and lateral loads must be considered in the wall design. Design for out-of-plane forces tributary to separate panels or panel elements.
- 3.5.1** Out-of-plane seismic forces shall be as required by ASCE 7 Section 12.11 and CBC Section 1604A.8.2.
- 3.5.2** Comply with ACI 318 Chapter 11 for wall design including section 11.8 for slender wall design.
- 3.5.3** See the Structural Engineers Association of California (SEAOC) 2015 Seismic Design Manual Volume 2, Example 5 for additional information.
- 3.5.4** Effect of Openings: See Chapter 7 of ACI 551.2R.
- 3.5.5** Pilasters: The path of vertical and lateral loads must be considered in the wall design. See ACI 551.2R for guidance on out-of-plane design of pilasters.
- 3.5.6** Anchorage to Diaphragms: Evaluate the load path in the detail, the assumptions made, and the statics to verify anchorage forces. Design connection for combined gravity loads and out-of-plane wall anchorage forces. The seismic anchorage force per ASCE 7 Section 12.11.2.1 need not be increased by the overstrength factor as permitted by CBC Section 1905A.1.8 Exception.
- 3.5.7** Anchorage force shall be increased for steel elements (not anchors) per ASCE 7 Section 12.11.2.2.
- 3.5.8** Roof Diaphragm Design: Sub-diaphragm and continuity ties transferring wall anchorage forces shall comply with ASCE 7, Section 12.11.2.2.

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- 3.5.9** Steel Roof Deck: Bare steel deck can serve as a continuous tie only in the span direction (i.e. parallel to flutes). ASCE 7 Section 12.11.2.2.4 does not permit the deck to be used as a continuous tie for wall anchorage perpendicular to the flutes. Design of the deck must meet the American Iron and Steel Institute (AISI) S100 for combined axial and bending forces, and the design of welds shall include combined forces where applicable.
- 3.6** **Interface of Roofs with Different Elevations:** Check for effects of low to high roof transitions and effects on load paths, and deformation compatibility.
- 3.7** **Collector Connections:** Design collector connections for loads complying with ASCE 7 Section 12.10.2.1 in combination with gravity loads. At beam connections to panels verify adequate connection to reinforcing in panel.
- 3.8** **Panel to Panel Connections:** Connection design must satisfy ductility requirements of CBC Section 1905A.1.10. Refer to Federal Emergency Management Agency (FEMA) P-751 document Chapter 8. Specifically, the design example in Section 8.3.5 illustrates a possible approach for satisfying the  $1.5 S_y$  and 80 percent of design strength requirements.
- 3.9** **Other Members:** Members not designated as part of the seismic force resisting system shall comply with ACI 318 Section 18.14.
- 3.10** **Seismic Separation Between Buildings:** The minimum seismic separation shall be determined in accordance with ASCE 7 Section 12.12.3. PC drawings must indicate the maximum lateral displacement demand for each building option in the Design Information section of the coversheet for use by the site-specific project applicant in correctly locating the building on the project site relative to existing and other new buildings.
- 4. LATERAL LOAD DESIGN – WIND:**
- 4.1** **Metal Roof Panel System:** Connection details and pattern/spacing for metal roofs shall be shown on the PC drawings. A manufacturer, product, and basis of approval for the metal roof and fastener parts/layout shall be specified. Metal roof panels shall comply with CBC Sections 1507.4 and 1504.3.2, or the exception in CBC Section 1504.3.2 which allows the use of AISI S100.
- 4.1.1** The wind load demand and uplift resistance provided by the panels and their connections shall be determined by a California registered Structural Engineer.
- 4.1.2** Substantiating fastener test data in accordance with American Society for Testing and Materials (ASTM) E1592 or Underwriters Laboratories (UL) 580 by an independent accredited lab shall be submitted per CBC Section 1504.3.2. If the exception in CBC Section 1504.3.2 is used, then test data shall be in accordance with AISI S100 Section I6.3 and AISI S906 (which references ASTM E1592).
- 4.1.3** Allowable uplift resistance shall be based on a minimum factor of safety of 2 applied to the highest uplift pressure. If the exception in CBC Section 1504.3.2 is used, then the allowable uplift resistance shall be per AISI S100 Section D6.2.
- 4.1.4** The PC drawings shall fully detail the panel clips' spacing and fasteners, metal material specification, panel profile, thickness, etc.
- 4.1.5** The underlayment, flashing, and other waterproofing shall be fully detailed on the PC drawings and shall comply with CBC Chapter 15.

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- 4.1.6** The interpretations noted above do not preclude the project from meeting the other requirements in CBC Chapter 15 (fire classification, insulation, etc.).
- 4.2 Wind Loads on Roof Framing:** Check roof framing for combinations with reduced dead load combined with wind uplift. For conditions where joists, trusses, girders, beams or purlins are subject to compression or net uplift, the bottom chord/flange shall be braced or justified by calculation as not requiring bracing. Similarly, where exterior wall bracing imparts a horizontal reaction from wind loads on the bottom flange or chord provide bracing or justification by calculation. In addition, member end connections shall be checked for wind uplift where occurs.
- 4.3 Wind Load on Wall Panels:** Determine whether wind loads governs over seismic loads at each critical location and load combination, including wall corner wind zone 5.
- 5. DETAILS:**
- 5.1 Embedded Items and Reinforcement:** Design details to coordinate closely spaced and/or large size reinforcement, ties, plates, welded studs, and other embedded items to avoid conflict at congested locations. Room is needed at connections for the reinforcement from or around the connection or weld plate or other details to lap with and fit in between the panel reinforcement.
- 5.2 Wall Rebar Dowel Connections:** Design shear friction dowels to tie to concrete slab in accordance with ACI 318 Section 22.9. Out of plane wall anchorage forces need not be amplified by the overstrength factor ( $\Omega_0$ ) as permitted by CBC Section 1905A.1.8 Exception.
- 5.3 Panel to Panel Corner Connections:** Anchorage forces often are transferred panel-to-panel at corners. It is recommended to allow for small vertical movements to reduce cracking and avoid damage to the connection.
- 5.4 Roof or Floor Ledgers and Connections:** Continuous ledgers, if used as chords with ties between panels, will commonly need some type of allowance for horizontal in-plane slip near the panel ends for temperature and shrinkage. See also Section 5.6 below.
- 5.5 Manufactured Connection Hardware:** For load combinations with seismic loads, design capacity values shall be 80 percent of the manufacturer's listed values per IR A-5, unless cyclically tested.
- 5.6 Shortening of Panels and Design of Connections Between Panels:** Comply with ACI 318 Sections 4.3 and 5.2. Shortening over a long line of panels could lead to build up of forces and to cracking around the connections spanning the gap between adjacent panels. Verify adequate de-bonding at panel gaps as required to accommodate shrinkage and temperature changes. See Section 4.4 of the PCI Design Handbook 7<sup>th</sup> Edition for guidance.
- 6. FOUNDATION:**
- 6.1 Panel to Foundation Connections:** Panel to foundation connections shall comply with CBC 1905A.1.10 and ACI 318 Sections 18.5.2 and 18.13.
- 6.1.1** Overstrength factor ( $\Omega_0$ ) applies to the design of connections to the foundation in accordance with CBC Section 1617A.1.16 (ASCE 7 Section 12.13.1.1). All connections of precast concrete walls to the foundation shall be designed to comply with this requirement, including in-plane shear dowels, overturning tie downs, intermediate tie downs at piers, connection plates, etc.



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- 6.1.2** ACI 318 Sections 18.5.2.2 (80 percent design strength) and 18.5.2.3 ( $1.5 S_y$ ), as modified by CBC 1905A.1.10, need not be satisfied for the foundation connection if designed for the amplified seismic loads from one of the three options (strength of superstructure elements, fully yielded structural system, or over-strength factor) in CBC Section 1617A.1.16. However, these sections of CBC Section 1905A.1.10 need to be satisfied if the foundations connection is designed to respond inelastically per Exception 2 of CBC Section 1617A.1.16. The design forces shall include the amplified seismic forces from CBC Section 1617A.1.16 to establish when the minimum foundation tension tie per ACI 318 Section 18.13.2.3 and 18.13.2.4 is required.
- 6.1.3** When designing the foundation-to-wall panel connection for the amplified seismic loads per CBC Section 1617A.1.16, the connecting elements (rebar, headed studs, etc.) embedded in the wall panel shall also comply with the amplified seismic loads and must be fully developed into the wall panel.
- 6.1.4** The “pour strip” tying the slab to the wall panel often serves as the connection to the foundation. When weld plates are used the design shall comply with ACI 318 Chapter 17 for the plate anchorages to concrete. Design of the panel to slab or footing welded plate connections shall include design for eccentricity of forces on the connections and welds. Where dowels are used to connect the panel to pour strip and/or slab, the required development length must be calculated.
- 6.2** **Opening in Panels:** Openings in panels at the foundation level on continuous foundations wider than 4 times the footing thickness and extensions of the footing beyond the end of the panel by more than 2 times the footing thickness would require design of the footing for amplified seismic loads per CBC Section 1617A.1.16. In the same cases the minimum flexural reinforcement required by ACI 318 Section 9.6.1.2 is required for foundation reinforcement. ACI 318 Section 9.6.1.3 is modified by CBC Section 1905A.1.3.
- 6.3** **Allowable Soil Pressure and Bearing:** A geotechnical report is required per CBC Section 1803A with the site-specific project application.
- 6.3.1** An allowable stress increase is not allowed for Basic Allowable Load Combinations including footings per CBC Section 1605A.3.1. An allowable stress increase is permitted with Alternative Basic Load Combinations per CBC Section 1605A.3.2.
- 6.3.2** Reduction of foundation overturning per ASCE 7 Section 12.13.4 is permitted with Basic Allowable Load Combinations but not allowed for Alternate Basic Load Combinations per CBC Section 1605A.3.2.
- 6.4** **Liquefiable Soil or Site Class F:** PC options shall not include liquefiable soil nor site Class F. If the structure is located in an area with liquefiable soil or Site Class F, OTC submittal is not allowed and site-specific project design is required. If the site is not in a mapped liquefaction hazard zone, it may be presumed that no liquefaction hazard exists on that site unless a site-specific geotechnical report identifies such hazard.
- 6.5** **Foundations on or Adjacent to Slopes:** PC drawing shall specify minimum setback limits (values are required) of the structure per CBC Section 1808A.7 for building clearance, foundation setback, etc. for protection from slope drainage, erosion, and shallow failures. If setback limits are smaller than CBC requires, a site-specific soils report is required.
- 6.6** **Foundation Design:** Design per CBC including Sections 1617A.1.16 and 1808A.1.

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**6.7 Concrete Mix:**

- 6.7.1** Unless concrete exposure is classified per the ACI 318 Section 19.3.1.1, whereby the concrete mix design can comply with ACI 318 Section 19.3.2.1, concrete mix shall consist of Type V cement with minimum compressive strength of 4,500 pounds per square inch (psi) and maximum water/cement ratio of 0.45.
- 6.7.2** If ACI 318 Section 19.3.2.1 is used for concrete mix design, the PC shall clearly indicate the exposure levels applicable in the Design Information section. This may be tabulated for multiple categories or limited to specific exposure categories with conservative values.
- 6.7.3** Concrete exposed to thaw and freeze cycles shall be air entrained per ACI 318 Section 19.3.3.1.

**7. ACCESS COMPLIANCE REQUIREMENTS:**

- 7.1 Accessibility:** Accessibility requirements shall comply with CBC Chapter 11B.
- 7.2 Operable Parts:** Refer to CBC Sections 11B-205 and 11B-309.
- 7.3 Doors:** Refer to CBC Sections 11B-206.5 and 11B-404.
- 7.4 Elevators:** Refer to CBC Sections 11B-206.6 and 11B-407.
- 7.5 Ramps:** Refer to CBC Sections 11B-405 and 11B-505.
- 7.6 Stairs:** Refer to CBC Sections 11B-504 and 11B-505.
- 7.7 Drinking Fountains:** Refer to CBC Sections 11B-211 and 11B-602.
- 7.8 Kitchens:** Refer to CBC Sections 11B-212 and 11B-804.
- 7.9 Sinks:** Refer to CBC Sections 11B-212.3 and 11B-606.
- 7.10 Toilet Facilities and Bathing Facilities:** Refer to CBC Section 11B-213 including the following:
  - 7.10.1** CBC Section 11B-603 Toilet and Bathing Rooms.
  - 7.10.2** CBC Section 11B-604 Water Closets and Toilet Compartments.
  - 7.10.3** CBC Section 11B-605 Urinals.
  - 7.10.4** CBC Section 11B-606 Lavatories and Sinks.
  - 7.10.5** CBC Section 11B-607 Bathtubs.
  - 7.10.6** CBC Section 11B-608 Shower Compartments.
  - 7.10.7** CBC Section 11B-609 Grab Bars.
  - 7.10.8** CBC Section 11B-610 Seats.
- 7.11 Dressing, Fitting, and Locker Rooms:** Refer to CBC Sections 11B-222, 11B-803 and 11B-903.
- 7.12 Storage Spaces and Lockers:** Refer to CBC Sections 11B-225, 11B-308.4 and 11B-811.
- 7.13 Work Surfaces:** Refer to CBC Sections 11B-226 and 11B-902.
- 7.14 Floor and Ground Surfaces:** Refer to CBC Section 11B-302.
- 7.15 Changes in Level:** Refer to CBC Section 11B-303.

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- 7.16 Protruding Objects:** Refer to CBC Section 11B-307.
- 7.17 Reach Ranges:** Refer to CBC Section 11B-308 for such items as controls, switches and receptacles.
- 7.18 Windows:** Where operable windows are provided at least one opening in each accessible room or space shall comply with CBC Sections 11B-229 and 11B-309.
- 8. FIRE AND LIFE SAFETY REQUIREMENTS:**
- 8.1 Type of Construction:** Specify type of construction per CBC Chapter 6.
- 8.2 Total and Allowable Areas of Structure:** Specify total area of structure and demonstrate that total area is less than allowable area per CBC Table 506.2 based on type of construction and proposed occupancy classification(s).
- 8.3 Use and Occupancy Classification(s):** Specify proposed use and occupancy classification(s) per CBC Chapter 3.
- 8.4 Occupant Load:** Specify proposed occupant load based on function of space per CBC Table 1004.1.2.  
The following may be required where occupant load exceeds 49:
  - 8.4.1** Two or more exits per CBC Table 1006.2.1. Exit and exit access doorway configuration shall comply with CBC Section 1007.1.
  - 8.4.2** Panic hardware per CBC Section 1010.1.10.
  - 8.4.3** Emergency power for egress illumination (including exterior landings) per CBC Section 1008.3.
  - 8.4.4** Exit signs with backup power per CBC Section 1013.1.
  - 8.4.5** Occupant load sign per CBC Section 1004.9.
- 8.5 Roof Fire Classification:** Specify roof fire hazard classification per CBC Sections 705A and 1505.
- 8.6 Fire Extinguishers:** Indicate fire extinguisher locations and specify type per California Fire Code (CFC) Section 906.
- 8.7 Interior Finishes:** Interior wall, ceiling, floor and decorative finishes shall comply with CBC Chapter 8.
- 8.8 Group E Door Hardware:** Group E doors may be required to be lockable from the inside per CBC Section 1010.1.11.
- 8.9 Stairways:** Stairways shall comply with CBC Section 1011.
- 8.10 Ramps:** Ramps shall comply with CBC Section 1012.
- 8.11 Handrails:** Handrails shall comply with CBC Section 1014.
- 8.12 Guards:** Guards shall comply with CBC Section 1015.
- 8.13 Safety Glazing:** Safety glazing is required in hazardous locations (in doors, adjacent to doors, in windows, etc.) per CBC Section 2406.4.
- 8.14 Solar Zones and Solar Ready Roofs:** Reflect required fire department access aisles per CBC Section 3111.

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### REFERENCES:

2019 California Code of Regulations (CCR) Title 24

Part 2: California Building Code (CBC), Chapters 10, 11B and Sections 104.11, 106.1, 506, 602.1, 705A, 1502, 1504.3, 1505, 1507.4, 1603A.1.8.1, 1604A.5, 1605A.3, 1606A.3, 1607A.12, 1612A, 1617A, 1808A.7, 1905A, 1910A, 2203A.1, 2406.4, 3111.

Part 9: California Fire Code (CFC), Section 906.

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This IR is intended for use by DSA staff and by design professionals to promote statewide consistency for review and approval of plans and specifications as well as construction oversight of projects within the jurisdiction of DSA, which includes State of California public schools (K–12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is subject to revision at any time. Please check DSA's website for currently effective IRs. Only IRs listed on the webpage at <https://www.dgs.ca.gov/dsa/publications> at the time of project application submittal to DSA are considered applicable.

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**PRE-CHECK (PC) DESIGN CRITERIA FOR PRECAST CONCRETE BUILDINGS:  
2019 CBC****APPENDIX A SITE-SPECIFIC APPLICATION OF PC PRECAST CONCRETE BUILDINGS**

The following notes are provided as a guide to assist design professionals and DSA plan reviewers when preparing and reviewing site-specific project applications that incorporate PC precast concrete buildings designed in accordance with this IR. This Appendix is not intended to be an all-inclusive list of design and submittal requirements but rather is an aid to identify aspects of the design criteria described in this IR of particular interest to its site application.

Refer also to *PL 07-02 Over-the-Counter Review of Projects Using Pre-Check Approved Designs*

1. Verify site-specific suitability of the PC including all parameters in PL 07-02 Section 3.
2. Verify site-specific requirements of PL 07-02 Section 4 are met.
3. Review the Appendix of the site-specific DSA 103 for any exemptions from the required structural tests and special inspections. Applicability and consideration of exemptions may be discussed during plan review for site-specific applications and shall be justified by the applicable project design professional for DSA review and approval. Refer to Section 1.3 above for additional information.
4. Verify Risk Category (RC) of the site-specific design is compliant with the Design Information section of the approved PC. Refer to Section 1.6 above for additional information.
5. Verify utility and services lines crossing building separation joints are designed to accommodate, without rupture or distress, differential building movements as defined on the PC drawings. Refer to Section 1.12 above for additional information.
6. If the site has a ground snow load greater than zero, verify the building is positioned with sufficient distance from any adjacent structures as defined on the PC drawings. If the horizontal separation is less than 20 feet, snow drift analysis shall be provided by the PC applicant, and the project is not eligible for OTC review. Refer to Section 2.6.2 above for additional information.
7. If the site is classified as Site Class D or E and the seismic design of the PC is not based on the short period seismic response parameter  $S_{DS}$  as indicated in the Design Information section of the PC drawings, verify if a site-specific ground motion hazard analysis is required. Refer to Section 3.1.2 above for additional information.
8. In addition to the requirements of PL 07-02 Section 3.1.3, if the PC design is based on a capped  $S_{DS}$  value per ASCE 7 Section 12.8.1.3 verify the site specific criteria are met. Refer to Section 3.1.3 above for additional information.
9. Verify the location of the building on the site complies with the dimensional requirements for building separation relative to existing or other new buildings as defined on the PC drawings. Unless a detailed analysis is provided, the movement of an adjacent existing building shall be assumed to be that corresponding to the maximum drift allowed by the governing code at the time of the existing building's design or construction. Alternately, the lateral displacement of an existing building can be assumed to be 3% (0.03h) of its height in accordance with ASCE 41 Section 7.2.13.1. Refer to Section 3.10 above for additional information.
10. If the building is placed adjacent to a slope, verify the building location complies with the setback requirements defined on the PC drawings. Refer to Section 6.5 above for additional information.