

CASE Tool 9-3 **Design Criteria Template**

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Design Criteria Document

Prepared by the CASE Toolkit Committee

Roger Parra, S.E.

Corey Matsuoka, P.E.

Jason Dreher, P.E.

Anthony LoCicero III, P.E., LEED AP, Assoc. DBIA (*Lead Author*)

Michael Stubbs, S.E., P.E., DBIA

Adam Hugo-Holman, S.E., Chair

Coalition of American Structural Engineers
1400 L Street, Suite 400, Washington, DC 20005
PHONE: 202-347-7474 FAX: 202-898-0068

www.acec.org/case

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Tool No. 9-3: Design Criteria Template

Introduction

In structural engineering design projects, the development of a Design Criteria Document is a pivotal step that ensures the success of the project. This document serves as a foundational guideline that outlines the specifications, standards, and expectations for the project team, the client, the owner, and stakeholders.

This document lays the groundwork for transparent communication and mutual understanding between the engineering team and the client. By clearly defining the project's scope, objectives, and specific requirements, the design criteria document helps to align client expectations with engineering capabilities. This Tool can work in parallel with CASE Tool 3-4 Project Work Plan, serving as Section 5.1 of the Work Plan.

Scope and Objectives: The document begins by outlining the project's overall objectives, scope, and goals. This provides the client with a high-level view of what the project aims to achieve and sets the stage for the detailed criteria that follow. If the project team is out of sync with the client at the outset of the project, this misunderstanding can be quickly highlighted as resolved before the project team has gone too far down the wrong path.

Structural System Description: This section includes a detailed description of the structural system to establish a clear understanding of the project's framework. This description serves as the foundation for design decisions and construction methods. It should include the system type (e.g., steel frame, reinforced concrete, wood), key components (e.g., beams, columns, slabs, shear walls), load transfer mechanisms, and any unique or innovative features specific to the project. Additionally, the description should address any specific architectural requirements.

Codes and Standards: It is essential to incorporate relevant industry standards, codes, and regulations that will guide the project. IBC Section 1603 – Construction Documents specifies certain structural design information which must be indicated on the contract documents. As this information needs to be documented anyway, starting the project by documenting it in the Design Criteria Document is a good first step with minimal additional effort. This section should also include any information on client standards to be followed.

Material Specifications: Details regarding materials to be used, including their properties, quality, and applicable ASTM or other standards, are specified. This is particularly important where materials may deviate from the most common material types, such as when additional corrosion resistance or sustainable construction practices are key project concerns.

Structural Performance Requirements: This section includes detailed descriptions of the expected performance of the structure, such as live load capacity, resilience to environmental factors, deflection and vibration criteria, and lifespan.

The attached template is set up to be worked with IBC 2024 and ASCE 7-22. The user is encouraged to update the provided fields to comply with the codes and standards that are applicable to their project.

Conclusion

In summary, the Design Criteria Document can be an important tool in structural engineering design projects. By providing a clear and structured framework for both external and internal stakeholders, it ensures that the project is executed with precision, transparency, and efficiency. For clients, it establishes trust and aligns expectations, while for the engineering team, it serves as a vital tool for project management, quality assurance, and team collaboration.

Template

Scope and Objectives

Insert Scope and Objectives Here

Structural System Description

Insert Structural System Description Here

Applicable Codes and Standards

- IBC Edition – Local Amendments
- ACI 318-xx Building Code Requirements for Structural Concrete
- AISC 360-xx, Specification for Structural Steel Buildings
- AISC 303-xx, Code of Standard Practice for Steel Buildings and Bridges
- TMS 402/602, Building Code Requirements and Specification for Masonry Structures
- ASCE 7-xx, Minimum Design Loads and Associated criteria for building and Other Structures
- AWS D1.1—D1.1M—20xx Structural Welding Code – Steel 2214.3
- AWS D1.3—D1.3M—20xx Structural Welding Code – Sheet Steel 2214.3
- AWS D1.4—D1.4M—20xx Structural Welding Code – Reinforcing Steel 2214.3
- AWS D9.1—D9.1M—20xx Sheet Metal Welding Code – 2214.3

Structural Materials

Structural Steel

- W or WT shapes ASTM A992, Grade 50 ($F_y = 50$ ksi)
- Structural Square or Rectangular Tubes (HSS), ASTM A1085 Gr. A, ($F_y = 50$ ksi)
- Structural Angles, Channels, and Plates, ASTM A36 ($F_y = 36$ ksi)
- High Strength Bolts – ASTM A3125 Slip-critical bolts, 7/8" diameter, ($F_u = 120$ ksi)
- Headed Shear Studs – $\frac{3}{4}$ " diameter ASTM A108 (AWS D1.1, Type B, $F_y = 50$ ksi, $F_u = 65$ ksi)
- Welding Electrodes: E70 XX, tensile strength = 70 ksi
- Anchor Rods: ASTM F1554, Gr. 55 ($F_y = 55$ ksi)

Reinforced Concrete

- Minimum 28-day compressive strength for structural concrete:
 - Foundations (Pile Caps, Grade Beams & Below-grade walls): 5,000 psi
 - Above-Grade Load Bearing and Blast Walls: 5,000 psi
 - Lightweight Concrete over metal deck: 4,000 psi
 - Precast Tilt-Up Walls: 5,000 psi
- Reinforcing Steel: ASTM A615, Grade 60, deformed bars ($F_y = 60$ ksi)

Structural Masonry

- CMU Unit: Hollow Load-bearing & Non Load-bearing ASM C90

- Minimum unit net area compressive strength: 1,900 psi
- Masonry Grout, ASTM A476, minimum compressive strength 2500 psi
- Compressive strength of CMU assemblage, f'_m 1,500 psi.

Structural Performance Requirements

Load Combinations

Load Combinations for Strength Design are used to check the following systems and conditions:

- Steel Superstructure – Strength Requirements
- Concrete Substructure, other than Geotechnical Criteria

Load Combinations for Allowable Stress Design are used to check the following systems and conditions:

- Steel Superstructure – Allowable Deflections and Building Drift
- Geotechnical Criteria

Dead Loads

Roof Dead Load

- Self-weight of Structural Members Estimated in Structural Analysis Model
- Roofing Material: 6" Rigid Insulation = 9 psf
- Collateral: 10 psf

Elevated Floor Dead Load

- Self-weight of Structural Members Estimated in Structural Analysis Model
- 6-inch CIP Lightweight slab + 2" Deck = 46 psf
- Collateral: 10 psf

Soil Loads

- If required

Hydrostatic Pressure Loads

- If required

Live Loads

Roof Live Load

- $L_o = 25$ psf; 300 lbs concentrated
 - Live Load reduction: Not considered

Elevated Floors Live Load

- *Office Occupancy*

- $L_o = 50$ psf
 - Live Load reduction: Considered
- Partition Load = 15 psf
- *Corridors*
 - $L_o = 80$ psf
 - Live Load reduction: Considered

Slab-on-Grade Live Load

- Open Garage Area: AASHTO HS-20 Truck Loading. One rear axle load of 32 kips with wheel spacing at 6-feet. The front axle load is 8 kips. The axle spacing is 14-feet. An impact factor of 1.10 shall be considered for this loading.

Snow Loads

- Flat-roof snow load, p_g
- Flat-roof snow load, p_f
- Snow exposure factor, c_e
- Risk Category = II
- Thermal Factor, C_t
- Slope Factor, C_s

- Snow Drift 1 – On low roof adjacent to high roof
 - Drift surcharge load, p_d
 - Width of snow drift, w
 - Winter wind parameter for snow drift, W_2

- Snow Drift 2 – On high roof, adjacent to parapet
 - Drift surcharge load, p_d
 - Width of snow drift, w
 - Winter wind parameter for snow drift, W_2

- Snow Drift 3 – On high roof adjacent to screen wall
 - Drift surcharge load, p_d
 - Width of snow drift, w
 - Winter wind parameter for snow drift, W_2

Rain Load

- Design rainfall, $i = xxx$ in/hr
- Rain load, $R = xxx$ psf

Ice Loads

- Risk Category = II
- Nominal ice thickness, $t = xxx$ in

Wind Loads

- Wind Loads on MWFRS Determined by Chapter 27: Directional Procedure for Buildings of all Heights
 - Risk Category II
 - Basic wind speed, $V = xxx$ mph
 - Basic wind speed, $V_{asd} = V \times \sqrt{0.6} = xxx$ mph
 - Wind Directionality Factor, $K_d = xxx$
 - Wind Exposure Category B
 - Topographic Factor, $K_{zt} = xxx$
 - Ground Elevation Factor, $K_e = xxx$
 - Gust Effect Factor, $G = xxx$
 - Enclosure Classification:
 - North elevation = Enclosed
 - East elevation = Enclosed
 - South elevation = Enclosed
 - West elevation = Enclosed
 - Internal Pressure Coefficient, GC_{pi}
 - North elevation = +/- 0.18
 - East elevation = +/- 0.18
 - South elevation = +/- 0.18
 - West elevation = +/- 0.18
 - External Pressure Coefficient, C_p
 - N-S Wind Direction
 - Windward = +0.8
 - Leeward = -0.xxx
 - Side Wall = -0.xxx
 - S-N Wind Direction
 - Windward = +0.8
 - Leeward = -0.xxx
 - Side Wall = -0.xxx
 - E-W Wind Direction
 - Windward = +0.8
 - Leeward = -0.xxx
 - Side Wall = -0.xxx
 - W-E Wind Direction
 - Windward = +0.8
 - Leeward = -0.xxx

- Side Wall = -0.xxx
 - Roof Wind, All Wind Directions
 - Mean roof height, $h = xxx$ ft
 - Roof length 0 to xxx ft from windward edge = -0.9 or -0.18
 - Roof length xxx ft to xxx ft from windward edge = -0.5 or -0.18
 - Roof length $> xxx$ ft from windward edge = -0.3 or -0.18
- Wind Loads on Components and Cladding Determined by Chapter 30 Parts 2 and 3: Directional Procedure
 - External Pressure Coefficient, GC_p
 - Roof - Zone 1 = -xxx or xxx
 - Roof - Zone 2 = -xxx or xxx
 - Roof - Zone 3 = -xxx or xxx
 - Walls - Zone 4 = -1.1 or 1
 - Walls - Zone 5 = -1.4 or 1

Tornado Loads

- Risk Category = III
- Tornado wind speed, $V_T = xxx$ mph
- Wind Exposure Category B
- Effective plan area, $A_e = xxx$ ft²
- Tornado Directionality Factor, $K_{dT} = xxx$
- Ground Elevation Factor, $K_e = xxx$
- Tornado Velocity Pressure, $q_{zT} = xxx$ mph

- Tornado Gust Effect Factor, $G_T = xxx$

- Tornado Enclosure Classification
- Tornado Internal Pressure Coefficient, GC_{pIT}
 - North elevation = +/- xxx
 - East elevation = +/- xxx
 - South elevation = +/- xxx
 - West elevation = +/- xxx

Earthquake Loads

- Risk Category = II
- Seismic Importance Factor, $I_e = 1.0$
- Spectral Response Acceleration Parameters
 - $S_s = 0.365$ (36.5%g)
 - $S_1 = 0.071$ (7.1%g)

- Site Class = D (per Geotech report “xxxx”)
- Spectral Response Coefficients, Short Period (S_{DS}) = 0.367
- Spectral Response Coefficients, 1-Sec. Period (S_{D1}) = 0.113
- Building Period, $T = 0.788$
- Design Spectral Response Acceleration Parameter, $S_A = xxx$
- Seismic Design Category based on more stringent of $S_{DS} = xxx$ and $S_{D1} = xxx$
- **Basic** Seismic-Force Resisting System = A3. Ordinary Reinforced Concrete Shear Walls
 - Response Modification Coefficient, $R = 4$
 - Overstrength Factor, $\Omega_o = 2.5$
 - Deflection Amplification Factor, $C_d = 4$
- Use the Equivalent Lateral Force Analysis Procedure
 - Seismic Response Coefficient(s), (C_s) = 0.03 (3%)
- **Project** Drift Criteria

Flood Load

- Flood design is based on FEMA flood map number 4207570095G, effective on 1/17/2007
- Flood design class =
- Flood Hazard Zone: Zone X - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with depth less than one foot or with drainage areas of less than one square mile.
- Base Flood Elevation (BFE): 2’-0”
- Design Flood Elevation (DFE): 4’-0”
- Elevation of the lowest floor: 3’-0”
 - {Required for any building other than those in coastal high hazard areas or costal A zones}
- Elevation of dry floodproofing: 4’-0”
 - {Required for any non-residential building other than those in coastal high hazard areas or costal A zones}
- Elevation of the bottom of the lowest horizontal structural member of the lowest floor: N/A
 - {Required for any building in coastal high hazard areas or costal A zones}

Allowable Deflections

- Lateral Deflection under Wind Loads = H/xxx
 - $H = xxx$ ft
 - Maximum Drift = xxx ft = xxx inches
- Seismic - Allowable Story Drift, $\Delta_a = 0.00xx h_{sx}$

Story	h_{sx} (feet)	Δ_a (inches)
1		
2		

3		
4		
5		
6		

- Vertical Deflection, Roof:
 - Total Load = Span/240
 - Live Load = Span/360
- Vertical Deflection, Mezzanine:
 - Total Load = Span/240
 - Live Load = Span/360

Vibration Criteria

- Describe if Required

Geotechnical Criteria

{User note: This section is written assuming shallow foundations are applicable to the project. The user is encouraged to reference CASE Tool 6-2 – Engaging Subconsultants to review what geotechnical parameters they should request from the project Geotechnical Engineer for a variety of foundation types.}

Based on Geotechnical Report “Report Title” Dated xx/xx/xx by Geotechnical Engineering Firm, Inc.

- Site Class = D
- Allowable Soil Bearing Pressure = x,xxx psf
- Minimum Foundation Depth = xx”
- Minimum Foundation Dimension = xx” Strip, xx” Isolated
- Allowable passive earth pressures resisting lateral forces
 - Soils above the water table = xxx pcf
 - Soils below the water table = xxx pcf
- Coefficient of Friction on Underside of Spread Footing = 0.xxx
- Modulus of subgrade reaction for slabs-on-grade = xxx pci

Lifespan and Enhanced Performance Requirements

Project shall be designed to achieve a service life of xxx years. To accommodate the required service life, the following supplemental project requirements are implemented:

- Durable Material Selection
 - Describe if applicable
- Environmental Considerations
 - Describe if applicable
- Load Management
 - Describe if applicable
- Corrosion Protection
 - Describe if applicable
- Structural Detailing
 - Describe if applicable
- Construction Practices
 - Describe if applicable
- Inspection and Maintenance Provisions
 - Describe if applicable
- Sustainability and Adaptability
 - Describe if applicable

List of Delegated Design Items

- Steel Connection Design
- Precast Concrete Connections
- Cold-Formed Steel (CFS) Framing
- Curtain Wall Support Systems
- Metal Building Systems
- Truss Design (Wood or Steel)
- Miscellaneous Metals – stairs, Guardrails
- Deep Foundation Elements
 - Helical Piles
 - Micropiles
 - Auger Cast Piles
 - Rammed Aggregate Piers