

Recommended Guidelines for  
Performing an Independent  
Structural Engineering Review  
in the State of Connecticut<sup>©</sup>  
Document SEC/CT-301-08

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**STRUCTURAL ENGINEERS COALITION**  
*a Coalition of the American Council of Engineering Companies of Connecticut*



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**Recommended Guidelines for Performing an Independent  
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## **Recommended Guidelines for Performing an Independent Structural Engineering Review in the State of Connecticut**

### I. Preface

A. These guidelines were prepared by the Threshold Review Committee of the Structural Engineers Coalition of American Council of Engineering Companies of Connecticut. It is the intent of the Structural Engineers Coalition that these guidelines will be used by:

- Independent Structural Engineering Consultants when identifying the breadth and depth of the structural review that is to be undertaken
- Structural Engineers of Record when identifying items they need to provide to the Independent Structural Engineering Consultant
- Building Owners when preparing Requests for Qualifications
- Building Officials when evaluating reports received from Independent Structural Engineering Consultants

These guidelines are not intended as a substitute for professional services or to establish any professional or legal standard. Users of these guidelines should consult with the appropriate professionals regarding the subjects discussed herein.

### II. Background

A. The requirements for an Independent Structural Engineering Review (ISER) were adopted by the Connecticut legislature under Connecticut Public Act 88-359 in 1988. This legislation was enacted in response to the collapse of the L'Amiance Plaza apartment complex in 1987 which resulted in the loss of 28 lives. This was the third major structural failure in the State of Connecticut in ten years, the other two being the Hartford Civic Center and the Mianus River Bridge. It was recognized that most building departments do not have the resources of plan reviewers who have the ability to assess the adequacy of the structural engineering design for complex building structures. While not all of the above-cited structural failures were directly attributable to structural design flaws, the legislation was intended to provide greater quality assurance for the structural design for structures which exceeded certain limits, hereafter referred to as "Threshold Limits". Revisions to the legislation were incorporated in Connecticut Public Act 89-255, and several additional minor revisions were included in subsequent Public Acts. The need for an ISER is also identified within the Connecticut Supplement to the State Building Code (see excerpt in Appendix "B").



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III. Objectives

- A. The primary objective of the ISER as stated in the Connecticut General Statutes (see excerpt in Appendix “A”) is to “*assure the stability and integrity of the primary structural support systems*”.
- B. An ISER is intended to provide an increased level of confidence regarding the predicted performance and safety of the project as documented by the design. This increased level of confidence shall be applicable to the following areas:
  - 1. Adequacy of the design criteria.
  - 2. Adequacy of the design and the design approach.
  - 3. Adequacy of structural design documentation.
- C. An ISER is an independent and objective technical review of the design of the project, by a structural engineering consultant experienced in the design of similar projects to the one being reviewed.
- D. An ISER is intended to encompass an actual review of the design using independently generated calculations. It is not intended to be simply a review of the calculations generated by the Structural Engineer of Record (SER).
- E. The ISER is intended to establish whether or not the building or structure conforms to the minimum structural design standards established by the Building Code. Providing that the design conforms to this criteria, it is irrelevant if the Independent Structural Engineering Consultant (ISEC) would have approached the design in a different fashion than the SER.
  - 1. If higher design standards are cited in the structural construction documents (e.g. higher design loads), then the ISER shall verify that the design conforms to the cited criteria.
- F. An ISER is not intended to encompass a review of secondary structural elements or cladding, although such a review may be performed as an Additional Service if so desired by the Owner.
- G. An ISER is not intended to encompass a review of mechanical or electrical equipment, ducts, conveyors, etc. Review of the primary structure used to support these items, when not an integral part of the equipment or a premanufactured item such as a curb, is part of the ISER.
- H. An ISER is not intended to replace or supplement the coordination functions between the SER, the architect and the other design disciplines. Should the ISEC



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detect any design coordination issues during the ISER, the ISEC may notify the applicable design discipline(s) as a courtesy.

- I. An ISER is not intended to assess constructability issues. Should the ISEC detect any potential constructability issues during the ISER, the ISEC may notify the SER as a courtesy.
- J. An ISER is not a value engineering study.

IV. Definitions

- A. **Primary Structural Support System:** The completed combination of elements which serve to support the building or structure's self-weight, the applicable live loads which are based on the occupancy and use of the spaces, the environmental loads such as wind and snow, plus the seismic loading.
- B. **Secondary Structural Elements:** Structural elements that are structurally significant for the function they serve but do not contribute to the strength or stability of the overall structure. Examples may include but not be limited to: stairs, equipment supports, ceiling supports, non-load bearing partitions; railings; elevator rails and hoist beams; and retaining walls independent of the primary building.
- C. **Cladding:** The load-resisting parts of a structure that enclose or partially enclose a building or other structure. Examples may include but not be limited to: curtainwall systems; masonry veneers; non load-bearing metal stud or concrete masonry back-up; non load-bearing architectural precast concrete panels. Non load-bearing walls which function as shearwalls would be considered to be part of the Primary Structural Support System.

V. Threshold Limits

- A. The Threshold Limits as defined by Connecticut Public Act 89-255 and the Building Code are as follows:
  - 1. Any building or addition having four stories
  - 2. Any building, addition or structure sixty (60) feet in height
  - 3. Any building, addition or structure with a clear span of 150 feet.
  - 4. Any building or addition containing 150,000 square feet of total gross floor area.
  - 5. Any building or addition with an occupant load of 1,000 persons.
  - 6. A building or addition in Use Group I (Institutional) with 150 beds or persons.
  - 7. A building or addition in Use Group R-1 (Residential – Hotels./Motels) which is a single structure and contains 200 rooms.



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8. A building or addition in Use Group R-2 (Residential – Multifamily) which is a single structure and contains 100 dwelling units.
  9. A building or addition in Use Group S (Storage) with 250,000 square feet of total gross floor area; this takes precedence over Threshold Limit No. 4.
  10. A parking structure (Use Group S – Storage) with 1,000 cars.
- B. Any proposed structure or addition which exceeds one or more of the Threshold Limits is subject to an ISER.
1. A structure which equals but does not exceed any of the Threshold Limits is not subject to an ISER. For instance, a four-story structure is not subject to an ISER unless it exceeds one of the other Threshold Limits; a five-story structure is subject to an ISER.
  2. Any building which is constructed using the lift-slab method of construction is subject to an ISER, regardless of its size.
- C. The following conditions have been interpreted as follows by the Office of the State Building Inspector:
1. If a vertical addition is added to the top of an existing building resulting a structure with five or more stories, the addition and the existing supporting structure are subject to an ISER.
  2. If a one-story (or more) vertical addition is added to the top of an existing building with five or more stories, the addition and the existing supporting structure are subject to an ISER.
  3. If a vertical addition is added to an existing non-threshold building and the building height including the addition exceeds 60 feet, the addition and the existing supporting structure are subject to an ISER.
  4. If a vertical addition is added to an existing building with a height in excess of 60 feet, the addition and the existing supporting structure are subject to an ISER.
  5. If a horizontal addition in itself does not exceed any of the threshold limits, the addition is not subject to an ISER regardless of the size or occupancy load of the combination of the new and existing structures.
  6. Under no circumstances would a horizontal addition necessitate an ISER of the existing building.
  7. The areas of the new and existing structures are not additive when applying threshold limits.
  8. The occupancy loads of the new and existing structures are not additive when applying threshold limits.



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9. When firewalls are utilized to create separate buildings within a single structure, the threshold limits are to be based on the full structure, not the separate buildings.
10. Threshold limits do not apply to repair, renovation or change of occupancy.
11. Building height is determined based on the average height of the highest roof of a building structure. The building height could be determined based on the height of an elevator override, a penthouse, a cupola or a similar building feature.
12. Architectural embellishments are not considered in the determination of building height. A spire is an example of an architectural embellishment.
13. If an accessory structure is added to the top of a building and the combined height of the building and the accessory structure exceeds 60 feet, then the building and the accessory structure are subject to an ISER. A cellular telephone tower is an example of an accessory structure.
14. Free-standing structures independent of the primary building or structure which do not exceed the Threshold Limits are not subject to an ISER. If the free-standing structure exceeds any of the Threshold Limits, it too would be subject to an ISER.

VI. Engineering Qualifications

- A. The Independent Structural Engineering Consultant (ISEC) shall be a Professional Engineer registered in the State of Connecticut. Alternatively, the ISEC may be a partnership or a registered engineering corporation employing a structural engineer registered in the State of Connecticut who will manage the ISER.
- B. The ISEC shall be actively engaged in the practice of structural engineering and shall have experience with the design of buildings/structures and structural systems comparable in size and complexity to those under consideration.
- C. The Structural Engineer of Record (SER) should be consulted in the selection of the ISEC. The ISEC should be able to cooperate with the SER and others involved, and should be able to conduct the review in an unbiased and constructive manner.
- D. The ISEC shall be engaged by the Owner and shall be completely independent of the design team and the contractors and suppliers who will be involved with the construction of the structure.
  1. The ISEC shall not perform an ISER on any project in which any portion of the design is the responsibility of others within the ISEC's firm, regardless of the design discipline.



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VII. Sequence of Review

In order to expedite the review and to reconcile differences of opinion, open and ongoing communication between the ISEC and the SER is encouraged throughout the sequence of the ISER. In order to minimize impact on construction cost, it is highly recommended that the applicable design reviews be completed prior to bidding the structural construction contracts.

- A. Preliminary Review: A review at the completion of the Design Development Phase is recommended, particularly for large and complex projects. If discrepancies are detected relative to the basic design assumptions, they are more readily resolved at this earlier stage than they would be at the completion of the Construction Documents Phase.
- B. Foundation Review: If the project schedule dictates, the Owner may desire to obtain a Foundation Permit prior to the completion of the superstructure design documents. This will require the ISEC to utilize incomplete documents for the basis of the foundation evaluation. Any special conditions or contingencies relating to a Foundation Review must be clearly identified to the Building Official; any assumptions must be confirmed during the Primary Design Review. The Building Official is not obligated to furnish this form of Partial Building Permit.
- C. Primary Design Review: The primary review for the project is conducted at which time the Construction Documents are at or near completion.
- D. Construction Phase Review: This would be limited to the review of contractor-designed elements which are part of the Primary Structural Support System. It would also include the review of changes to the Primary Structural Support System.

VIII. Scope and Methodology of Review

- A. Preliminary Review (Optional Phase)
  - 1. Review design criteria to verify compliance with the Building Code.
  - 2. Assess assumptions made by the SER.
- B. Foundation Review (Optional Phase for Early Foundation Permit)
  - 1. If Preliminary Review was not performed, then perform those tasks identified under Preliminary Review. If Preliminary Review was performed, confirm that design criteria and assumptions have not changed.



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2. Establish foundation loads via independent analysis. Alternatively, obtain foundation loads from SER contingent upon subsequent verification. Obtain soil design parameters from geotechnical engineering report.
3. Perform independent analyses of representative foundation elements including spread footings, pile caps, foundation walls, grade beams, piles, etc. Review of a minimum of 25% of foundation elements is recommended, depending on the relative nature or complexity of the project. Depending on the results of the independent analysis, the ISEC may find it necessary to increase the percentage of elements reviewed to determine compliance with the State Building Code.
4. Review specification sections pertaining to foundation system including earthwork, piles, concrete work, etc.
5. Review performance criteria for contractor-designed components such as mini-piles, tie-down anchors, etc.

C. Primary Design Review

1. If Foundation Review and Preliminary Review were not performed, then perform those tasks identified under Preliminary Review. If Foundation Review was not performed but Preliminary Review was performed, confirm that design criteria and assumptions identified in Preliminary Review have not changed.
2. Review load paths for gravity and lateral loads to confirm that loads are distributed through the height of the structure to the foundation in a rational fashion.
3. Perform independent analyses of the gravity force and lateral force-resisting systems. Perform independent analyses of representative components of the Primary Structural Support System including slabs, beams, columns, braces, diaphragms, etc. Review of a minimum of 25% of framing components is recommended, depending on the relative nature or complexity of the project. Depending on the results of the independent analysis, the ISEC may find it necessary to increase the percentage of elements reviewed to determine compliance with the State Building Code.
  - a. Check building drift and separation under seismic loading conditions.
  - b. Check frame element deflections under the applicable gravity loading conditions.



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4. If Foundation Review was not performed, then perform independent analyses of representative foundation elements including spread footings, pile caps, foundation walls, grade beams, piles, etc. Review a minimum of 25% of foundation elements is recommended, depending on the relative nature or complexity of the project. Depending on the results of the independent analysis, the ISEC may find it necessary to increase the percentage of elements reviewed to determine compliance with the State Building Code. If Foundation Review was performed and was based on loads furnished by the SER, confirm that loads on which Foundation Review was based coincide with those established in the independent analysis.
5. Review structural framing connections which are part of the Primary Structural Support System including shear connections, braced frame connections, moment-resisting connections, timber framing connections, etc. When connections are not detailed on the design drawings, verify adequacy of the cited connection design loads/procedures.
6. Perform general review of design to evaluate presence of any conditions which might precipitate conditions of instability or structural overstress. Examples would include unbraced beams or columns; composite beams where openings compromise the composite action; excessive unshored deck spans; conditions which induce out-of-plane loads into framing components, etc.
7. Review specification sections pertaining to Primary Structural Support System.
8. Review performance criteria for contractor-designed components such as precast concrete elements, shear connections, braced frame connections, moment-resisting connections, cold-formed metal framing components (primary framing components, not cladding), pre-engineered metal building systems, wood trusses, etc.

D. Construction Phase Review

1. Review structural calculations and design drawings for contractor-designed components which are part of the Primary Structural Support System. Perform independent analyses as required to supplement contractor's engineering calculations.
  - a. Review by ISEC shall not commence until design of contractor-designed components has been reviewed and approved by SER.
  - b. Review of contractor's design drawings shall not be construed as a comprehensive shop drawing review. Comprehensive shop drawing review is the responsibility of the SER.



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2. Review any changes to the design of the Primary Structural Support System.
  - a. The ISEC shall review sketches and/or revised drawings prepared by the SER which document the changes.
  - b. If sketches and/or revised drawings are not available, the ISEC shall review shop drawings to ascertain the adequacy of the design. Such review shall commence only after the shop drawings have been reviewed and approved by the SER.

IX. Minimum Report Requirements

- A. The following items shall be included in the final ISER report:
  1. List of the documents on which the review was based (include structural drawing numbers with revision dates)
  2. Building Code on which the ISER was based
  3. Basis of the review (e.g. SEC/CT Guidelines)
  4. Outstanding items / unresolved issues
  5. Items to be subsequently reviewed (e.g. Contractor-designed items)
  6. Exclusions/limitations (e.g. ISER was limited to primary structural support systems)
- B. The final ISER report shall be addressed to the Building Official having jurisdiction. Copies of the report shall be distributed to the Owner/Owner's representative and the SER.
- C. Prior to the issuance of the final ISER report, the ISEC is encouraged to exchange review comments with the SER in order to reconcile as many issues as possible.

X. Design Conflict Resolution

- A. During the generation of his/her independent calculations, the ISEC may find that some of the primary structural support systems are not in conformance with the Building Code, and this information is then brought to the attention of the SER. Should the SER disagree with the ISEC's findings, the SER shall furnish the ISEC with the SER's applicable structural calculations (including computer analyses) which substantiate the adequacy of the portion of the structural design in question.
  1. After review of the SER's structural calculations, if the issue in question has not been reconciled, then the ISEC shall furnish the SER with the ISEC's applicable independent structural calculations (including computer analyses) for the SER's assessment.



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- B. In the event that a dispute between the SER and the ISEC cannot be resolved, the parties are encouraged to engage the services of a neutral structural engineering consultant to assist in the resolution of the dispute. The office of the American Council of Engineering Companies of Connecticut maintains a list of structural engineering consultants who offer ISER dispute resolution services.

XI. Suggested Items to be Included in a Request for Proposal

- A. It is recommended that the following items be submitted to a potential ISEC when requesting a proposal for an ISER:
1. Set of current structural drawings
  2. Current architectural plans, sections and elevations
  3. Structural systems design narrative
  4. General building narrative (number of stories, gross building area, estimated construction cost, unique features, etc.)
  5. Reference of the SEC/CT Guidelines as the basis for the ISER
  6. Design schedule
  7. Special phasing (e.g. will a Foundation Permit be sought in advance of the full Building Permit?)
  8. Professional Services Agreement to be utilized (the use of CASE Document 5, *An Agreement for Structural Project Peer Review Services*, is recommended)
- B. An ISER is an important professional service. As such, the qualifications of the ISEC should be strongly considered when selecting an ISEC. For more information on procuring professional services, contact the Connecticut QBS Council at [www.ctqbs.org](http://www.ctqbs.org).

XII. Information to be Furnished to the ISEC

- A. Items to be Furnished by the Owner or the Owner's Designated Representative:
1. Complete set of drawings (structural, architectural, mechanical, electrical, plumbing, site)
  2. Structural specifications
  3. Geotechnical engineering report
  4. Structural design criteria summary (e.g. design basis and structural systems narrative)
  5. Special design criteria (wind tunnel test reports; snow load reports; etc.)
  6. Major equipment loads
  7. Existing building drawings/data if impacted by or impacting the threshold structure



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B. Items to be Furnished by the SER:

1. Drawings/calculations for contractor-designed components
2. Drawings/sketches pertaining to structural design revisions

XIII. Disclaimer

- A. The provisions stated herein are a guideline developed by SEC/CT as a basis for ascertaining the adequacy of the design of the primary structural systems. Specific procedures cited herein are not a requirement set forth by Connecticut State Building Code or the Connecticut General Statutes. These guidelines are not intended as a substitute for professional services or to establish any professional or legal standard. Users of these guidelines should consult with the appropriate professionals regarding the subjects discussed herein
- B. These guidelines are a minimum, and it is the responsibility of the ISEC to review the structural design to the extent necessary to ensure the stability and integrity of the primary structural support systems.
- C. An ISER often results in revisions to the original structural design and construction documents. In order to minimize impact on construction cost, it is highly recommended that the Primary Design Review of the ISER (and the Foundation Review, if applicable) be completed prior to bidding the structural construction contracts. Some of these changes may result in increased construction costs. Neither the ISEC nor the SER shall be responsible for such additional costs.



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**Appendix “A” – Excerpt from Connecticut General Statutes**

**General Statutes of Connecticut** (revised to January 1, 2007)

**Title 29: Public Safety and State Police**

**Chapter 541: Building, Fire and Demolition Codes  
Fire Marshals and Fire Hazards  
Safety of Public and Other Structures**

**Sec. 29-276b. "Threshold limit" defined. Requirements when structure or addition will exceed threshold limit. Standards for facilities which perform testing of construction materials.** (a) For the purposes of this section, the term "threshold limit" shall apply to any structure or addition thereto (1) having four stories, (2) sixty feet in height, (3) with a clear span of one hundred fifty feet in width, (4) containing one hundred fifty thousand square feet of total gross floor area, or (5) with an occupancy of one thousand persons.

(b) The following use groups shall have the following additional threshold limits:

Use Group	Threshold Limit
I–Institutional I-1 Residential care I-2 Incapacitated care I-3 Restrained, jails and asylums	150 beds or persons
R–Residential R-1 Residentail–hotel/motel R-2 Residential–multifamily	Single structure with 200 rooms Single structure with 100 dwelling units
S–Storage S-1 Moderate hazard S-2 Low hazard	Parking structures with 1,000 cars 250,000 square feet 250,000 square feet

(c) If a proposed structure or addition will exceed the threshold limit as provided in this section, the building official of the municipality in which the structure or addition will be located shall require that an independent structural engineering consultant review the structural plans and specifications of the structure or addition to be constructed to determine their compliance with the requirements of the State Building Code to the extent necessary to assure the stability and integrity of the primary structural support systems of such structure or addition. Any modifications of approved structural plans or



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design specifications shall require shop drawings to the extent necessary to determine compliance with the requirements of the State Building Code and shall be reviewed by such consultant. Any fees relative to such review requirements shall be paid by the owner of the proposed building project. The building official may prequalify independent structural engineering consultants to perform the reviews required under this subsection. In the case of such a project, each general contractor and major subcontractor shall keep and maintain a daily construction log in a manner prescribed by the State Building Inspector. The building official shall, upon request, have access at all reasonable times to such log. If a structure or addition exceeds the threshold limit, the architect of record, professional engineer of record responsible for the design of the structure or addition and general contractor involved in such project shall sign a statement of professional opinion affirming that the completed construction is in substantial compliance with the approved plans and design specifications. If fabricated structural load-bearing members and assemblies are used in such construction, the professional engineer licensed in accordance with chapter 391 responsible for the design of such members or assemblies shall sign a statement of professional opinion affirming that the completed fabrication is in substantial compliance with the approved design specifications.

(d) The building official of the municipality in which the structure or addition will be located shall satisfy himself that each architect, professional engineer, general contractor and major subcontractor involved in the project holds a license to engage in the work or occupation for which the appropriate building permit has been issued. If fabricated structural load-bearing members or assemblies will be used in such construction, the building official shall satisfy himself that each professional engineer responsible for the design of such members or assemblies holds a license issued in accordance with the provisions of chapter 391.



**Appendix “B” – Excerpt from Connecticut State Building Code**

**STATE BUILDING CODE**  
**2005 CONNECTICUT SUPPLEMENT**  
(effective December 31, 2005)

(Add) **106.1.5 Threshold limits.** For the purposes of this section, the term “threshold limit” shall apply to any proposed structure or addition thereto: (1) having four stories; (2) 60 feet in height; (3) with a clear span of 150 feet in width; (4) containing 150,000 square feet of total gross floor area; or (5) with an occupancy of 1,000 persons. The following use groups shall have the following additional threshold limits:

<b><u>Use Group</u></b>	<b><u>Threshold Limit</u></b>
I Institutional	150 beds or persons
R-1 Residential - hotels or motels	Single structure with 200 rooms
R-2 Residential - multi-family	Single structure with 100 dwelling units
S Storage	250,000 square feet or parking structures with 1,000 cars

Threshold limits shall not apply to alterations, repairs or change of occupancy to any existing building.

(Add) **106.1.5.1 Requirements for proposed structures or additions that exceed the threshold limits.** Pursuant to section 29-276b of the Connecticut General Statutes, if a proposed structure or addition to an existing structure will exceed the threshold limit set forth in Section 106.1.5 of this code, the building official of the municipality in which the structure or addition will be located shall require that an independent structural engineering consultant review the structural plans and design specifications of the structure or addition to be constructed to determine compliance with the requirements of this code to the extent necessary to assure the stability and integrity of the primary structural support systems of such structure or addition. Any modifications of approved structural plans or design specifications shall require shop drawings to the extent necessary to determine compliance with the requirements of this code and shall be reviewed by such consultant. Any fees relative to such review requirements shall be paid by the owner of the proposed building project.



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If a structure or addition exceeds the threshold limit, the architect of record, professional engineer of record responsible for the design of the structure or addition and the general contractor shall sign a statement of professional opinion affirming that the completed construction is in substantial compliance with the approved plans and design specifications. If fabricated structural load-bearing members or assemblies are used in the construction, the professional engineer responsible for the design of such members or assemblies shall sign a statement of professional opinion affirming that the completed fabrication is in substantial compliance with the approved design specifications.

The building official of the municipality in which the structure or addition will be located shall satisfy himself that each architect, professional engineer, including each professional engineer responsible for the design of fabricated structural load-bearing members or assemblies, general contractor and major subcontractor involved in the project holds a license to engage in the work or occupation for which the appropriate building permit has been issued.

(Add) **106.1.6 Lift slab construction.** Pursuant to subsection (b) of section 29-276a of the Connecticut General Statutes, any building designed to be constructed utilizing the lift-slab method of construction shall be classified as exceeding the “threshold limit” and shall be subject to the provisions of Sections 106.1.5.1 and 106.1.6.1.